NASA SP-7041 (20)

NASA

Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041 (20)
January 1979

National Aeronautics and
Space Administration

Earth Resources

Earth Resources
A Continuing Bibliography with Indexes

Pages 229 - 269
January 1979

PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

Remote Sensing of Earth Resources	(NASA SP-7036)
Earth Resources	(NASA SP-7041(01))
Earth Resources	(NASA SP-7041(02))
Earth Resources	(NASA SP-7041(03))
Earth Resources	(NASA SP-7041(04))
Earth Resources	(NASA SP-7041(05))
Earth Resources	(NASA SP-7041(06))
Earth Resources	(NASA SP-7041(07))
Earth Resources	(NASA SP-7041(08))
Earth Resources	(NASA SP-7041(09))
Earth Resources	(NASA SP-7041(10))
Earth Resources	(NASA SP-7041(11))
Earth Resources	(NASA SP-7041(12))
Earth Resources	(NASA SP-7041(13))
Earth Resources	(NASA SP-7041(14))
Earth Resources	(NASA SP-7041(15))
Earth Resources	(NASA SP-7041(16))
Earth Resources	(NASA SP-7041(17))
Earth Resources	(NASA SP-7041(18))
Earth Resources	(NASA SP-7041(19))

This bibliography was prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Information Systems Company.

NASA SP-7041 (20)

EARTH RESOURCES

A Continuing Bibliography
With Indexes
Issue 20

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 October 1, 1978 and December 31, 1978

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

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

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

INTRODUCTION

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

This literature survey lists 273 reports, articles, and other documents announced between October 1 and December 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;

STAR entries identified by accession number series N78-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

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

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A78-10000 Series)

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

Minimum air-mail postage to foreign countries is $1.00 and all foreign orders are shipped on payment of pro-forma invoices.

All inquiries and requests should be addressed to AIAA Technical Information Service. Please refer to the accession number when requesting publications.

STAR ENTRIES (N78-10000 Series)

One or more sources from which a document announced in *STAR* is available to the public is ordinarily given on the last line of the citation. The most commonly indicated sources and their acronyms or abbreviations are listed below. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source line.

Avail: NTIS. Sold by the National Technical Information Service. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code followed by the letters HC or MF in the *STAR* citation. Current values for the price codes are given in the tables on page vii.

Documents on microfiche are designated by a pound sign (#) following the accession number. The pound sign is used without regard to the source or quality of the microfiche.

Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) is available at greatly reduced unit prices. For this service and for information concerning subscription to NASA printed reports, consult the NTIS Subscription Section, Springfield, Va. 22161.

NOTE ON ORDERING DOCUMENTS: When ordering NASA publications (those followed by the * symbol), use the N accession number. NASA patent applications (only the specifications are offered) should be ordered by the US-Patent-Appl-SN number. Non-NASA publications (no asterisk) should be ordered by the AD, PB, or other *report* number shown on the last line of the citation, not by the N accession number. It is also advisable to cite the title and other bibliographic identification.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The current price and order number are given following the availability line. (NTIS will fill microfiche requests, at the standard $3.00 price, for those documents identified by a # symbol.)

(1) A microfiche is a transparent sheet of film, 105 by 148 mm in size, containing as many as 60 to 98 pages of information reduced to micro images (not to exceed 26:1 reduction).

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration, Public Documents Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the NASA Space Technology Laboratories, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in *Energy Research Abstracts*. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center - Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from *Dissertation Abstracts* and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this introduction. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, California. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: ZLDI. Sold by the Zentralstelle für Luftfahrtdokumentation und -Information, Munich, Federal Republic of Germany, at the price shown in deutschmarks (DM).

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: U.S. Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of 50 cents each, postage free.

Other availabilities: If the publication is available from a source other than the above, the publisher and his address will be displayed entirely on the availability line or in combination with the corporate author line.

SUBSCRIPTION AVAILABILITY

This publication is available on subscription from the National Technical Information Service (NTIS). The annual subscription rate for the quarterly supplements is $30.00 domestic; $60.00 foreign. All questions relating to the subscription should be referred to NTIS, Attn: Subscriptions, 5285 Port Royal Road, Springfield, Virginia 22161.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics
and Astronautics
Technical Information Service
750 Third Ave.
New York, N.Y. 10017

British Library Lending Division,
Boston Spa, Wetherby, Yorkshire,
England

Commissioner of Patents and
Trademarks
U.S. Patent and Trademark Office
Washington, D.C. 20231

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

ESA-Information Retrieval Service
ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Scientific and Technical Information
Facility
P.O. Box 8757
B. W. I. Airport, Maryland 21240

National Aeronautics and Space
Administration
Scientific and Technical Information
Branch (NST-41)
Washington, D.C. 20546

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, California 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, Michigan 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey
1033 General Services Administration
Building
Washington, D.C. 20242

U.S. Geological Survey
601 E. Cedar Avenue
Flagstaff, Arizona 86002

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

U.S. Geological Survey
Bldg. 25, Denver Federal Center
Denver, Colorado 80225

Zentralstelle fuer Luft Raumfahrtd
Dokumentation U. Information
c/o Fachinformationszentrum E P M
Attn: Library
Kernforschungszentrum
7514 Eggenstein Leopoldsaffen
Federal Republic of Germany

NTIS PRICE SCHEDULES

Schedule A

STANDARD PAPER COPY PRICE SCHEDULE

(Effective October 1, 1977)

Price Code	Page Range	North American Price	Foreign Price
A01	Microfiche	$ 3.00	$ 4.50
A02	001-025	4.00	8.00
A03	026-050	4.50	9.00
A04	051-075	5.25	10.50
A05	076-100	6.00	12.00
A06	101-125	6.50	13.00
A07	126-150	7.25	14.50
A08	151-175	8.00	16.00
A09	176-200	9.00	18.00
A10	201-225	9.25	18.50
A11	226-250	9.50	19.00
A12	251-275	10.75	21.50
A13	276-300	11.00	22.00
A14	301-325	11.75	23.50
A15	326-350	12.00	24.00
A16	351-375	12.50	25.00
A17	376-400	13.00	26.00
A18	401-425	13.25	26.50
A19	426-450	14.00	28.00
A20	451-475	14.50	29.00
A21	476-500	15.00	30.00
A22	501-525	15.25	30.50
A23	526-550	15.50	31.00
A24	551-575	16.25	32.50
A25	576-600	16.50	33.00
A99	601-up	-- 1/	-- 2/

1/ Add $2.50 for each additional 100 page increment from 601 pages up.

2/ Add $5.00 for each additional 100 page increment from 601 pages up.

Schedule E

EXCEPTION PRICE SCHEDULE

Paper Copy & Microfiche

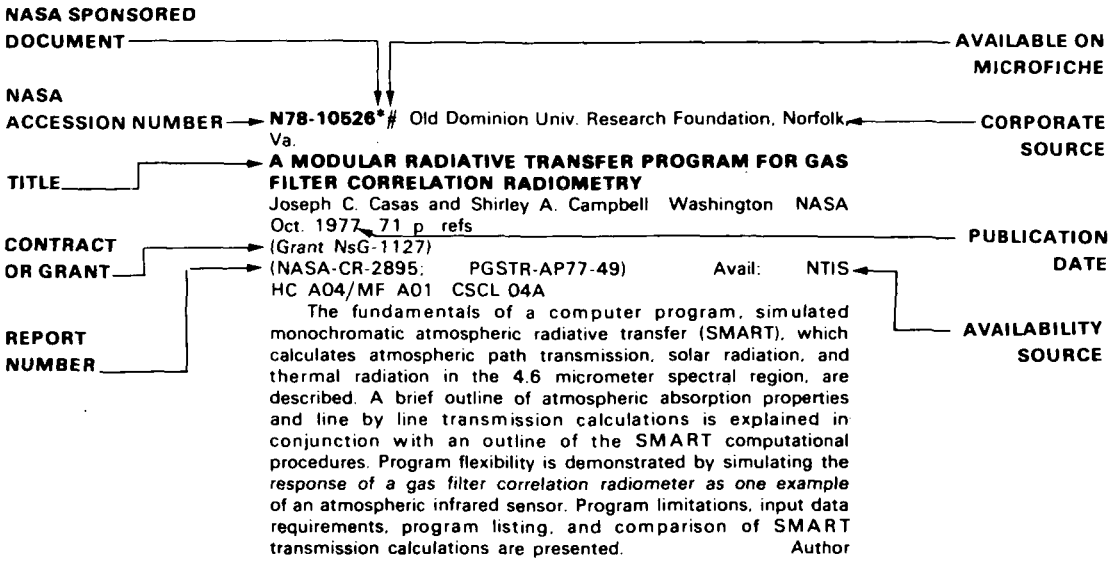
Price Code	North American Price	Foreign Price
E01	$ 3.25	$ 6.50
E02	4.75	9.50
E03	6.25	12.50
E04	7.50	15.00
E05	9.00	18.00
E06	10.50	21.00
E07	12.50	25.00
E08	15.00	30.00
E09	17.50	35.00
E10	20.00	40.00
E11	22.50	45.00
E12	25.00	50.00
E13	28.00	56.00
E14	31.00	62.00
E15	34.00	68.00
E16	37.00	74.00
E17	40.00	80.00
E18	45.00	90.00
E19	50.00	100.00
E20	60.00	120.00
E99 - Write for quote		
N01	28.00	40.00

TABLE OF CONTENTS

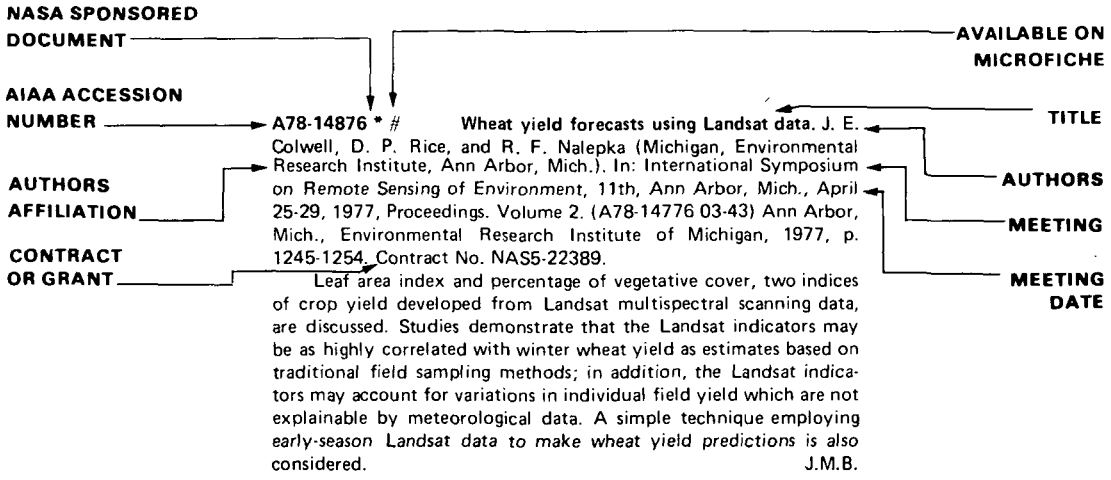
Subject Categories

Abstracts in this Bibliography are grouped under the following categories: *page:*

TYPICAL CITATION AND ABSTRACT FROM *STAR*



TYPICAL CITATION AND ABSTRACT FROM *IAA*



EARTH RESOURCES

A Continuing Bibliography (Issue 20)

JANUARY 1979

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.

A78-43304 # **Remote sensing in agronomy and pedology - In search of a methodology (La télédétection en agronomie et pédologie - A la recherche d'une méthodologie).** M. C. Girard and C. M. Girard (Institut National Agronomique Paris-Grignon, Thiverval-Grignon, Yvelines, France). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 1-7. 5 refs. In French.

The application of remote sensing technology in agronomy and pedology is discussed in terms of data collection and data interpretation. With reference to data collection, attention is given to wavelength-band selection as determined by the subject under study, and altitude selection as determined by the dimensions of the plot under study. Methods for data interpretation are outlined including analytical, statistical, and cartographic techniques. S.C.S.

A78-43305 # **Global agricultural productivity estimation from Landsat data.** A. R. Mack (Agriculture Canada, Soil Research Institute, Ottawa, Canada), J. Schubert, C. Goodfellow, P. Chagarlamudi, and H. Moore (Gregory Geoscience, Ltd., Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 8-18. 5 refs.

Landsat data have been computer processed in order to determine indices of growing conditions for general vegetation, cultivated areas, and specific crops such as spring wheat. Individual pixels are classified as to vegetation density and the biomass is calculated. Regression equations (obtained from biomass indices from various sites) are used to calculate predicted crop yields in terms of bushels per acre. A comparison is made between the actual distribution of classified pixels in spring wheat yields and the predicted distribution. It is found that the predicted values for final yield are within plus or minus 10 percent of the actual yields for ten out of eleven estimates made for various regions of Canada. S.C.S.

A78-43308 # **Computer-assisted forest land classification by means of several classification methods on the CCRS Image-100.** Y. J. Lee (Pacific Forest Research Centre, Victoria, British Columbia, Canada), F. Towler, H. Bradatsch, and S. Finding (British Columbia Forest Service, Victoria, British Columbia, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 37-46. 9 refs.

Results are reported for computer-assisted forest-land classification using the CCRS Image-100 supervised classification technique. The study was conducted at three Canadian test sites. The results from principal-components color enhancement revealed that logged-over, urban, power-line, and cultivated areas were easily distinguishable and that vegetation could be mapped. Poor results were obtained from unsupervised classification on the five identifiable forest-land classes with the exception of water. Computer-assisted classification using supervised classification algorithms was found to identify broad forest-land classes which may be subsequently used for further sampling by small-scale aerial photographs and ground surveys. S.C.S.

A78-43312 # **A basis for multistage forest inventory in the Boreal forest region.** C. L. Kirby and P. I. van Eck (Environment Canada, Northern Forest Research Centre, Edmonton, Alberta, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 71-94. 29 refs.

Consideration is given to the interpretation of Landsat imagery and ultra-small and large-scale aerial photography with reference to a multistage sampling design for forest regions. It is found that: (1) a multistage design incorporating sampling units based on variable probability is applicable to large-area inventories, (2) ultra-small, infrared, color aerial photographs may be used to estimate stand volumes for preparing forest cover and soil maps, and (3) large-scale photo sampling may partially replace extensive ground sampling when estimating timber volume, cut-over land, and habitat types. S.C.S.

A78-43314 # **Quantitative predictions of chemical soil conditions from multispectral airborne ground and laboratory measurements.** H. Schreier (British Columbia, University, Vancouver, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 106-112. 20 refs.

Multispectral reflectance measurements are used to make quantitative predictions of chemical soil conditions. Data are collected from five parent materials from the air, on the ground, and in the laboratory. Spectral reflection curves are determined over the 400-1000 nm range and mean and range values are found. It is noted that percent carbon, iron, and exchangeable magnesium are most correlated with the spectral measurements. A curvilinear regression fitting an exponential function satisfactorily predicts carbon and exchangeable magnesium values whereas a straight linear function satisfactorily predicts iron values. The airborne, ground, and laboratory analyses are found to yield similar results. S.C.S.

A78-43321 # **Remote sensing of the thermal characteristics of ground surfaces covered with vegetation - Trial interpretation key (Télédétection des caractéristiques thermiques des surfaces terrestres végétalisées - Essai de clef d'interprétation).** F. Bonn, R. Brochu, and M. Lajeunesse (Sherbrooke, Université, Sherbrooke, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 180-188. 18 refs. In French.

Remote sensing techniques used to evaluate ground-level energy exchanges and the thermal characteristics of the ground cover are reviewed. Studies conducted at ground level, using an airborne PRT5 radiometer, and using a Daedalus scanner are described. The soil parameters which may be monitored are presented along with a thermal classification of the primary types of ground cover. Seasonal variations are described and a synoptic table is proposed for data interpretation. S.C.S.

A78-43336 # **Specific study of rice cultivation by remote sensing - Cartography and production evaluation (Etude spécifique d'une culture /riz/ par télédetection - Cartographie et évaluation de production).** T. Le Toan (Centre d'Etudes Spatiales des Rayonnements, Toulouse, France). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 355-364. In French.

Landsat data have been used in conjunction with aerial photography and field data to evaluate the rice-growing areas in the Camargue region of southern France. The data were collected from eight Landsat passages made in 1975 and aerial photographs taken at 1500 and 7000 m. It is found that optimal results are obtained using supervised classification techniques, multidate observations, and methods employing linear discriminant functions. S.C.S.

A78-43342 # **Vegetation classification with digital X-band and L-band dual polarized SAR imagery.** R. Shuchman (Michigan, Environmental Research Institute, Ann Arbor, Mich.) and R. T. Lowry (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 444-458. 10 refs.

Digital multispectral and multipolarization synthetic aperture radar have been used for vegetation classification in coastal wetlands regions. The basic components of the X-L radar system are the two-channel X-band (3.2 cm) and L-band (25.0 cm) radars. The two radar parameters are varied in the multiplexed system. The data are digitized by the ERIM hybrid optical-digital processor and seven classes are identified: inland H2O, coniferous trees, palmettoes and palm/secondary story, marsh grass, coastal marsh grass, sand and shell fragments, and dry grass and palmettoes. S.C.S.

A78-43347 # **Study of alfalfa survival in Quebec by color and infrared photography at scales of 1:6000 to 1:40,000 (Etude sur la survie de la luzerne au Québec au moyen de photos couleurs et infra-rouges à des echelles de 1:6000 à 1:40000).** R. Paquin (Agriculture Canada, Station de Recherche, Sainte-Foy, Quebec, Canada), G. Ladouceur, R. Desrosiers (Université Laval, Sainte-Foy, Quebec, Canada), and A. Mack (Agriculture Canada, Institut de Recherches sur les Sols, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 506-515. In French.

A78-44801 **Application of multispectral aerial photographs to soil surveys in New Zealand.** W. C. Rijkse (Department of Scientific and Industrial Research, Soil Bureau, Rotorua, New Zealand). *New Zealand Journal of Science,* vol. 20, Dec. 1977, p. 363-370.

Multispectral aerial photographs of two river valleys near Tolaga Bay and Ruatoria, East Coast, North Island showed much better definition of soil boundaries of alluvial soils than conventional panchromatic photographs. The photographs were in four wavelength bands that approximate Landsat satellite passbands. They showed differences between parent materials and erosion patterns of hill country. Black and white prints of the infrared range produced more information on soil type separation than panchromatic photos, but they were inferior in erosion pattern detection. (Author)

A78-47320 * **Plant canopy light absorption model with application to wheat.** J. E. Chance and E. W. LeMaster (Pan American University, Edinburg, Tex.). *Applied Optics,* vol. 17, Aug. 15, 1978, p. 2629-2636. 14 refs. Grant No. NsG-9033.

A light absorption model (LAM) for vegetative plant canopies has been derived from the Suits reflectance model. From the LAM the absorption of light in the photosynthetically active region of the spectrum (400-700 nm) has been calculated for a Penjamo wheat crop for several situations including (a) the percent absorption of the incident radiation by a canopy of LAI 3.1 having a four-layer structure, (b) the percent absorption of light by the individual layers within a four-layer canopy and by the underlying soil, (c) the percent absorption of light by each vegetative canopy layer for variable sun angle, and (d) the cumulative solar energy absorbed by the developing wheat canopy as it progresses from a single layer through its growth stages to a three-layer canopy. This calculation is also presented as a function of the leaf area index and is shown to be in agreement with experimental data reported by Kanemasu on Plainsman V wheat. (Author)

A78-48005 * **Area estimation of crops by digital analysis of Landsat data.** M. E. Bauer, M. M. Hixson, and B. J. Davis (Purdue University, West Lafayette, Ind.). *Photogrammetric Engineering and Remote Sensing,* vol. 44, Aug. 1978, p. 1033-1043. 18 refs. Contract No. NAS5-20793.

The study for which the results are presented had these objectives: (1) to use Landsat data and computer-implemented pattern recognition to classify the major crops from regions encompassing different climates, soils, and crops; (2) to estimate crop areas for counties and states by using crop identification data obtained from the Landsat identifications; and (3) to evaluate the accuracy, precision, and timeliness of crop area estimates obtained from Landsat data. The paper describes the method of developing the training statistics and evaluating the classification accuracy. Landsat MSS data were adequate to accurately identify wheat in Kansas; corn and soybean estimates for Indiana were less accurate. Systematic sampling of entire counties made possible by computer classification methods resulted in very precise area estimates at county, district, and state levels. P.T.H.

A78-51618 # **Simultaneous microwave and optical wavelength observations of agricultural targets.** F. J. Ahern, D. G. Goodenough, A. L. Grey, R. A. Ryerson, R. J. Vilbikaitis (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and M. Goldberg (Ottawa, University, Ottawa, Canada). *Canadian Journal of Remote Sensing,* vol. 4, Aug. 1978, p. 127-142. 11 refs.

A 13.3 GHz scatterometer and a nadir-viewing radiometer measuring reflected radiance in the Landsat bands were flown simultaneously over a number of fields near Ottawa containing eleven different forage crops. The purpose of the experiments was to compare the relative ability of the optical and microwave sensors to differentiate the various crop types, and to investigate the advantages of combining optical and microwave measurements for crop discrimination. Confusion matrices were calculated for both the optical and the microwave data. Microwave and optical sensors provide complementary information which, when combined, permit the most accurate classifications to be achieved. The better single sensor based on classification accuracy is a multispectral optical sensor. It was found that the most significant features derivable from the scatterometer data were the dual-polarized scattering coefficients at nadir and the linear slopes of the scattering coefficients as a function of observation angle. (Author)

A78-51619 # **Feature subset selection in remote sensing.** D. G. Goodenough, P. M. Narendra, and K. O'Neill (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada; Honeywell, Inc., Minneapolis, Minn.). *Canadian Journal of Remote Sensing,* vol. 4, Aug. 1978, p. 143-148. 5 refs.

Consideration is given to the feature subset selection system as part of the interactive image analysis-display system of the Canada

Centre for Remote Sensing. The branch and bound algorithm for feature subset selection and the feature selection criteria are described. Experimental results are given for applying the algorithm to 12-channel airborne multispectral-scanner data from LARS C-1 flight-line and Landsat data. It is found that multitemporal Landsat imagery yields higher classification accuracies for agricultural crop identification. S.C.S.

A78-53649 **Crop discriminability in the visible and near infrared regions.** V. R. Rao (Indian Space Research Organization, Bangalore, India), E. J. Brach, and A. R. Mack (Agriculture Canada, Research Branch, Ottawa, Canada). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Sept. 1978, p. 1179-1184. 9 refs.

Field spectroradiometer data at 10-nm intervals in the region of 350 to 1840 nm, from 1976 experimental field plots of wheat, oats, barley, fababean, soybean, and rapeseed, were analyzed statistically to assess discriminability among the crops. At early stages of plant growth, interference from soil reflectance was dominant. Analysis of the data obtained between early heading and early seed development showed similar spectral patterns among the crops and their cultivars. Unique differences were obtained among them at certain narrow bands in relation to the over-all mean radiance based on coefficients of variation. An index of discriminability, determined to assess separability of crops throughout the spectrum, was used to distinguish between two wheat cultivars at 950 and 1400 nm which corresponds to the water absorption region for leaves. (Author)

N78-28558 State Univ. of New York, Buffalo.
A PHOTOGRAPHIC REMOTE SENSING SYSTEM FOR THE DETECTION AND QUANTIFICATION OF URBAN TREE STRESS Ph.D. Thesis
Bov Bang Eav 1977 207 p
Avail: Univ. Microfilms Order No. 78-06180

A statistical model was developed to permit quantitative prediction of urban tree stress levels based on spot microdensitometric measurements. Multidate, large scale, 70 mm color and color infrared photography was acquired simultaneously with ground data for 1156 maple trees at four study sites in Syracuse, New York. Results indicated that: (1) broad band microdensitometric data extracted from color infrared photography can be used in some cases to previsually detect the presence of urban tree stress, (2) the multiple regression model developed permitted accurate prediction of quantitative tree stress indices for drought-induced stress, (3) an index expressing tree foliage symptoms was most accurately predicted from the aerial photographic data, (4) color infrared film proved to be superior to normal color film in predicting tree stress symptoms, (5) multiple stress symptom parameters measured on the ground can be combined into a small number of composite stress indices through factor analysis, and, (6) the timing of aerial photography with respect to rainfall and development of stress manifestation accrued on the ability of aerial data to predict drought-related stress. Dissert. Abstr.

N78-28559 Minnesota Univ., Minneapolis.
LANDSAT DIGITAL DATA APPLICATION TO FOREST VEGETATION AND LAND-USE CLASSIFICATION IN MINNESOTA Ph.D. Thesis
Roy Alan Mead 1977 112 p
Avail: Univ. Microfilms Order No. 78-09702

Three methods of accuracy verification were applied to eleven land cover categories mapped from LANDSAT data. As a result, it was quite apparent that the accuracy of mapping land cover on large blocks of land, including transition zones and vegetation type mixtures, gave lower estimates of accuracy than was realized on either training sets or test sets. Evaluation of the various map solutions by experienced field resource management cooperators resulted in the judgment that the classification accuracies were so low as to preclude practical use for their purposes at this time. Dissert. Abstr.

N78-28566*# Academy of Scientific Research and Technology, Cairo (Egypt).
SOIL RESOURCES AND POTENTIAL FOR AGRICULTURAL DEVELOPMENT IN BAHR EL JEBEL IN SOUTHERN SUDAN, JONGLEI CANAL PROJECT AREA
Victor I. Myers, Donald G. Moore, M. A. Abdel-Hady, A. G. Abdel-Samie, E. M. ElShazly, Principal Investigators, Hussein Youvis, B. K. Worcester, A. A. Klingebiel, M. M. ElShazly, M. A. Hamad et al Apr. 1978 189 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (E78-10161; NASA-CR-157279) Avail: NTIS HC A09/MF A01 CSCL 02C

The author has identified the following significant results. Fourteen LANDSAT scenes were used to produce mosaics of the 167, 474 sq km study area. These were black and white MSS 7 images and false color composite images. Five major soil-landscape units were delineated on the mosaics, and these were subdivided into a total of 40 soil mapping units. Aerial reconnaissance was useful in defining boundaries between mapping units and in estimating the proportion of the various soils which composed each mapping unit. Ground surveying permitted first-hand observation of major soils and sampling for quantitative laboratory analysis. Soil interpretations were made, including properties, potentials, and limitations.

N78-28578*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Jan. - 31 Mar. 1978
R. P. Mroczynski, Principal Investigator 20 Mar. 1978 40 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15325)
(E78-10173; NASA-CR-151737) Avail: NTIS HC A03/MF A01 CSCL 02F

N78-29529# British Library Lending Div., Boston Spa (England).
USING A 70-mm STEREO CAMERA SYSTEM WITH LARGE-SCALE PHOTOGRAMMETRIC INTERPRETATION FOR FOREST INVENTORY
B. Rhody 1 Nov. 1977 15 p refs Transl. into ENGLISH from Forstarchiv (West Germany), 48, 4, 1977 p 65-70 In ENGLISH and GERMAN
(FCT-492) Avail: British Library Lending Div., Boston Spa, Engl.

Large scale 70 mm picture format photogrammetry of forests in northern Germany were obtained by using two stereocameras in an aluminum housing installed 4 to 5 m apart on the wing struts of a light aircraft, and a motor-driven small image camera for taking series photographs with stereo overlap. The two cameras were synchronously operated by means of a cable with a simultaneous triggering instrument actuated by the photographer in the aircraft. Measurement data based on the photogrammetric evaluation of the aerial photos are compared with ground data measured on the same sample plots using 35 mm wide angle overview photos. Standard errors in tree height measurement, stem diameters, crown diameters and volume estimates are discussed as well as methods for photointerpretation and data processing. A.R.H.

N78-29534*# National Aeronautics and Space Administration. *Goddard Space Flight Center, Greenbelt, Md.*
ANALYSIS OF THE DYNAMICS OF SHIFTING CULTIVATION IN THE TROPICAL FORESTS OF NORTHERN THAILAND USING LANDSAT MODELING AND CLASSIFICATION OF LANDSAT IMAGERY
Lee D. Miller, Kaew Nualchawee (Colorado State Univ.), and Craig Tom, Principal Investigators (HRB-Singer, Inc., Ft. Collins, Colo.) May 1978 20 p refs Presented at the 12th Intern. Symp. on Remote Sensing of Environment, Manila, Phillipines, 20-28 Apr. 1978 Original contains imagery. Original photography

may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10178; NASA-TM-79545) Avail: NTIS HC A02/MF A01 CSCL 08F

N78-29536*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF WAVELENGTH GROUPS FOR DISCRIMINATION OF AGRICULTURAL COVER TYPES
Ravindra Kumar Apr. 1978 13 p refs Submitted for publication
(Grant NGL-15-005-112)
(NASA-CR-157393; INPE-1210-PE/120) Avail: NTIS HC A03/MF A01 CSCL 02C

Multispectral scanner data in twelve spectral channels, in the wavelength range 0.46 to 11.7 mm, acquired in July 1971 for three flightlines, were analyzed by applying automatic pattern recognition techniques. These twelve spectral channels were divided into four wavelength groups (W1, W2, W3 and W4), each consisting of three wavelength channels -- with respect to their estimated probability of correct classification (P sub c) in discriminating agricultural cover types. The same analysis was also done for the data acquired in August, to investigate the effect of time on these results. The effect of deletion of each of the wavelength groups on P sub C in the subsets of one to nine channels, is given. Values of P sub C for all possible combinations of wavelength groups, in the subsets of one to eleven channels are also given. Author

N78-29537*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECTS OF SYSTEMIC AND NON-SYSTEMIC STRESSES ON THE THERMAL CHARACTERISTICS OF CORN
Ravindra Kumar, L. F. Silva, and M. E. Baer (Purdue Univ.) Jun. 1978 33 p refs Submitted for publication
(Grant NGL-15-005-112)
(NASA-CR-157391; INPE-1282-PE/138) Avail: NTIS HC A03/MF A01 CSCL 02C

Experiments were conducted on corn plants using a calibrated spectroradiometer under field conditions in the indium antimonide channel (InSb, 2.8 to 5.6 mm) and the mercury cadmium telluride channel (HgCdTe, 7 to 14 mm). A ground cover experiment, an experiment on nonsystemic corn plants, and an experiment on systemic-stressed corn plants were included. The average spectral radiance temperature of corn plant populations was found (1) to be statistically significantly different for four healthy corn plant populations, (2) to increase with increased blight severity, and (3) to be statistically significantly different for varying rates of nitrogen applications. J.M.S.

N78-29561# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
CROP FORECASTING BY SATELLITE: PROGRESS AND PROBLEMS Report to the Congress
31 Mar. 1978 37 p refs
(PB-279437/8; PSAD-78-52) Avail: NTIS HC A03/MF A01 CSCL 02B

The progress and problems in research to improve the Department of Agriculture's foreign crop forecasting system are discussed. The experiment uses satellite imagery from LANDSAT to measure how many acres of wheat are growing, and also uses weather data to estimate the yield. GRA

N78-30637*# General Electric Co., Huntsville, Ala. Space Div.
GLOBAL CROP PRODUCTION FORECASTING: AN ANALYSIS OF THE DATA SYSTEM PROBLEMS AND THEIR SOLUTIONS
J. Neiers and H. Graf May 1978 83 p refs
(Contract NAS8-32491)
(NASA-CR-150749; Rept-78HV031) Avail: NTIS HC A05/MF A01 CSCL 02C

Data related problems in the acquisition and use of satellite data necessary for operational forecasting of global crop production are considered for the purpose of establishing a measurable baseline. For data acquisition the world was divided into 37 crop regions in 22 countries. These regions represent approximately 95 percent of the total world production of the selected crops of interest, i.e., wheat, corn, soybeans, and rice. Targets were assigned to each region. Limited time periods during which data could be taken (windows) were assigned to each target. Each target was assigned to a cloud region. The DSDS was used to measure the success of obtaining data for each target during the specified windows for the regional cloud conditions and the specific alternatives being analyzed. The results of this study suggest several approaches for an operational system that will perform satisfactorily with two LANDSAT type satellites. G.G.

N78-30639*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING CORN AND SOYBEAN CROP DEVELOPMENT BY REMOTE SENSING TECHNIQUES
Compton J. Tucker, James H. Elgin, Jr., and James E. McMurtrey, III Aug. 1978 16 p refs
(NASA-TM-79607) Avail: NTIS HC A02/MF A01 CSCL 02C

A system for spectrally monitoring the stages of crop development for corn and soybeans based upon red and photographic infrared spectral radiances is proposed. The red and photographic infrared spectral radiance, highly correlated with the green leaf area index or geen leaf biomass, enable nondestructive monitoring of the crop canopy throughout the growing season. Five distinct periods are apparent which are related to crop development for corn and soybeans. Author

N78-31481*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AUTOMATIC CLASSIFICATION OF REFORESTED PINUS SPP AND EUCALYPTUS SPP IN MOGI-GUACU, SP, BRAZIL, USING LANDSAT DATA
Nelson deJesusParada, Principal Investigator, Y. E. Shimabukuro, P. E. Hernandez, N. F. Koffler, and S. C. Chen Apr. 1978 15 p refs Presented at 12th Intern. Symp. of Remote Sensing of Environment, Malina, Philippines, Apr. 1978 Sponsored by NASA ERTS
(E78-10182; NASA-CR-157372; INPE-1223-PE/125) Avail: NTIS HC A02/MF A01 CSCL 02F

The author has identified the following significant results. Single date LANDSAT CCTs were processed, by Image-100 to classify Pinus and Eucalyptus species and their age groups. The study area Mogi-Guacu was located in the humid subtropical climate zone of Sao Paulo. The study was divided into ten preliminary classes and featured selection algorithms were used to calculate Bhattacharyya distance between all possible pairs of these classes in the four available channels. Classes having B-distance values less than 1.30 were grouped in four classes: (1) class PE - P. elliottii, (2) class PO - Pinus species other than P. elliotii, (3) class EY - Eucalyptus spp. under two years, and (4) class EO - Eucalyptus spp. more than two years old. The percentages of correct classification ranged from 70.9% to 94.12%. Comparisons of acreage estimated from the Image-100 with ground truth data showed agreement. The Image-100 percent recognition values for the above four classes were 91.62%, 87.80%, 89.89%, and 103.30%, respectively.

N78-31483*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INPE'S CROP SURVEY PROGRAM USING COMBINED LANDSAT AND AIRCRAFT DATA
Nelson deJesusParada, Principal Investigator, Getulio Teixeira Batista, Antonio Tebaldi Tardin, Rene Antonio Novaes, Francisco Jose Mendonca, David Chung Liang Lee, and Sherry Chou Chen Jun. 1978 27 p refs Sponsored by NASA ERTS
(E78-10184; NASA-CR-157374; INPE-1289-NTE/124) Avail: NTIS HC A03/MF A01 CSCL 02C

N78-31485*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF LANDSAT DATA TO IDENTIFY AND EVALUATE AREAS OF SUGAR CANE
Nelson deJesusParada, Principal Investigator, Getulio Teixeira Batista, Franciso Jose Mendonca, David Chung Liango Lee, Antonio Tebaldi Tardin, Sherry Chou Chen, and Rene Antonio Novaes Apr. 1978 30 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10186; NASA-CR-157376; INPE-1228-NTE/116) Avail: NTIS HC A03/MF A01 CSCL 02C

N78-31488*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF LANDSAT IMAGERY FOR SOIL SURVEY
Nelson deJesusParada, Principal Investigator, Mario Valerio Filho, Nilton Tocicazu Higa, and Vitor CelsodeCarvalho Apr. 1977 24 p refs Sponsored by NASA ERTS
(E78-10189; NASA-CR-157379; INPE-1012-NTE/082) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. The MSS channels 6 and 7 were considered the best to study the relative tonality of different spectral responses of soils, while channels 5 and 7 were best for natural vegetation, drainage patterns, and land use. Frequency ratio was the recommended index for use when analyzing a drainage pattern quantitatively.

N78-31491*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF LANDSAT DATA TO MONITOR PASTURE PROJECT IN AMAZONIA
Nelson deJesusParada, Principal Investigator, Armando Pacheco dosSantos, and Evlyn Marcia Leao de Moraes Novo Apr. 1977 17 p refs Sponsored by NASA ERTS
(E78-10192; NASA-CR-157382; INPE-1009-NTE/079) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. No differences were found between acreage evaluation by visual and automatic interpretation of LANDSAT images. It was necessary to interpret both channels 5 and 7 to exactly outline the deforested areas. Channel 7 was necessary for the identification of deforested areas in the presence of recently grown natural vegetation, and channel 5 was necessary to identify the deforested areas in the cerrado regions. Automatic interpretation permitted the discrimination between areas with predominant grass coverage and recently grown natural vegetation.

N78-31492*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ASSESSMENT OF THE DAMAGE CAUSED BY THE FROST OF 1975 TO COFFEE AND WHEAT CROPS IN THE NORTHWEST OF THE STATE OF PARANA USING LANDSAT IMAGES WITH AUTOMATIC CLASSIFICATION
Nelson deJesusParada, Principal Investigator, Antonio Tebaldi Tardin, Carlos Vicente Barbieri Palestino, and Claudio Roland Sonnenburg Mar. 1977 15 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10193; NASA-CR-157383; INPE-1007-NTE/078) Avail: NTIS HC A02/MF A01 CSCL 02C

N78-31497*# Commission of the European Communities, Ispra (Italy).
AGRESTE PROJECT: AGRICULTURAL RESOURCES INVESTIGATIONS IN NORTHERN ITALY AND SOUTHERN FRANCE Final Report
A. Berg, Principal Investigator, G. Flouzat, and S. Galli DeParatesi Jun. 1978 176 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10199; NASA-CR-157388) Avail: NTIS HC A09/MF A01 CSCL 02C

The author has identified the following significant results. Recognition of rice varieties at the flowering stage by using airborne scanner data at low altitude (1500 m) seems to be feasible. The accuracies obtained on a reduced test area (3 sq km) range from 65% to 83%. Variations of a single cultural factor, such as nitrogen fertilization, induce variations of the total rice biomass at harvest, which can be correlated closely to the values of the reflectance ratio at earing. When grain production is correlated to total biomass, prediction of yield can be achieved based on reflectance data measured two months before harvest.

N78-31498*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
ANALYTICAL TECHNIQUES FOR THE STUDY OF SOME PARAMETERS OF MULTISPECTRAL SCANNER SYSTEMS FOR REMOTE SENSING
E. R. Wiswell and George R. Cooper, Principal Investigators Jun. 1978 195 p refs EREP
(Contract NAS9-15466)
(E78-10200; NASA-CR-151827; LARS-TR-061778; EE-TR-78-28) Avail: NTIS HC A09/MF A01 CSCL 05B

The author has identified the following significant results. The concept of average mutual information in the received spectral random process about the spectral scene was developed. Techniques amenable to implementation on a digital computer were also developed to make the required average mutual information calculations. These techniques required identification of models for the spectral response process of scenes. Stochastic modeling techniques were adapted for use. These techniques were demonstrated on empirical data from wheat and vegetation scenes.

N78-31499*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
ATLAS OF SELECTED CROP SPECTRA, IMPERIAL VALLEY, CALIFORNIA
Stephen G. Ungar, Principal Investigator, William Collins (Columbia Univ.), Jerry C. Coiner (Columbia Univ.), Dwight Egbert (General Telephone and Electronics), Richard Kiang (General Telephone and Electronics), Tina Cary (Columbia Univ.), Peter Coulter (General Telephone and Electronics), Nurit Landau (General Telephone and Electronics), Elaine Mathews (Columbia Univ.), Stephen Lytle (Columbia Univ.) et al Jun. 1977 195 p refs ERTS
(Contract NAS5-20749; Grants NsG-5080; NGR-33-008-191; NsG-5014)
(E78-10201; NASA-TM-79743) Avail: NTIS HC A09/MF A01 CSCL 02C

N78-31500*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM: PROCEDURE 1 APPLICABILITY TO RANGELAND CLASSIFICATION Final Report
C. A. Reeves, Principal Investigator Jun. 1978 52 p refs EREP
(Contract NAS9-15200)
(E78-10202; NASA-CR-151809; LEC-12174; D-63-1737-5335-02) Avail: NTIS HC A04/MF A01 CSCL 08F

The author has identified the following significant results. An assumption that short prairie grass and salt grass could be differentiated on aircraft photographs was inaccurate for the Weld County site. However, rangeland could be differentiated using procedure 1 from LACIE. Estimates derived from either random or systematic sampling were satisfactory. Level 1 features were separated and mapped, and proportions were estimated with accompanying confidence statements.

N78-31501*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM: TEN-ECOSYSTEM STUDY (TES) SITE 5 REPORT, KERSHAW COUNTY, SOUTH CAROLINA, REPORT 4
R. D. Dillman, Principal Investigator Jun. 1978 68 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15200)
(E78-10203; NASA-CR-151813; LEC-11863) Avail: NTIS HC A04/MF A01 CSCL 13B

The author has identified the following significant results. The Kershaw County site, South Carolina, was selected to be representative of both the oak-pine ecosystem and the southeastern pine ecosystem. The following processing results have concluded that: (1) early spring LANDSAT data provide the best contrast between forest features; (2) level 2 forest features (softwood, hardwood, grassland, and water) can be classified with an accuracy of 70% + or - 5.7% at the 90% confidence level; (3) level 3 species classification was inconclusive; (4) temporal data did not provide a significant increase in classification accuracy of level 2 features, over single date classification to warrant the additional processing; and (5) training fields from only 10% of the site can be used to classify the entire site.

N78-31504*# Houston Univ., Tex.
LINEAR FEATURE SELECTION WITH APPLICATIONS
H. P. Decell, Jr. and L. F. Guseman, Jr., Principal Investigators (Texas A and M Univ., College Station) Jul. 1978 30 p refs EREP
(Contract NAS9-15543)
(E78-10206; NASA-CR-151820; Rept-70) Avail: NTIS HC A03/MF A01 CSCL 02C

N78-31505*# Environmental Research Inst. of Michigan, Ann Arbor.
ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 15 Mar. - 14 Jun. 1978
Richard F. Nalepka, Principal Investigator, Richard J. Kauth, Richard C. Cicone, Peter F. Lambeck, William A. Malila, and John E. Colwell 14 Jun. 1978 130 p refs EREP
(Contract NAS9-15476)
(E78-10207; NASA-CR-151754; ERIM-132400-7-L) Avail: NTIS HC A07/MF A01 CSCL 02C

N78-32525*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RED AND PHOTOGRAPHIC INFRARED LINEAR COMBINATIONS FOR MONITORING VEGETATION
Compton J. Tucker May 1978 37 p refs Submitted for publication
(NASA-TM-79620) Avail: NTIS HC A03/MF A01 CSCL 08F

In situ collected spectrometer data were used to evaluate and quantify the relationships between various linear combinations of red and photographic infrared radiances and experimental plot biomass, leaf water content, and chlorophyll content. The radiance variables evaluated included the red and photographic infrared (IR) radiance and the linear combinations of the IR/red ratio, the square root of th IR/red difference, the vegetation index, and the transformed vegetation index. In addition, the corresponding green and red linear combinations were evaluated for comparative purposes. Three data sets were used from June, September, and October sampling periods. Regression analysis showed the increase utility of the IR and red linear combinations vis-a-vis the same green and red linear combinations. The red and IR linear combinations had 7% and 14% greater regression significance than the green and red linear combinations for the June and September sampling periods, respectively. The VI, TVI, and square root of the IR/red ration were the most significant followed closely by the IR/red ratio. Less than 6% difference separated the highest and lowest of these four IR and red linear combinations. The use of these linear combinations was shown to be sensitive primarily to the green leaf area or green leaf biomass. Author

N78-33507*# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
DEVELOPMENT OF HEAVILY VEGETATED AREA IN BRAZIL [PLANETAMENTO DO PROJETO CERRADO]
Nelson deJesusParada, Principal Investigator, Hideyo Aoki, Joao Roberto dosSantos, and Vitor Celso deCarvalho Jan. 1978 24 p In PORTUGUESE Sponsored by NASA ERTS
(E78-10157; NASA-CR-157268; INPE-1186-NTE/109) Avail: NTIS HC A02/MF A01 CSCL 08F

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.

A78-43337 # **Utilization of Landsat data for ecological studies of the arid zones of Tunisia /the Arzotu experiment/ (Expérimentation sur l'utilisation des données Landsat pour l'étude ecologique des zones arides de Tunisie /expérience Arzotu/).** G. Long, B. Lacaze, G. Deblissche, E. Le Floc'h (CNRS, Centre d'Etudes Phytosociologiques et Ecologiques, Montpellier, France), M. Sta-M'Rad (Institut National de la Recherche Agronomique de Tunisie, Ariana, Tunisia), R. Pontanier, and A. Le Cocq (Office de la Recherche Scientifique et Technique d'Outre-Mer, Paris, France). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 365-375. In French.

Landsat data collected during 1975-1976 have been used in ecological studies conducted in southern Tunisia. Information has been gathered on major surface features, vegetation, and surface soil characteristics. Color-treated imagery has been used to create a zoning system based on homogeneous ecological parameters. S.C.S.

A78-44235 ***The use of Landsat imagery in a land system classification of Jordan.*** C. W. Mitchell (Reading, University, Reading, Berks., England). *British Interplanetary Society, Journal (Remote Sensing)*, vol. 31, Aug. 1978, p. 283-292. 39 refs.

The natural environment of the Hashemite Kingdom of Jordan is discussed in terms of remote sensing observations. Landsat data was used for most of the imaging, whereby information was compiled on a scale of 1:250,000, and published on a scale of 1:1,000,000. Landsat pictures, i.e., color composites, were classified into a system of discrete boundaries with the aid of a Zeiss Jena Interpretoscope. The data (encompassing geology, hydrology, soils, vegetation, and conservation) were checked by on-site ground observations. Attention is given to the morphology and location of the various geological regions, e.g., desert sandstone, upland limestone, lava flows, etc. D.M.W.

A78-44236 **A methodology for employing Landsat data for rural land use surveys in developing countries.** B. F. Lock (Salisbury College of Advanced Education, Adelaide, Australia) and J. L. van Genderen (Fairey Surveys, Ltd., Maidenhead, Berks., England). *British Interplanetary Society, Journal (Remote Sensing)*, vol. 31, Aug. 1978, p. 293-304. 18 refs. Research supported by the University of Sheffield.

A Landsat MSS 1:250,000 survey of Murcia Province, Spain, is presented as an illustration of the usefulness of Landsat data for the mapping of semi-arid regions of developing countries, in general. The methodology of the survey is divided into two parts: pre-operational and operational. The pre-operational phase consists of a formulation of objectives and techniques, with special attention to the development of the classification scheme to be used. The operational phase involves the interpretation of specific data. After Ground Truth has been established, a final map can be produced. D.M.W.

N78-28588# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
GUIDANCE FOR APPLICATION OF REMOTE SENSING TO ENVIRONMENTAL MANAGEMENT. APPENDIX A: SOURCES OF AVAILABLE REMOTE SENSOR IMAGERY
John R. May Mar. 1978 69 p
(DA Proj. 4A7-62720-A-896)
(AD-A053673; WES-INSTR-M-78-2-App-A) Avail: NTIS HC A04/MF A01 CSCL 14/5

Results are presented of a survey conducted to determine the sources, characteristics, and availability of remotely sensed imagery held by various Federal and state governmental organizations. Data presented were collected primarily by direct contact with Federal and state agencies and through extensive examination of published documents. The remote sensor data identified as a result of the survey comprises two principal categories of data: aircraft and satellite imagery. Data collected during the survey is presented and tabulated under eight general headings: agency or organization (sources), type of imagery, range of scales, coverage areas, coverage period and frequency, availability and characteristics of imagery, products available and cost, and procedures for obtaining imagery. Information concerning sources and availability of remote imagery held by commercial, private, and academic organizations is not presented.
Author (GRA)

N78-28655# California Univ., Livermore. Lawrence Livermore Lab.
METHODOLOGY FOR ASSESSING THE POTENTIAL IMPACT ON AIR QUALITY RESULTING FROM GEOTHERMAL RESOURCE DEVELOPMENT IN THE IMPERIAL VALLEY
P. H. Gudiksen, M. C. Axelrod, D. L. Ermak, K. C. Lamson, and R. Lange 17 Oct. 1977 17 p refs Presented at the Intern. Clean Air Conf., Brisbane, Australia, 15-19 May 1978
(Contract W-7405-eng-48)
(UCRL-79388; Conf-780504-1) Avail: NTIS HC A02/MF A01

The installation of a network of air quality stations for characterizing the air quality and atmospheric transport properties in the valley prior to development is discussed. Analyses of geothermal fluids for various gases were performed to evaluate the potential emission rates from future geothermal power plants. The principal pollutant of concern was H2S because of its noxious odor and potential release rate. These estimated source emission rates and the appropriate meteorological measurements were used as input to a three dimensional, atmospheric transport code to estimate the potential changes in air quality that result from various scenarios for development of geothermal power. ERA

N78-30725# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
REMOTE SENSING OF ATMOSPHERIC POLLUTION FROM SPACE
J. E. Harries Apr. 1978 47 p refs
(NPL-QU-44) Avail: NTIS HC A03/MF A01

A brief review is presented of techniques and instruments for remotely sensing pollution in the lowest layers of the earth's atmosphere from an orbiting spacecraft. The associated difficulties and problems including the weakness of pollutant signals; the high intensity of background radiation; scattering and attenuation due to clouds, aerosols and particulate matter; and atmospheric temperature structure anomalies are discussed. Four basic techniques which should be investigated further are discussed. These are laser absorption spectrometer; microwave absorption spectrometer; gas correlation radiometer; and correlation spectrometer. It is concluded that a combination of several sensors may eventually be used in an operational mode and that further studies of these selected areas should be carried out leading to test flights possibly utilizing platforms such as Spacelab and the space shuttle. Author (ESA)

N78-31482*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LANDSAT (MSS): IMAGE DEMOGRAPHIC ESTIMATIONS
Nelson deJesusParada, Principal Investigator and Celina Foresti Nov. 1977 35 p refs Presented at Simposio Internacional de Percepcion Remota Applicada a Demografia y Uso Actual de Tierra, Lapaz, Bolivia, 28-30 Nov. Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10183; NASA-CR-157373; INPE-1151-PE/103) Avail: NTIS HC A03/MF A01 CSCL 05K

The author has identified the following significant results. Two sets of urban test sites, one with 35 cities and one with 70 cities, were selected in the State, Sao Paulo. A high degree of colinearity (0.96) was found between urban and areal measurements taken from aerial photographs and LANDSAT MSS imagery. High coefficients were observed when census data were regressed against aerial information (0.95) and LANDSAT data (0.92). The validity of population estimations was tested by regressing three urban variables, against three classes of cities. Results supported the effectiveness of LANDSAT to estimate large city populations with diminishing effectiveness as urban areas decrease in size.

N78-31486*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF ORBITAL IMAGES AS A BASIS FOR LAND UTILIZATION
Nelson deJesusParada, Principal Investigator, Mario Valerio Filho, Nilton Tocicazu Higa, and Vitor CelsodeCarvalho Jul. 1977 38 p refs In PORTUGUESE; ENGLISH summary ERTS
(E78-10187; NASA-CR-157377; INPE-1054-NTE/091) Avail: NTIS HC A03/MF A01 CSCL 05B

N78-31496*# 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, Principal Investigator Mar. 1977 83 p refs EREP
(E78-10198; NASA-TM-79742; Rept-163) Avail: NTIS HC A05/MF A01 CSCL 05B

N78-31507*# Missouri Dept. of Natural Resources, Rolla.
REMOTE SENSING APPLICATIONS TO MISSOURI ENVIRONMENTAL RESOURCES INFORMATION SYSTEM
Final Report
Robert E. Myers, Principal Investigator 15 Jan. 1978 114 p ERTS
(Contract NAS8-31766)
(E78-10209; NASA-CR-150726) Avail: NTIS HC A06/MF A01 CSCL 05B

N78-32518*# Delaware Univ., Newark. College of Marine Studies.
REMOTE SENSING OF COASTAL POLLUTANTS
V. Klemas, Principal Investigator 1978 2 p Presented at UN Intern. Seminar on the Benefits of Remote Sensing for National Development, Manila, Philippines, 17-19 Apr., 1978 Sponsored by NASA ERTS
(E78-10213; NASA-CR-157586) Avail: NTIS HC A02/MF A01 CSCL 13B

N78-33617*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
QUANTITATIVE MAPPING BY REMOTE SENSING OF AN OCEAN ACID-WASTE DUMP
Craig W. Ohlhorst Oct. 1978 27 p refs
(NASA-TP-1275; L-11927) Avail: NTIS HC A02/MF A01 CSCL 13B

Results from quantitative analysis show that airplane remotely sensed spectral data can be used to quantify and map an acid-waste dump in terms of its particulate iron concentration. These same data, however, could not be used to map the dump in terms of total suspended solids, organic suspended solids, or inorganic suspended solids concentrations. A single-variable equation using the ratio of band 2 (440 to 490 nm) radiance to band 4 (540 to 580 nm) radiance was used to quantify the iron concentration in the acid-waste dump. The acid waste that was mapped varied in age from freshly dumped to 31/2 hr. Particulate iron concentrations in the acid waste were estimated to range up to 1.1 mg/l at a depth of 0.46 m. A classification technique was developed to identify pixels in the data set affected by sun glitter. Author

03
GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A78-43306 # **Digital processing of Landsat data for cartography (Le traitement numérique des données de Landsat pour la cartographie).** J. Beaubien (Ministère des Pêches et de l'Environnement, Centre de Recherches Forestières des Laurentides, Sainte-Foy, Quebec, Canada) and S. J. Daus (California, University, Berkeley, Calif.). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 19-26. 13 refs. In French.

A study has been made to determine the applicability of using Landsat data for the mapping of the forest cover in Quebec, Canada. The two-site study (Anticosti Island and the Laurentian Plateau) was based on photographic records and a mixed classification technique. The Anticosti Island study indicates that various types of forest cover, reforested and nonforested areas, and damaged forest land may be identified. The Laurentian Plateau study indicates that deciduous and coniferous areas may be distinguished along with post-damage stages of development. Factors influencing reflectance are identified as atmospheric conditions (such as the amount of water vapor) and conditions inherent to the ground surface (such as the slope exposure). S.C.S.

A78-43311 # **Evaluation of a semiautomatic interpretation method for the cartography of clearcut zones in the southern James Bay area (Evaluation d'une méthode d'interprétation semi-automatique pour la cartographie des zones de coupe dans le sud du territoire de la Baie James).** P. Laframboise and P. Bedard (Société de Développement de la Baie James, Montreal, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 67-70. In French.

A semiautomatic interpretation method for Landsat data has been used to establish land-occupation and land-use maps in the southern James Bay area. The data included Landsat imagery, aerial photographs, and maps on various scales. Based on the multispectral analyzer display system, which utilizes the maximum likelihood algorithm and the unsupervised classification method, information categories were identified including clearcut zones, upgrowth zones, hardwood regions, resinous regions, peat bogs, and infrastructures. S.C.S.

A78-43319 # **Use of topographic data for land-use land-cover identification by Landsat imagery.** S. I. Solomon (Waterloo, University, Waterloo, Ontario, Canada), A. S. Aggarwal, T. Nazar (Environment Canada, Water Resources Branch, Ottawa, Canada), and T. Chadwick (Ontario Ministry of the Environment, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 158-162. 9 refs.

Landsat imagery has been used along with topographic data for land-use and land-cover identification. Based on the WATMAP software system, slope and slope-orientation data for square grid elements approximately corresponding to pixels are given. The WATMAP data is then superimposed on the Landsat data using an affine transformation. For maize, a distinct correlation is found between reflectance and slope and slope orientation. The technique yields accuracy to within 75-85% for samples of 100 field data per class. S.C.S.

A78-45924 * **Detection of crustal motion using spaceborne laser ranging systems.** M. Kumar and I. I. Mueller (Ohio State University, Columbus, Ohio). *(International Association of Geodesy, International Symposium on Recent Crustal Movements, Palo Alto, Calif., July 25-30, 1977.) Bulletin Géodésique*, vol. 52, no. 2, 1978, p. 115-130. 13 refs. Grant No. NGR-36-008-204.

Laser ranging systems operated from space are capable of detecting motions on earth in the 2-5 cm range. Attention is given to the detection of crustal motion, specifically along the San Andreas fault, and a mathematical model is presented for a geometric mode system consisting of at least five grid and three distant (fundamental) stations to be operated with airborne and spaceborne lasers. The ground stations are designed to operate unattended, and to work in conjunction with Shuttle-based hardware to become operational in 1982. The Shuttle laser ranging system is expected to provide survey data within a period from one to two weeks, with a resurvey capability to be used as required. D.M.W.

N78-29543# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETERMINATION OF VARIOUS TOPOGRAPHIES USING PHOTOGRAPHIC TEXTURE ANALYSIS OF LANDSAT IMAGES [DETERMINACAO DE VARIACOES TOPOGRAFICAS ATRAVES DA ANALISE DE TEXTURA FOTOGRAFICA DE IMAGENS LANDSAT]
Evlyn Marcia Leao DeMoraesNovo and Armando Pacheco DosSantos Jul. 1977 31 p refs In PORTUGUESE; ENGLISH summary
(INPE-1077-NTE/103) Avail: NTIS HC A03/MF A01

The relationship between the texture of LANDSAT images and topographic variation was studied. Topographic data were collected from LANDSAT images and topographic maps. A roughness index was used to represent image texture. This index represents the tonal variation within a 0.5 cm x 0.5 cm grid. Declivity data were collected from topographic maps at different scales to correlate with the roughness index. The obtained results showed the possibility of characterizing topographic conditions by analyzing the texture of LANDSAT images. J.M.S.

N78-29545# Army Engineer Topographic Labs., Fort Belvoir, Va.
NEAR REAL TIME APPLICATION OF DIGITAL TERRAIN DATA IN A MINICOMPUTER ENVIRONMENT
James R. Jancaitis and William R. Moore Apr. 1978 30 p
(AD-A054008; ETL-0142) Avail: NTIS HC A03/MF A01 CSCL 08/2

Two developments have combined to significantly impact the growing number of applications dependent upon digital terrain elevation data, mathematical terrain modeling, and minicomputer growth. Digital representation of terrain form has previously required vast amounts of mass storage with the relatively slow speed data access associated with large databases. A technique has been developed for compact digital storage of elevation data which also decreases the data access times significantly, a polynomial terrain model. Also, the minicomputer industry has been experiencing dramatic increases in the processing speeds and digital storage capabilities along with steadily declining costs. Preliminary results of a recently initiated study into the impact of these developments on utilization of digital terrain elevation data is presented. Author (GRA)

N78-30755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINING CRUSTAL STRAIN RATES WITH SPACE-BORNE GEODYNAMICS RANGING SYSTEM DATA. 1: BASELINE ANALYSIS
Steven C. Cohen and Glenn R. Cook Jun. 1978 28 p refs
(NASA-TM-79565) Avail: NTIS HC A03/MF A01 CSCL 08G

A satellite-borne laser ranging system is proposed that is capable of making highly precise geodetic measurements over baselines ranging from a few tens of kilometers to several hundred kilometers. The precision with which crustal strain rates are derived from measurements made with this system is analyzed by using simple site configurations, intersite distances of about 25-70 kilometers, and measurement programs ranging from a few years to fifteen years. It is concluded that precisions of several parts in 10 to the 9th power per year are achievable. Compared to the expected shear strain rates of about 7 x 10 to the minus 7th power yr/1, this produces very favorable signal-to-noise ratios. G.G.

N78-31489*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TOPOGRAPHIC STUDIES THROUGH TEXTURE IMAGE ANALYSIS OF LANDSAT DATA
Nelson deJesusParada, Principal Investigator, Armando Pacheco dosSantos, and Evlyn Marcia Leao de Moraes Novo Apr. 1977 24 p refs Sponsored by NASA ERTS
(E78-10190; NASA-CR-157380; INPE-1011-NTE/081) Avail: NTIS HC A02/MF A01 CSCL 08B

N78-33503 Kansas Univ., Lawrence.
ECOSYSTEM MAPPING BY INTERPRETATION OF LANDSCAPES FROM SATELLITE IMAGERY Ph.D. Thesis
Donald Lee Williams 1977 221 p
Avail: Univ. Microfilms Order No. 77-28925

Images produced by LANDSAT-1 were interpreted for five test sites. These sites, located in Kansas, Tennessee, Uganda, Western Australia, and Papua, New Guinea, were selected to include a wide range of vegetation and landform types in areas where either direct observations or previously published landscape maps were available. Interpretation techniques employed were adapted from techniques used by human interpreters of conventional aerial photography. A four-point methodology for preparing landscape maps from satellite imagery is proposed. This methodology covers (1) criteria for selection of suitable imagery and procedure for collection of supporting data, (2) consideration of image interpretation techniques most appropriate to this type of mapping, (3) the field survey program, and (4) procedures in the preparation of a finished landscape map. Dissert. Abstr.

N78-33645*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADAR OBSERVATIONS OF A VOLCANIC TERRAIN: ASKJA CALDERA, ICELAND
D. L. Evans 1 Oct. 1978 46 p refs
(Contract NAS7-100)
(NASA-CR-157765; JPL-Pub-78-81) Avail: NTIS HC A03/MF A01 CSCL 08F

Surface roughness spectra of nine radar backscatter units in the Askja caldera region of Iceland were predicted from computer-enhanced like- and cross-polarized radar images. A field survey of the caldera was then undertaken to check the accuracy of the preliminary analysis. There was good agreement between predicted surface roughness of backscatter units and surface roughness observed in the field. In some cases, variations in surface roughness could be correlated with previously mapped geologic units. G.G.

04
GEOLOGY AND MINERAL RESOURCES

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

A78-43310 # **Surficial geology in the Pas area of Manitoba - An application of digital Landsat data.** V. Singhroy (Department of Mines, Resources and Environmental Management, Mineral Resources Div., Winnipeg, Manitoba, Canada) and B. Bruce (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 57-66. 6 refs.

The CCRS-100 system was used to distinguish six large-scale biophysical land categories in the Pas region of Manitoba, Canada: ablation till, black spruce bogs, alluvial deposits, fens, water bodies having a high suspended-sediment content, and shallow marsh and bog lakes. Both supervised and unsupervised techniques were employed. An extensive field program evaluated the Landsat data in order to perform superficial geological mapping. S.C.S.

A78-43331 # **Mapping mine wastes with Landsat images.** H. D. Moore, J. H. Adams, and A. F. Gregory (Gregory Geoscience, Ltd., Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 294-304. 23 refs.

Landsat imagery has been used for mapping mine wastes in Canada including tailings, spoil or transported overburden, slag, and waste rock. The Landsat imagery provides information on the location and area of mine dumps, the percent of vegetative cover, the location and size of mine-related water bodies, the location of deciduous and coniferous cover, and environmental changes with time. The study indicates a total area of mine wastes of 47,233 acres which represents 0.004% of the surface area of Canada. Of this area 46.8% is overburden, 37.3% is tailings, 15.3% is waste rock, and 0.6% is slag. Approximately 14.8% of the wastes have vegetative cover. S.C.S.

A78-43348 # **The use of remote sensing /infrared thermal profiles and photofacsimiles/ for the geological reconnaissance of dam sites - Four specific cases (Emploi de la télédétection - thermographies et photographies en couleurs infrarouges - dans les reconnaissances géologiques de site de barrages: Exemple de quatre cas précis).** L. Caillon, J. C. Gros, Ch. Beliard, and P. Ch. Levêque (Bordeaux I, Université, Talence, Gironde, France). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 516-531. 8 refs. In French.

A78-43639 The geological interpretation of the Tibesti from Landsat-1 imagery /Republic of Chad/ - Explanations regarding the map Tibesti 1:1,000,000 (Geologische Interpretation des Tibesti nach Aufnahmen von Landsat-1 /Republik Tschad/ - Erläuterungen zur Karte Tibesti 1:1,000,000). F. K. List, D. Helmcke, B. Meissner (Berlin, Freie Universität, Berlin, West Germany), G. Pöhlmann (Berlin, Technische Fachhochschule, Berlin, West Germany), and N. W. Roland (Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, West Germany). *Bildmessung und Luftbildwesen,* vol. 46, July 1, 1978, p. 139-145. 40 refs. In German.

The launching of the Landsat-1 satellite in July 1972 made it for the first time possible to obtain on a routine basis repeatable small-scale multispectral pictures of the entire surface of the earth. The great number of geomorphological and photogeological studies conducted in the central part of the Tibesti mountains since 1964 provided an opportunity to use this arid region as a test area for a study concerning the applicability of satellite picture mapping. The objectives of the reported investigation are related to a study of the information provided by a geological satellite picture interpretation involving a scale of 1:1,000,000, taking into account for a comparison aerial-photograph evaluations involving a scale of 1:50,000 and ground-based terrain studies. G.R.

A78-53376 Remote-sensing applications for mineral exploration. Edited by W. L. Smith (Michigan, Environmental Research Institute, Arlington, Va.). Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977. 404 p. $50.

Consideration is given to mineral exploration on the basis of remotely sensed data. Landsat applications are reviewed and the exploration for fossil and nuclear fuels from orbital altitudes is explored. Remote sensing projects for energy development are outlined along with geochemical mapping by spectral ratioing methods. Remote sensing projects in Brazil and India are noted. S.C.S.

A78-53377 Foreseeable energy and mineral resource problems. W. L. Smith (Michigan, Environmental Research Institute, Arlington, Va.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 9-27. 27 refs.

The paper surveys present and anticipated mineral resource requirements noting the U.S. dependence on foreign sources. Projected energy resources are discussed with reference to oil and gas liquids, coal, natural gas, nuclear energy, and geothermal power. Landsat projects in monitoring surface water, soil moisture, snowpack, and for resource mapping are discussed. Remote sensing for nonfuel minerals such as beryllium, cobalt, molybdenum, tungsten, and zinc is considered. S.C.S.

A78-53378 *Gap between raw remote-sensor data and resources and environmental information.* B. F. Grossling and J. E. Johnston (U.S. Geological Survey, Reston, Va.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 28-41.

Attention is given to the economic resources necessary for developing remote sensing projects. Institutional funding for the collection of resource information is discussed. The interpretation of raw remote-sensor data is discussed from the point of view of user orientation. Geological mapping is reviewed noting the choice of map scale and two- versus three-dimensional geology. Oil exploration on the basis of remotely sensed data is considered along with a steel-mill project and an agrarian reform project. S.C.S.

A78-53379 * Summary of Landsat applications and results. E. P. Mercanti (NASA, Goddard Space Flight Center, Communications and Navigation Div., Greenbelt, Md.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 42-72.

A review of applications and results of Landsat projects is presented. Attention is given to the MSS bands, band ratios, and

color composites noting the applications of each in agriculture, forestry and range, water resources, geology, land use, and marine resources. A series of Landsat images is presented noting forest regions, burn scars, vegetated areas, and flood regions. A geological map compiled from an analysis of Landsat imagery is presented along with a strip-mine map also constructed from the data of Landsat images. Landsat data is further discussed with reference to mineral exploration, earthquake-zone investigations, and geothermal surveys. S.C.S.

A78-53380 Remote-sensing applications for mineral resources. W. L. Smith (Michigan, Environmental Research Institute, Arlington, Va.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 73-98. 44 refs.

Five categories have been identified as surficial indicators of possible mineral resources: topography, igneous and volcanic features, lineaments and geological structure, mineralogical-lithological association, and stratigraphic sequence. The characteristics of obscured deposits are discussed noting blind, leached, zoned, and truncated orebodies and ores obscured by post-ore concealment. Remote-sensor data are discussed in terms of the analysis of surface characteristics and the analysis of data products. S.C.S.

A78-53381 * Earth observations from remote-sensing platforms - Outlook. R. S. Houston, R. W. Marrs (Wyoming, University, Laramie, Wyo.), N. M. Short, and P. D. Lowman, Jr. (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 99-156. 61 refs.

Observations of the earth from remote-sensing platforms are discussed noting the NASA Earth Resources Aircraft Program, Earth Resources Technology Satellite program, and the Earth Resources Experiments Package. Techniques for geological mapping are described including automatic mapping, visual interpretation, band selection, radar, band combination, and image enhancement. S.C.S.

A78-53382 * Exploration for fossil and nuclear fuels from orbital altitudes. N. M. Short (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 157-198.

The paper discusses the application of remotely sensed data from orbital satellites to the exploration for fossil and nuclear fuels. Geological applications of Landsat data are described including map editing, lithologic identification, structural geology, and mineral exploration. Specific results in fuel exploration are reviewed and a series of related Landsat images is included. S.C.S.

A78-53383 The role of remote sensing for energy development. J. E. Johnston (U.S. Geological Survey, Office of Energy, Reston, Va.) and F. J. Janza (California State University, Sacramento, Calif.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 199-234. 20 refs.

The application of remote sensing techniques to energy development projects is considered noting the nature of the data collected and the various types of remote sensors available, such as photography devices, infrared scanners, radiometers, and radar systems. Processes for converting sensor data into the necessary form are described including magnification, restoration, image transfer, enhancement, and image coding. Several types of static hardware and image data processors are listed. S.C.S.

A78-53384 Digital enhancement of Landsat MSS data for mineral exploration. R. M. Hord (Institute for Advanced Computation, Falls Church, Va.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 235-250.

The procedure for the digital enhancement of Landsat MSS data for mineral exploration is outlined. Computer-compatible tapes are discussed noting their dynamic range, precision, repeatability, and resolution. Several digital image processing operations are described by means of actual images. They include contrast enhancement, density slicing, digital photomosaic, and logarithmic ratioing. S.C.S.

A78-53385 Geochemical mapping by spectral ratioing methods. R. K. Vincent (Geospectra Corp., Ann Arbor, Mich.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 251-278. 31 refs.

The paper discusses the application of spectral ratioing techniques to geochemical mapping. It is noted that multispectral scanners collecting data in the 0.4-2.5-micron range are particularly important for studying transition-metal ions and that the 8-14-micron region yields information on silicate rock types. Compositional information in image form may be mapped from spectral ratio images from aircraft and satellite scanners. S.C.S.

A78-53386 Landsat applications in the less-developed areas. W. L. Smith (Michigan, Environmental Research Institute, Arlington, Va.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 279-291. 23 refs.

The impact of Landsat programs in less-developed areas is discussed with reference to the preparation of base maps and computer-compatible tapes. A potential exploration procedure is outlined noting the selection of areas for exploration, surveys of geological data, reconnaissance, geological mapping, test drilling, and subsurface exploration. S.C.S.

A78-53387 Analysis of geological structures based on Landsat-1 images. C. E. Brockmann, A. Fernandez, R. Ballón, and H. Claure (Servicio Geológico de Bolivia, La Paz, Bolivia). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 292-317. 16 refs.

Landsat imagery has been used for the analysis of geological structures including anticlinal and synclinal folds, lineaments, fractures, and faults. Structural data may be applied for mineral exploration, the study of thermal springs, and the identification of regions of hydrothermal alteration. S.C.S.

A78-53388 The geological application of Landsat imagery in Brazil. A. C. Corrêa, F. de Mendonça, and C. C. Liu (Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 318-333. 33 refs.

Three areas of Brazil have been chosen for the application of Landsat imagery in geological studies: the Sao Domingos Range, the Pocos de Caldas region, and the area of the Middle Araguaia and Tocantins Rivers. Structural information extracted from the data has been used to evaluate the geological evolution of north-central Brazil and the physical properties of the lithosphere. S.C.S.

A78-53389 **Studies utilizing orbital imagery of India for geology and land use.** R. D. Sharma (Indian Space Research Organization, Bangalore, India), B. N. Raina (Indian Photo Interpretation Institute, Dehra Dun, India), and M. S. Dhanju (Indian Space Research Organization, Space Applications Center, Ahmedabad, India). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 334-362. 11 refs.

Landsat orbital imagery has been used in geological and land-use studies in India. Data have been gathered on drainage patterns, rainfall and water bodies, and drainage density. A land-use classification in the Punjab has been conducted using single-band Landsat images and their quantitative analysis employing electronic image data. A series of Landsat images and corresponding geological maps is presented. S.C.S.

A78-53390 **Environmental monitoring of mineral-related industries.** S. S. Verner (U.S. Environmental Protection Agency, Office of Monitoring and Technical Support, Washington, D.C.). In: Remote-sensing applications for mineral exploration. Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 363-388. 8 refs.

The article surveys the environmental monitoring of mineral-related industries on the basis of remote-sensor data. Attention is given to various imaging systems including camera systems and to the characteristics of various aerial films and radiometers. The remote sensing of air, land, and water quality is discussed. A series of images is presented including those depicting strip mining, oil seepage, thermal and infrared images, radiometric images, and associated thermal contour maps. S.C.S.

N78-28563*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGY OF KHARGA-DAKHLA OASES AREA, WESTERN DESERT, EGYPT, FROM LANDSAT-1 SATELLITE IMAGES
E. M. ElShazly, M. A. Abdel-Hady, I. A. ElKassas, A. B. Salman, H. ElAmin, M. M. ElShazly, and A. A. AbdelMegid, Principal Investigators Apr. 1976 63 p refs Sponsored by NASA Original contains color illustrations ERTS
(E78-10158; NASA-CR-157276) Avail: NTIS HC A04/MF A01 CSCL 08G

N78-28564*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGIC INTERPRETATION OF LANDSAT SATELLITE IMAGES FOR THE QATTARA DEPRESSION AREA, EGYPT
E. M. ElShazly, M. A. Abdel-Hady, M. A. ElGhawaby, S. M. Khawasik, and M. M. ElShazly, Principal Investigators Nov. 1976 100 p refs Sponsored by NASA Original contains color illustrations ERTS
(E78-10159; NASA-CR-157277) Avail: NTIS HC A05/MF A01 CSCL 08G

The author has identified the following significant results. For the first time the regional geological units are given. Faults, fractures, and folds are included, as well as drainage lines which help to visualize the environmental impact of the Qattara project for electric power generation and to assess the regional questions involved in its implementation.

N78-28565*# *Academy of Scientific Research and Technology,* Cairo (Egypt).
SATELLITE MAPPING: REGIONAL GEOLOGY, GEOMORPHOLOGY, STRUCTURE, DRAINAGE AND HYDROLOGY OF BAHR EL JEBEL AREA, JONGLEI CANAL PROJECT AREA, SOUTHERN SUDAN
E. M. ElShazly, M. A. Abdel-Hady, M. A. ElGhawaby, A. B. Salman, I. A. ElKassas, S. M. Khawasik, M. M. Elrakaiby, H. ElAmin, M. M. ElShazly, and W. Iskandar, Principal Investigators Apr. 1978 229 p refs Sponsored by NASA Original contains color illustrations ERTS
(E78-10160; NASA-CR-157278) Avail: NTIS HC A11/MF A01 CSCL 08G

N78-28567*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES
Final Progress Report
M. A. Abdel-Hady, Principal Investigator [1978] 6 p Sponsored by NASA ERTS
(E78-10162; NASA-CR-157280) Avail: NTIS HC A02/MF A01 CSCL 08G

N78-28568*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES
Quarterly Progress Report
M. A. Abdel-Hady, Principal Investigator [1978] 14 p Sponsored by NASA ERTS
(E78-10163; NASA-CR-157281; QPR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

N78-28569*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES
Quarterly Progress Report
M. A. Abdel-Hady, Principal Investigator [1978] 17 p refs Sponsored by NASA ERTS
(E78-10164; NASA-CR-157282; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

N78-28571*# Academy of Scientific Research and Technology, Cairo (Egypt).
APPLICATION OF LANDSAT IMAGERY IN THE GEOLOGICAL AND SOIL INVESTIGATIONS IN THE CONTROL WESTERN DESERT, EGYPT
E. M. ElShazly, M. A. Abdel-Hady, M. M. ElShazly, M. A. ElGhawaby, S. M. Khawasik, A. A. Haraga, S. Sanad, and S. H. Attia, Principal Investigators 1978 10 p refs Presented at 12th Intern. Symp. on Remote Sensing of the Environment, Manila, Philippines, 20-26 Apr. 1978 Sponsored by NASA ERTS
(E78-10166; NASA-CR-157284) Avail: NTIS HC A02/MF A01 CSCL 08G

N78-28572*# *Academy of Scientific Research and Technology,* Cairo (Egypt).
APPLICATION OF LANDSAT SATELLITE IMAGERY FOR IRON ORE PROSPECTING IN THE WESTERN DESERT OF EGYPT
E. M. ElShazly, M. A. Abdel-Hady, M. A. ElGhawaby, and S. M. Khawasik, Principal Investigators 1977 12 p refs Presented

at 11th Intern. Symp. on Remote Sensing of Environment, Michigan, 25-29 Apr. 1977 Sponsored by NASA ERTS
(E78-10167; NASA-CR-157285) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. The delineation of the geological units and geological structures through image interpretation, corroborated by field observations and structural analysis, led to the discovery of new iron ore deposits. A new locality for iron ore deposition, namely Gebel Qalamun, was discovered, as well as new occurrences within the already known iron ore region of Bahariya Oasis.

N78-28573*# Academy of Scientific Research and Technology, Cairo (Egypt).
LANDSAT SATELLITE MAPPING IN EGYPT AND ITS POSSIBLE APPLICATIONS IN PETROLEUM AND NATURAL GAS EXPLORATION
E. M. ElShazly and M. A. Abdel-Hady, Principal Investigators 1977 19 p refs Presented at 10th Arab Petroleum Congr., Tripoli, 19-25 Dec. 1977 Sponsored by NASA ERTS
(E78-10168; NASA-CR-157286) Avail: NTIS HC A02/MF A01 CSCL 08B

N78-28574*# Academy of Scientific Research and Technology, Cairo (Egypt).
REGIONAL PROSPECTING FOR IRON ORES IN BAHARIYA OASIS-EL FAIYUM AREA, EGYPT, USING LANDSAT-1 SATELLITE IMAGES
E. M. ElShazly, M. A. Abdel-Hady, M. A. ElGhawaby, and S. M. Khawasik, Principal Investigators Feb. 1976 63 p refs Sponsored by NASA Original contains color illustrations ERTS
(E78-10169; NASA-CR-157287) Avail: NTIS HC A04/MF A01 CSCL 08G

The author has identified the following significant results. New discoveries of iron deposits were registered as a result of the LANDSAT imagery, and the conditions of the already known iron deposits and occurrences were regionally connected and verified.

N78-28575*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND GROUNDWATER POTENTIAL STUDIES OF EL ISMAILIYA MASTER PLAN STUDY AREA
E. M. ElShazly, M. A. Abdel-Hady, M. M. ElShazly, M. A. ElGhawaby, I. A. ElKassas, A. B. Salman, and M. A. Morsi, Principal Investigators Apr. 1975 58 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10170; NASA-CR-157288) Avail: NTIS HC A04/MF A01 CSCL 08G

N78-28706*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Earth and Space Sciences Div.
COMPUTER IMAGE PROCESSING: GEOLOGIC APPLICATIONS
Michael J. Abrams 1 Jun. 1978 36 p refs
(Contract NAS7-100)
(NASA-CR-157347; JPL-Pub-78-34) Avail: NTIS HC A03/MF A01 CSCL 08G

Computer image processing of digital data was performed to support several geological studies. The specific goals were to: (1) relate the mineral content to the spectral reflectance of certain geologic materials, (2) determine the influence of environmental factors, such as atmosphere and vegetation, and (3) improve image processing techniques. For detection of spectral differences related to mineralogy, the technique of band ratioing was found to be the most useful. The influence of atmospheric scattering and methods to correct for the scattering were also studied. Two techniques were used to correct for atmospheric effects: (1) dark object subtraction, (2) normalization of use of ground spectral measurements. Of the two, the first technique proved to be the most successful for removing the effects of atmospheric scattering. A digital mosaic was produced from two side-lapping LANDSAT frames. The advantages were that the same enhancement algorithm can be applied to both frames, and there is no seam where the two images are joined. Author

N78-29533*# Stanford Univ., Calif. School of Earth Sciences.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator Jul. 1978 2 p ERTS
(Contract NAS5-24479)
(E78-10177; NASA-CR-157272) Avail: NTIS HC A02/MF A01 CSCL 08M

N78-29540# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PROJECT GEOLOGICAL MAP TO THE MILLIONTH SCALE
Athos R. DosSantos, L. C. Chiang, P. R. Meneses, P. Veneziani, U. P. DosSantos, C. E. DosAnjos, E. Crepani, F. S. DoNascimento, M. P. Barbosa, P. R. Martini et al Jul. 1977 13 p In PORTUGUESE; ENGLISH summary
(INPE-1074-NTE/100) Avail: NTIS HC A02/MF A01

Methodologies for the systematic use of remote sensing techniques for regional geological mapping are reported. A large amount of new geological information was obtained permitting a better understanding of structural, tectonic and stratigraphical problems. The results obtained are important for delineating areas of mineral deposits. F.O.S.

N78-29547# Los Alamos Scientific Lab., N. Mex.
GEOTHERMAL RESERVOIR CATEGORIZATION AND STIMULATION STUDY
Harold L. Overton (CER, Inc.) and Robert J. Hanold Jul. 1977 62 p refs
(Contract W-7405-eng-36)
(LA-6889-MS) Avail: NTIS HC A04/MF A01

Analyses of the fraction of geothermal wells that are dry indicate that geothermal reservoirs can be fitted into four basic categories: (1) Quaternary to late Tertiary sediments; (2) Quaternary to late Tertiary extrusives; (3) Mesozoic or older metamorphic rocks; and (4) Precambrian or younger rocks. Failure of geothermal wells to flow economically is due mainly to low permeability formations in unfractured regions. It is the high stress/low permeability category that is most amenable to artificial stimulation by hydraulic fracturing, propellant fracturing, or chemical explosive fracturing. Category (1) geothermal fields are not recommended for artificial stimulation because these younger sediments almost always produce warm or hot water. Most geothermal fields fit into category (2) and in certain cases, possess some potential for stimulation. The Geysers is a category (3) field, and its highly stressed brittle rocks should make this site amenable to stimulation by explosive fracturing techniques. Roosevelt Springs, UT, well 9-1 is in category (4) and is a flow failure. It represents a prime candidate for stimulation by hydraulic fracturing. ERA

N78-30638# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSING APPLIED TO REGIONAL GEOLOGICAL MAPPING IN THE SAO FRANCISCO RIVER AREA M.S. Thesis [SENSORIAMENTO REMOTO APLICADO AO MAPEAMENTO GEOLOGICO REGIONAL: FOLHA RIO SAO FRANCISCO]
Athos Ribeiro DosSantos, Paulo Roberto Meneses, and Ubiratan Porto DosSantos Sep. 1977 181 p refs In PORTUGUESE; ENGLISH summary
(INPE-1111-TPT/064) Avail: NTIS HC A09/MF A01

A working method that permits the integrated interpretation of various available products of remote sensing was developed for LANDSAT 1 multispectral imagery, Project RADAM's radar (SLAR) mosaics, and the black and white and colored multispectral photographs of SKYLAB for regional geological mapping. The two geological provinces considered are the southeastern part of the Parnaiba Sedimentary Basin and an area of Precambrian metamorphic rocks. In the Precambrian area the stratigraphy was changed as follows: the San Marcos formation was extended to Estreito and Boqueirao ranges; the Rio Preto group was differentiated. The existence of two members in the Ipupiara Formation was reconsidered. B.B.

N78-31490*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COLLECTED SUMMARIES OF WORKS DEALING WITH THE APPLICATION OF LANDSAT IMAGERY IN THE SURVEY OF MINERAL RESOURCES
Nelson deJesusParada, Principal Investigator Apr. 1977 25 p Sponsored by NASA ERTS
(E78-10191; NASA-CR-157381; INPE-1010-NTE/080) Avail: NTIS HC A02/MF A01 CSCL 08G

N78-31493*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Apr. - Jun. 1978
Anne B. Kahle and Helen N. Paley, Principal Investigators Aug. 1978 4 p ERTS
(Contract NAS7-100)
(E78-10195; NASA-CR-157385; HCM-028) Avail: NTIS HC A02/MF A01 CSCL 08G

N78-31511*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A STUDY OF ALTERATION ASSOCIATED WITH URANIUM OCCURRENCES IN SANDSTONE AND ITS DETECTION BY REMOTE SENSING METHODS, VOLUME 1
James E. Conel, M. J. Abrams, and A. F. H. Goetz 1 Aug. 1978 261 p refs Prepared for DOE
(Contract NAS7-100)
(NASA-CR-157600; JPL-Pub-78-66-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 08G

The anomalous coloration of altered rocks associated with tabular uranium occurrences in the San Raphael Swell, Utah, and remnants of roll-front type deposits in the Powder River Basin, Wyoming was studied. Field and Laboratory spectral reflectance studies on these uranium deposits or occurrences were carried out and supplemented with mineralogical and chemical analyses to determine the origin of spectral features observed. The principal alteration products are geothite/limonite (Utah deposits) and geothite/limonite and hematite (Wyoming deposits). The principal clay mineral present in the deposits is montomorillonite. Statistical analysis of the field data was performed using a stepwise linear discriminant function analysis computer program that determines which combinations of input wavelength bands provide best separation of specified groupings of data. Altered and unaltered rocks could be repeated with 95% accuracy using spectral data including all wavelength bands. Of the satellite-simulated wavelength region tests, LANDSAT D bands gave the best classification accuracy. A.R.H.

N78-31512*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A STUDY OF ALTERATION ASSOCIATED WITH URANIUM OCCURRENCES IN SANDSTONE AND ITS DETECTION BY REMOTE SENSING METHODS, VOLUME 2
James E. Conel, Michael J. Abrams, and A. F. H. Goetz 1 Aug. 1978 139 p refs Prepared for DOE
(Contract NAS7-100)
(NASA-CR-157601; JPL-Pub-78-66-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 08G

This document contains tabular and graphic data for volume 1. A.R.H.

N78-32517*# Geological Survey, Denver, Colo.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Jun. - 31 Aug. 1978
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Aug. 1978 6 p Sponsored by NASA ERTS
(E78-10212; NASA-CR-157585) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. The proportional and linear relationship between absolute and relative thermal inertia was theoretically evaluated, and a more accurate expression for thermal inertia was proposed. Radiometric and meteorological data from three stations in the Powder River Basin were acquired, as well as 400 miles of low altitude scanner data between July 25-28.

N78-32520*# Geological Survey, University, Ala.
REMOTE SENSING OF STRIPPABLE COAL RESERVES AND MINE INVENTORY IN PART OF THE WARRIOR COAL FIELD IN ALABAMA Final Report
Thomas J. Joiner, Charles W. Copeland, Jr., Donald D. Russell, Francis E. Evans, Jr., C. Daniel Sapp, and Peter A. Boone Jul. 1978 128 p refs
(Contract NAS8-31573)
(NASA-CR-150781) Avail: NTIS HC A07/MF A01 CSCL 08G

Methods by which estimates of the remaining reserves of strippable coal in Alabama could be made were developed. Information acquired from NASA's Earth Resources Office was used to analyze and map existing surface mines in a four-quadrangle area in west central Alabama. Using this information and traditional methods for mapping coal reserves, an estimate of remaining strippable reserves was derived. Techniques for the computer analysis of remotely sensed data and other types of available coal data were developed to produce an estimate of strippable coal reserves for a second four-quadrangle area. Both areas lie in the Warrior coal field, the most prolific and active of Alabama's coal fields. They were chosen because of the amount and type of coal mining in the area, their location relative to urban areas, and the amount and availability of base data necessary for this type of study. J.M.S.

N78-33500 Oregon State Univ., Corvallis.
RELATIONSHIPS OF CLAY MINERALOGY TO LANDSCAPE STABILITY IN WESTERN OREGON Ph.D. Thesis
Ronald David Taskey 1978 234 p
Avail: Univ. Microfilms Order No. 78-11993

Clay fractions of soils from a large number of sites in Oregon's Western Cascades were characterized in order to

determine the relationships of various clay materials to mass movements. Each site was either designated as stable or assigned to one or more of the following categories: debris avalanche, debris flow, slump earthflow, creep. All clay samples were analyzed by X-ray diffraction, and certain selected samples were analyzed by differential thermal analysis and/or electron microscopy. The more stable sites occur either at high elevations, with poorly formed soils having minimal clay development; or at low elevations, with relatively well drained soils containing kaolinite, dehydrated halloysite, chloritic integrades, and microaggregates bound by amorphous materials. Dissert. Abstr.

N78-33504 Dartmouth Coll., Hanover, N.H.
MAPPING ULTRAMAFIC ROCKS BY COMPUTER ANALYSIS OF DIGITAL LANDSAT DATA Ph.D. Thesis
Gerald George Carlson 1978 277 p
Avail: Univ. Microfilms Order No. 7816101

A new algorithm, PROBLYMAP, was developed to classify digital LANDSAT data for the purpose of mapping geology or terrain type. The algorithm assigns to each pixel a set of probabilities belonging to each terrain type. An important feature of this algorithm is that the classification of a pixel is influenced not only by its own probabilities but also by those of its eight adjacent neighbors. The main application of the algorithm was the mapping of the suite of ultramafic and mafic rocks and related sediments in the desert environment of the Oman Mountains, Sultanate of Omán. The resulting classification map shows good agreement with the best ground truth available, which includes a geology map at 1:30,000 and 1:60,000 black and white air photos. Using training sites from three known copper deposits, 180 other gossan zones were identified within the gabbro/basalt sequence. Dissert. Abstr.

N78-33505*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
A STUDY OF THE TYRONE-MOUNT UNION LINEAMENT BY REMOTE SENSING TECHNIQUES AND FIELD METHODS Final Report, 1 Jan. 1976 - 30 Jun. 1977
David P. Gold, Principal Investigator Dec. 1977 65 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-22822)
(E78-10155; NASA-CR-156815) Avail: NTIS HC A04/MF A01 CSCL 08B

The author has identified the following significant results. This study has shown that subtle variations in fold axes, fold form and stratigraphic thickness can be delineated. Many of the conclusions were based on extrapolation in similitude to different scales. A conceptual model was derived for the Tyrone-Mount Union lineament. In this model, the lineament was the morphological expression of a zone of fracture concentrations which penetrated basement rocks and may have acted as a curtain to regional stresses or as a domain boundary between uncoupled adjacent crustal blocks.

N78-33519# Texas Instruments, Inc., Dallas.
MANUAL FOR THE APPLICATION OF NURE 1974-1977 AERIAL GAMMA-RAY SPECTROMETER DATA
D. F. Saunders and M. J. Potts Sep. 1977 184 p
(Contract EY-76-C-13-1664)
(GJBX-13-78) Avail: NTIS HC A09/MF A01

Instructions for the interpretation and application of high-sensitivity aerial gamma-ray spectrometer data in uranium exploration are presented. Particular emphasis is on the first 10 radiometric surveys performed under the National Uranium Resource Evaluation program to map regional distributions of near-surface natural radioelements. The fundamentals of uranium geology and geochemistry along with interpretive approaches which may be used to identify statistically and geochemically significant uranium anomalies and uraniferous provinces are outlined. Follow-up prospecting methods are summarized along with guides to recent literature. Specific suggestions are made as to interpretive approaches and applicable follow-up prospecting procedures tailored to fit the data characteristics and general environment of the aerial gamma-ray spectrometer surveys. ERA

N78-33644*# Arkansas Univ., Fayetteville.
PRELIMINARY GEOLOGIC EVALUATION OF L-BAND RADAR IMAGERY: ARKANSAS TEST SITE Final Report
H. MacDonald and W. P. Waite Nov. 1977 29 p Prepared for JPL
(Contracts NAS7-100; JPL-954697)
(NASA-CR-157761) Avail: NTIS HC A03/MF A01 CSCL 08G

The relatively small angles of incidence (steep depression angles) of the L-band system provide minimal shadowing on terrain back-slopes and considerable foreshortening on terrain fore-slopes which sacrifice much of the topographic enhancement afforded by a more oblique angle of illumination. In addition, the dynamic range of the return from vegetated surfaces is substantially less for the L-band system, and many surface features defined primarily by subtle changes in vegetation are lost. In areas having terrain conditions similar to those of northern Arkansas, and where LANDSAT and shorter wavelength aircraft radar data are available, the value of the JPL L-band imagery as either a complimentary or supplementary geologic data source is not obvious. L.S.

05

OCEANOGRAPHY AND MARINE RESOURCES

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

A78-43315 # **Ocean information and management systems.** L. W. Morley, A. K. McQuillan (Canada Centre for Remote Sensing, Ottawa, Canada), and D. J. Clough (Waterloo, University, Waterloo, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 113-124.

Management systems for ocean surveillance are discussed with reference to satellites, aircraft, ship, data-buoy, and fixed land- and ocean-stages providing multilevel data integration. Areas requiring particular surveillance are identified as renewable resources (e.g., fisheries), nonrenewable resources (e.g., oil, gas, minerals), marine-environment protection, navigation control, and ocean-service activities (e.g., forecasting, rescue). Various data-generating subsystems are outlined such as sensors (including synthetic aperture radar), telemetry methods to transmit data from sensors to receivers, and commercial networks for electronic data distribution. Cost-effective aspects of mixed surveillance systems are considered along with predicted gross benefits for environmental surveillance systems to the year 2000. S.C.S.

A78-43320 # **Thermal studies of the Grand Banks Gulf Stream slope using airborne radiation thermometers and satellite data.** H. G. Ketchen (International Ice Patrol, Governors Island, N.Y.), P. E. La Violette (U.S. Navy, Naval Ocean Research and Development Activity, Bay St. Louis, Miss.), and R. D. Worsfold (Newfoundland, Memorial University, St. John's, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 163-179. 19 refs.

Three sources of thermal infrared data on the Grand Banks Gulf Stream slope are discussed: NOAA satellite data, airborne radiation thermometer data, and sea-surface temperature data as recorded by ships. Two correction techniques to account for atmospheric attenuation are evaluated: the Pickett method which uses a correction equation derived by multiple regression, and the atmospheric environment service method which determines instrument drift, plots an environmental correction graph, and applies a correction factor for errors due to the water vapor mass below the aircraft. It is concluded that the correlation of the three data sources constitutes a feasible method for determining iceberg deterioration rates. S.C.S.

A78-43324 # **Diurnal temperature variations and their usefulness in mapping sea ice from thermal infrared imagery.** J. Cihlar and K. P. B. Thomson (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 208-219. 12 refs.

An 8-14-micron thermal infrared scanner and a PRT-5 were flown at 390 m at sunset and in the afternoon over the Beaufort Sea in order to measure ice surface temperature changes. The scanner magnetic tape was used to produce a black and white transparency of the recorded and reference signals. A gray level stepwedge was used to relate film density to voltage and surface temperature. It was found that solar radiation dominates the surface temperature distribution during the afternoon. The surface temperature patterns at sunset reflected the spatial thermal resistivity fluctuations of ice-snow thickness combinations. The difference between measured temperatures represents the combined effect of solar radiation and heat passing upward from the ice-water boundary. It is observed that daytime or nighttime surface temperature distributions may be useful in mapping from high-resolution thermal infrared imagery. S.C.S.

A78-43339 # **Microwave sensing of sea surface wave patterns.** J. F. R. Gower (Institute of Ocean Sciences, Victoria, British Columbia, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 395-406. 5 refs.

Sea-surface wave patterns in the northeast Pacific have been monitored by the GEOS-3 altimeter and airborne synthetic aperture radar. Waveheight values obtained from the altimeter are compared to surface truth measurements and weather reports. An accuracy to within plus or minus one meter is found. When the measurements are processed by a technique based on a pulse-variation model and which compensates for timing and tracking loop errors, accuracy to within 0.5 meter is found. S.C.S.

A78-43340 # **A joint topside-bottomside remote sensing experiment on Arctic sea ice.** P. Wadhams (Scott Polar Research Institute, Cambridge, England) and R. T. Lowry (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 407-423. 16 refs. Contract No. N00014-76-C-0660.

The ice cover on the Arctic Ocean has been studied simultaneously from above by laser and from below by sonar in order to determine the relationship between the distributions of ridge height and keel draft. Results are presented for rms keel drafts as a function of the mean number of keels per km of track, the probability density function of ice drafts from the first 270 km of track, the probability density function of ice drafts from 90-km sections of track, and the distribution of surface ridge heights. S.C.S.

A78-43343 # **Radar techniques in the measurement of floating ice thickness.** R. H. Goodman, E. Outcalt, and B. B. Narod (Innovative Ventures, Ltd., Calgary, Alberta, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 459-468. 8 refs. Research supported by the National Research Council of Canada.

Two models of airborne downward looking radars have been used to measure sea ice thicknesses. An experimental 36 cm high power directional radar developed at the University of British Columbia, and a GSSI 'ESP' radar were mounted on a Puma helicopter to measure ice thicknesses off of the Labrador coast. The capabilities of each system were investigated to measure sea ice thickness. The 36 cm radar's capabilities were studied with particular application to thick multiyear ice and iceberg measurements, while

the GSSI radar's capabilities were investigated with emphasis on the measurement of thinner ice, below the minimum range of the 36 cm radar. Typical data will be presented and analyzed. (Author)

A78-43346 # **On the analysis of airborne synthetic aperture radar imagery of the ocean.** R. T. Lowry, D. G. Goodenough (Canada Centre for Remote Sensing, Ottawa, Canada), J. S. Zelenka, and R. A. Shuchman (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings.
Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 480-505. 25 refs.

Using the ERIM optical/digital data correlator, synthetic aperture radar (SAR) imagery has been used for studies of the ocean. Procedures for correcting radar data for geometric distortion and radiometric nonuniformity of imagery are outlined. The influence of wave train movement on the design of a Seasat correlator is evaluated. Techniques for calculating the two-dimensional Fourier transform of an SAR image are presented along with the necessary radar parameters for specific surveillance tasks. These tasks include deep-water waves, in-shore waves and the surf zone, and ships located in at least 10 m of water. Wave-imaging mechanisms are described with reference to a velocity modulation model, radar cross-section models, and the tangent plane model. S.C.S.

A78-43349 # **A method for the remote measurement of the vertical distribution of phytoplankton in seawater.** J. F. R. Gower and R. A. Neville (Institute of Ocean Sciences, Victoria, British Columbia, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings.
Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 532-542. 16 refs.

A78-43350 # **Remote sensing of chlorophyll - A new experimental approach to the problem (Télédétection de la chlorophylle - Une nouvelle approche expérimentale du problème).** P. Y. Deschamps, P. Lecomte, and M. Viollier (Lille I, Université, Villeneuve d'Ascq, Nord, France). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 543-548. 9 refs. In French. Research supported by the Muséum National d'Histoire Naturelle.

A radiometer has been designed for the remote sensing of ocean color in order to determine chlorophyll content. Upwellings and downwellings are simultaneously measured at 466, 525, 550, and 600 nm. Calculations of albedo differences at two wavelengths are used to relate ocean color to optical characteristics and to eliminate distortions caused by surface reflection and atmospheric disturbances. Color variations are noted to be related to the cycle of coastal upwellings. Experiments indicate that factors such as the vertical gradients of phytoplankton, water turbidity, and the discontinuity of chlorophyll content relative to depth influence the results. S.C.S.

A78-43638 **The problem of remote sensing of substances in water using a multispectral scanner (Zum Problem der Fernerkundung von Substanzen im Wasser mit dem Multispektralabtaster).** R. Doerffer (Hamburg, Universität, Hamburg, West Germany). *(Symposium über Flugzeugmessprogramm, Technische Universität Hannover, Hanover, West Germany, Aug. 29-31, 1977.) Bildmessung und Luftbildwesen,* vol. 46, July 1, 1978, p. 133-138. 8 refs. In German.

An important objective of remote sensing in the case of marine investigations is related to a mapping of substances found in the water close to the surface of the sea. The employment of the multispectral scanner as measurement device provides information regarding the type and concentration of a substance on the basis of the spectrum of the radiation which is reflected by the water. In accordance with their optical characteristics, the substances to be studied can be divided into three groups, including dissolved organic substances, suspended matter, and phytoplankton. Attention is given to signal sources, the dependence of the wanted signal on the concentration of the substances, and the effect of disturbing signal sources. G.R.

A78-47084 **Extraction of rich-plankton area off the northern Japan from Skylab multispectral pictures.** K. Watanabe (Tokai University, Shimizu, Japan). In: International Symposium on Space Technology and Science, 12th, Tokyo, Japan, May 16-20, 1977, Proceedings. Chofu, Tokyo, National Aerospace Laboratory, 1977, p. 611-616.

A78-47196 * **Ice sheet topography by satellite altimetry.** R. L. Brooks (EG & G Washington Analytical Services Center, Inc., Pocomoke City, Md.), W. J. Campbell (U.S. Geological Survey, Tacoma, Wash.), R. O. Ramseier (Department of the Environment, Ottawa, Canada), H. R. Stanley (NASA, Wallops Flight Center, Wallops Island, Va.), and H. J. Zwally (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Nature,* vol. 274, Aug. 10, 1978, p. 539-543. 20 refs.

The measured time between the transmission and return of 13.9 GHz radar pulses from the GEOS 3 satellite (at a mean altitude of 844.5 km and an inclination of 114 deg 52 min) is used to determine the thickness of the Greenland ice cap, with an accuracy in surface elevation on the order of 2 m. Attention is given to changes in ice thickness as an indicator of climatic change in general, and change in mean sea level in particular. Each elevation data point obtained by the satellite represents an average along 0.67 km of ground track, and three-dimensional maps are presented to illustrate the data. D.M.W.

A78-47498 **The microprocessor in measurement data acquisition (Der Mikroprozessor in der Messdatenerfassung).** J. Rathlev. *Elektronik,* vol. 27, Aug. 1978, p. 53-58. 5 refs. In German.

The use of a microprocessor for data acquisition and preprocessing is described and illustrated by the example of a microprocessor-controlled shipborne ocean probe system that measures ocean depth, temperature, electrical conductivity, optical attenuation, and speed of sound. The system makes use of peripheral equipment including a digital magnetic tape unit, X-Y-plotter, numerical display, and printer. The basic hardware of the system consists of a microprocessor 8080 with 3 K PROM and 1 K RAM. The structure of the multiprobe service routine is shown, and programs for calculating polynomials, salinity, and tangents are given. P.T.H.

A78-48525 # **Maritime geophysical exploration: Elements of the theory of electromagnetic methods (Morskaia geofizicheskaia razvedka: Elementy teorii elektromagnitnykh metodov).** V. I. Gordienko. Kiev, Izdatel'stvo Naukova Dumka, 1978. 164 p. 132 refs. In Russian.

The book deals with questions associated with the development of a theory that may serve as a basis for designing maritime stations of electromagnetic geophysical exploration. A new theory, based on the consideration of the slow motion of the sea, is proposed, and its range of applicability is identified. Theories are developed from contactless magnetic-field emitters and for the contactless measurement of low-frequency electric fields. Promising system geometries are analyzed. The generalized properties of electric fields are formulated, and possible means of reproducing them are discussed. V.P.

A78-48740 **Airborne remote sensing experiment /ocean temperature and color/ in the Straits of Dover (Expérience aéroportée de télédétection /température et couleur de la mer/ dans le détroit du Pas-de-Calais).** M. Viollier, P. Lecomte (Lille I, Université,

Villeneuve d'Ascq, Nord, France), M. Bougard, and A. Richard (Institut de Biologie Maritime et Régionale, Wimereux, Pas-de-Calais, France). *Oceanologica Acta,* vol. 1, July 1978, p. 265-269. 9 refs. In French. Research supported by the Conseil Régional du Nord Pas-de-Calais and Ministère de la Culture et de l'Environnement.

Airborne remote sensing measurements were compared with sea truth measurements of water temperature, chlorophyll content, and Secchi depth in the Straits of Dover, and the two sets of measurements are found to be in good agreement. The remote sensing measurements were obtained by an aircraft flying at 150 m; infrared radiometry determined the surface temperature, and the reflectivities at 466, 525, 550, and 600 nm provided information on the presence of phytoplankton and sediments. It is concluded that aerial measurements can be used to describe the coastal gradient of hydrobiological properties in the strait. M.L.

A78-48900 Colour, ultraviolet absorbance and salinity of the surface waters off the west coast of Ireland. E. C. Monahan and M. J. Pybus (University College, Galway, Ireland). *Nature,* vol. 274, Aug. 24, 1978, p. 782-784. 9 refs.

Measurements of water color and of various chemical, biological, and physical properties were obtained at 73 hydrographic stations in Galway Bay and other waters off the west coast of Ireland during the late summer and autumn of 1977, and a strong correlation was found between color and surface salinity and also between color and the concentration of dissolved organic matter. The data were obtained in accord with a version of the 'sea-truth' protocol adopted for an earlier 'Ocean Color Scanner' experiment, and the results suggest that images transmitted by this multispectral scanner could help identify and delineate runoff-influenced waters. Techniques for determining water color are discussed, and a positive correlation between summed UV absorbance of a surface sample and the 'yellowness' (presumably representing humic materials introduced by freshwater flowoff) of the surface sample is considered. M.L.

A78-49112 Effect of sea-state on the performance of laser fluorosensors. D. M. Rayner, M. Lee, and A. G. Szabo (National Research Council, Div. of Biological Sciences, Ottawa, Canada). *Applied Optics,* vol. 17, Sept. 1, 1978, p. 2730-2733. 9 refs. Research supported by the Department of Energy, Mines and Resources of Canada.

A description is presented of the theoretical effect of an inclined target on the measurements made by both steady-state (spectral) and time-resolved laser fluorosensors. The considered theory is used in conjunction with existing oceanographical information on waves to estimate the extent of the sea-state error and hence to predict the restrictions placed on fluorosensing by the sea-state. In theory the sea-state will effect the performance of laser fluorosensors. However, it is found that for spectral measurements the effect is negligible for the sea-states to be expected in deep water. For temporal measurements the instrument response is distorted, but if the full width at half maximum technique is used for deconvolution no significant extra error is introduced above those already associated with the technique. G.R.

A78-49436 * # Remote sensing of sea state by analysis of backscattered microwave phase fluctuations. S. F. Clifford and D. E. Barrick (NOAA, Wave Propagation Laboratory, Boulder, Colo.). *IEEE Transactions on Antennas and Propagation,* vol. AP-26, Sept. 1978, p. 699-705. 13 refs. NASA Order P-67583-G.

The relative phase of a normally incident microwave signal scattered off the sea surface is a random function of space and time. The statistics of these random phase fluctuations contain information about the wave-height statistics. This study demonstrates that the wave-height spectra can be deduced directly in terms of the spectra of the phase fluctuations without recourse to inversion techniques even when surface roughness exceeds many wavelengths of the incident signal. In the particular case of a nadir-directed satellite-mounted microwave source operating in the backscatter mode, the wave-height and phase spatial spectra are proportional with a constant proportionality of (2k0) squared, where k0 is the wavenumber of the scattered signal. (Author)

A78-49651 Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volumes 1 & 2. Conference sponsored by the Institute of Electrical and Electronics Engineers and Marine Technology Society. New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977. Vol. 1, 367 p.; vol. 2, 422 p. Price of two volumes, members, $26.25; nonmembers, $35.

Papers are presented on buoy systems, microprocessors for ocean-related matters, undersea vehicles, floating industrial complexes, satellite (NOAA and Landsat) imagery data acquisition and processing, applications of underwater acoustics in the ocean, port operations, diving technology and operations, underwater optics, and university programs in marine studies. Consideration is also given to environmental effects on marine biota, automated measurement techniques, technical training of marine manpower, tanker operations, cables and connectors, component reliability, marine water quality, marine navigation and control systems, ocean thermal energy conversion, environmental aspects of offshore petroleum development, and safety aspects of ship operations. B.J.

A78-49652 Remote ocean environmental data acquisition. L. Livingston, R. Roten (NOAA, Data Buoy Office, Bay St. Louis, Miss.), G. Haas, and R. Mueller (Sperry Rand Corp., Bay St. Louis, Miss.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977, p. 2A-1 to 2A-9. 8 refs.

Since the summer of 1971, the NOAA Data Buoy Office has deployed numerous environmental moored data buoys with automated data acquisition and over-the-horizon telemetry features. Initially the data link requirements were successfully met by judicious implementation of on-board HF communications and cooperative shore stations. This paper reviews the orderly transition of the data buoy system from HF to satellite communications. The various phases of satellite communications from testing to operational confidence and finally to full operational satellite mode are described. Analyses of data defining satellite communication performance in terms of link reliability and data quality are considered, and data acquisition and telemetry implementation are discussed with a view towards assisting potential satellite link subscribers in scoping out their system. B.J.

A78-49653 Survey of NOAA satellite data availability from Environmental Data Service. G. W. Hunolt (NOAA, Satellite Data Service Branch, Washington, D.C.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977, p. 9A-1 to 9A-4.

Descriptions are given of the major types of satellite oceanographic data available from the Satellite Data Services Branch of the Environmental Data Service's National Climatic Center, with the services available in each case noted. Consideration is given to: (1) scanning radiometer and very high resolution radiometer data from the polar-orbiting ITOS/NOAA satellites, (2) VISSR GOES products, (3) Landsat products, (4) DMSP data, and (5) Skylab products. Other major types of data to be available in the near future from TIROS-N, Seasat-A, and Nimbus-G CZCS are also described. B.J.

A78-49656 Recent progress in earth satellite data applications to marine activities. E. P. McClain (NOAA, National Environmental Satellite Service, Washington, D.C.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 1.
New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, DC., Marine Technology Society, 1977, p. 14A-1 to 14A-8. 27 refs.

SR and VHRR data from the NOAA polar-orbiting satellites and VISSR data from GOES are being used in a variety of ocean-oriented activities, including sea surface temperature mapping, sea ice monitoring, and detection of ocean currents and upwelling. New techniques of image and digital data processing, including time-lapse methods, have been developed recently. Landsat multispectral imagery has been used to demonstrate the feasibility of detecting ocean-scene color variations associated with such factors as water depth, sediment load, and chlorophyll concentration. The next Nimbus spacecraft is to carry the Coastal Zone Color Scanner, a sensor system developed specifically for these tasks. B.J.

A78-49657 * Detection and interpretation of ocean roughness variations across the Gulf Stream inferred from radar cross section observations. D. E. Weissman (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.; Hofstra University, Hempstead, N.Y.) and T. W. Thompson (California Institute of Technology, Jet Propulsion Laboratory; Science Applications, Inc., Pasadena, Calif.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977, p. 14B-1 to 14B-10. 14 refs. Contract No. NAS7-100.

Radar cross section data shows that the Gulf Stream has a higher cross section per unit area (interpreted here as a greater roughness) than the water on the continental shelf. A steep gradient in cross section was often seen at the expected location of the western boundary. There were also longer-scale (10-20 km) gradual fluctuations within the stream of significant magnitude. These roughness variations are correlated with the surface shear stress that the local wind imposes on the sea. Using the available surface-truth information concerning the wind speed and direction, an assumed Gulf Stream velocity profile, and high-resolution ocean-surface temperature data obtained by the VHRR onboard a NOAA-NESS polar-orbiting satellite, the present study demonstrates that the computed surface stress variation bears a striking resemblance to the measured radar cross-section variations. B.J.

A78-49658 Monitoring the effects of Gulf Stream meanders and eddys on the New England fishing grounds. J. L. Chamberlin (NOAA, National Marine Fisheries Service, Narragansett, R.I.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977, p. 14D-1 to 14D-7. 12 refs.

The effect of Gulf Stream meanders and eddies on the New England fishing grounds include: direct warming of the bottom on the outer shelf and upper slope, injection of warm water onto the shelf, entrainment of water off the shelf, and increases in currents. This paper describes National Marine Fisheries Service program for monitoring these effects. The program has two parts: (1) the utilization of IR-radiometer imagery from NOAA satellites and weekly interpretation of this imagery in order to observe the location, movement, and size of meanders and eddies as they appear on the sea surface; and (2) since satellite imagery is limited to the sea surface, the observation of these Gulf Stream effects from aboard ship. B.J.

A78-49665 U.S. Coast Guard utilization of remote sensing techniques for ocean surveillance. J. R. White, D. R. Freezer, and R. R. Vollmers (U.S. Coast Guard, Washington, D.C.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 2.
New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977, p. POSTER-E-1 to POSTER-E-4.

The United States Coast Guard performs a number of missions, including pollution surveillance, search and rescue, ice reconnaissance, and enforcement of laws and treaties, which require large scale ocean surveillance. This paper describes several airborne remote sensing systems used by the Coast Guard. Particular attention is given to AOSS II, a system which includes side-looking radar, IR/UV line scanner, aerial reconnaissance, and passive microwave imager, and the Aireye system which includes all the sensors of AOSS II except the passive microwave imager. B.J.

A78-49667 Remote multispectral imaging for nearshore bathymetry. C. B. Koesy and M. T. Cooper (U.S. Navy, Naval Coastal Systems Laboratory, Panama City, Fla.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 2. New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977, p. POSTER-H-1 to POSTER-H-4. 5 refs.

Simultaneous signatures of nearshore bottoms have been obtained using multispectral scanning sensors in a low altitude aircraft and in the Landsat 2 Satellite. The signatures were taken in nearshore environments ranging from an ocean front to the shallow waters of an enclosed bay. The water turbidity had absorption coefficients ranging from 0.15 to 1.60 and scattering coefficients ranging from 0.07 to 0.87. Using points of known depth the signatures have been analyzed by means of a simple algorithm to establish depth at a large number of other points in the scene. Lines of these points have been compared to transects obtained by a precision acoustic fathometer. The low altitude aircraft results demonstrate potential capability for accurate mapping of nearshore bottoms where the bottom reflectances are reasonably consistent. The technique is also useful on multispectral signatures obtained from Landsat satellites although the areal resolution is less by a factor of approximately 700 and the mapping results are more subject to degradation by cloud cover.
(Author)

A78-49759 # Estimate of suspension and chlorophyll concentrations in the sea from the spectrum of the emerging radiation measured from a helicopter (Otsenka kontsentratsii vzvesi i khlorofilla v more po izmeriaemomu s vertoleta spektru vykhodiashchego izlucheniia). V. N. Pelevin (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR). *Okeanologiia,* vol. 18, May-June 1978, p. 428-434. 16 refs. In Russian.

A78-51544 # **A multifrequency radiometer system.** N. Skou (Danmarks Tekniske Hojskole, Lyngby, Denmark). In: European Microwave Conference, 7th, Copenhagen, Denmark, September 5-8, 1977, Proceedings. Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd., 1978, p. 419-423.

A radiometer system having four channels, 5 GHz, 17 GHz, 34 GHz, all vertical polarization, and a 34-GHz sky horn, is described. The system, which is designed for collecting glaciological and oceanographic data, is intended for airborne use, and imaging is achieved by means of a multifrequency conically scanning antenna. Implementation of the noise-injection technique ensures the high absolute accuracy needed for oceanographic purposes. The collected data can be preprocessed in a microcomputer system and displayed in real time. Simultaneously, the data are recorded digitally on tape for more elaborate processing later, using ground facilities. In conjunction with a side-looking radar which is under development at present, the radiometers are intended as the remote-sensing basis for an all-weather ice reconnaissance service in the Greenland seas. (Author)

A78-51620 # **An interactive correction and analysis system for air-borne laser profiles of sea ice.** R. T. Lowry (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada) and C. J. Brochu (Defence Research Establishment, Ottawa, Canada). *Canadian Journal of Remote Sensing*, vol. 4, Aug. 1978, p. 149-160. 14 refs.

A78-52151 **Chapman Conference on Oceanic Fronts, New Orleans, La., October 11-14, 1977, Proceedings.** Conference sponsored by AGU, AMS, and U.S. Navy. *Journal of Geophysical Research*, vol. 83, Sept. 20, 1978. 222 p.

A study is made of sea-surface temperature fronts by means of environmental satellites with particular attention to the winter cycle in the northeastern Gulf of Mexico. Climatic features of the Antarctic Polar Front Zone are considered along with front overlaying of the continental slope in the eastern Bering Sea and scales of motion in the subtropical convergence zone. Fronts on the continental shelf are evaluated and tidal fronts on the shelf seas around the British Isles are examined. Papers are presented on wind effects on the surface to bottom fronts, a model of narrow jets in a zonal ocean, and asymmetric disturbances in the frontal zone of a Gulf Stream ring. Heat and mass transport processes in subsea permafrost are outlined and short-term variability in the bottom boundary layer of the deep ocean is reported. S.C.S.

A78-52152 # **A survey of worldwide sea surface temperature fronts detected by environmental satellites.** R. Legeckis (NOAA, National Environmental Satellite Service, Washington, D.C.). *(AGU, AMS, and U.S. Navy, Chapman Conference on Oceanic Fronts, New Orleans, La., Oct. 11-14, 1977.) Journal of Geophysical Research*, vol. 83, Sept. 20, 1978, p. 4501-4522. 55 refs.

Data from environmental satellites have been used to evaluate worldwide sea-surface temperature fronts. The VHRR images from the NOAA polar-orbiting satellites are described with reference to the dates and location of data collection. The data are discussed in terms of the effects of noise in the infrared images, limitations to data collection due to seasonal variability, cloud cover, and atmospheric attenuation. Procedures for image enhancement and geometric corrections are outlined. Images are presented and discussed for a series of specific geographical locations. S.C.S.

A78-52153 **Winter cycle of sea surface thermal patterns, northeastern Gulf of Mexico.** O. K. Huh, W. J. Wiseman, Jr., and L. J. Rouse, Jr. (Louisiana State University, Baton Rouge, La.). *(AGU, AMS, and U.S. Navy, Chapman Conference on Oceanic Fronts, New Orleans, La., Oct. 11-14, 1977.) Journal of Geophysical Research*, vol. 83, Sept. 20, 1978, p. 4523-4529. 8 refs. Navy-sponsored research.

During the winter of 1976-1977 a time series of NOAA satellite data was obtained which documented the seasonal cycle of sea surface temperatures. Data were obtained as both marine-enhanced images and computer compatible tapes. Fall cooling initially affected only the lakes and estuaries. A band of cold inner shelf waters then formed along the coast. This expanded seaward to the shelf break as the winter season progressed. At the extreme of winter cooling, two major thermal fronts remained: one near the shelf edge, separating the shelf from deep gulf surface waters, and the other the cyclonic boundary of the Loop Current. The onset of spring warming was indicated by an increase in surface temperatures in the shallow inshore areas. The seasonal cycle was completed with the formation of nearly isothermal surface waters throughout the region, a condition characteristic of the summer season. (Author)

A78-52155 **Estimation of rates of frontogenesis and frontolysis in the North Pacific Ocean using satellite and surface meteorological data from January 1977.** G. I. Roden (Washington, University, Seattle, Wash.) and D. F. Paskausky (U.S. Navy, Office of Naval Research, NSTL Station, Miss.). *(AGU, AMS, and U.S. Navy, Chapman Conference on Oceanic Fronts, New Orleans, La., Oct. 11-14, 1977.) Journal of Geophysical Research*, vol. 83, Sept. 20, 1978, p. 4545-4550. 11 refs. Contract No. N00014-75-C-0502.

A simple prognostic model based on Ekman dynamics and available satellite sea surface temperature and wind data is used to estimate rates of frontogenesis and frontolysis in the central North Pacific in the winter of 1977. The computed patterns and rates are compared to those sensed by satellite, and reasonable agreement is found. In the subtropical region, frontogenetic and frontolytic bands tend to occur in pairs, an occurrence which is attributed to a wind stress maximum over the area. Typical observed frontogenetic rates are 0.5-1 deg C/100 km per week. The computed rates underestimate the observed ones. (Author)

A78-52158 **Scales of motion in the subtropical convergence zone.** A. Leetmaa (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla.) and A. D. Voorhis (Woods Hole Oceanographic Institution, Woods Hole, Mass.). *(AGU, AMS, and U.S. Navy, Chapman Conference on Oceanic Fronts, New Orleans, La., Oct. 11-14, 1977.) Journal of Geophysical Research*, vol. 83, Sept. 20, 1978, p. 4589-4592. 8 refs. Contract No. N00014-74-C-0262. NR Project 083-004.

Satellite infrared data show that the sea surface temperature pattern in the subtropical convergence consists of meridionally oriented alternating warm and cold plumes with a wavelength of about 200 km. In 1973, shipboard measurements during the Mid-Ocean Dynamics Experiment (Mode) revealed that the cold plumes resulted from southward advection of the surface water on the eastern flank of the Mode eddy and that the warm plumes were a result of northward advection on the western side. Along the edges of the plumes, small-scale frontogenesis was observed but was not resolved by the sampling scheme. Detailed measurements were made in March 1977 of the frontal structure at the southern end of a cold plume. These revealed the presence of smaller-scale motions with wavelengths of the order of 50 km. Temporal evolution of surface features in the vicinity and along the front occurred extremely rapidly and was barely resolved by surveys spaced 3-5 days apart. (Author)

A78-52159 # **Recent observations of the Alboran Sea frontal system.** R. E. Cheney (U.S. Naval Oceanographic Office, Washington, D.C.). *(AGU, AMS, and U.S. Navy, Chapman Confer-*

ence on Oceanic Fronts, New Orleans, La., Oct. 11-14, 1977.) Journal of Geophysical Research, vol. 83, Sept. 20, 1978, p. 4593-4597. 13 refs.

Observations in the Alboran Sea during fall and winter are reported. The data suggest that the Alboran Sea Front (located in the upper 200 m and having an average width of 35 km) persists throughout the year, moving from Gibraltar eastward through the basin. At times it establishes alternating cyclonic and anticyclonic gyres. The anticyclonic gyre is bounded on the north by the Atlantic water jet and has a diameter of 75-100 km. The features of the Alboran Sea circulation are enhanced when cold surface water along the southern coast of Spain is entrained into the gyre. S.C.S.

A78-52161 **Fronts on the continental shelf.** J. H. Simpson, C. M. Allen, and N. C. G. Morris (North Wales, University College, Bangor, Wales). *(AGU, AMS, and U.S. Navy, Chapman Conference on Oceanic Fronts, New Orleans, La., Oct. 11-14, 1977.) Journal of Geophysical Research,* vol. 83, Sept. 20, 1978, p. 4607-4614. 8 refs.

On the basis of NOAA 5 images, radio-tracked drogues, and conventional ship techniques, a study is made of fronts occurring in the shelf seas around the UK. Consideration is also given to a model of stratification and mixing in shallow waters (Simpson and Hunter, 1974) extended to include the influence of wind mixing. S.C.S.

A78-52162 **Tidal fronts on the shelf seas around the British Isles.** R. D. Pingree (Institute of Oceanographic Sciences, Wormley, England) and D. K. Griffiths (Marine Biological Association of the United Kingdom, Plymouth, England). *(AGU, AMS, and U.S. Navy, Chapman Conference on Oceanic Fronts, New Orleans, La., Oct. 11-14, 1977.) Journal of Geophysical Research,* vol. 83, Sept. 20, 1978, p. 4615-4622. 9 refs.

A numerical model is used to derive the Simpson-Hunter stratification parameter on the shelf seas surrounding the British Isles. Positions of predicted fronts are compared with structures observed in infrared satellite images and the measurements of sea surface temperature recorded on a cruise around the British Isles. The numerical model predicts the stability of the frontal systems, and baroclinic instability is suggested as the main candidate for cross-frontal mixing. (Author)

A78-52164 * **Large-scale Gulf Stream frontal study using GEOS 3 radar altimeter data.** N. E. Huang, C. D. Leitao (NASA, Wallops Flight Center, Wallops Island, Va.), and C. G. Parra (EG & G Washington Analytical Service Center, Inc., Pocomoke City, Md.). *(AGU, AMS, and U.S. Navy, Chapman Conference on Oceanic Fronts, New Orleans, La., Oct. 11-14, 1977.) Journal of Geophysical Research,* vol. 83, Sept. 20, 1978, p. 4673-4682. 12 refs.

From data obtained by the GEOS 3 radar altimeter, sea surface heights are found by both editing and filtering the raw sea surface height measurements and then referencing these processed data to a 5 foot by 5 foot geoid. Any trend between the processed data and the geoid is removed by subtracting out a linear fit to the residuals in the open ocean. Data from individual passes are further processed by applying a minimum variance technique at the subsatellite crossing points to produce surface topography maps for the 6 months and an overall mean map which reveal important details about the Gulf Stream system. The differences between the monthly mean and the overall mean are calculated for each of the 6 months to show the temporal and spatial changes of the Gulf Stream front and spawned eddies. The standard deviation map is even more informative and shows preferred locations of Gulf Stream meanders. (Author)

N78-30795# National Technical Information Service, Springfield, Va.
OCEAN WAVE SENSING. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1964 - May 1978
Audrey S. Hundemann Jun. 1978 243 p Supersedes NTIS/PS-77/0507, NTIS/PS-76/0435 NTIS/PS-75/413, and COM-74-10107
(NTIS/PS-78/0560/9; NTIS/PS-77/0507; NTIS/PS-76/0435; NTIS/PS-75/413; COM-74-10107) Avail: NTIS HC $28.00/MF $28.00 CSCL 08C

Abstracts pertaining to methods and equipment for measuring ocean waves and sea surface roughness are presented. Remote sensing of ocean waves, height indicators, wave spectrum measurement, the use of radar, wave direction detection, and a few abstracts dealing with general studies are included. (This updated bibliography contains 236 abstracts, 35 of which are new entries to the previous edition). GRA

N78-31684# National Ocean Survey, Rockville, Md.
NATIONAL OCEAN SURVEY, FISCAL YEAR 1977
Mar. 1978 85 p
(PB-281390/5; NOAA-78041207) Avail: NTIS HC A05/MF A01 CSCL 08B

A brief account of the activities during Fiscal Year 1977 (October 1976 through September 1977) and the interim quarter FY 7T (July, August, September 1976) is given. Areas of major national concern include marine boundaries, ocean dumping, sea-floor probes, geodetic studies, and congested airways control. The following departments report their activities: Office of National Geodetic Survey, Office of Marine Surveys and Maps, Office of Aeronautical Charting and Cartography, Office of Program Development and Management, Office of Marine Technology, Office of Fleet Operations, Atlantic Marine Center, and Pacific Marine Center. GRA

N78-32663# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN. PART 1: PHYSICAL, CHEMICAL, AND GEOLOGICAL PROPERTIES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1970 - 1975
Robena J. Brown Jun. 1978 179 p
(NTIS/PS-78/0562/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 08C

A description is given of remote sensing methods as they are applied to ocean temperature, sea ice, marine biology, marine geology, and sound and light transmission. Techniques of measurement using radiometry, microwave spectroscopy, radar systems, infrared spectroscopy, and photography are described. These measurements are made from both aircraft and satellites. GRA

N78-32664# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN. PART 1: PHYSICAL, CHEMICAL, AND GEOLOGICAL PROPERTIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1975 - May 1978
Robena J. Brown Jun. 1978 81 p Supersedes NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446
(NTIS/PS-78/0563/3; NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

This updated bibliography contains 75 abstracts. The studies describe remote sensing methods as they are applied to ocean temperatures, sea ice, marine biology, marine geology, and sound light transmission. Techniques of measurement using radiometry, microwave spectroscopy, rad systems, infrared spectroscopy, and photography are described. These measurements are made from both aircraft and satellites. GRA

N78-32665# National Technical Information Service, Springfield, Va.

REMOTE SENSING OF THE OCEAN. PART 2: DYNAMICS. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1970 - May 1978

Robena J. Brown Jun. 1978 147 p Supersedes NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75/447

(NTIS/PS-78/0564/1; NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75/447) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

Remote sensing methods as they are applied to ocean currents, wind sediment transport, ocean waves, sea states, and air water interactions are described. The various techniques of measurement using radiometers, lasers, radar, and microwave and infrared equipment are described. GRA

N78-33696*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

GEOS-3 OCEAN CURRENT INVESTIGATION USING RADAR ALTIMETER PROFILING Final Report

Clifford D. Leitao, Norden E. Huang, and Carlos G. Parra (EG and G Washington Anal. Serv. Center, Inc., Pocomoke City, Md.) Oct. 1978 32 p refs

(Contract NAS6-2730)

(NASA-TM-73280) Avail: NTIS HC A03/MF A01 CSCL 08C

Both quasi-stationary and dynamic departures from the marine geoid were successfully detected using altitude measurements from the GEOS-3 radar altimeter. The quasi-stationary departures are observed either as elevation changes in single pass profiles across the Gulf Stream or at the crowding of contour lines at the western and northern areas of topographic maps generated using altimeter data spanning one month or longer. Dynamic features such as current meandering and spawned eddies can be monitored by comparing monthly mean maps. Comparison of altimeter inferred eddies with IR detected thermal rings indicates agreement of the two techniques. Estimates of current velocity are made using derived slope estimates in conjunction with the geostrophic equation. A.R.H.

N78-33698# National Weather Service, Silver Spring, Md. Oceanographic Services Branch.

GULFSTREAM: MONTHLY PUBLICATIONS, JANUARY - DECEMBER 1977. VOLUME 3, NOS. 1 - 12

1977 92 p

(PB-283177/4; NOAA-78051201) Avail: NTIS HC A05/MF A01 CSCL 08C

This publication contains the monthly issues, each having the following information: Gulf Stream position; selected bathythermograms; mean sea surface temperature; surface temperatures; monthly changes; and SST anomalies. The illustrations carry statements elaborating on the data. GRA

N78-33700# National Technical Information Service, Springfield, Va.

GULF STREAM. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978

Audrey S. Hundemann Aug. 1978 204 p Supersedes NTIS/PS-77/0719; NTIS/PS-76/0629; NTIS/PS-75/525

(NTIS/PS-78/0844/7; NTIS/PS-77/0719; NTIS/PS-76/0629; NTIS/PS-75/525) Avail: NTIS HC $28.00/MF $28.00 CSCL 08C

Abstracts dealing primarily with the Gulf Stream's currents, salinity, temperature and transport properties are presented. A few abstracts pertain to oceanographic equipment used in the studies. Remote sensing studies are included. This updated bibliography contains 197 abstracts, 35 of which are new entries to the previous edition. GRA

Page intentionally left blank

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.

A78-43316 # **Satellite imagery analysis of snow cover in the Saint John and Souris River basins.** H. L. Ferguson and S. Lapczak (Department of the Environment, Atmospheric Environment Service, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 126-142. 7 refs.

Satellite imagery from the NOAA-4 and Landsat 1 and 2 satellites has been used to study the snow cover in the Saint John and Souris River basins. Images of visible and infrared data were analyzed by the optical-electrical method and an interpretation systems incorporated image analyzer which evaluated shades of gray and display images on a television screen. Density-sliced satellite images were also superimposed on ground truth data and snow-depth isopleths were drawn. Consideration was also given to maps of vegetative cover, relief, cloud cover, and weather reports in order to interpret the data. S.C.S.

A78-43317 # **A study of snowmelt progression from Winnipeg to the Arctic Islands using ERTS photographs.** R. Hofer and G. Fuller (Regina, University, Regina, Saskatchewan, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 143-148. Research supported by the National Research Council of Canada.

Photographs from the Earth Resources Technology Satellite (ERTS) have been applied to monitoring snowmelt progression in various regions of Canada. The regions represent a potential route for natural gas pipelines. On the basis of 155 ERTS photographs, four stages of snowmelt development are identified: the disappearance of the snow cover along ridges and southward facing valley walls, the dark appearance of small lakes, the appearance of dark open river reaches, and the final disappearance of the snow cover. It is noted that the presence of cloud cover significantly influences the number of useful photographs available. S.C.S.

A78-43318 # **A key study on the interpretation of regional soil moisture on satellite imagery.** S. Palabekiroglu (Ontario Centre for Remote Sensing, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 149-157.

Landsat imagery has provided a regional representation of surface-soil moisture conditions in Canadian agricultural areas. The factors which influence the accuracy of the results are identified as: crop cover, surface dryness, and surface thaw. Comparisons have been made between images from different seasons. The study indicates a relationship between areas having soil samples with high clay content and the moisture bands of the Landsat imagery. Many fields within the moisture bands are noted to contain drainage tiles. It is concluded that if the imagery is monitored for suitable ground and weather conditions, the mapping of poorly-drained soils in agricultural regions may be effected using Landsat data. S.C.S.

A78-43332 # **Water dynamics at Lac Saint-Jean, Quebec based on Landsat-1 and Landsat-2 data (Etude de la dynamique des eaux du Lac Saint-Jean au Québec, à l'aide des satellites Landsat-1 et Landsat-2).** G. Jones, W. Sochanska, J.-P. Fortin (Québec, Université, Quebec, Canada), and E. J. Langham (Ministère des Pêches et de l'Environnement, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 305-312. In French.

Water distribution has been studied in Lac Saint-Jean, Quebec on the basis of multispectral digital data from Landsat-1 and Landsat-2. Using the methods of Langham and Taylor (1975), the images are enhanced in order to determine turbid zones. Grey levels are found for each multispectral band so as to increase the signal-to-noise ratio and the precision with which water reflectance is measured. S.C.S.

A78-43333 # **An automatic system for analyzing lake characteristics by satellite (Un système automatisé d'analyse des caractéristiques des lacs par satellite).** G. Rochon (Université Laval, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 313-324. 13 refs. In French. Research supported by the Ministère des Richesses Naturelles, National Research Council of Canada, Ministère de l'Education, Ministère de l'Environnement, and Université Laval.

It is shown that Landsat imagery may be used to evaluate lake characteristics including lake contents, water distribution, morphometric parameters, drainage, and local ground cover. Landsat imagery is also applicable to studying near-lake ecosystems and modifications occurring over extended periods of time. S.C.S.

A78-43334 # **Progress toward a Landsat water quality monitoring system.** T. T. Alfoldi (Canada Centre for Remote Sensing, Ottawa, Canada) and J. C. Munday, Jr. (Virginia Institute of Marine Science, Gloucester Point, Va.). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 325-340. 28 refs.

Chromaticity analyses of Landsat images are used for quantitative water-quality monitoring. Multispectral scanner radiances are normalized to eliminate brightness and enhance hue and saturation. Two modes of operation on the Image-100 analyzer are possible: point and area. Discrete loci are identified for bathymetry, chlorophyll, and suspended sediment. Atmospheric corrections are made for the effects of haze, air pollution, sunlight, and clouds. The results are displayed on a color television monitor and computer terminal. They may be output on a line printer or reproduced on hard copy. S.C.S.

A78-43335 # **Study of the central delta of the Niger River - Project 'Saphyr' /Satellite Project Hydrology Research/ (Etude du delta central du Fleuve Niger - Project 'Saphyr' /Satellite Project Hydrology Research/).** M. Bied-Charreton, J. Cruette, G. Dandoy, G. Dubee, J. P. Lamagat, and J. Noel (Office de la Recherche Scientifique et Technique d'Outre-Mer, Paris, France). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 341-354. In French.

The central delta of the Niger River, located in the Republic of Mali, is studied with the aid of Landsat imagery. Particular attention is given to the groundwater flow systems of the flood zone and the vegetation. Data from channels 4, 5, and 7 are used to assess the changes occuring in vegetation and flooded zones over extended time periods. Estimates are made of the free water surface area and the biomass in small-surface zones. S.C.S.

A78-48001 **Landsat as an aid in the preparation of hydrographic charts.** D. K. Warne (Australian National University, Canberra, Australia). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Aug. 1978, p. 1011-1016. 6 refs.

Water depth in the Torres strait was determined from Landsat MSS imagery and the results were compared with ground truth sounding data. The method consists of attempting to fit the simple optical model for the radiance passing through the water and reaching the Landsat detector to the raw Landsat data. Parameters of the model had to be recalculated for each test area. Evaluation was made difficult by the presence of broad scale and localized disturbances of the depth-radiance relationship. Other sources of errors were small features and steep gradients beyond the resolving power of the MSS system and subsequent data correction process. An accuracy of 10% of nominal depth was attainable for depth penetration to 20 m. P.T.H.

A78-48006 **A technique for evaluating inland wetland photointerpretation - The cell analytical method /CAM/.** D. L. Civco, W. C. Kennard, and M. W. Lefor (Connecticut, University, Storrs, Conn.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Aug. 1978, p. 1045-1052. 20 refs.

A procedure was developed to analyze quantitatively the wetland photointerpretations performed by investigators associated with a project designed to evaluate freshwater wetlands definition. The Cell Analytical Method (CAM) used for comparing wetland delineations derived from different photointerpreters and map sources permitted both graphical and statistical analyses of cell-encoded, aerial photograph- and map-derived wetland information. P.T.H.

A78-48067 * **Differences in radar return from ice-covered North Slope Lakes.** W. F. Weeks, A. G. Fountain (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.), M. L. Bryan, and C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Journal of Geophysical Research*, vol. 83, Aug. 20, 1978, p. 4069-4073. 7 refs. Navy-supported research; Contract No. NAS7-100.

Comparisons are made between L and X band synthetic aperture radar images of frozen lakes on the North Slope of Alaska and ground truth observations of the nature of their ice covers. It is shown that the differences in radar backscatter observed on different areas of a lake can be correlated with whether or not the lake is frozen completely to the bottom at the site in question. This explanation is reasonable inasmuch as the reflection coefficient associated with the high-dielectric contrast ice/water interface is significantly higher than that associated with a low-contrast ice/soil interface. However, the presence of the ice/water interface cannot be the only condition required for the higher backscatter because the ice/water interface per se would be specular at X and L band frequencies, causing the energy returned from the interface to be reflected away from the radar receiver. The other principal factor contributing to the return of energy from the ice/water interface to the receiver is believed to be the presence in the ice of numerous vertically elongated air bubbles which would act as scatters. (Author)

A78-49531 **Rain estimation from geosynchronous satellite imagery - Visible and infrared studies.** C. G. Griffith, W. L. Woodley, P. G. Grube (NOAA, National Hurricane and Experimental Meteorology Laboratory, Coral Gables, Fla.), D. W. Martin, J. Stout (Space Science and Engineering Center, Madison, Wis.), and D. N. Sikdar (Wisconsin, University, Milwaukee, Wis.). *Monthly Weather Review*, vol. 106, Aug. 1978, p. 1153-1171. 38 refs. NOAA-supported research.

The paper reports on the first results of an empirical technique which estimates convective rainfall using geosynchronous visible and infrared satellite imagery. The technique is based on brightness (reflected radiance) or temperature (emitted radiance) as parameters for identifying raining clouds, cloud area as a measure of the extent of the rain area, and stage of development as an indicator of rain intensity. To verify the derived relationships, satellite rain estimations are compared to rain-gage and/or radar data for two areas in south Florida, for an area in Venezuela, and for several hurricanes. It is shown that real-time application of the method through computerization has promise for pinpointing flash-flood situations, such as the Big Thompson flood. The accuracy of future results is expected to increase with the use of digital data. S.D.

A78-53648 **Application of Landsat imagery to shoreline erosion.** C. W. Welby (North Carolina State University, Raleigh, N.C.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Sept. 1978, p. 1173-1177. 9 refs.

Landsat imagery from a 5-year time span has been used to study water circulation patterns on Croatan Sound and Pamlico Sound, North Carolina, as the patterns relate to erosion of the mainland shoreline. Evidence of probable attack by the sound waters on the shoreline has been correlated with a recent aerial photographic study of shoreline erosion. Approximately one-half of the Landsat images used in the study showed evidence of attack upon each of the several points studied. Landsat imagery, with its repetitive nature together with the accumulated images, provides a relatively inexpensive tool for rapid evaluation of potential for erosion along mainland shores of estuaries. (Author)

N78-28570*# Academy of Scientific Research and Technology, Cairo (Egypt).
GROUNDWATER STUDIES IN ARID AREAS IN EGYPT USING LANDSAT SATELLITE IMAGES
E. M. ElShazly, M. A. Abdel-Hady, and M. M. ElShazly, Principal Investigators 1977 10 p refs Presented at 11th Intern. Symp. on Remote Sensing of Environment, Michigan, 25-29 Apr. 1977 Sponsored by NASA ERTS
(E78-10165; NASA-CR-157283) Avail: NTIS HC A02/MF A01 CSCL 08H

N78-29303*# California Univ., Berkeley. College of Engineering.
RESEARCH OF MICROWAVE SCATTERING PROPERTIES OF SNOW FIELDS Final Technical Report, 1 Feb. 1976 - 31 Jul. 1978
D. J. Angelakos Aug. 1978 32 p refs
(Grant NsG-5093)
(NASA-CR-157472) Avail: NTIS HC A03/MF A01 CSCL 20N

The results obtained in the research program of microwave scattering properties of snow fields are presented. Experimental results are presented showing backscatter dependence on frequency (5.8-8.0 GHz), angle of incidence (0-60 degrees), snow wetness (time of day), and frequency modulation (0-500 MHz). Theoretical studies are being made of the inverse scattering problem yielding some preliminary results concerning the determination of the dielectric constant of the snow layer. The experimental results lead to the following conclusions: snow layering affects backscatter, layer response is significant up to 45 degrees of incidence, wetness modifies snow layer effects, frequency modulation masks the layer response, and for the proper choice of probing frequency and for nominal snow depths, it appears to be possible to measure the effective dielectric constant and the corresponding water content of a snow pack. F.O.S.

N78-29531*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Apr. - Jun. 1978
R. A. Halliday, Principal Investigator and I. A. Reid Jul. 1978 8 p Sponsored by NASA ERTS
(E78-10174; NASA-CR-157269) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. The project continued to demonstrate the feasibility of transmitting hydrometric data in the LANDSAT and GOES mode and using these data operationally. All elements except for the GOES downlink at PASS were functioning well.

N78-29532*# Texas A&M Univ., College Station. Remote Sensing Center.
MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS Progress Report, 1 Apr. 1977 - 1 Jun. 1978
Bruce J. Blanchard, Principal Investigator 1 Jun. 1978 110 p ERTS
(Grant NsG-5134)
(E78-10176; NASA-CR-157271; RSC-3458-2) Avail: NTIS HC A06/MF A01 CSCL 08M

The author has identified the following significant results. Repeated looks at surfaces that maintain constant roughness can provide an estimate of soil moisture in the surface, when appropriate radar look angles are used. Significant influence due to differences in soil moisture can be detected in the 13.3 GHz and 1.6 GHz scatterometer returns. Effects of normal crop densities have little influence on the surface soil moisture estimate, when appropriate look angles are used. It appears that different look angles are optimum for different frequencies to avoid effects from vegetation. Considering the frequency and look angles used on the Seasat-A imaging radar, differences in soil moisture should produce as much as 9 db difference in return on that system.

N78-31484*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGICAL MAPPING OF REGIONAL DRAINAGE NETWORK IN BRAZIL USING LANDSAT IMAGES
Nelson deJesusParada, Principal Investigator and Tania Maria Sausen Jun. 1978 55 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E78-10185; NASA-CR-157375; INPE-1279-NTE/122) Avail: NTIS HC A04/MF A01 CSCL 08H

N78-31487*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SURFACE HYDRODYNAMICAL MODELS THROUGH SYNOPTIC INTERPRETATION OF LANDSAT MSS IMAGES IN LAGOONAL AND COASTAL WATERS
Nelson deJesusParada, Principal Investigator and Renato Herz Apr. 1977 16 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10188; NASA-CR-157378; INPE-1013-NTE/083) Avail: NTIS HC A02/MF A01 CSCL 08H

N78-31513# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
COMPUTER PROCESSING OF LANDSAT DIGITAL DATA AND SENSOR INTERFACE DEVELOPMENT FOR USE IN NEW ENGLAND RESERVOIR MANAGEMENT
Carolyn J. Merry and Harlan L. McKim Apr. 1978 68 p refs
(AD-A055762; CRREL-SR-78-6) Avail: NTIS HC A04/MF A01 CSCL 08/6

A preliminary analysis of LANDSAT digital data using the NASA GISS computer algorithms for an 11 February scene of the upper St. John River Basin, Maine, showed that the total radiance of pixels contained in three snow courses varied from 5.34 to 7.74 mW/sq cm sr for a water equivalent of approximately 24.1 cm (9.5 in.) of water. This correlation between radiance values and water equivalent of the snowpack still needs to be tested. A multispectral signature was developed with an accuracy of 75% for a wetlands category in the Merrimack River estuary. Low-water reservoir and flood water stages were mapped from grayscale printouts of MSS band 7 for 27 October 1972 and 7 July 1973, respectively, for the Franklin Falls reservoir area, New Hampshire. Two snow pillow transducer systems for measuring the water equivalent of the snowpack in northern Maine were interfaced and field tested. Temperature data from the surface to a depth of 30 m (100 ft) were transmitted through the LANDSAT DCS. Also, a tensiometer/transducer system to measure moisture tension and soil volumetric moisture content was successfully interfaced to the LANDSAT DCS. GRA

N78-31518# South Dakota State Univ., Brookings. Dept. of Physics.
APPLICATION OF HEAT-FLOW TEMPERATURE MODEL FOR REMOTELY ASSESSING NEAR SURFACE SOIL MOISTURE BY THERMOGRAPHY Final Report
Jerald A. Tunheim Nov. 1977 50 p refs
(Contract DI-14-31-0001-6043)
(PB-279616/7; W78-05932) Avail: NTIS HC A03/MF A01 CSCL 08H

Detection and mapping of near-surface ground water by the use of remote sensed thermal emittance data (thermography) are reported. The specific focus was on detection of saline seeps in their preemergence stages. Soil temperature profiles, water table depths, and other pertinent data were collected in two potential seep areas. These data were related to thermal emittance acquired during three aircraft flights and results were used to modify a theoretical model. Author

N78-32513*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Final Report, Jul. 1974 - Mar. 1978
R. A. Halliday, Principal Investigator and I. A. Reid Apr. 1978 34 p refs Sponsored by NASA ERTS
(E78-10179; NASA-CR-157274) Avail: NTIS HC A03/MF A01 CSCL 08H

The author has identified the following significant results. The LANDSAT program has demonstrated that polar orbiting satellites can be used to relay hydrologic data from any part of Canada to a user without difficulty and at low cost. These data can be used for many operational purposes, the most important of which were identified as follows: hydroelectric power plant operation; water supply for municipalities, industries, and irrigation; navigation; flood forecasting; operation of flood control structures and systems; and recreation.

N78-32514*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Progress Report, Jul. - Sep. 1978
James C. Barnes, Principal Investigator 28 Sep. 1978 5 p Sponsored by NASA ERTS
(E78-10194; NASA-CR-157384) Avail: NTIS HC A02/MF A01 CSCL 08H

N78-32516*# National Oceanic and Atmospheric Administration, *Washington, D. C.*
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES
Donald R. Wiesnet, Principal Investigator 15 Sep. 1978 3 p Sponsored by NASA ERTS
(E78-10211; NASA-CR-157584; Rept-4) Avail: NTIS HC A02/MF A01 CSCL 08H

N78-32526*# Ecosystems International, Inc., Gambrills, Md.
APPLICATIONS OF REMOTE SENSING TO HYDROLOGIC PLANNING Final Report
Harry Loats, Jr., Thomas Fowler, and Peter Castruccio Aug. 1978 148 p
(Contract NAS8-32423)
(NASA-CR-3041; M-258) Avail: NTIS HC A07/MF A01 CSCL 08H

The transfer of LANDSAT remote sensing technology from the research sector to user operational applications requires demonstration of the utility and accuracy of LANDSAT data in solving real problems. This report describes such a demonstration project in the area of water resources, specifically the estimation of non-point source pollutant loads. Non-point source pollutants were estimated from land cover data from LANDSAT images. Classification accuracies for three small watersheds were above 95%. Land cover was converted to pollutant loads for a fourth watershed through the use of coefficients relating significant pollutants to land use and storm runoff volume. These data were input into a simulator model which simulated runoff from average rainfall. The result was the estimation of monthly expected pollutant loads for the 17 subbasins comprising the Magothy watershed. Author

N78-33508*# *World Meteorological Organization, Geneva* (Switzerland).
A PLAN FOR THE COLLECTION AND TRANSMISSION OF HYDROMETEOROLOGICAL DATA IN THE BRASILIAN AMAZON BASIN
Robert A. Halliday, Principal Investigator Apr. 1978 97 p refs Sponsored by NASA ERTS
(E78-10175; NASA-CR-157270; BRA372/010) Avail: NTIS HC A05/MF A01 CSCL 08F

N78-33511*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RADAR TARGET REMOTELY SENSING HYDROLOGICAL PHENOMENA Patent Application
Wilford E. Sivertson, Jr., inventor (to NASA) Filed 22 Sep. 1978 18 p
(NASA-Case-LAR-12344-1; US-Patent-Appl-SN-945041) Avail: NTIS HC A02/MF A01 CSCL 08H

Apparatus for remotely measuring and accessing water status at selected locations on the surface of the earth is disclosed. A radar target whose radar cross-section varies as a function of the height of the water level within the target is described. The target consists essentially of a right circular cylinder with its central axis perpendicular to the ground level, a flat circular plate symmetrically attached to the lower end of the cylinder and parallel to the ground level surface, and a catch basin including said circular cylinder and said circular plate for catching and retaining water. The circular cylinder and the flat circular plate are made from a material (electrical conductor) that reflects radar signals such as aluminum, copper, and stainless steel. The brightness of the image taken by a radar from a satellite or an airplane decreases as the level of the water increases. The level of water in a radar target is indicative of the water status at the location of that particular radar target. NASA

N78-33517# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
NURE GEOCHEMICAL INVESTIGATIONS IN THE EASTERN UNITED STATES
V. Price 1977 46 p refs Presented at the 7th Intern. Geochem. Exploration Symp., Golden, Colo., 6-20 Apr. 1978
(Contract EY-76-C-09-0001)
(DP-MS-77-101; Conf-780435-1) Avail: NTIS HC A03/MF A01

Stream samples were collected at a density of one per 13 square kilometers in crystalline rock areas and 25 square kilometers in sedimentary rock areas. Stream sediment was taken at each site, and stream water was concentrated on ion exchange resin in some areas. Ground water samples were collected at an average density of about one site per 20 square kilometers. Measurements made at each site included alkalinity, pH, and conductivity of water. Measurements of the radon and helium contents of ground water samples were made on a semiregional scale in pilot studies. Samples were analyzed by neutron activation techniques. Concentrations of uranium and about 20 other elements were determined in concentrated water samples. Results from several studies are discussed including a Triassic Basin area near Sanford, North Carolina; the North and South Carolina Coastal Plain; and from reconnaissance studies in the Carolinas-Virginia Piedmont and Blue Ridge areas. ERA

N78-33523# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO HYDROLOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Audrey S. Hundemann Aug. 1978 196 p Supersedes NTIS/PS-77/0677
(NTIS/PS-78/0792/8; NTIS/PS-77/0677) Avail: NTIS HC $28.00/MF $28.00 CSCL 08H

The use of aerial and satellite imagery in hydrologic studies, including water resources planning and management, is discussed. The abstracts cover remote sensing studies of water quality, soil moisture, floodplain delineation, ice cover, and determination of snow depth and water equivalent. (This updated bibliography contains 189 abstracts, 33 of which are new entries to the previous edition.) GRA

N78-33616*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LABORATORY AND FIELD MEASUREMENTS OF UPWELLED RADIANCE AND REFLECTANCE SPECTRA OF SUSPENDED JAMES RIVER SEDIMENTS NEAR HOPEWELL, VIRGINIA
Charles H. Whilock, William G. Witte, E. A. Gurganus, and J. W. Usry Oct. 1978 30 p refs
(NASA-TP-1292; L-12298) Avail: NTIS HC A03/MF A01 CSCL 13B

Spectral reflectance characteristics of suspended Bermuda Hundred and Bailey Bay bottom sediments taken from the Hopewell, Va., area were measured in the laboratory for water mixture total suspended solids concentrations between 4 and 173 parts per million. Field spectral reflectance measurements were made of the James River waters near Bermuda Hundred on two occasions. The results of these tests indicate that both Bermuda Hundred and Bailey Bay suspended sediments produce their strongest reflectance in the green and red regions of the spectrum. Author

07
DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A78-43307 # Biophysical mapping in northwestern Ontario from aircraft and satellite remote sensing data. N. J. Kozlovic and P. J. Howarth (McMaster University, Hamilton, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 27-36. 16 refs. Research supported by the National Research Council of Canada and McMaster University.

Aircraft and satellite remote sensing data have been used for biophysical mapping in northwestern Ontario. Data were collected from field studies, aerial photography, and the Landsat multispectral scanner. The Landsat data were analyzed visually, by digital means, and using a signature-file extension. S.C.S.

A78-43323 # Interpretation and planning of thermal IR imagery. J. Vleck (Toronto, University, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 200-207. 6 refs.

Various heat-transfer models used in the interpretation of thermal infrared imagery are discussed. An energy balance equation at the terrain surface, in terms of the net radiation flux representing the difference between incident solar flux and the reflected and emitted radiation components, is presented. Heat transfer at the atmospheric boundary layer is noted to be a function of wind profile, temperature gradients, and the three-dimensional surface configuration. Two sources of thermal radiation detected by the sensor are identified: the radiant power emitted by the surface, and the reflection of the atmosphere by surface features which are not perfect absorbers. Sample thermal images are presented for a bare field in the spring, a winter wheat field, a surface-drainage channel scar, a newly cultivated field, and forestland. S.C.S.

A78-43326 # The Canada Centre for Remote Sensing's image analysis system /CIAS/. D. G. Goodenough (Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 227-244. 19 refs.

Attention is given to the image analysis system developed by the Canada Centre for Remote Sensing. The system consists of a modified Image-100 device and a PDS color microdensitometer. The system makes it possible to classify a full Landsat frame into 93 distinct classes with maximum likelihood discrimination. The entire process takes less than 14 minutes. Three parallel data paths are provided: the UNIBUS, the RH70/DWR70 bus, and the IAP-supported path. Images are stored in 44-megaword disks. A graphics tablet is employed for limited map-information digitization, map-information selection, the selection of test sites, and map overlay. Output consists of single-class plots matching map scales from 1:50,000 to 1:1,000,000 color photographs. S.C.S.

A78-43329 # Computer processing of Landsat data as a means of mapping land use for the Canada land inventory. J. S. Schubert (Gregory Geoscience, Ltd., Ottawa, Canada), J. Thie, and D. Gierman (Environment Canada, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 268-281. 14 refs.

Techniques for computer processing Landsat data for land-use mapping in Canada are described. Visual classification is performed using a television display of computer-enhanced remotely sensed data. The visual classification includes the simulation of color infrared imagery and Taylor's enhancement technique. Computer classification consists of both supervised and nonsupervised interactive methods and the Land-Analysis automatic classification technique developed for the classification of vegetation. S.C.S.

A78-43330 # The mapping of ecological land units of Labrador utilizing Landsat imagery. N. A. Prout (Department of Fisheries and Environment, Environmental Management Service, Halifax, Nova Scotia, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 282-293. 8 refs.

A78-43351 # Recognition and modification of areas less than a minimum. W. A. Davis (Alberta, University, Edmonton, Canada) and F. G. Peet (Canadian Forestry Service, Forest Management Institute, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 549-557. 7 refs. National Research Council of Canada Grant No. A-7634.

With reference to related studies, the article discusses the processing of digital thematic maps from classified Landsat imagery such that after processing, the map regions have areas less than a preset minimum. The technique is based on an algorithm developed by Davis and Peet (1976) which finds all regions having areas less than a determined minimum and converts them to their most likely neighbor. S.C.S.

A78-43352 # Computer processing of remotely-sensed data and automatic cartography (Le traitement par ordinateur des données de télédétection et leur cartographie automatique). D.-J. David (Paris I, Université, Paris, France), G. Joly (CNRS, Laboratoire d'Information et de Documentation en Géographie, Paris, France), and F. Verger (Ecole Normale Supérieure, Montrouge, Hauts-de-Seine, France). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings.
Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 558-564. 5 refs. In French. Centre National d'Etudes Spatiales Contract No. 75-322.

Techniques for automatic cartography on the basis of computer-processed remotely sensed data are outlined. Several correction and classification programs are described, including the FRACORCA, FRALISSE, FRACARTO, and FRACAM programs. Applications to studies of mud-flat geomorphology and marine turbidity are noted. S.C.S.

A78-43353 # Computerized generation of control points on Landsat imagery (Génération automatisée de points de contrôle sur les images Landsat). A. Scott (CDC System, Ottawa, Canada) and G. Rochon (Université Laval, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 565-572. In French.

A new procedure for generating control points on Landsat imagery with a view to subsequent geometric correction has been designed and tested. The procedure is based on locating by computer the mass centres of the lakes appearing on the Landsat images. The lakes which are located and identified and whose morphometric characteristics remain largely unchanged from one image to the next are retained as control points. An affine transformation using these control points and applied to an image of 500 pixels per side gave a residual error of less than 0.5 RMS pixels. (Author)

A78-43355 # **Landsat atmospheric corrections at CCRS.** F. J. Ahern, D. G. Goodenough, S. C. Jain, V. R. Rao (Canada Centre for Remote Sensing, Ottawa, Canada), and G. Rochon (Université Laval, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 583-594. 15 refs.

Methods used to correct Landsat data for atmospheric variability are discussed. Attention is given to the Multiplicative and Additive Scene Correction (MASC) algorithm (Henderson, 1975) which assumes that certain types of ground cover have stable spectral reflectances. Atmospheric corrections utilizing oligotrophic lakes as standard reflectors (Ahern, et al., 1977) are described. The methods are evaluated for ground and aircraft measurements made with Landsat passes over Canadian lake regions. It is found that when using oligotrophic lakes as standard reflectance targets, atmospheric variability is removed to within plus or minus one grey level on a 128-grey-level scale. S.C.S.

A78-43356 # **Diffuse backscatter of solar radiation.** E. J. Langham (Department of Fisheries and Environment Canada, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings.
Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 595-601.

A method for using cloud shadows in order to correct satellite images for the effects of backscattered solar radiation is proposed. The technique is evaluated for an area south of Lake St. Clair near Detroit. A similar method for using cloud shadows for image corrections (Piech and Schott, 1974) is noted. S.C.S.

A78-43619 # **Application of space-borne photography to mapping and investigation of earth resources (Ob ispol'zovanii materialov kosmicheskikh s'emok pri kartografirovanii i izuchenii prirodnykh resursov).** Iu. P. Kienko, L. I. Zlobin, V. I. Bumblis, Iu. G. Kel'ner, V. V. Kiselev, V. V. Kozlov, and M. E. Solomatin. *Geodeziia i Kartografiia,* Apr. 1978, p. 20-29. In Russian.

In the present paper, potential uses of remote sensing are examined, with particular reference to the study of earth resources and the preparation of respective maps. The principles and possibilities of satellite photography are discussed, along with photogrammetric processing and digitizing. V.P.

A78-43967 # **Use of a remote computer terminal during field checking of Landsat digital maps.** C. J. Robinove and C. F. Hutchinson. *U.S. Geological Survey, Journal of Research,* vol. 6, July-Aug. 1978, p. 511-514.

Small-scale, land-classification maps digitally produced from Landsat data have been field checked using a remote portable teletypewriter linked to the Interactive Digital Image Manipulation System. The terminal provided image classification, statistical manipulation, class grouping, and map printout in alphanumeric form. The process is observed to make field checking faster, to provide statistical data integration, and to reduce the required time and costs. Some difficulties were encountered with the telephone lines. It is suggested that the original computer-produced maps taken to the field contain more classes than are expected to be mapped because in the field it is easier to group classes than to reclassify or separate classes when only the remote terminal is available for display. S.C.S.

A78-44237 **Methods and accuracy of location of Landsat MSS points on maps.** J. R. Hardy (Reading, University, Reading, Berks., England). *British Interplanetary Society, Journal (Remote Sensing),* vol. 31, Aug. 1978, p. 305-311. 7 refs.

The linear least squares method of transformation of coordinates from Landsat MSS to map systems and vice versa is described and illustrated, with reference to Landsat and map geometry. It is shown that, for a whole Landsat scene, map points can be matched with a standard deviation of about plus or minus 200 metres, while for small areas this figure can be improved to about plus or minus 50 metres. It is shown that eight to ten pairs of homologous points are sufficient to achieve this accuracy and that little or no improvement is achieved by using more. The implications for mapping scales are discussed. (Author)

A78-47081 **Digital processing of meteorological satellite /NOAA/ images.** M. Takagi and K. Tamura (Tokyo, University, Tokyo, Japan). In: International Symposium on Space Technology and Science, 12th, Tokyo, Japan, May 16-20, 1977, Proceedings. Chofu, Tokyo, National Aerospace Laboratory, 1977, p. 593-598. 6 refs.

A small digital processing system has been applied to NOAA images. Image enhancement of these images improves contrast. An interpolation method was used to study the conversion of the NOAA data to a mapping system such as Mercator or polar stereo. A grey level histogram technique is used to extract the sea area from the IR image, and the temperature distribution of the sea surface is displayed. Interpolation of picture elements is discussed, and image magnification with boundary smoothing is considered. B.J.

A78-47082 **Image processing in remote sensing.** A. K. S. Gopalan, D. S. Kamat, K. L. Majumder, C. V. S. Prakash, and V. L. Swaminathan (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). In: International Symposium on Space Technology and Science, 12th, Tokyo, Japan, May 16-20, 1977, Proceedings. Chofu, Tokyo, National Aerospace Laboratory, 1977, p. 599-604. 11 refs.

Certain aspects of image processing in remote sensing is reviewed with reference to extraction of information on earth resources from Landsat and aircraft pictures. Attention is given to agricultural land use using supervised and unsupervised classification, and to the study of forest cover. Digital processing techniques are applied to photogeology, and water turbidity and quality studies. Analog processing is also discussed. B.J.

A78-47083 **Standard Mesh compatible Landsat mapping.** S. Tanaka, H. Kano (Remote Sensing Technology Center of Japan, Tokyo, Japan), and Y. Suga (Hosei University, Koganei, Tokyo, Japan). In: International Symposium on Space Technology and Science, 12th, Tokyo, Japan, May 16-20, 1977, Proceedings. Chofu, Tokyo, National Aerospace Laboratory, 1977, p. 605-610.

A procedure is described for rendering Landsat MSS data for Japan compatible with the Standard Areal Mesh established by the Japanese Statistics Bureau. The basic features of this Standard-Mesh-compatible Landsat map are that (1) the pixel feature is almost square, (2) the pixel number corresponding to the Mesh is the same in every image, and (3) the radiometric value of MSS data is sufficiently preserved. B.J.

A78-47085 The analyses of multispectral data obtained from space. K. Tsuchiya, T. Iwata, H. Nakamura (National Space Development Agency of Japan, Tokyo, Japan), H. Ochiai (Toba National Merchant Marine College, Toba, Japan), and K. Takeda (Science and Technology Agency, Tokyo, Japan). In: International Symposium on Space Technology and Science, 12th, Tokyo, Japan, May 16-20, 1977, Proceedings. Chofu, Tokyo, National Aerospace Laboratory, 1977, p. 617-622. 12 refs.

Two Landsat MSS images of four areas in Japan - a farming area, a city, a mountain area, and a bay - are examined in an effort to compare radiance values. The radiance value of Band 4 (0.5-0.6 micron) taken in October 1972 is greater than that of Band 4 taken in September 1975 for all the areas, while the reverse is true for Band 6 (0.7-0.8 micron). The differences in radiance are apparently due to the effects of weather and vegetation. Using the same images, four different methods of ground control point matching are tested. Landsat data is then applied to the detection of red tide off Japan. B.J.

A78-48003 * Photographic contrast enhancement of Landsat imagery. R. G. Best and J. R. Smith (South Dakota State University, Brookings, S. Dak.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Aug. 1978, p. 1023-1026. Grant No. NGL-42-003-007.

The effect of increased contrast of Landsat imagery is to stretch the informational content over a much greater density range. This results in greater density differences among scene features and provides a more interpretable image. The stretch required for MSS 5 and 7 is in the gamma range of 1.5 to 3.0. Several different film types, developers, and development times were used to reprocess Landsat images in a range of gammas from 1.0 to above 4.0. The gamma value to which the imagery was processed depended on the densitometric range of scene features in the image relative to the gray scale. An example of a photographically enhanced MSS 4 image is shown, in which the standard 0.94 density units was increased to 2.19 density units. The results are similar to those obtained in a computerized contrast stretch of digital CCT data, but are obtained at a far lesser cost. P.T.H.

A78-48007 * Use of manual densitometry in land cover classification. D. C. Jordan, D. H. Graves, and M. C. Hammetter (Kentucky, University, Lexington, Ky.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Aug. 1978, p. 1053-1059. 13 refs. Research sponsored by the University of Kentucky Research Foundation; Contract No. NAS8-31006.

Through use of manual spot densitometry values derived from multitemporal 1:24,000 color infrared aircraft photography, areas as small as one hectare in the Cumberland Plateau in Kentucky were accurately classified into one of eight ground cover groups. If distinguishing between undisturbed and disturbed forest areas is the sole criterion of interest, classification results are highly accurate if based on imagery taken during foliated ground cover conditions. Multiseasonal imagery analysis was superior to single data analysis, and transparencies from prefoliated conditions gave better separation of conifers and hardwoods than did those from foliated conditions. P.T.H.

A78-49654 Landsat data availability from the EROS data center and status of future plans. R. A. Pohl and G. G. Metz (U.S. Geological Survey, EROS Data Center, Sioux Falls, S. Dak.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977, p. 9D-1 to 9D-4.

The Department of Interior's EROS Data Center was established in 1972 in Sioux Falls, South Dakota to serve as a principal dissemination facility for Landsat and other remotely sensed data. Through mid-1977, the Center had supplied about 1.7 million copies of images from the more than five-million images of the earth surface archived at the Center. Landsat accounted for nearly half of these images, and approximately 5800 computer-compatible tapes of Landsat data were also supplied to users. New methods for processing data products to make them more useful are being developed, and new accession aids for determining data availability are being placed in operation. B.J.

A78-50226 Interpretation of aerial photographs /3rd edition/. T. E. Avery. Minneapolis, Minn., Burgess Publishing Co., 1977. 400 p. 200 refs. $16.95.

Photography, films, and filters are considered along with questions related to orientation and study of aerial photographs, photoscale and stereoscopic parallax, stereogram, shadow heights, flight planning, planimetric and topographic mapping, nonphotographic imaging systems, land information systems and land-cover mapping, prehistoric and historic archeology, agriculture and soils, forestry applications, landforms and physiographic features, engineering applications and mining patterns, urban-industrial patterns, and air intelligence and military target analysis. Attention is given to remote sensing and interpretation, relative apertures, camera viewing angles, photographic film, developing and printing, resolution and spectral sensitivity, infrared color or camouflage-detection film, the development of photogrammetry, principles of object recognition, three-dimensional photography, the precision of height determinations, topographic maps from paper prints, the nature of infrared radiation, radar image interpretation, the significance of land use patterns, site evaluations, land and crop classifications, water erosion, the classification of vegetation, applications of photogeology, and nonphotographic imagery. G.R.

A78-51617 # Exploiting spectral, spatial and semantic constraints in the segmentation of Landsat images. D. W. Starr and A. K. Mackworth (British Columbia, University, Vancouver, Canada). *(Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb. 21-23, 1977.) Canadian Journal of Remote Sensing*, vol. 4, Aug. 1978, p. 101-107. 17 refs. Research supported by the National Research Council of Canada.

A critique of traditional classification techniques for Landsat images and consideration of some scene analysis techniques, exploiting spatial organization and meaning, lead to a new approach to computer programs for Landsat image understanding. To justify this approach, a program that combines modified maximum likelihood techniques with interpretation-controlled region merging methods to interpret forest cover in Landsat images is described. For comparison purposes, a pure supervised classifier using the same data made 43% more errors and produced a segmentation twice as complex. (Author)

A78-53650 Enhancement of linear features by rotational exposure. D. L. Lawton and D. F. Palmer (Kent State University, Kent, Ohio). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Sept. 1978, p. 1185-1189. 8 refs. Research supported by the AMAX Foundation.

The described method for the photographic enhancement of linear features involves the use of overlaid positive and negative transparencies maintained in perfect registration to eliminate the bias due to offsetting. By placing the transparences so that the emulsion is up on the top film and down on the bottom film, almost all light in the normal direction is blocked, so that only a small amount of light will pass through by means of oblique illumination and reach the unexposed negative film placed below the positive and negative pair. Since light will pass through only at the boundaries of light and dark areas, linear features are enhanced for both man-made and geologic features on satellite-acquired images. M.L.

N78-28585*# Bendix Aerospace Systems Div., Ann Arbor, Mich.
MULTISPECTRAL DATA RESTORATION STUDY Final Report
Navinchandra J. Shah and C. L. Wilson May 1977 84 p refs (Contract NAS5-23384)
(NASA-CR-156790; BSR-4246) Avail: NTIS HC A05/MF A01 CSCL 05B

A digital resampling technique for LANDSAT data is reported that incorporates a deconvolution concept to minimize spatial and radiometric degradation of data during resampling for geometric correction. A quantitative comparison of cubic convolution and digital restoration methods establishes the latter as the superior technique. G.G.

N78-28593# Committee on Space Research (COSPAR), Paris (France).
SATELLITE IMAGERY INTERPRETATION: SUGGESTIONS FOR LABORATORY DESIGN
T. T. Alfoeldi (Can. Centre for Remote Sensing, Ottawa) and R. A. Ryerson (Can. Centre for Remote Sensing, Ottawa) May 1976 24 p refs
(Tech-Man-Ser-5) Avail: NTIS HC A02/MF A01

Suggestions for the design, staffing, and instrumentation of a basic satellite imagery analysis laboratory are presented. The cost of the equipment and furniture for the basic laboratory is approximately $60,000. Recommended optimal equipment is also listed. ESA

N78-29538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 WORLD STANDARD CATALOG, 1 JAN. - 30 APR. 1978
1978 172 p
(NASA-TM-79740; NTISUB/D/276-004) Avail: NTIS HC A08/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 2 which has been processed and input to the data files during the referenced months. Data, such as 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

N78-29541# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTRODUCTION TO A MULTISPECTRAL DATA ANALYSIS SYSTEM [APRESENTACAO DE UMA SISTEMATICA PARA A ANALISE DE DADOS MULTIESPECTRAIS]
Vitor Celso CelsodeCarvalho Apr. 1978 40 p refs In PORTUGUESE
(INPE-1227-NTE/115) Avail: NTIS HC A03/MF A01

A system that automatically translates multispectral data obtained by remote sensing is described. Basic concepts were examined briefly, and examples of application in various areas of natural resources were reviewed. Transl. by B.B.

N78-29546# Los Alamos Scientific Lab., N. Mex.
TECHNIQUE FOR DYNAMIC RANGE REDUCTION FOR LANDSAT RATIO IMAGES
G. W. Wecksung and J. R. Breedlove, Jr. 1978 7 p refs Presented at Electron. in Resources Management Conf., Alamogordo, N.M., 12-14 Apr. 1978
(Contract W-7405-eng-36)
(LA-UR-78-347; Conf-780410-1) Avail: NTIS HC A02/MF A01

A scheme for dynamic range reduction, based on a mathematical model of the multispectral image, is presented. It can be implemented on stand-alone digital image processing systems as well as general purpose computers. This technique also has potential application in machine classification of geological data. Digital image processing examples are presented in which this new scheme is compared with other commonly used techniques for dynamic range reduction. ERA

N78-29558# Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
THE USE OF SATELLITE IMAGERY FOR LAKE CLASSIFICATION IN WISCONSIN
K. W. Holmquist and F. L. Scarpace 1977 41 p ref
(Contract DI-14-34-0001-6052; DI-14-34-0001-5050; OWRT Proj. A-062-WIS(1))
(PB-279628/2; WIS-WRC-77-08; W78-05935) Avail: NTIS HC A03/MF A01 CSCL 08H

The trophic status of inland lakes in the State of Wisconsin was assessed from LANDSAT data. The feasibility of using both the photographic representation of the LANDSAT imagery as well as the digital representation of the LANDSAT imagery to classify lakes was investigated. It was determined that LANDSAT imagery can be used to predict lake water parameters or trophic classification. Time series data analyses indicated the necessity of a periodic rather than a one-time data extraction process. GRA

N78-30501# Ferranti Ltd., Bracknell (England). Digital Systems Div.
DESCRIPTION OF A SIMULATION MODEL OF SYNTHETIC APERTURE RADAR SYSTEMS. VOLUME 1: SUMMARY
R. Sellars Paris ESA Jul. 1977 72 p refs 2 Vol.
(Contract ESTEC-2567/75-HP)
(Rept-2831-Vol-1; ESA-CR(P)-1059-Vol-1) Avail: NTIS HC A04/MF A01

The development of a digital computer simulation model for a satellite-borne Synthetic Aperture Radar (SAR) system is reported. Requirements of earth remote sensing are outlined, showing how a synthetic aperture radar can satisfy these requirements. The development of a simulation program to study SAR processing operations is discussed, based on a broad type of SAR system. The program design philosophy and the most important program segments are dealt with. A few examples are given of results from the program, and the use of the model by an SA systems designer is shown. Recommendations are given for future work. ESA

N78-30502# Ferranti Ltd., Bracknell (England). Digital Systems Div.
DESCRIPTION OF A SIMULATION MODEL OF SYNTHETIC APERTURE RADAR SYSTEMS. VOLUME 2: THEORY AND RESULTS
P. R. Tucker, D. Farquharson, A. J. Dick, and R. Sellars Paris ESA Jul. 1977 147 p 2 Vol.
(Contract ESTEC-2567/75-HP)
(Rept-2831-Vol-2; ESA-CR(P)-1059-Vol-2) Avail: NTIS HC A07/MF A01

The development of a digital computer simulation model for a satellite-borne Synthetic Aperture Radar (SAR) system is reported. The broad type of SAR system that was assumed, is described, as well as a general theory of SAR systems. Methods of simulating the various system components are presented. The data analysis and output facilities provided by the model are outlined, and its use is discussed. A number of secondary studies performed during the model development are described, and a few examples are given of results from the model to indicate the form of the output. Suggestions are made for future work. ESA

N78-30634*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOME OBSERVATIONS ABOUT LANDSAT DIGITAL ANALYSIS
Robert R. Jayroe, Jr. Aug. 1978 40 p
(NASA-TM-78184) Avail: NTIS HC A03/MF A01 CSCL 05B

Several hypotheses concerning LANDSAT data are analyzed. These hypotheses are: (1) LANDSAT does not discriminate vegetation types, but mostly sees chlorophyl and canopy cover. (2) A majority of the features in the ground scene possess linearly proportional amounts of color from each spectral band. (3) The data are continuous and as a result there is no true separability

of ground scene features in the data, but some features possess an excess of color in a particular band pair. (4) There are relatively few features present in the spectral data, and these do not correspond to the conventional definitions that are used. (5) Aside from seasonal effects, in a distributional sense all LANDSAT data are essentially the same. The only difference is the way the data are spatially arranged in the image. S.B.S.

N78-30635*# *Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.*
APPLICATION OF MULTISPECTRAL RADAR AND LANDSAT IMAGERY TO GEOLOGIC MAPPING IN DEATH VALLEY
M. Daily, C. Elachi, T. Farr, W. Stromberg, S. Williams, and G. Schaber (Geol. Surv., Flagstaff, Ariz.) 30 Mar. 1978 59 p refs Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-157557; JPL-Pub-78-19) Avail: NTIS HC A04/MF A01 CSCL 08B

Side-Looking Airborne Radar (SLAR) images, acquired by JPL and Strategic Air Command Systems, and visible and near-infrared LANDSAT imagery were applied to studies of the Quatenary alluvial and evaporite deposits in Death Valley, California. Unprocessed radar imagery revealed considerable variation in microwave backscatter, generally correlated with surface roughness. For Death Valley, LANDSAT imagery is of limited value in discriminating the Quaternary units except for *alluvial units distinguishable by presence or absence of desert* varnish or evaporite units whose extremely rough surfaces are strongly shadowed. In contrast, radar returns are most strongly dependent on surface roughness, a property more strongly correlated with surficial geology than is surface chemistry.
Author

N78-30640# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
SOME NEW MAP DATA ENCODING SCHEMES Interim Report
Herbert Freeman 1978 11 p refs
(Grant AF-AFOSR-2937-76)
(AD-A054853; AFOSR-78-0946TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

Some new schemes for encoding map data are introduced. The schemes can be regarded as generalizations of the well known 8-direction chain coding scheme. Instead of being limited to 8 types of links for approximating a curve, the new schemes possess 16, 24, 32, 48, or even more link types. The new schemes permit increased smoothness of representation, exhibit greater precision, and require less processing time for comparable resolution than present methods. Author (GRA)

N78-30876# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETECTION OF IMAGE BOUNDARIES: MATHEMATICAL FORMULAS [DETECCAO DE BORDAS EM IMAGENS: FORMULACAO ESTATISTICA]
Nelson Delfino Davila Mascarenhas and Lucila Olivia daCosta Prado Jul. 1977 44 p refs In PORTUGUESE; ENGLISH *summary*
(INPE-1058-NTE/094) Avail: NTIS HC A03/MF A01

New statistical techniques for the boundary detection problem in earth resources imagery are developed. The image is modeled by signal and noise which are additive, independent, gaussian and autorregressive in two dimensions. The parameters of the model are determined by correlation measurements. The optimal solution, in terms of signal detection theory, leads to a test which takes a decision among 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 presented. Author

N78-31306# Plessey Radar Ltd., Havant (England).
A CCD DIGITAL IMAGE STORE
D. M. Balston and P. R. Samways *In* AGARD Impact of Charge Coupled Devices and Surface Acoustic Wave Devices on Signal Process. and Imagery in Advanced Systems Jun. 1978 9 p refs (For primary document see N78-31279 22-31)
Avail: NTIS HC A21/MF A01

A digital image store, based on CCD technology designed for an image processing system is described. The processing system, termed IDP 3000, was introduced to fulfill a requirement in the field of Earth Resource Surveying and the design of the store reflects the requirements of the specific area application. The requirements were introduced and the specific solution adopted is described. Particular attention is paid to the relationship with a standard 625 line TV signal. Each function available in the store is discussed and the method of implementation is summarized. An indication of the reliability of the store was given as well as a description of its application to simulator development. B.B.

N78-31479*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INPE LANDSAT SYSTEM
Nelson deJesusParada, Principal Investigator, Marcio Nogueira Barbosa, and Sergio de Paula Pereira Apr. 1977 16 p Presented at LANDSAT Ground Station Operations Working Ground Meeting, 12-14 Apr. 1977 Sponsored by NASA ERTS
(E78-10180; NASA-CR-157370; INPE-1008-RRE/031) Avail: NTIS HC A02/MF A01 CSCL 05B

N78-31480*# *Instituto de Pesquisas Espaciais, Sao Jose dos* Campos (Brazil).
STUDY OF GEOMETRIC DISTORTIONS OF LANDSAT IMAGES
Nelson DeJesusParada, Principal Investigator, Wilson Custodio C. Dasilva, Jose Carlos Maia, and Luis Danilo Damasceno Ferreira Jun. 1978 61 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E78-10181; NASA-CR-157371; INPE-1286-PE/140) Avail: NTIS HC A04/MF A01 CSCL 05B

N78-31508*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH ALTITUDE PERSPECTIVE
1978 33 p Original contains color illustrations
(NASA-SP-427) Avail: NTIS MF A01; SOD HC $1.60 CSCL 14E

The capabilities of the NASA Ames Center U-2 aircraft for research or experimental programs are described for such areas as Earth resources inventories; remote sensing data interpretation, electronic sensor research and development; satellite investigative support; stratospheric gas studies; and astronomy and astrophysics. The availability of this aircraft on a cost-reimbursable basis for use in high-altitude investigations that cannot be performed by the private sector is discussed. A.R.H.

N78-31516# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
THE COVERAGE FIELD OF EARTH OBSERVATION SATELLITES AT THE EARTH SURFACE. DESCRIPTION OF THE COMPUTER PROGRAM COFI [DAS UEBERDECKUNGSFELD ERDBEOBACHTENDER SATELLITEN AUF DER ERDOBERFLAECHE. BESCHREIBUNG DES RECHNERPROGRAMS COFI]

E. Fritz Jochim and W. Pawlik 1977 66 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-487)
(DLR-IB-552-77/40) Avail: NTIS HC A04/MF A01

FORTRAN 4 a computer program which generates a geographical coordinates or latitude-mean solar time printer plot of coverage field and coverage frequency of an earth observation satellite is described. Any nadir angle and half width of the perpendicular to the trajectory scanning sensor may be selected. Repeatedly covered regions are characterized by different output characters. The presentation may be limited on certain local solar time intervals. Author (ESA)

N78-32528# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
SHADED PERSPECTIVE IMAGE OF TERRAIN
Thomas M. Strat Mar. 1978 39 p refs
(Contract N00014-75-C-0643)
(AD-A055070; AI-M-463) Avail: NTIS HC A03/MF A01 CSCL 08/2

In order to perform image analysis, one must have a thorough understanding of how images are formed. This memo presents an algorithm that produces shaded perspective images of terrain as a vehicle to understanding the fundamentals of image formation. The image is constructed using standard projection equations along with an efficient hidden-surface removal technique. The image intensity is calculated using the reflectance map, a convenient way of describing the surface reflection as a function of surface gradient. Aside from its use as a tool toward understanding image analysis, the algorithm has several applications of its own, including providing video input to a flight simulator. Author (GRA)

N78-32534*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 WORLD STANDARD CATALOG, 1 MAY - 31 JULY 1978
31 Jul. 1978 322 p
(NASA-TM-79935; GSFC/LWC2-78/07; NTISUB/D/276-007) Avail: NTIS HC A14/MF A01 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Author

N78-32538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 3 WORLD STANDARD CATALOG, 6 MARCH - 31 JULY 1978
Jul. 1978 531 p
(NASA-TM-79902; GSFC/LWC3-78/07; NTISUB/D/277-007) Avail: NTIS HC A23/MF A01 CSCL 05B

The World Standard Catalog lists imagery acquired by LANDSAT 3 which was processed and input to the data files during the referenced period. Information such as date of entry, cloud cover, and image quality is given for each scene. The microfilm roll and frame on which the scene may be found is also indicated. A.R.H.

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A78-43327 # **The activities of the Groupement pour le Développement de la Télédétection Aérospatiale /GDTA/ (Activités du Groupement pour le Développement de la Télédétection Aérospatiale /G.D.T.A./).** H. Guichard, M. Guy, L. Laidet, and Y. Vuillaume (Groupement pour le Développement de la Télédétection Aérospatiale, Toulouse, France). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 245-253. In French.

The article surveys French remote sensing projects. Devices including visible and infrared cameras and multispectral scanners, thermal infrared scanners, and microwave multifrequency radar are described. Methods for data processing and interpretation are presented noting multipath numbering techniques, interactive digital viewing systems, and digital-data printing systems. Target projects are discussed with reference to resource and water monitoring, vegetation and forestland mapping, and pollution studies. Projects incorporating side-looking airborne radar, thermal detectors, and Landsat data are reviewed. S.C.S.

A78-43338 # **Interpretation techniques for X-band SLAR.** J. T. Parry (McGill University, Montreal, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 376-394. 22 refs.

The operation and interpretation of X-ray side-looking airborne radar (SLAR) are discussed with reference to both real aperture and synthetic aperture configurations. Operational parameters associated with the aircraft flight and the radar equipment are reviewed. Limits to SLAR performance are identified, including range display, swath width, scale, and resolution. The terrain features which influence radar return are considered, noting the conductivity and dielectric constant of the ground, surface geometry, local surface roughness, relief, and slope. Procedures for SLAR imagery interpretation, considering tone, speckle, texture, size, shape, shadow, and association, are outlined. S.C.S.

A78-43344 # **A synthetic aperture radar /SAR/ program for environmental and resource management in Canada.** R. Inkster and M. Kirby (INTERA Environmental Consultants, Ltd., Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1977, p. 469-473. 7 refs.

Canadian environmental and resource management using synthetic aperture radar (SAR) systems is outlined. The program is designed to identify cost-effective potential applications for radar remote sensing. The ERIM X-L SAR system, consisting of imaging sensors transmitting in the X- and L-bands, is described. Attention is given to hybrid optical-digital signal processing. This procedure consists of an optical processor interfaced to an image dissector, a computer program providing digitization, and recording and display apparatus. S.C.S.

A78-43637 **An experimental radar device for the observation of the earth from an aircraft (Ein Experimental-Radargerät zur Erdbeobachtung vom Flugzeug aus).** F. Schlude (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Flugfunk und Mikrowellen, Oberpfaffenhofen, West Germany). *Bildmessung und Luftbildwesen,* vol. 46, July 1, 1978, p. 123-131. In German.

Remote sensing data in the optical, infrared, and microwave range have become indispensible for a number of scientific investigations. The importance of the microwave sensor has increased in recent years in connection with its all-weather capability, which is vital for the geographical latitudes of Central Europe. Current limitations regarding the use of the microwave sensor are related to technological problems. In connection with the clearly recognized European need for a suitable microwave sensor, West Germany wants to improve the technology related to the microwave remote sensing of the earth. It is planned to provide for the users an operational satellite sensor system during the mid-1980s. A program for implementing this objective is being prepared. The first step taken in this connection was the design of a cost-efficient experimental radar device for the observation of the earth from an aircraft. Basic information regarding the observation of the earth with radar is considered and a survey is provided regarding the performance of the new device, taking into account the first results. G.R.

A78-43640 **The remote sensing experiments of the first Spacelab mission (Die Fernerkundungs-Experimente der ersten Spacelab-Mission).** J. Albertz (Darmstadt, Technische Hochschule, Darmstadt, West Germany). *Bildmessung und Luftbildwesen,* vol. 46, July 1, 1978, p. 147-151. In German.

It is intended to employ two remote sensing systems built in West Germany during the first Spacelab mission. The systems include a photogrammetric camera and a microwave remote sensing instrument. The microwave instrument can be used as a two-frequency scatterometer for sea-state measurements, as a radiometer providing brightness temperatures, or as an imaging synthetic aperture radar system. The basis for the Spacelab program is an agreement between NASA and the European Space Agency. The remote sensing experiments of the first Spacelab mission can be considered as preliminary stages concerning the development of a European satellite for remote-sensing applications. The sensors employed during the first Spacelab mission are subsequently to be modified for additional experiments which are to be conducted during a later Spacelab mission. G.R.

A78-44828 **The NRC camera calibrator.** P. D. Carman and H. Brown (National Research Council, Div. of Physics, Ottawa, Canada). *Photogrammetria,* vol. 34, July 1978, p. 147-165. 7 refs.

Equipment and techniques for the calibration of aerial survey cameras have been developed progressively at the National Research Council of Canada with the goals of providing a high level of real accuracy, versatility to accomodate a variety of camera, filters, and emulsions, and an economy of operation which permits recalibration at yearly intervals. Present apparatus and methods are described, and reasons for their construction and choice are explained. Results of three calibrations, made at different times, of two test cameras are given. They illustrate the degree to which cameras change with time and use. (Author)

A78-45023 # **A case study comparison of microwave radiometer measurements over bare and vegetated surfaces.** I. J. Barton (Commonwealth Scientific and Industrial Research Organization, Div. of Atmospheric Physics, Mordialloc, Victoria, Australia). *Journal of Geophysical Research,* vol. 83, July 10, 1978, p. 3513-3517. 14 refs.

Airborne microwave measurements with a nadir-viewing X band radiometer operating at a wavelength of 2.65 cm are described. The measurements over adjacent bare and vegetated surfaces are compared with ground truth samples of soil moisture content (SMC). For the bare surface the emissivity is highly correlated ($r = -0.97$) with the SMC of the top 0.5 cm, with an antenna temperature dependence

of -2.1 K/(percent SMC). In contrast, the correlation over vegetated surfaces is very poor (-0.25). Thus it cannot be expected that the technique at this wavelength would be generally useful as a measure of SMC, and this is borne out by comparison with the Nimbus 5 electrically scanned microwave radiometer data. If aircraft or satellite radiometers are to measure SMC under vegetated conditions, it will be necessary to increase their wavelengths well beyond the X-band. (Author)

A78-45687 # **A distortion-free map projection for analysis of satellite remote sensing.** J. L. Junkins and J. D. Turner (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Astrodynamics Conference, Palo Alto, Calif., Aug. 7-9, 1978, AIAA Paper 78-1425.* 12 p. Grant No. DAAG53-76-C-0067.

A dynamic map projection is formulated and tested numerically. In contrast to classical static map projections, the invariant line (projected free of length and normal-view curvature distortions) is not restricted to be an equator, a meridian, or a parallel; rather the satellite's subpoint trace (groundtrack) on the reference ellipsoid is the invariant line. Since the projection is dynamic, a local sensing time is associated with each (phi, lambda) in the satellite sensors' field of view (assumed to be a Landsat-type scanner/electro-optical detector). Length and angle distortions are rigorously zero along the groundtrack projection; the largest distortions within the finite sensed strip of the earth's surface are a few parts per 10,000 for most applications. The formulation is valid for any continuous satellite orbit or orbit segment (interfacing with state-of-the-art orbit integration software is straightforward). (Author)

A78-45750 * **Central swath mapping by a future satellite-borne fan-beam microwave scatterometer for inferring global ocean wind fields.** K. Tomiyasu (General Electric Co., Valley Forge Space Center, Philadelphia, Pa.). *IEEE Journal of Oceanic Engineering,* vol. OE-3, July 1978, p. 70-72. 6 refs. Contract No. NAS1-14173.

The Seasat-A satellite scatterometer is a microwave sensor designed to provide a capability for mapping the global ocean surface wind speed and direction. Four fan beams whose major axes are oriented at + or - 45 deg and + or - 135 deg to the flight vector cover a swath width of 1900 km, but a central region remains that is inadequately mapped. In this paper, two additional fan beams for a future scatterometer are suggested which provide more complete coverage of the central region. (Author)

A78-48514 # **Practical work in the study of aerial photocameras (Praktikum po issledovaniiu aerofotoapparatury).** E. P. Arzhanov; R. T. Vasil'ev, and V. B. Il'in. Moscow, Izdatel'stvo Nedra, 1977. 136 p. 12 refs. In Russian.

The book deals with laboratory investigations of aerial cameras, including cameras used for topographic purposes and for studying natural resources. Practical recommendations are given for checking optical systems, shutters, cassettes, time-lag devices for obtaining longitudinal overlaps, gyrostabilizers, statoscopes, and radio altimeters. Review questions at the end of each chapter make the volume well suited as a textbook. V.P.

A78-49440 **Estimates of brightness temperatures from scanning radiometer data.** A. Stogryn (Aerojet ElectroSystems Co., Azusa, Calif.). *IEEE Transactions on Antennas and Propagation,* vol. AP-26, Sept. 1978, p. 720-726. 9 refs.

In the analysis of antenna temperature maps of the earth obtained by satellite-borne microwave radiometers, estimates of brightness temperatures or averages of brightness temperatures over areas considerably smaller than the region sensed at a given position of the radiometer antenna are often needed. An application of the Backus-Gilbert methodology is made to obtain an objective criterion of the best resolution (in a least squares sense) obtainable from a given system and to investigate the trade-off between resolution and noise in the derived average brightness temperatures. The mathematically related problem of simultaneously analyzing antenna temperature measurements made at different frequencies by antennas with noncoincident antenna patterns is also considered. (Author)

A78-49765 # **Experience in operational processing of geophysical data with the aid of the DGU-2 plotter (Opyt operativnoi obrabotki geofizicheskoi informatsii s ispol'zovaniem grafopostroitelia DGU-2).** A. E. Suziumov (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR) and M. B. Leibov (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Okeanologiia,* vol. 18, May-June 1978, p. 542-545. In Russian.

A78-53732 # **Determination of earth soil moisture by means of microwave radiometry /Review/ (Opredelenie vlazhnosti zemnykh pokrovov metodami SVCh-radiometrii /Obzor/).** A. E. Basharinov and A. M. Shutko. *Radiotekhnika i Elektronika,* vol. 23, Sept. 1978, p. 1778-1791. 60 refs. In Russian.

The paper is a survey of theoretical and experimental studies of the microwave radiometry of soil moisture. Consideration is given to the physics of moisture-radiation relationships, the radiation properties of nonuniformly moist soils, and the screening effect of vegetation. B.J.

N78-28576*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A PARAMETRIC MULTICLASS BAYES ERROR ESTIMATOR FOR THE MULTISPECTRAL SCANNER SPATIAL MODEL PERFORMANCE EVALUATION
B. G. Mobasseri, C. D. McGillem, and P. E. Anuta, Principal Investigators 1978 294 p refs EREP
(Contracts NAS9-14016; NAS9-14970; NAS9-15466)
(E78-10171; NASA-CR-151745; LARS-TR-061578; TR-EE-78-22) Avail: NTIS HC A13/MF A01 CSCL 05B

The author has identified the following significant results. The probability of correct classification of various populations in data was defined as the primary performance index. The multispectral data being of multiclass nature as well, required a Bayes error estimation procedure that was dependent on a set of class statistics alone. The classification error was expressed in terms of an N dimensional integral, where N was the dimensionality of the feature space. The multispectral scanner spatial model was represented by a linear shift, invariant multiple, port system where the N spectral bands comprised the input processes. The scanner characteristic function, the relationship governing the transformation of the input spatial, and hence, spectral correlation matrices through the systems, was developed.

N78-28589# Fairchild Imaging Systems, Syosset, N. Y. Night Vision Lab.
DATA PROCESSOR (RPV) Final Report
Jun. 1977 43 p
(Contract DAAG53-76-C-0207)
(AD-A053536; ED-AX-80) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report describes a program for the development, brassboard fabrication and testing of an airborne Solid State CCD Data Processor that demonstrates a method of transmitting a standard TV signal over a narrow bandwidth link by processing the TV signal, using CCD-488 devices in an 'analog storage mode'. The Data Processor brassboard shown in Figure 1, is designed to electrically interface with the Systems Research Laboratory's (SRL) TV Camera, 326-H2 and the Fairchild CCD-488 TV Camera (MV301) and to mechanically interface with the Aquila air frame. GRA

N78-29139# National Environmental Satellite Service, Washington, D. C.
THE TIROS-N POLAR ORBITING-ENVIRONMENTAL SATELLITE SYSTEM
W. John Hussey Oct. 1977 32 p Presented at the 10th Session of the ESCAP/WMO Typhoon Committee, Tokyo, Japan, 28 Oct. 1977
(PB-280743/6; NOAA-78041213) Avail: NTIS HC A03/MF A01 CSCL 22B

The TIROS operational satellite (ITOS); launched in its current configuration with radiometers as NOAA-2 in October 1972, is the present type of NOAA polar orbiting operational satellite. Satellite and ground system capabilities of interest to the users of direct readout services from the system were examined in detail. GRA

N78-29424*# Barnes Engineering Co., Waltham, Mass.
ADVANCED MULTISPECTRAL SCANNER (AMS) STUDY Final Report
30 Jun. 1978 217 p refs
(Contract NAS9-15323; Proj. 2738)
(NASA-CR-151753; MA-183T) Avail: NTIS HC A10/MF A01 CSCL 14B

The status of aircraft multispectral scanner technology was accessed in order to develop preliminary design specifications for an advanced instrument to be used for remote sensing data collection by aircraft in the 1980 time frame. The system designed provides a no-moving parts multispectral scanning capability through the exploitation of linear array charge coupled device technology and advanced electronic signal processing techniques. Major advantages include: 10:1 V/H rate capability; 120 deg FOV at V/H = 0.25 rad/sec; 1 to 2 rad resolution; high sensitivity; large dynamic range capability; geometric fidelity; roll compensation; modularity; long life; and 24 channel data acquisition capability. The field flattening techniques of the optical design allow wide field view to be achieved at fast f/nos for both the long and short wavelength regions. The digital signal averaging technique permits maximization of signal to noise performance over the entire V/H rate range. A.R.H.

N78-29544*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SPECTRAL METHOD FOR DETERMINING THE PERCENTAGE OF LIVE HERBAGE MATERIAL IN CLIPPED SAMPLES
Compton J. Tucker Nov. 1977 24 p refs Submitted for publication
(NASA-TM-78019) Avail: NTIS HC A02/MF A01 CSCL 20F

A laboratory spectroradiometric method for the rapid determination of live/dead vegetation percentages from clipped grass samples has been developed and preliminarily tested. The method utilizes the red and photographic infrared reflectance or radiance differences between green vegetation and that of dead vegetation. Mixtures of green and dead material were found to have reflectances or radiances proportional to the percentage of green material present. This method offers the possibility that rapid live/dead spectroradiometric determinations may replace the tedious hand-sorting now generally in use for many situations. Author

N78-30748*# Hughes Aircraft Co., Culver City, Calif.
GEOSYNCHRONOUS MICROWAVE ATMOSPHERIC SOUNDING RADIOMETER (MASR) FEASIBILITY STUDIES. VOLUME 1: MANAGEMENT SUMMARY
Jan. 1978 55 p
(Contracts NAS5-24082; NAS5-24087)
(NASA-CR-156804; HAC-D8647/D9236-Vol-1; SCG-70531R-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 04A

The mission of the microwave atmospheric sounding radiometer (MASR) is to collect data to aid in the observation and prediction of severe storms. The geosynchronous orbit allows the continuous atmospheric measurement needed to resolve mesoscale dynamics. The instrument may operate in conjunction with this document, Volume 1 - Management, which summarizes the highlights of final reports on both the radiometer instrument and antenna studies. The radiometer instrument summary includes a synopsis of Volume 2 - Radiometer Receiver Feasibility, including design, recommended configuration, performance estimates, and weight and power estimates. The summary of the antenna study includes a synopsis of Volume 3 - Antenna Feasibility, including preliminary design tradeoffs, performance of selected design, and details of the mechanical/thermal design. G.Y.

N78-30749*# Hughes Aircraft Co., Culver City, Calif.
GEOSYNCHRONOUS MICROWAVE ATMOSPHERIC SOUNDING RADIOMETER (MASR) FEASIBILITY STUDY. VOLUME 2: RADIOMETER RECEIVER FEASIBILITY Final Report
F. E. Goodwin, M. S. Hersman, and M. Luming Jan. 1978 214 p refs
(Contract NAS5-24082)
(NASA-CR-156805; HAC-Ref-D8647-Vol-2; SCG-70532R-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 04A

For abstract, see N78-30748.

N78-31509*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SKYLAB S191 SPECTROMETER EXPERIMENT: ANALYSIS OF DATA AND THEIR APPLICATIONS TO THE EARTH SCIENCES
V. R. Wilmarth, D. A. Rainey (Lockheed Electron. Co., Houston, Tex.), and W. R. Johnson (Lockheed Electron. Co., Houston, Tex.) Jul. 1978 89 p refs
(NASA-TM-58208; JSC-13886) Avail: NTIS HC A05/MF A01 CSCL 05B

The data in the visible and near-infrared portions of the spectrum as recorded by identical spectrometers on Skylab and on a helicopter are examined to establish the significance of spectral reflectances from the Earth surface as influenced by water vapor, atmospheric gases, and aerosols. Models of radiation transfer show good agreement of theoretical computations and observed measurements. Author

N78-31510*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EVALUATION OF THE FIRST FOUR LANDSAT-D THEMATIC MAPPER REFLECTIVE SENSORS FOR MONITORING VEGETATION: A COMPARISON WITH OTHER SATELLITE SENSOR SYSTEMS
Compton J. Tucker May 1978 53 p refs
(NASA-TM-79617) Avail: NTIS HC A04/MF A01 CSCL 08F

The first four LANDSAT-D thematic mapper sensors were evaluated and compared to: the return beam vidicon (RBV) and multispectral scanners (MSS) sensors from LANDSATS 1, 2, and 3; Colvocoresses' proposed 'operational LANDSAT' three band system; and the French SPOT three band system using simulation/intergration techniques and in situ collected spectral reflectance data. Sensors were evaluated by their ability to discriminate vegetation biomass, chlorophyll concentration, and leaf water content. The thematic mapper and SPOT bands were found to be superior in a spectral resolution context to the other three sensor systems for vegetational applications. Significant improvements are expected for most vegetational analyses from LANDSAT-D thematic mapper and SPOT imagery over MSS and RBV imagery. Author

N78-32134# Indian Inst. of Science, Bangalore.
REMOTE SENSING
Y. V. Venkatesh *In its* Space Sci., Technol. and Appl.: An Overview Apr. 1978 11 p refs (For primary document see N78-32114 23-12)
Avail: NTIS HC A10/MF A01

A lecture is presented and attempts to enumerate how, in man-made remote sensing systems, the data are acquired, how they are modified and, above all, how they can be organized, analyzed and interpreted to provde new information. Of particular value and interest to the engineer, plannar and resource manager are remote sensing systems that supply information about the terrestrial environment from aerial or space vantage point. The following topics are discussed: (1) fundamentals of remote sensing; (2) idealized remote sensing systems; (3) energy sources; (4) target interactions; (5) atmospheric effects; (6) practical remote sensing systems - multi-band photographic system, radiometers, scanners, side-looking airborne radar, passive microwave systems; and (7) data processing. G.Y.

N78-32397* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MAGNETOMETER WITH A MINIATURE TRANSDUCER AND AUTOMATIC SCANNING Patent
William J. Jr. Debnam, Carl L. Fales, Jr., Roger A. Breckenridge, and Arthur V. Pohm, inventors (to NASA) (Iowa State Univ. of Sci. and Technol.) Issued 9 May 1978 5 p Filed 19 Mar. 1976 Supersedes N77-17430 (15 - 08, p 1035) Continuation of abandoned US Patent Appl. SN-547072, filed 4 Feb. 1975
(NASA-Case-LAR-11617-2; US-Patent-4,088,954; US-Patent-Appl-SN-668771; US-Patent-Class-324-249; US-Patent-Appl-SN-547072) Avail: US Patent Office CSCL 14B

The magnetometer is based on the time variation of the magnetic permeability in the magnetic material of its transducer; however, its operation is substantially different from the ordinary flux-gate magnetometer. The transducer uses 0.05 mm diameter plated magnetic wire and is made flat enabling it to make measurements of transverse magnetic fields as close as 0.08 mm from the surface, and it has very good spatial resolution because of its small active region of approximately 0.64 mm by 0.76 mm. The magnetometer uses an inexpensive clip-on millimeter for driving and processing the electrical signals and readout. It also utilizes an automatic scanning technique which is made possible by a specially designed transducer holding mechanism that replaces the ink pen on an X-Y recorder.
Official Gazette of the U.S. Patent Office

N78-32398*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VISIBLE AND INFRARED POLARIZATION RATIO SPECTRO-REFLECTOMETER Patent Application
Carmen E. Batten, inventor (to NASA) Filed 28 Jul. 1978 19 p
(NASA-Case-LAR-12285-1; US-Patent-Appl-SN-929087) Avail: NTIS HC A02/MF A01 CSCL 14B

The invention relates to an instrument for determining the optical constants of a sample material by causing light of various angles of polarization to impinge upon the sample at various angles of incidence and measuring the intensity of the reflected light at various wavelength. The ratio of the intensity of the reflected light for parallel polarized light to that for perpendicular polarized light at two different angles of incidence can be used to determine the optical constants of the sample. The novel feature of the invention appears to reside in a spectroreflectometer employing coordinated rotating platforms which enable the automatic alignment of the instrument at a wide variety of angles of incidence. NASA

N78-33502 Virginia Univ., Charlottesville.
DETECTION AND LOCATION OF RESEAUX USING PICTORIAL PATTERN RECOGNITION Ph.D. Thesis
James Hiram Aylor 1977 133 p
Avail: Univ. Microfilms Order No. 7812135

An automatic system to locate plus-like images called reseaux on aerial photographs is presented. A minicomputer system and microdensitometer is used for accurate location of these images within a photograph. A model was generated from the statistics of actual reseaux samples to create a test vehicle for the performance of various picture processing algorithms. A method of including various photographic effects into the model is presented. Various combinations of scene analysis schemes are presented with results for the center location problem. Preprocessing techniques for noise removal are described. Also developed is a scheme for noise removal. Two methods of center location are described and comparative speed and accuracy results presented. The operation of the final system is also described.
Dissert. Abstr.

N78-33512*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF ATMOSPHERIC WATER VAPOR, LIQUID WATER AND WIND SPEED AT THE OCEAN SURFACE BY PASSIVE MICROWAVE TECHNIQUES FROM THE NIMBUS-5 SATELLITE
A. T. C. Chang and T. T. Wilheit Jun. 1977 33 p refs
(NASA-TM-79568) Avail: NTIS HC A03/MF A01 CSCL 04A

The microwave brightness temperature measurements for Nimbus-5 electrically scanned microwave radiometer and Nimbus E microwave spectrometer are used to retrieve the atmospheric water vapor, liquid water and wind speed by a quasi-statistical retrieval technique. It is shown that the brightness temperature can be utilized to yield these parameters under various weather conditions. Observations at 19.35 GHz, 22.235 GHz and 31.4 GHz were input to the regression equations. The retrieved values of these parameters for portions of two Nimbus-5 orbits are presented. Then comparison between the retrieved parameters and the available observations on the total water vapor content and the surface wind speed are made. The estimated errors for retrieval are approximately 0.15 g/sq cm for water vapor content, 6.5 mg/sq cm for liquid water content and 6.6 m/sec for surface wind speed. Author

N78-33513*# Systems and Applied Sciences Corp., Riverdale, Md.
REMOTE SENSING OF RAIN OVER THE OCEAN Final Report
8 May 1978 36 p refs
(Contract NAS5-24198)
(NASA-CR-156843; R-SAG-5/78-01) Avail: NTIS HC A03/MF A01 CSCL 04B

Computer models of the microwave emission from the earth's atmosphere were used to study the problem of retrieving meteorological information from the SMMR instrument that will be flown on NIMBUS-G. Methods for retrieving rain rate, wind speed, cloud height, and ocean temperature are described for the case when the satellite is over the ocean. G.G.

N78-33642*# National Aeronautics and Space Administration, Washington, D. C.
OPTICAL CHARACTERISTICS OF THE EARTH'S SURFACE AND ATMOSPHERE FROM THE POINT OF VIEW OF THE REMOTE SENSING OF NATURAL RESOURCES: REVIEW OF THE CONTEMPORARY STATUS OF THE PROBLEM
V. I. Tarnopolskiy Oct. 1978 73 p refs Transl. into ENGLISH of "Opticheskiye Kharakteristiki Poverkhnosti i Atmosfery Zemli s Tochki Zreniya Distantsionnogo Issledovaniya Prirodnykh Resursov", Rept. Pr-287 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 73 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75548; Pr-287) Avail: NTIS HC A04/MF A01 CSCL 04A

Widely used remote probing methods, and especially the multispectral method, for studying the earth from aerospace platforms necessitate the systematization and accumulation of data on the relationships between remote observations and measured parameters and characteristic properties and conditions of phenomena on the earth's surface. Data were presented on the optical characteristics of natural objects which arise during observations of these objects over a wide spectral interval which encompasses solar radiation reflected by the object as well as the object's inherent thermal radiation. The influence of the earth's atmosphere on remote measurements and several problems in simulation and calculation are discussed. B.B.

09
GENERAL

Includes economic analysis.

A78-43303 **Canadian Symposium on Remote Sensing, 4th, Quebec, Canada, May 16-18, 1977, Proceedings.** Symposium sponsored by the Canadian Remote Sensing Society, Department of Fisheries and the Environment Canada, Canada Centre for Remote Sensing, l'Association Québécoise de Télédétection, and Canadian Institute of Surveying. Ottawa, Canadian Aeronautics and Space Institute, 1977. 626 p. In English and French. $40.

Primary applications of remote sensing technology are discussed, including agronomy, agriculture, and cartography. Attention is given to the machine-assisted classification of remote sensing data with reference to biophysical mapping and forest-land classification. Applications of satellite imagery to hydrology are outlined along with techniques for thermal infrared imagery (noting ground surfaces covered with vegetation, sea and ice mapping, and building heat-loss). Various world-wide Landsat applications are discussed and processes for the interpretation of microwave data are outlined. Multispectral studies utilizing remote sensing data are described including the geological reconnaissance of dam sites, the measurement of the vertical distribution of phytoplankton in sea-water, and the remote sensing of chlorophyll. Procedures for making geometric and radiometric adjustments are presented. S.C.S.

A78-43636 **Possible applications of Meteosat for remote sensing (Mögliche Anwendungen von Meteosat für die Fernerkundung).** K. G. Lenhart (ESA, European Space Operation Centre, Darmstadt, West Germany). *Bildmessung und Luftbildwesen,* vol. 46, July 1, 1978, p. 113-122. In German.

Meteosat, the first European weather satellite, was successfully launched on November 23, 1977. The first pictures of the terrestrial disk were provided on December 9, 1977. The Meteosat project was conducted by the European Space Agency. Pictures of the terrestrial surface and the cloud cover in the visible and infrared region are obtained as a basis for the derivation of meteorological information. In a discussion of the possibilities for the application of Meteosat data, attention is given to the measurement of sea surface temperatures, the measurement of ground humidity, applications for agriculture, the administration and surveillance of water resources, the distribution of vegetation zones and their seasonal and climate-related changes, and geologic investigations for the identification of large-scale structures. G.R.

A78-45887 # **The Earthnet Programme.** L. Marelli (ESA, Directorate of Planning and Future Programmes, Paris, France). *ESA Bulletin,* no. 13, May 1978, p. 41-46.

The objectives, structure, interfaces, planning, and prospects of the Earthnet Program for the acquisition, preprocessing, archiving, and distribution of remote-sensing satellite data are described. The Earthnet Program, organized February 1977, is a first step towards the establishing of a European remote-sensing program. The achievements of the Earthnet Program are considered, dates for the start of operations of participating Landsat stations are listed, and the number of Landsat orbits performed and images obtained are reported. M.L.

A78-45888 # **LEDA - An ESA data bank dedicated to images of earth seen from space (LEDA - Une Banque de Données de l'ESA consacrée aux images de la Terre vue de l'espace).** G. A. Proca (ESA, Space Documentation Service, Frascati, Italy). *ESA Bulletin,* no. 13, May 1978, p. 47-51. In French.

The Line Earthnet Data Availability (LEDA) system created by the Space Documentation Service of the ESA is described. LEDA is a data bank which can be interrogated in real time and in conversational mode by means of terminals connected to the SDS computer. The data acquired can be applied to the interpretation of space images. The scope of data and operations available is explained. M.L.

N78-28577*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
ECHO USER'S GUIDE
D. A. Landgrebe, Principal Investigator, James L. Kast, Philip H. Swain, Barbara J. Davis, and Paul W. Spencer Aug. 1977 79 p refs EREP
(Contract NAS9-14970)
(E78-10172; NASA-CR-157289; LARS-Publ-083077) Avail: NTIS HC A05/MF A01 CSCL 05B

N78-28587*# Missouri Univ. -Rolla. Dept. of Mining, Petroleum and Geological Engineering.
A MANUAL FOR INEXPENSIVE METHODS OF ANALYZING AND UTILIZING REMOTE SENSOR DATA
C. Dale Elifrits and David J. Barr Jul. 1978 32 p refs
(Contract NAS8-31767)
(NASA-CR-150731) Avail: NTIS HC A03/MF A01 CSCL 05B

Instructions are provided for inexpensive methods of using remote sensor data to assist in the completion of the need to observe the earth's surface. When possible, relative costs were included. Equipment need for analysis of remote sensor data is described, and methods of use of these equipment items are included, as well as advantages and disadvantages of the use of individual items. Interpretation and analysis of stereo photos and the interpretation of typical patterns such as tone and texture, landcover, drainage, and erosional form are described. Similar treatment is given to monoscopic image interpretation, including LANDSAT MSS data. Enhancement techniques are detailed with respect to their application and simple techniques of creating an enhanced data item. Techniques described include additive and subtractive (Diazo processes) color techniques and enlargement of photos or images. Applications of these processes, including mappings of land resources, engineering soils, geology, water resources, environmental conditions, and crops and/or vegetation, are outlined. G.G.

N78-29032# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY: PHYSICAL SCIENCES AND TECHNOLOGY, NO. 41
20 Jul. 1978 101 p refs Transl. into ENGLISH from various Russian journals
(JPRS-71512) Copyright. Avail: NTIS HC A06/MF A01

Soviet progress is reported in automation technology, industrial robot use and development, and in satellite observations of earth resources. Oceanographic studies of atmospheric circulation above the Pacific Ocean, and the tectonic structure of its bottom are included.

N78-29038# Joint Publications Research Service, Arlington, Va.

SPACE PHOTOGRAPHY FEATS, OBJECTIVES DESCRIBED

Yuriy Zaytsev *In its* Transl. on USSR Sci. and Technol. (JPRS-71512) 20 Jul. 1978 p 70-73 Transl. into ENGLISH from Kierunki (Warsaw), no. 27, 2 Jul. 1978 p 3 (For primary document see N78-29032 19-99)

Copyright. Avail: NTIS HC A06/MF A01

Applications of space technology methods in geology, oceanography, hydrology, geobotany, soil science, agrobiology, and forestry are reviewed. The problem of finding various natural resources on earth and of studying phenomena occurring in nature is considered. The basic material for spacebased research of earth resources is either black and white or colored photographs. However, if photographs in the visible part of the spectrum and in the light from infrared radiation are made at the same time, the properties of the objects observed can be better investigated. Irradiation measurements of other wavelengths are also important. By determining the radio temperature of various sectors of the earth's surface, deep-lying layers of the earth's crust may be observed. A.R.H.

N78-29125# Council for Scientific and Industrial Research, Pretoria (South Africa).

SPACE RESEARCH IN THE REPUBLIC OF SOUTH AFRICA: REPORT TO COSPAR Annual Report

F. J. Hewitt May 1978 10 p

Avail: NTIS HC A02/MF A01

Results are given of various experiments and studies conducted in the areas of solar terrestrial physics and satellite remote sensing. Programs in ionospheric sounding, geomagnetism, cosmic rays, and whistlers, VLF, ELF, and auroral emissions are included along with satellite remote sensing of oceanographic parameters. Image processing of LANDSAT data to provide information for forest mapping, antarctic mapping, agricultural land use, and the study of coastal areas is summarized. J.M.S.

N78-29535*# National Aeronautics and Space Administration, Washington, D. C.

SOYUZ 22: NEW CONTRIBUTION TO EARTH STUDY FROM SPACE

L. A. Vedeshin, V. V. Ivanov, and Ye D. Sulidi-Kondratyev Oct. 1977 9 p Transl. into ENGLISH from Priroda (USSR), no. 3, Mar. 1977 p 20-23 Original language doc. announced as N77-28559 Original doc. Prep. by Interkosmos Council, Academy of Sciences, USSR Transl. by Transemantics, Inc., Washington, D. C.

(Contract NASw-2792)

(NASA-TM-75055) Avail: NTIS HC A02/MF A01 CSCL 05B

The mission of space flight Soyuz-22 was to develop new and improved methods and means for finding tthe Earth's natural resources from outer space to aid the economy. With the help of the new multispectral space camera, MKF-6, the cosmonauts were able to photograph selected areas of U.S.S.R. and the German Democratic Republic in 4 visible and 2 infrared regions of the spectrum. The MKF-6 can simultaneously photograph areas in 6 spectral regions and register both the natural electromagnetic radiation of surface objects and the solar radiation reflected by them. L.S.

N78-29548# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

THE COVERAGE BEHAVIOR OF ERDSAT FOR SOME SELECTED REGIONS OF THE WORLD [UEBERDECKUNGS-VERHALTEN DES ERDSAT FUER EINIGE AUSGEWAEHLTE GEBIETE AUF DER ERDOBERFLAECHE]

E. F. Jochim Mar. 1978 72 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-494)

(DLR-IB-552-78/1) Avail: NTIS HC A04/MF A01

The coverage behavior of a proposed European remote sensing satellite was investigated for each of its onboard sensors for Europe, the Amazon Basin, Indonesia, and Brazil. The proposed satellite will carry a multispectral scanner and a microwave sensor. It is concluded that the satellite orbit can be optimal only for one sensor for one region on the earth. ESA

N78-30146*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

SPACELAB MISSION 1 EXPERIMENT DESCRIPTIONS

Paul D. Craven, ed. May 1978 154 p

(NASA-TM-78173; ESA/FSLP-EX-001) Avail: NTIS HC A08/MF A01 CSCL 22A

Brief descriptions of experiments and facilities planned for Spacelab I are presented. These experiments and facilities were selected from the responses to the Announcement of Opportunity for the first Spacelab mission. These experiments are grouped under the topics of: atmospheric physics and earth observations, space plasma physics, material sciences and technology, astronomy and solar physics, and life sciences. S.B.S.

N78-30154* National Aeronautics and Space Administration, Washington, D. C.

FIRST IN NEW ENVIRONMENTAL SPACECRAFT SERIES TO BE LAUNCHED

5 Sep. 1978 23 p

(NASA-News-Release-78-132; P78-10139) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

A series of operational meteorological monitoring satellites (TIROS-N) is described. Emphasis is placed on environmental monitoring instruments onboard the satellites that provide technological advances over previous sensors. Benefits in the areas of weather forecasting, oceanography, water resource management, and flood forecasting are discussed along with the operational capability to collect and transmit environmental data from platforms on land, at sea, and airborne, and to track stations motion. The participation of Canada, Great Britain, and France is mentioned and a description of the launch vehicle is included. J.M.S.

N78-31506*# National Aeronautics and Space Administration, Washington, D. C.

A SUMMARY OF THE USERS PERSPECTIVE OF LAND-SAT-D AND REFERENCE DOCUMENT OF LANDSAT USERS

A. Donald Goedeke and Alexander J. Tuyahov, Principal Investigator 31 Jan. 1977 330 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(E78-10208; NASA-TM-79744) Avail: NTIS HC A15/MF A01 CSCL 05B

N78-31517# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.

LANDSAT POLICY ISSUES STILL UNRESOLVED

17 Apr. 1978 34 p

(PB-279701/7; PSAD-78-58) Avail: NTIS HC A03/MF A01 CSCL 08B

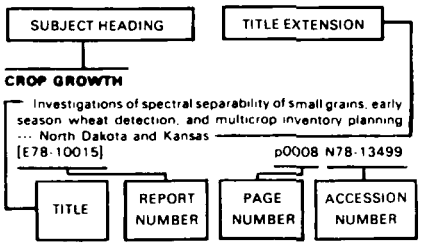
The need to keep the Congress informed on the goals and results of studies relating to satellite-based, remote-sensing policy issues is discussed. GRA

N78-32519*# Missouri Univ., Columbia.
APPLICATION TRANSFER ACTIVITY IN MISSOURI Final Report, Jan. 1976 - Jun. 1978
David J. Barr and Chris J. Johannsen Sep. 1978 44 p refs (Contract NAS8-31767)
(NASA-CR-150805) Avail: NTIS HC A03/MF A01 CSCL 05B

Experimental demonstrations and workshop instructional courses were conducted to transfer the technology of satellite remote sensing to a wide audience of resource managers. This audience included planning commissions, state agencies, federal agencies, and special councils of the Governor. Some of the experiments and workshops are outlined. J.M.S.

N78-33506*# General Electric Co., Philadelphia, Pa. Space Div.
PLACE: POST LANDSAT D ADVANCED CONCEPT EVALUATION Final Report
Larry Alexander, Principal Investigator 18 Aug. 1978 418 p refs ERTS
(Contract NAS2-9580)
(E78-10156; NASA-CR-156818; DOC-78SDS4238) Avail: NTIS HC A18/MF A01 CSCL 05B

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.

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

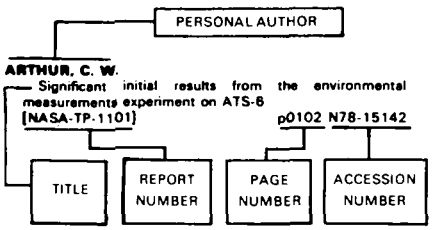
V

W

Y

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title, e.g., p 0102 N78-15142. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

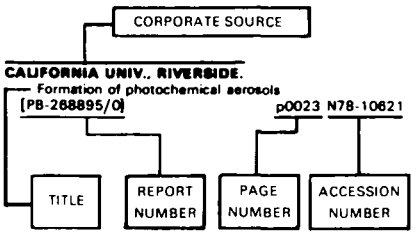
V

W

Y

Z

Typical Corporate Source Index Listing



The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

A

ACADEMY OF SCIENTIFIC RESEARCH AND TECHNOLOGY, CAIRO (EGYPT).
Geology of Kharga-Dakhla Oases area, western desert, Egypt, from LANDSAT-1 satellite images
[E78-10158] p0241 N78-28563
Geologic interpretation of LANDSAT satellite images for the Qattara Depression area, Egypt
[E78-10159] p0241 N78-28564
Satellite mapping: Regional geology, geomorphology, structure, drainage and hydrology of Bahr El Jebel area, Jonglei Canal project area, southern Sudan
[E78-10160] p0241 N78-28565
Soil resources and potential for agricultural development in Bahr El Jebel in southern Sudan, Jonglei Canal project area
[E78-10161] p0231 N78-28566
Geological and environmental resources investigations in Egypt using LANDSAT images
[E78-10162] p0241 N78-28567
Geological and environmental resources investigations in Egypt using LANDSAT images
[E78-10163] p0241 N78-28568
Geological and environmental resources investigations in Egypt using LANDSAT images
[E78-10164] p0241 N78-28569
Groundwater studies in arid areas in Egypt using LANDSAT satellite images
[E78-10165] p0254 N78-28570
Application of LANDSAT imagery in the geological and soil investigations in the control western desert, Egypt
[E78-10166] p0241 N78-28571
Application of LANDSAT satellite imagery for iron ore prospecting in the western desert of Egypt
[E78-10167] p0241 N78-28572
LANDSAT satellite mapping in Egypt and its possible applications in petroleum and natural gas exploration
[E78-10168] p0242 N78-28573
Regional prospecting for iron ores in Bahariya Oasis-El Faiyum area, Egypt, using LANDSAT-1 satellite images
[E78-10169] p0242 N78-28574
Geological and groundwater potential studies of El Ismailiya master plan study area
[E78-10170] p0242 N78-28575

ARKANSAS UNIV., FAYETTEVILLE.
Preliminary geologic evaluation of L-band radar imagery: Arkansas test site
[NASA-CR-157761] p0244 N78-33644

ARMY COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.
Differences in radar return from ice-covered North Slope Lakes p0254 A78-48067
Computer processing of LANDSAT digital data and sensor interface development for use in New England reservoir management
[AD-A055762] p0255 N78-31513

ARMY ENGINEER TOPOGRAPHIC LABS., FORT BELVOIR, VA.
Near real time application of digital terrain data in a minicomputer environment
[AD-A054008] p0237 N78-29545

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
Guidance for application of remote sensing to environmental management. Appendix A: Sources of available remote sensor imagery
[AD-A053673] p0235 N78-28588

B

BARNES ENGINEERING CO., WALTHAM, MASS.
Advanced Multispectral Scanner (AMS) study
[NASA-CR-151753] p0265 N78-29424

BENDIX AEROSPACE SYSTEMS DIV., ANN ARBOR, MICH.
Multispectral data restoration study
[NASA-CR-156790] p0260 N78-28585

BRITISH LIBRARY LENDING DIV., BOSTON SPA (ENGLAND).
Using a 70-mm stereo camera system with large-scale photogrammetric interpretation for forest inventory
[FCT-492] p0231 N78-29529

C

CALIFORNIA UNIV., BERKELEY.
Research of microwave scattering properties of snow fields
[NASA-CR-157472] p0254 N78-29303

CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
Methodology for assessing the potential impact on air quality resulting from geothermal resource development in the Imperial Valley
[UCRL-79388] p0235 N78-28655

COMMISSION OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY).
AGRESTE project: Agricultural resources investigations in northern Italy and southern France
[E78-10199] p0233 N78-31497

COMMITTEE ON SPACE RESEARCH (COSPAR), PARIS (FRANCE).
Satellite imagery interpretation: Suggestions for laboratory design
[TECH-MAN-SER-5] p0260 N78-28593

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA (SOUTH AFRICA).
Space research in the Republic of South Africa: Report to COSPAR p0268 N78-29125

D

DARTMOUTH COLL., HANOVER, N.H.
Mapping ultramafic rocks by computer analysis of digital LANDSAT data p0244 N78-33504

DELAWARE UNIV., NEWARK.
Remote sensing of coastal pollutants
[E78-10213] p0236 N78-32518

DEPARTMENT OF ENVIRONMENT, OTTAWA (ONTARIO).
Ice sheet topography by satellite altimetry p0246 A78-47196

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO).
Retransmission of hydrometric data in Canada
[E78-10174] p0255 N78-29531
Retransmission of hydrometric data in Canada
[E78-10179] p0255 N78-32513

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, OBERPFAFFENHOFEN (WEST GERMANY).
The coverage behavior of ERDSAT for some selected regions of the world
[DLR-IB-552-78/1] p0268 N78-29548
The coverage field of earth observation satellites at the earth surface. Description of the computer program COFI
[DLR-IB-552-77/40] p0261 N78-31516

DU PONT DE NEMOURS (E. I.) AND CO., AIKEN, S. C.
NURE geochemical investigations in the eastern United States
[DP-MS-77-101] p0256 N78-33517

E

ECOSYSTEMS INTERNATIONAL, INC., GAMBRILLS, MD.
Applications of remote sensing to hydrologic planning
[NASA-CR-3041] p0256 N78-32526

EG AND G WASHINGTON ANALYTICAL SERVICES CENTER, INC., POCOMOKE CITY, MD.
Ice sheet topography by satellite altimetry p0246 A78-47196
Large-scale Gulf Stream frontal study using GEOS 3 radar altimeter data p0250 A78-52164

ENVIRONMENTAL RESEARCH AND TECHNOLOGY, INC., CONCORD, MASS.
Investigation of the application of HCMM thermal data to snow hydrology
[E78-10194] p0255 N78-32514

ENVIRONMENTAL RESEARCH INST. OF MICHIGAN, ANN ARBOR.
Analysis of scanner data for crop inventories
[E78-10207] p0234 N78-31505

F

FAIRCHILD IMAGING SYSTEMS, SYOSSET, N. Y.
Data processor (RPV)
[AD-A053536] p0264 N78-28589

FERRANTI LTD., BRACKNELL (ENGLAND).
Description of a simulation model of synthetic aperture radar systems. Volume 1: Summary
[REPT-2831-VOL-1] p0260 N78-30501
Description of a simulation model of synthetic aperture radar systems. Volume 2: Theory and results
[REPT-2831-VOL-2] p0260 N78-30502

G

GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
Crop forecasting by satellite: Progress and problems
[PB-279437/8] p0232 N78-29561
LANDSAT policy issues still unresolved
[PB-279701/7] p0268 N78-31517

GENERAL ELECTRIC CO., HUNTSVILLE, ALA.
Global crop production forecasting: An analysis of the data system problems and their solutions
[NASA-CR-150749] p0232 N78-30637

GENERAL ELECTRIC CO., PHILADELPHIA, PA.
Central swath mapping by a future satellite-borne fan-beam microwave scatterometer for inferring global ocean wind fields p0264 A78-45750
PLACE: Post LANDSAT D Advanced Concept Evaluation
[E78-10156] p0269 N78-33506

GEOLOGICAL SURVEY, DENVER, COLO.
Geologic application of thermal-inertia mapping from satellite
[E78-10212] p0243 N78-32517

GEOLOGICAL SURVEY, TACOMA, WASH.
Ice sheet topography by satellite altimetry p0246 A78-47196

GEOLOGICAL SURVEY, UNIVERSITY, ALA.
Remote sensing of strippable coal reserves and mine inventory in part of the Warrior Coal Field in Alabama
[NASA-CR-150781] p0243 N78-32520

H

HOFSTRA UNIV., HEMPSTEAD, N. Y.
Detection and interpretation of ocean roughness variations across the Gulf Stream inferred from radar cross section observations p0248 A78-49657

HOUSTON UNIV., TEX.
Linear feature selection with applications
[E78-10206] p0234 N78-31504

O

P

R

S

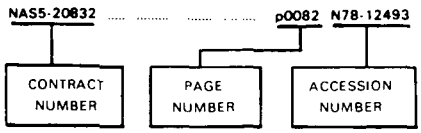
T

V

W

CONTRACT NUMBER INDEX

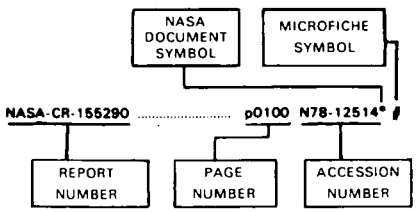
Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

REPORT/ACCESSION NUMBER INDEX

Typical Report/Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The page number indicates the page on which the citation is located. The accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

1. Report No. NASA SP-7041 (20)	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle EARTH RESOURCES A Continuing Bibliography (Issue 20)		5. Report Date January 1979 6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D. C. 20546		10. Work Unit No. 11. Contract or Grant No.
12. Sponsoring Agency Name and Address		13. Type of Report and Period Covered 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This bibliography lists 273 reports, articles, and other documents introduced into the NASA scientific and technical information system between October 1 and December 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.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Bibliographies Earth Resources Program Remote Sensors	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	86	E05 $9.00 HC

*For sale by the National Technical Information Service, Springfield, Virginia 22161

NASA-Langley, 1979

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC

NASA distributes its technical documents and bibliographic tools to ten special libraries located in the organizations listed below. Each library is prepared to furnish the public such services as reference assistance, interlibrary loans, photocopy service, and assistance in obtaining copies of NASA documents for retention.

CALIFORNIA
University of California, Berkeley
COLORADO
University of Colorado, Boulder
DISTRICT OF COLUMBIA
Library of Congress
GEORGIA
Georgia Institute of Technology, Atlanta
ILLINOIS
The John Crerar Library, Chicago
MASSACHUSETTS
Massachusetts Institute of Technology, Cambridge
MISSOURI
Linda Hall Library, Kansas City
NEW YORK
Columbia University, New York
PENNSYLVANIA
Carnegie Library of Pittsburgh
WASHINGTON
University of Washington, Seattle

NASA publications (those indicated by an "*" following the accession number) are also received by the following public and free libraries:

CALIFORNIA
Los Angeles Public Library
San Diego Public Library
COLORADO
Denver Public Library
CONNECTICUT
Hartford Public Library
MARYLAND
Enoch Pratt Free Library, Baltimore
MASSACHUSETTS
Boston Public Library
MICHIGAN
Detroit Public Library
MINNESOTA
Minneapolis Public Library
MISSOURI
Kansas City Public Library
St. Louis Public Library
NEW JERSEY
Trenton Public Library
NEW YORK
Brooklyn Public Library
Buffalo and Erie County Public Library
Rochester Public Library
New York Public Library
OHIO
Akron Public Library
Cincinnati Public Library
Cleveland Public Library
Dayton Public Library
Toledo Public Library
OKLAHOMA
Oklahoma County Libraries, Oklahoma City
TENNESSEE
Memphis Public Library
TEXAS
Dallas Public Library
Fort Worth Public Library
WASHINGTON
Seattle Public Library
WISCONSIN
Milwaukee Public Library

An extensive collection of NASA and NASA-sponsored documents and aerospace publications available to the public for reference purposes is maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, New York, 10017.

EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. By virtue of arrangements other than with NASA, the British Library Lending Division also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from: ESRO/ELDO Space Documentation Service, European Space Research Organization, 114, av. Charles de Gaulle, 92-Neuilly-sur-Seine, France.

National Aeronautics and Space Administration

Washington, D.C.
20546

Official Business
Penalty for Private Use, $300

THIRD-CLASS BULK RATE

Postage and Fees Paid
National Aeronautics and
Space Administration
NASA-451

NASA

POSTMASTER: If Undeliverable (Section 158 Postal Manual) Do Not Return

NASA CONTINUING BIBLIOGRAPHY SERIES

NUMBER	TITLE	FREQUENCY
NASA SP–7011	AEROSPACE MEDICINE AND BIOLOGY Aviation medicine, space medicine, and space biology	Monthly
NASA SP–7037	AERONAUTICAL ENGINEERING Engineering, design, and operation of aircraft and aircraft components	Monthly
NASA SP–7039	NASA PATENT ABSTRACTS BIBLIOGRAPHY NASA patents and applications for patent	Semiannually
NASA SP–7041	EARTH RESOURCES Remote sensing of earth resources by aircraft and spacecraft	Quarterly
NASA SP–7043	ENERGY Energy sources, solar energy, energy conversion, transport, and storage	Quarterly
NASA SP–7500	MANAGEMENT Program, contract, and personnel management, and management techniques	Annually

Details on the availability of these publications may be obtained from:

SCIENTIFIC AND TECHNICAL INFORMATION OFFICE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington, D.C. 20546