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TECHNOLOGY APPLICATION CENTER

A CENTER OF THE
INSTITUTE FOR SOCIAL RESEARCH AND DEVELOPMENT
THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO

QUARTERLY LITERATURE REVIEW
of the
REMOTE SENSING OF NATURAL RESOURCES

FOURTH QUARTER 1977

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QUARTERLY LITERATURE REVIEW
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REMOTE SENSING OF NATURAL RESOURCES

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INTRODUCTION

Remote sensing is so strongly an interdisciplinary science that one cannot easily keep abreast of the activity without taking a large portion of the available time for reviewing the literature. The Technology Application Center (TAC) has made a major effort in order to provide a review of this rapidly advancing field with its Quarterly Literature Review of the Remote Sensing of Natural Resources. This service has been initiated to provide the investigator with up-to-date information in a readable and indexed form.

In an attempt to review the literature of remote sensing from the many hundreds of sources and thousands of documents available, a definition of boundaries was necessary. TAC, reviewing abstracted literature sources (see Information Sources), selects documented data and data gathering techniques which are performed or obtained remotely from space, aircraft or groundbased stations. All of the documentation is related to remote sensing sensors or the remote sensing of the natural resources. Meteorology and extraterrestrial sensing are normally not selected. Sensors are primarily those operating within the 10^{-8} to 1 meter wavelength band (ultraviolet through radar). There are exceptions to this when overlapping data is reported, and these have been selected.

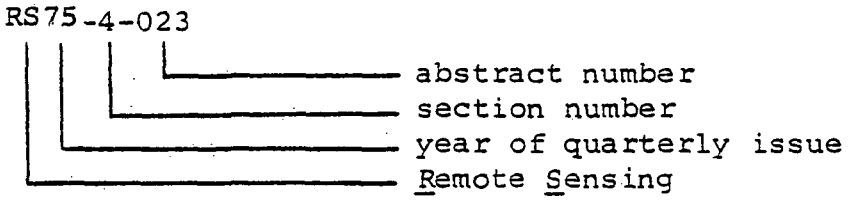
Beginning January 1977, following the Information Source descriptions are recent releases concerning remote sensing. Included are NASA Tech Briefs, ARAC Industrial Applications Reports, U.S. Navy Technical Reports, U.S. Patent reports, and other technical articles and reports that come to the attention of the TAC staff. This section has not been key worded or numbered.

Editors

Charles B. Fears
Michael H. Inglis

USER GUIDE

This Quarterly Literature Review has been divided into eight sections as shown in the table of contents. Within each section, the abstracts have been provided an RS number. This number indicates the section, as RS74-4 indicates Marine Science or Section 4 in the table of contents. The numbers following the section identification place the abstract in numerical order within that section.



In the absence of page numbers, the section and number provide ready access to the abstract.

All abstracts within this Quarterly Literature Review have been "key-worded" by the TAC staff. Key words include generalized terms used or indicated by the title or abstract. The first author's last name, shown on the abstract, is also used as a key word and is indicated by an asterisk (*). This provides an author index within the key word index found in Section 7, Alphabetical Index of Authors and Key Words. Sample key-wording (key words used are underlined):

> RS75-4-015 Evaluate the Application of ERTS-A Data for Detecting and Mapping Sea Ice; James C. Barnes, Principal Investigator

Section 8 contains an order form for the document service provided by the Technology Application Center. In order to facilitate this service, complete Quarterly numbers, RS numbers and abstract titles are necessary.

INFORMATION SOURCES

The following list describes the information resources currently used by the Technology Application Center for the Remote Sensing Quarterly Review.

I. National Aeronautics and Space Administration (NASA)

The NASA file, dating from 1962, contains more than 600,000 documents and grows at the rate of 70,000 new entries each year. It is approximately 16% NASA-generated, the bulk of the citations being reports collected by NASA from world-wide sources for use in the aerospace program. These articles are abstracted in two semi-monthly journals:

A. International Aerospace Abstracts (IAA)

IAA is an abstractive and indexing service covering the world's published literature in the field of aeronautics and space science and technology. Periodicals, books, meeting papers, conference proceedings, translations of foreign journal articles, and aerospace reports are typically abstracted by IAA.

B. Scientific and Technical Aerospace Reports (STAR)

STAR is a comprehensive abstracting and indexing journal covering current worldwide report literature on the science and technology of space and aeronautics. Publications abstracted in STAR include scientific and technical reports issued by NASA and its contractors, other U.S. Government agencies, corporations, universities, and research organizations throughout the world. Pertinent theses, translations, NASA-owned patents and patent applications, and other separate documents are also abstracted.

II. Engineering Index Monthly (EIM)

The Engineering Index Monthly is a compilation of abstracts and items covering the world's significant technological literature

and conferences encompassing all engineering disciplines. The EIM covers the technological side of Remote Sensing with such subjects as new equipment and techniques, and specific field applications of engineering methods and devices.

III. Selected Water Resources Abstracts

Selected Water Resources Abstracts is published by the Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior. It includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats.

IV. Government Reports Announcements (GRA)

GRA is published by the National Technical Information Service (NTIS), Springfield, Virginia. The NTIS collection now exceeds 730,000 titles, to which some 60,000 new reports are added annually. Abstracts cover environmental surveys, energy source prospecting (minerals, geothermal sources, etc.), oceanography, hydrology, climate, agriculture, geology, tracing of tagged wildlife, and more esoteric aspects of this field.

V. Bibliography and Index of Geology

Bibliography and Index of Geology is published by the Geological Society of America in Boulder, Colorado, and covers the earth science literature of the entire world and theses in North America.

VI. ERDA Energy Research Abstracts (ERA)

ERA covers scientific and technical reports originated by the U.S. Energy Research and Development Administration and its contractors, other U.S. Government agencies, other governments, universitites, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Subjects covered by ERA include energy systems, conservation, safety, environmental protection, physical research and biology and medicine.

RECENT RELEASES

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AEROSPACE RESEARCH APPLICATIONS CENTER (ARAC)

Indianapolis Center for Advanced Research
Indiana University-Purdue University at
Indianapolis, 1201 East

REFLECTION CLASSIFICATION OF ROAD SURFACES

E. Frederiksen, Kai Sorensen. Light Res. Technol., V8, N4, p. 175-186, 1976

A method of classifying road surfaces with respect to their light reflection properties has been developed. The classification system unifies the four existine N classes for dry road surfaces and four new classes for wet road surfaces. The classification system has been developed by statistical analysis of a great number of measurements of road surfaces, in both dry and wet conditions. The system of classes is intended for use in road lighting codes based on luminance requirements, and especially such codes which contain luminance requirements for both dry and wet conditions. The system of classes will also be useful for investigations on optimal latern light distributions and road lighting geometries. EI7705035001
Industrial Applications Report #I-5627

AMBIENT CARBON MONOXIDE MONITOR

Darrell E. Burch, Francis J. Gates, and John D. Pembrook. Aeronutronic Ford Corp., Newport Beach, CA 30 p., July 1976

A portable instrument was designed and two units were built to monitor the concentration of CO in ambient air. The air flows through a sampling section that is approximately 43 cm long with a 28 pass optical system that produces a total path of 12 meters. Gas filter correlation methods are employed for the detection and discrimination against other gas species in the air. An H_2O monitor built into the main instrument measures the concentration of H_2O and automatically accounts for a small amount of interferences by all other atmospheric gases is negligible. The minimum detectable concentration of CO is less than 0.02 ppm. The instrument is powered either by batteries or by a battery pack. N77-20420
Industrial Applications Report #I-5630

NAVY TECHNICAL DISCLOSURE BULLETIN

V2, N10, October 1977. Navy Tech. Cat. No. 1201 - Navy Case No. 61474

HARDWARE INTERFACE BETWEEN A COMPUTER AND A DIGITAL-TO-ANALOG CONVERTER

Paul Klose
APL, Johns Hopkins University, Laurel, Maryland

A high digital data conversion rate between a computer and a multichannel digital-to-analog (D/A) converter is achieved by an interface

including a digital to analog data register (DADR) a R/L shift register and first-in first-out (FIFO) formatter stage. The interface is faster than more expensive software techniques.

NAVY TECHNICAL DISCLOSURE BULLETIN

V1, N8, December 1976. Navy Case No. 60134

IMPROVED ANGLE-ERROR DETECTOR FOR MONOPULSE RADAR

Dean R. Howard
David C. Cross
Naval Research Laboratory, Washington DC

A monopulse radar system which includes apparatus to determine the elevation and azimuth angle errors of a target from the antenna boresight and their respective polarities. The apparatus includes linear detectors which receive elevation and azimuth different IF signals and determine the magnitudes of the elevation and azimuth angle errors therefrom. Also included in the apparatus are phase detectors which receive the elevation and azimuth difference IF signals and a reference IF signal from which the polarities of the elevation and azimuth angle errors are determined.

AEROSPACE AND HVCAR & R: SPINOFF '77, REAPING THE DIVIDENDS

Neil P. Ruzic, ASHRAE Journal, p. 30-35, August 1977

An important new tool for implementing the national energy conservation program is a product of space technology: Remote sensing to determine heat loss through roofs, and thus improperly insulated buildings. Other space transfers affecting heating, refrigeration, and air-conditioning engineering include fuel cells, heat pipes, turbine fabrication processes, spacesuits for heated clothing, fans from aircraft propeller design, and a variety of solar energy developments.

The heat-loss-through-roofs project is an imaginative transfer of remote sensing techniques devised originally for weather and survey satellites. It was first demonstrated through a NASA grant to the Remote Sensing Institute at South Dakota State University. A thermal infrared scanner is flown at low altitude over cities at night. Roof temperatures are recorded on magnetic tape. In the resulting imagery, called thermograms, sihouettes of individual buildings are seen easily. Warm roofs appear in light tones; cool roofs are darker.

In a series of flights over parts of Nebraska and South Dakota sponsored by Cengas, the local utility company, more than a third of the buildings were estimated to be losing excessive heat. In that experiment, the utility mailed notices with its gas bills inviting each customer to examine the survey result for his building. In the Lincoln area, school, business, and home owners responded by reroofing and insulating their buildings. Sales of insulation in the area increased by 20%. Incentives were simply fuel cost savings. The program began in 1975, well before conservation tax incentives were imminent.

Other cities also are adopting the technique now. A NASA C-47 soon will fly over demonstration areas in Cleveland. The State of Nebraska is developing a plan to utilize National Guard aircraft to make thermograms of every town in the State. Extensive thermograms have been made at the National Space Technology Laboratory in Bay St. Louis, Mississippi, where the primary concern was to locate heat loss in more than thirteen miles of underground high-temperature hot water lines. Conventional spot-checks including excavation at selected locations would have cost about $100,000 - compared with the thermal scanning cost of $7,000.

Section 1

GENERAL

Theory, General Surveys, Miscellaneous Studies

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RS77-1-468

N77-23576*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN OPERATIONAL EARTH RESOURCES SATELLITE SYSTEM: THE LANDSAT FOLLOW-ON PROGRAM
W. G. Stroud Mar. 1977 23 p refs Presented at 14th Space Congr., Lompoc, Calif., 27-29 Apr. 1977 Submitted for publication
(NASA-TM-X-71306; X-900-77-68) Avail: NTIS HC A02/MF A01 CSCL 22A

The LANDSATS 1 and 2 have demonstrated the role of remote sensing from satellite in research, development, and operational activities essential to the better management of our resources. Hundreds of agricultural, geological, hydrological, urban land use, and other investigations have raised the question of the development of an operational system providing continuous, timely data. The LANDSAT Follow-on Study addressed the economics, technological performance, and design of a system in transition from R and D to operations. Economic benefits were identified; and a complete system from sensors to the ultilization in forecasting crop production, oil and mineral exploration, and water resources management was designed.
Author

RS77-1-469

N77-28548*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB EXPLORES THE EARTH
Washington 1977 531 p refs Original contains color illustrations
(NASA-SP-380) Avail: NTIS MF A01; SOD HC $17.50 CSCL 08F

The quality and the quantity of photographic and observational data that could be acquired by the crew of the many types of earth features when supported by multidisciplinary scientific training before lift-off, by real-time science mission planning, and by a comprehensive onboard set of procedures, maps, and photographs are evaluated. The visual observations experiment aimed the following: (1) determine the types of surface, air, and water phenomena the crew could visually identify from the Skylab orbit, (2) determine what visual observations, supplemented by photography, could be accomplished to support scientific investigations, (3) explore the use of several data parameters in the study of multidisciplinary areas; and (4) determine the type of crew training necessary to perform the visual observations desired by scientists.
Author

RS77-1-470

N77-23570*# Instituto Geografico y Catastral, Madrid (Spain).
THEMATIC MAPPING, LAND USE, GEOLOGICAL STRUCTURE AND WATER RESOURCES IN CENTRAL SPAIN Final Report
Nunez DelasCuevas, Principal Investigator 6 Nov. 1976 286 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10167; NASA-CR-152668) Avail: NTIS HC A13/MF A01 CSCL 08B

The author has identified the following significant results. The images can be positioned in an absolute reference system (geographical coordinates or polar stereographic coordinates) by means of their marginal indicators. By digital analysis of LANDSAT data and geometric positioning of pixels in UTM projection, accuracy was achieved for corrected MSS information which could be used for updating maps at scale 1:200,000 or smaller. Results show that adjustment of the UTM grid was better obtained by a first order, or even second order, algorithm of geometric correction. Digital analysis of LANDSAT data from the Madrid area showed that this line of study was promising for automatic classification of data applied to thematic cartography and soils identification.

RS77-1-471

N77-28562# Swedish Space Corp., Solna.
QUICK-LOOK CAPABILITY IN A EUROPEAN EARTH RESOURCES SATELLITE DATA NETWORK Final Report
15 Apr. 1977 152 p refs
(Contract ESA-SC/128-HQ)
(FU15-4) Avail: NTIS HC A08/MF A01

The Swedish satellite data processing system is analyzed to identify user requirements for quick-look data in the area covered by the planned European network, and to assess the elements required for an optimum quick-look system to meet user requirements within the planned network.
Author

RS77-1-472

N77-27479*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.
DIGITAL OVERLAYING OF THE UNIVERSAL TRANSVERSE MERCATOR GRID WITH LANDSAT-DATA DERIVED PRODUCTS
Thomas W. Pendleton Jun. 1976 45 p refs
(NASA-TM-74761; Rept-160) Avail: NTIS HC A03/MF A01 CSCL 08B

Software has been written in FORTRAN IV for a Varian 73 computer which reformats LANDSAT-data-derived surface classifications and pictorial representations into a digital array which corresponds to the Universal Transverse Mercator Grid.
Author

RS77-1-473

N77-26578*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
REMOTE SENSING IN MICHIGAN FOR LAND RESOURCE MANAGEMENT Final Report, 1 Jun. 1972 - 31 May 1977
I. J. Sattinger, L. B. Istvan, N. E. G. Roller, and D. S. Lowe May 1977 81 p refs
(Grant NGR-23-005-552)
(NASA-CR-153392; ERIM-193400-16-F) Avail: NTIS HC A05/MF A01 CSCL 05A

An extensive program was conducted to establish practical uses of NASA earth resource survey technology in meeting resource management problems throughout Michigan. As a result, a broad interest in and understanding of the usefulness of remote sensing methods was developed and a wide variety of applications was undertaken to provide information needed for informed decision making and effective action.
Author

RS77-1-474

N77-27487# DBA Systems, Inc., Melbourne, Fla.
STUDIES IN ADVANCED PHOTOGRAMMETRIC TRIANGULATION TECHNIQUES Final Technical Report, Mar. - Oct. 1976
T. Riding and S. Mundy Mar. 1977 145 p refs
(Contract F30602-76-C-0172)
(AD-A038138; RADC-TR-77-72) Avail: NTIS HC A07/MF A01 CSCL 14/5

Analytical photogrammetry, spurred on by a rapidly evolving computer technology has achieved major advances within the past decade. Contained in this report is an attempt to define those near term challenges brought about by larger data sets, such developments as the Global Positioning System, and continued improvement in auxiliary sensors (e.g., inertial platforms, stratoscope units, etc.). Continued research commensurate with these challenges are of paramount importance where a first order, wide area mapping requirement exists.
GRA

RS77-1-475

N77-23574*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DISSEMINATING TECHNOLOGICAL INFORMATION ON REMOTE SENSING TO POTENTIAL USERS
J. D. Russell and John C. Lindenlaub 1977 12 p refs
(Contracts NAS9-14016; NAS9-149170)
(NASA-CR-151340; IN-042777) Avail: NTIS HC A02/MF A01 CSCL 05B

The Laboratory for Applications of Remote Sensing developed materials and programs which range from short tutorial brochures to post-doctoral research programs which may span several years. To organize both the content and the instructional techniques, a matrix of instructional materials was conceptualized. Each row in the matrix represents a subject area in remote sensing and each column in the matrix represents a different type media or instructional strategy. Author

RS77-1-476

N77-27478*# Scientific Translation Service, Santa Barbara, Calif.
RESTEC (REMOTE SENSING TECHNOLOGY CENTER), VOLUME 1, NO. 1, 1976
Washington NASA May 1977 133 p refs Transl. into ENGLISH from RESTEC (Remote Sensing Technology Center) (Japan), v. 1, no. 1, 1976 p 1-75
(Contract NASw-2791)
(NASA-TT-F-17532) Avail: NTIS HC A07/MF A01 CSCL 05B

Articles are presented on the use of LANDSAT photographs in geology, remote sensing in agriculture, remote sensing of the seas, the history of remote sensing, and other subjects. Author

RS77-1-477

N77-27473*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 CUMULATIVE NON-US STANDARD CATALOG Annual Cumulative Report, 22 Jan. 1976 - 22 Jan. 1977
22 Feb. 1977 1424 p
(NASA-TM-74758; GSFC/LN-C/013; NTISUB/C/139-013) Avail: NTIS HC A99/MF A01 CSCL 05B

The Non-U.S. Standard Catalog lists imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referred month. Data, such as data acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

RS77-1-478

N77-27486*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2 CUMULATIVE US STANDARD CATALOG Annual Cumulative, 22 Jan. 1976 - 22 Jan. 1977
22 Feb. 1977 878 p
(NASA-TM-74757; GSFC/LU-C/013; NTISUB/C/138-013) Avail: NTIS HC A99/MF A01 CSCL 05B

The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality, are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

RS77-1-479

N77-26594*# General Electric Co., Philadelphia, Pa. LANDSAT Operations Control Center.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT Quarterly Report, 23 Jan. - 23 Apr. 1976
14 Jul. 1976 223 p refs
(Contract NAS5-21808)
(NASA-CR-152475; Doc-76SDS4248; QR-16) Avail: NTIS HC A10/MF A01 CSCL 05B

The LANDSAT-1 spacecraft was launched from the Western Test Range on 23 July 1972, at 18:08:06.508Z. The launch and orbital injection phase of the space flight was nominal and deployment of the spacecraft followed predictions. Orbital operations of the spacecraft and payload subsystems were satisfactory through Orbit 147, after which an internal short circuit disabled one of the Wideband Video Tape Recorders (WBVTR-2). Operations resumed until Orbit 196, when the Return Beam Vidicon failed to respond when commanded off. The RBV was commanded off via alternate commands. LANDSAT-1 continued to perform its imaging mission with the Multispectral Scanner and the remaining Wideband Video Tape Recorder providing image data. Author

RS77-1-480

N77-26593*# General Electric Co., Philadelphia, Pa. GE LANDSAT Operations Control Center.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT, 23 JULY - 23 OCTOBER 1976
30 Nov. 1976 220 p
(Contract NAS5-21808)
(NASA-CR-152474; Doc-76SDS4278) Avail: NTIS HC A10/MF A01 CSCL 05B

The LANDSAT-1 spacecraft was launched from the Western Test Range on 23 July 1972, at 18:08:06.508Z. The launch and orbital injection phase of the space flight was nominal, and deployment of the spacecraft followed predictions. Performance evaluation of the spacecraft is presented. Author

RS77-1-481

N77-23455# Air Force Flight Test Center, Edwards AFB, Calif.
PHOTOGRAPHY IN SCIENTIFIC RESEARCH: SELECTED BIBLIOGRAPHY AND REFERENCE MATERIALS Final Report
Louis Harris Cohen Jul. 1976 356 p
(AD-A034497; AFFTC-TIH-76-4) Avail: NTIS HC A16/MF A01 CSCL 14/5

Contents: aerial and underwater photography; high-speed photography--applications, equipment, principles and processes; holography and lasers--principles and applications; optics--basic principles, design, instrumentation problems, plastic optics and fiber optics; reference materials--dictionaries, handbooks, guidebooks, encyclopedias, glossaries and selected collections; science and technology--astronomy, close-up photography, infrared photography, photomicrography, photomacrography, scientific research, symposiums, techniques in biology and medicine, and television; high-voltage photography (Kirlian photography); abstracts, indexes, bibliographical sources; brochures, dissertations, speeches, masters' theses, reports, translations and technical notes; kinesiology--selected materials; journals and periodicals--selected articles; selected list of journals and periodicals for use as reference materials; photographic reference materials; index. GRA

RS77-1-482

N77-27168*# Lockheed Electronics Co., Houston, Tex.
THE STATUS OF ENVIRONMENTAL SATELLITES AND AVAILABILITY OF THEIR DATA PRODUCTS
C. L. Hughes and C. E. Campbell Mar. 1977 152 p refs
(Contract NAS9-15200)
(NASA-CR-151459; JSC-12706; LEC-10344) Avail: NTIS HC A08/MF A01 CSCL 22B

The latest available information about the status of unclassified environmental satellite (flown by the United States) and their data products is presented. The type of environmental satellites discussed include unmanned earth resource and meteorological satellites, and manned satellites which can act as a combination platform for instruments. The capabilities and data products of projected satellites are discussed along with those of currently operating systems. Author

RS77-1-483

N77-23566*# Atomic Energy Commission, Dacca (Bangladesh).
INVESTIGATIONS USING DATA FROM LANDSAT-2 Quarterly Report, Jan. - Mar. 1977
Anwar Hossain, Principal Investigator Apr. 1977 3 p refs
Sponsored by NASA ERTS
(E77-10152; NASA-CR-152698) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. LANDSAT imageries of Mirpur area of Dacca district were used in connection with surveys for black plastic clay. The imageries showed the broad pattern of small valleys cutting into Madhupur clay. Land use maps of Haor areas of Sylhet and Mymensingh districts were prepared. As a test case, two thana areas, namely Nickley and Astogram, were classified in different categories such as crop, settlement, and water. It does not show much agreement with the Agriculture Dept.'s statistics.

RS77-1-484

N77-27472*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
GEMINI PHOTOGRAPHS OF THE WORLD: A COMPLETE INDEX
L. E. Giddings May 1977 106 p
(Contract NAS9-15200)
(NASA-CR-151445; LEC-10508) Avail: NTIS HC A06/MF A01 CSCL 05B

The most authoritative catalogs of photographs of all Gemini missions are assembled. Included for all photographs are JSC (Johnson Space Center) identification number, percent cloud cover, geographical area in sight, and miscellaneous information. In addition, details are given on cameras, filters, films, and other technical details. Author

RS77-1-485

N77-28556*# National Scientific Labs., Inc., Falls Church, Va.
FREQUENCY REQUIREMENTS FOR ACTIVE EARTH OBSERVATION SENSORS Final Report
May 1977 109 p refs Prepared for JPL
(Contract JPL-954669)
(NASA-CR-153939) Avail: NTIS HC A06/MF A01 CSCL 05B

The foundation and rationale for the selection of microwave frequencies for active remote sensing usage and for subsequent use in determination of sharing criteria and allocation strategies for the WARC-79 are presented. Author

RS77-1-486

N77-27805# Purdue Univ., Lafayette, Ind. Dept. of Electrical Engineering.
IMAGE UNDERSTANDING AND INFORMATION EXTRACTION Quarterly Report, 1 May - 31 Jul. 1976
T. S. Huang and K. S. Fu Griffis AFB, N. Y. RADC Jan. 1977 147 p refs
(Contract F30602-75-C-0150)
(AD-A036869; RADC-TR-77-17; QR-3) Avail: NTIS HC A07/MF A01 CSCL 09/2

The objective of our research is to achieve a better understanding of image structure and to use this knowledge to develop techniques for image analysis and processing tasks, especially information extraction. Our emphasis is on syntactic decomposition and recognition of imagery based on scene analysis. It is our hope that the results of this research will form the basis for the development of technology relevant to military applications of machine extraction of information from aircraft and satellite imagery. GRA

RS77-1-487

N77-27485*# Environmental Research Inst. of Michigan, Ann Arbor.
ACTIVE AND PASSIVE MULTISPECTRAL SCANNER FOR EARTH RESOURCES APPLICATIONS: AN ADVANCED APPLICATIONS FLIGHT EXPERIMENT Final Report, 12 Jun. 1975 - 20 Apr. 1977
P. G. Hasell, Jr., L. M. Peterson, F. J. Thomson, E. A. Work, and F. J. Kriegler Jun. 1977 98 p refs
(Contract NAS9-14594)
(NASA-CR-151461; ERIM-115800-49-F) Avail: NTIS HC A05/MF A01 CSCL 20F

The development of an experimental airborne multispectral scanner to provide both active (laser illuminated) and passive (solar illuminated) data from a commonly registered surface scene is discussed. The system was constructed according to specifications derived in an initial programs design study. The system was installed in an aircraft and test flown to produce illustrative active and passive multi-spectral imagery. However, data was not collected nor analyzed for any specific application. Author

RS77-1-488

N77-27484*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF THE ATMOSPHERE FROM ENVIRONMENTAL SATELLITES
Lewis J. Allison, Raymond Wexler, Charles R. Laughlin, and William R. Bandeen Jun. 1977 124 p refs Submitted for publication
(NASA-TM-X-71353; X-901-77-132) Avail: NTIS HC A06/MF A01 CSCL 04A

Various applications of satellite remote sensing of the earth are reviewed, including (1) the use of meteorological satellites to obtain photographic and radiometric data for determining weather conditions; (2) determination of the earth radiation budget from measurements of reflected solar radiation and emitted long wave terrestrial radiation; (3) the use of microwave imagery for measuring ice and snow cover; (4) LANDSAT visual and near infrared observation of floods and crop growth; and (5) the use of the Nimbus 4 backscatter ultraviolet instrument to measure total ozone and vertical ozone distribution. Plans for future activities are also discussed. D.M.L

RS77-1-489

N77-27477*# Transemantics, Inc., Washington, D.C.
EXPERIMENTAL PROGRAM FOR THE OPERATIONAL STUDY OF DATA COLLECTION PLATFORMS IN BOLIVIA
Washington NASA Jun. 1977 13 p Transl. into ENGLISH from Serv. Geol. Bolivia, (La Paz), Dec. 1975 p 1-10z
(Contract NASw-2792)
(NASA-TM-75019) Avail: NTIS HC A02/MF A01 CSCL 05B

The system developed for the SMS/GOES satellite while learning the limitations possessed by this system with regard to the LANDSAT 1 and 2 satellites with respect to the transmission distance and norizon angle is investigated. The advantages possessed by this system in comparison with conventional methods are evaluated so as to permit studying the feasibility of introducing it into this country in the near future. Author

RS77-1-490

N77-23575*# Purdue Univ., Lafayette, Ind. Laboratory for Applications of Remote Sensing.
THE FOCUS SERIES: A COLLECTION OF SINGLE-CONCEPT REMOTE SENSING EDUCATIONAL MATERIALS
S. M. Davis 1977 83 p
(Contract NAS9-14016; NAS9-14970; Grant NGL-15-005-112)
(NASA-CR-151341; LARS-IN-052977) Avail: NTIS HC A05/MF A01 CSCL 05B

The FOCUS series is a collection of two-page foldout documents each consisting of a diagram or photograph and an extended option of three to four hundred words. The series was developed to present basic remote sensing concepts in a simple, concise way. Issues currently available are collected in this information note. Author

RS77-1-491

N77-27475*# Transemantics, Inc., Washington, D.C.
THE ROLE OF SATELLITE OBSERVATIONS IN THE MANAGEMENT OF ENVIRONMENTAL RESOURCES, WITH PARTICULAR REGARD TO THE AGRESITE PROJECT
Gianna Calabresi NASA Jul. 1977 10 p Transl. into ENGLISH of Report, no. B/11156, Dept. of Political Sci., Rome Univ., 1975 - 1976 p 143-156
(Contract NASw-2792)
(NASA-TM-X-75028) Avail: NTIS HC A02/MF A01 CSCL 05A

Potential applications of LANDSAT remote sensing technology to worldwide resources management are discussed. Some concern is expressed regarding a potential threat to individual national security. D.M.L

RS77-1-492

N77-27471*# General Electric Co., Philadelphia, Pa. Space Systems Organization.
LANDSAT D OPERATIONS CONTROL CENTER STUDY
L. Alexander, G. Brown, B. Clemson, J. Efner, N. Engelberg, J. Owen, and T. Winchester 2 May 1977 97 p
(Contract NAS5-23412)
(NASA-CR-152543; Doc-77SDS4232) Avail: NTIS HC A05/MF A01 CSCL 05B

Various aspects of the planned LANDSAT D system are discussed. LANDSAT D incorporates the Thematic Mapper (TM) as a sensor, it utilizes the Multi-mission Modular Spacecraft (MMS), it makes use of the Tracking and Data Relay Satellite System (TDRSS) and it employs a more advanced ground system. Each of these represent significant improvements in the state-of-the-art. Author

RS77-1-493

N77-24381# Technology Service Corp., Santa Monica, Calif.
DIGITAL SIMULATION OF HIGH RESOLUTION RADAR IMAGERY Final Technical Report, Jun. 1975 - Jun. 1976
Jeffrey W. Bell Griffiss AFB, N. Y. RADC Oct. 1976 70 p refs
(Contract F30602-75-C-0303)
(AD-A033714; TSC-PD-8486-2; RADC-TR-76-290) Avail: NTIS HC A04/MF A01 CSCL 14/5

This study was an exploratory development program with the purpose of establishing the fundamental capability of simulating SAR imagery of future systems for use in exercising change detection processors. To this end the objectives of the program were twofold: (1) to develop algorithms and techniques for simulating high resolution imagery for future SAR systems using aerial photography, topographical maps, and SAR imagery from present systems as source data, and (2) to generate a set of simulated imagery under a variety of conditions to demonstrate the methods. Author (GRA)

RS77-1-494

N77-23586# Army Engineer Topographic Labs., Fort Belvoir, Va. Computer Sciences Lab.
STEREO ANALYSIS OF A SPECIFIC DIGITAL MODEL SAMPLED FROM AERIAL IMAGERY
Michael A. Crombie Sep. 1976 64 p refs
(AD-A033567; ETL-0072) Avail: NTIS HC A04/MF A01 CSCL 08/2

Approximately 160,000 points were matched over a digitized stereo model using correlation algorithms coded in FORTRAN for the CDC 6400. Each of the digitized stereo pair was represented by over 4 million pixels, which were measured on a microdensitometer and stored on disc in the Image Processing Center at ETL. The matched point coordinates and the associated local coordinates were also stored on disc. The derived digital model will be used in the Interactive Image Processing Center to evaluate a variety of problems in digital image processing of stereo photography. GRA

RS77-1-495

N77-24460# Stanford Research Inst., Menlo Park, Calif.
INTERACTIVE AIDS FOR CARTOGRAPHY AND PHOTO INTERPRETATION Semiannual Technical Report, 12 May - 12 Nov. 1976
Harry G. Barrow Nov. 1976 52 p refs
(Contract DAAG29-76-C-0057; ARPA Order 2894)
(AD-A033727) Avail: NTIS HC A03/MF A01 CSCL 14/5

This report describes the work performed during the first six months of our project on Image Understanding. The central scientific goal of the research program is to investigate and develop ways in which diverse sources of knowledge may be brought to bear on the problem of interpreting images. The research is focused on the specific problems entailed in interpreting aerial photographs for cartographic or intelligence purposes, with a view to the eventual development of a collaborative aid to the cartographer or photo interpreter. A key concept is the use of a generalized digital map to guide the process of image interpretation. Author (GRA)

RS77-1-496

A77-43815 * **Data management in pattern recognition and image processing systems.** A. L. Zobrist and N. A. Bryant (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Western Electronic Show and Convention, Los Angeles, Calif., September 14-17, 1976, Technical Papers. (A77-43801 20-33) North Hollywood, Calif., Western Periodicals Co., 1976, p. 13/3-1 to 13/3-4. 5 refs.

Data management considerations are important to any system which handles large volumes of data or where the manipulation of data is technically sophisticated. A particular problem is the introduction of image-formatted files into the mainstream of data processing application. This report describes a comprehensive system for the manipulation of image, tabular, and graphical data sets which involve conversions between the various data types. A key characteristic is the use of image processing technology to accomplish data management tasks. Because of this, the term 'image-based information system' has been adopted. (Author)

RS77-1-497

A77-41256 **Plant growth and soil humidity above wall remnants - Preliminary results of a soil test as a contribution to aerial-picture archeology (Pflanzenwachstum und Bodenfeuchte über Mauerresten - Vorläufige Ergebnisse eines Bodenversuchs zur Luftbildarchäologie).** D. Lorenz and W. Sölter (Deutscher Wetterdienst, Agrarmeteorologische Forschungsstelle, Bonn, West Germany). *Bildmessung und Luftbildwesen,* vol. 45, July 1, 1977, p. 113-118. 8 refs. In German.

Archeological investigations conducted with the aid of aerial photography are partly based on differences between the appearance of the surface above old wall remnants and the appearance of the surrounding area. These differences are the result of the effect of the underlying wall structure upon the vegetation cover. An investigation was conducted concerning the influence of wall remnants in and under the ground on the soil humidity and the growth of certain cereals as a function of the weather characteristics. The effects of the wall remnants on the vegetation can be related to the restriction of the root growth of the plants and also to a reduced ground-water content of the soil layers above the wall remnants. The investigation has the objective to clarify the relative importance of the two factors. However, the currently available data are not yet sufficient for a definite answer regarding this question. G.R.

RS77-1-498

A77-35260 # **Minimum areal of detection of a geosystem from the results of iconometric analysis of remote-sensing data (Minimum-areal vyiavleniia geosistemy po rezul'tatam ikonometricheskogo analize distantsionnykh dannykh).** B. V. Vinogradov (Akademiia Nauk SSSR, Institut Geografii, Moscow, USSR). *Akademiia Nauk SSSR, Doklady,* vol. 233, Mar. 1, 1977, p. 253-256. In Russian.

The minimum areal in the identification of a geosystem is understood to mean such an area of the system in which both the global concept of the geosystem and the integrity of the component relations are retained. In terms of iconometric analysis, the minimum areal is defined as the minimal sampling aggregate of the iconographic elements of the geosystem, which (within a prescribed probability and permissible deviation) is characteristic of the global features of the system. In the present paper, the determination of the minimum areal from the iconographic characteristics of an aerial photograph is discussed and is demonstrated for an actual geosystem. V.P.

RS77-1-499

A77-34563 **Ground mapping resolution accuracy of a scanning radiometer from a geostationary satellite.** F. G. Stremler, R. J. Parent (Wisconsin, University, Madison, Wis.), and M. A. Khalil (Mitre Corp., McLean, Va.). *Applied Optics,* vol. 16, June 1977, p. 1619-1627. Grants No. NOAA-NG-26-72; No. NOAA-3-35372.

Measures of the spatial and spatial rate (frequency) mapping of scanned visual imagery from an earth reference system to a spin-scan geostationary satellite are examined. Mapping distortions and coordinate inversions to correct for these distortions are formulated in terms of geometric transformations between earth and satellite frames of reference. Probabilistic methods are used to develop relations for obtainable mapping resolution when coordinate inversions are employed. (Author)

RS77-1-500

A77-38340 **Scatter and emission characteristics of natural media at 3 millimeter wavelength.** E. Schanda, G. Schaerer, and R. Hofer. *(Radiotekhnika,* vol. 31, Sept. 1976, p. 3-10.) *Telecommunications and Radio Engineering, Part II - Radio Engineering,* vol. 31, Sept. 1976, p. 54-58. 9 refs. Translation.

Imagery of the thermal radiation of the earth at 3 mm wavelength with a radiometer of 10 arcminutes angular resolution has been performed. In particular the scatter and emission properties of flat, rough and heterogeneous surface layers of natural media have been studied. Examples of the mm-wave images of various sceneries are presented. The results of the experimental scatter and emission studies, the characterization of the emission properties of the media and the classification due to the structuring are discussed. (Author)

RS77-1-501

A77-35454 # **Comparison of color, color infrared, and thermal infrared images.** S. A. Morain (Arizona, University, Tucson, Ariz.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 4, Jan. 1977, p. 18-26.

The theoretical basis of color, color infrared, and thermal infrared images is outlined. The information which can be provided by each type of image is discussed, and their applications are compared. Special attention is given to the reasons for which the appearance of vegetation differs from one type of image to another. C.K.D.

RS77-1-502

A77-37422 **A change detection and classification system for side-look radar images.** T. P. Truitt, D. T. Bissell, and G. E. Tisdale (Westinghouse Defense and Electronic Systems Center, Baltimore, Md.). In: NAECON '76; Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 18-20, 1976. (A77-37352 17-33) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 533-538.

A change detection method is described for side-look airborne radar images, which is different from the conventional approach in two basic ways. First, pattern recognition techniques are used directly on the mission and reference images to isolate individual objects. Then, a comparison is made between images on an object-by-object basis. Second, the digital processing techniques use a special-purpose preprocessor that extracts key image features and reduces the image bandwidth by up to 100:1 over 6-bit gray levels. B.J.

RS77-1-503

A77-33651 **A radiometric interpretive legend for Landsat digital thematic maps.** C. J. Robinove (U.S. Geological Survey, Reston, Va.). *Photogrammetric Engineering and Remote Sensing*, vol. 43, May 1977, p. 593, 594.

A legend is suggested for use with computer-generated thematic maps made from Landsat digital data that designates some of the radiometric characteristics of each thematic map unit as well as the described terrain attributes of each map unit. The relationship between spectral band and radiance for each map unit is shown by a two-dimensional polygon with the four Landsat multispectral scanner bands plotted on the ordinate and radiance levels on the abscissa. The resulting shape is colored to correspond with the map unit color, thus facilitating the recognition and understanding of the computer-generated map units. (Author)

RS77-1-504

A77-35767 # **Investigation of earth from space - The cooperative experiment** carried out by scientists of the USSR and the German Democratic Republic using the Soyuz-22 spacecraft (**Issledovanie zemli iz kosmosa - Sovmestnyi eksperiment uchenykh SSSR i GDR na kosmicheskom korable 'Soiuz-22'**). R. Z. Sagdeev. *Akademiia Nauk SSSR, Vestnik*, no. 3, 1977, p. 6-19; Discussion, p. 19, 20. In Russian.

Major steps in the evolution of spectral observations of the earth from a space platform are briefly reviewed. A description at the layman's level of the multispectral space photosystem MKF-6, developed in a cooperative program with the German Democratic Republic for monitoring earth resources, is provided. The adaptation of this system to the Soyuz-22 spacecraft is discussed in general terms. During the Soyuz-22 mission, 2000 photographs, each covering an area of 165 by 115 km with a resolution of 10-20 m, were transmitted. The high quality of these photographs indicates a bright future for systems similar to the MKF-6 in evaluating natural resources and in monitoring crop growth. C.K.D.

RS77-1-505

A77-36420 **An automatic image registration and overlay system.** K. Y. K. Ng (Operational Research and Analysis Establishment, Ottawa, Canada). *Computers and Electrical Engineering*, vol. 4, Mar. 1977, p. 71-85. 10 refs.

In this paper we present an automatic algorithm for registering and overlaying imagery. The algorithm basically attempts to find by successive approximations the best affine transformation or second order polynomial relating to the two images. The method requires the specification of only a matching pair of control points, then new control points are found approximately by extrapolating the old affine transformation to larger areas and then using correlation to find the best match. Thus an obvious advantage of this algorithm lies in its automatic feature in locating and matching more potential ground control points. This paper also discusses the effect of the distribution of control points on the affine transformation. Finally, the method is tested on Landsat data and the results are discussed. (Author)

RS77-1-506

A77-35453 # **Radar image interpretation.** S. A. Morain (Arizona, University, Tucson, Ariz.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Jan. 1977, p. 10-17.

A sample exercise in radar image interpretation is presented. The image used was obtained with the Goodyear 'GEMS' side-looking radar system at an altitude of 35,000 feet over Tucson, Arizona. Characteristic types of terrain-system interaction represented in the sample image are discussed. C.K.D.

RS77-1-507

A77-33620 **Contribution to accuracy enhancement in terrestrial photogrammetric point determination (Zur Leistungssteigerung der terrestrisch-photogrammetrischen Punktbestimmung).** B. Wrobel and K.-H. Ellenbeck. *Bildmessung und Luftbildwesen*, vol. 45, May 1, 1977, p. 69-77. 11 refs. In German.

Measured orientation parameters treated in a bundle block adjustment with photo coordinates are discussed; requisite analytical formulas are derived. Accuracy studies based on an example taken from architectural photogrammetry demonstrate the advantage of introducing additional information into the bundle block adjustment: reduction of the number of ground control points or even elimination of control points in close-range work; homogeneous accuracy of triangulated points. It is shown that at least three images can be bridged without measured orientation elements and without ground control points, with only slight degradation. R.D.V.

RS77-1-508

A77-37599 # **Calculation of the total illumination of the earth surface when taking photographs from great heights and in the solution of photometric problems (Podschet summarnoi osveshchennosti zemnoi poverkhnosti pri fotografirovanii s bol'shikh vysot i pri reshenii fotometricheskikh zadach).** A. I. Lavrov and G. I. Ovchinnikov (Vsesoiuznoe Ob'edinenie Lesproekt, USSR). *Geodeziia i Aerofotos'emka*, no. 1, 1977, p. 87-89. 6 refs. In Russian.

A formula in which the type of atmosphere is taken into consideration is proposed for calculating the total illumination of the earth surface. The formula is helpful in determining exposures when taking photographs from great heights. It yields illuminance value to within 10%, which is of importance in the determination of luminance factors of objects. V.P.

RS77-1-509

A77-38193 **A two-stage classifier for remotely sensed data.** D. Kazakos (New York, State University, Buffalo, N.Y.). In: Modeling and simulation. Volume 7 - Proceedings of the Seventh Annual Pittsburgh Conference, Pittsburgh, Pa., April 26, 27, 1976. Part 1. (A77-38176 17-66) Pittsburgh, Pa., Instrument Society of America, 1976, p. 281, 282.

Maximum likelihood classifications under the multivariate Gaussian assumption are considered for the machine processing of remotely sensed data. A description is presented of a new type of classifier which by design takes into account computational costs. The classifier makes use of a two-stage decision process. Attention is given to the trade-off between computational cost and classification accuracy. G.R.

RS77-1-510

A77-35452 # **Diazo Landsat color composites.** C. L. Ernst (Purdue University, West Lafayette, Ind.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Jan. 1977, p. 6-9.

The diazo development method, with which color images are made easily and inexpensively from Landsat black and white positive transparencies, is described. The process uses a special diazo film, which is exposed to ultraviolet light (or direct sunlight) and developed in ammonia gas. Color composites are obtained by overlaying three separate diazo transparencies. The process does not damage the original Landsat transparency; total cost is about $0.30 per diazo. C.K.D.

RS77-1-511

A77-43699 **Managerial applications of a 4-year regional program in remote sensing.** D. B. Fuller, D. M. Harman, and K. B. Fuller (Maryland, University, Frostburg, Md.). *Coastal Zone Management Journal*, vol. 3, no. 2, 1977, p. 183-196. 7 refs.

A study was conducted to determine the degree of regional utilization of remote sensing data from the NASA Wallops four-year old Chesapeake Bay Ecological Program. Forty-three managerial agencies utilized the data in more than 80 projects related to regional management. User and project emphases were categorized on a primary and secondary basis. The results of the study indicate that remote sensing is being practically applied to the accomplishment of a diverse variety of managerial objectives by a significant proportion of the public agencies of the middle-Atlantic states. (Author)

RS77-1-512

A77-35451 # **CIR interpretation exercise - Landsat.** J. W. Frasca (California State College (Sonoma), Rohnert Park, Calif.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Jan. 1977, p. 1-5.

A two-part lab exercise which may be used to develop skills in interpreting satellite imagery at a variety of scales is described. Slides of Landsat imagery of different terrains are used in a portable, rear-screen slide projector unit equipped with an audio component (cassette-type tape recorder) on which questions may be prerecorded. In the second part of the exercise, individual students view Landsat MSS images using portable light tables. A series of questions regarding the imagery is provided to each student by the instructor. Anderson's Level I and II land-use classification system for remote-sensor data is used as a lab text. C.K.D.

RS77-1-513

A77-42502 **Optical window interferograms - A simple method for their evaluation.** J. M. Geary (Food and Drug Administration Bureau of Radiological Health, Rockville, Md.). *Applied Optics*, vol. 16, Aug. 1977, p. 2134-2136. 5 refs.

The selection of optical windows for photographic aerial reconnaissance is considered, taking into account an interferogram whose fringe pattern represents phase variations across the aperture or pupil of an optical component or system. It is pointed out that fringe departure from parallelism and equispacing implies image degradation. An approach for obtaining a simple measure of this degradation is discussed. In the considered case, a window was judged acceptable if the average magnitude of its wavefront deviation was equal or less than a certain critical value. The establishment of this criterion makes it possible to base future tests on similar components only on interferometric considerations. G.R.

RS77-1-514

A77-40999 # **The use of remote sensing to study earth resources (Izuchenie prirodnykh resursov zemli metodami distantsionnogo zondirovaniia).** G. T. Beregovoi and Iu. P. Kienko. *Geodeziia i Kartografiia*, Apr. 1977, p. 1-9. In Russian.

The use of such remote sensors as photographic systems, TV systems, infrared scanners, passive superhigh-resolution radiometers, and radar for the study of earth resources is reviewed. Particular attention is given to satellite remote-sensing and future directions in the application of space technology to the study of earth resources are considered. B.J.

RS77-1-515

A77-35675 **The uses of air photography /2nd edition/.** Edited by J. K. S. Saint Joseph (Cambridge University, Cambridge, England). London, John Baker (Publishers), Ltd., 1977. 194 p. $16.35.

The scope of air photography is examined and aspects of air photography and cartography are investigated, taking into account the effect of height distortion, the parallax bar, the assembling of slotted templates, a modern analog-type plotting machine, single image photogrammetry, flight lines of an aircraft on survey, the schematic diagram of a stereoscope, the measurement of parallax, and the working principles of the multiplex plotter. Attention is also given to air photography and geology, air photography and geography, air photography and soil science, air photography and plant ecology, air photography and plant disease, air photography and zoology, air photography in East African game management, air photography and archaeology, air photography and history, towns and monumental buildings, and contemporary planning. G.R.

RS77-1-516

A77-37600 # **Automatic interpretation of topographic landscape aerial photographs (K voprosu ob avtomaticheskom deshifrirovanii aerofotoizobrazhenii ploshchadnykh topograficheskikh ob'ektov).** V. I. Gorbunov, B. N. Epifantsev, and V. A. Molodykh (Tomskii Politekhnicheskii Institut, Tomsk, USSR). *Geodeziia i Aerofotos'emka*, no. 1, 1977, p. 91-96. 8 refs. In Russian.

In the present paper, the concept of treating aerial photographs of topographic areal features as random optical-density fields is used to formulate, within the framework of probability and random-process theories, a methodological approach to automatic interpretation. In this approach, interpretation may be centered on any one of the three following issues: the identification of the boundaries of *random texture fields; the establishment* of the class to which the identified field belongs; and the numerical evaluation of the field parameters of particular interest. Some specific aspects of solving the automation problem are examined. V.P.

RS77-1-517

A77-37435 **Variable apparent temperature targets for thermal imaging sensors.** W. J. Bentz, R. A. Nichols, and R. E. Siwecki (USAF, Aeronautical Systems Div., Wright-Patterson AFB, Ohio). In: NAECON '76; Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 18-20, 1976. (A77-37352 17-33) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 655-660.

This paper examines several infrared target configurations. The targets were designed to meet various mission requirements with minimal cost impact. One target design has been constructed and is presently supporting initial testing of the Pave Low III Helicopter Night Rescue program. The development of high resolution thermal imaging sensors has added a new capability to many weapon systems. Economy and efficiency demand full system evaluation prior to production. Low cost testing and analysis methods are needed to fulfill these requirements. This testing is accomplished by utilization of resolution bar targets to compare basic system performance against specification and mission requirements. The targets detailed in this paper attempt to perform these functions. (Author)

RS77-1-518

A77-43401 # Investigation of the natural environment using radio-physical methods /Review/ (Issledovaniia prirodnoi sredy radiofizicheskimi metodami /Obzor/). N. A. Armand, A. E. Basharinov, and A. M. Shutko (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *Radiofizika*, vol. 20, no. 6, 1977, p. 809-841. 166 refs. In Russian.

The paper discusses the microwave (radiometric and radar) investigation of the earth surface. Attention is given to the study of the physical and chemical properties of the ocean surface, sea surface states and variations of the sea level, ice and snow cover, soil moisture, vegetation, and geology. B.J.

RS77-1-519

REMOTE SENSING OF EARTH RESOURCES: (1970-1973 SUPPLEMENT) A LITERATURE SURVEY WITH INDEXES, SECTION 2, INDEXES.
National Aeronautics and Space Administration, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as N-75-25236, Price codes: A18 in paper copy, A01 in microfiche. NASA SP-7036(01), Februarv 1975. 402 p.
Descriptors: *Bibliographies, *Remote sensing, *Information retrieval, *Documentation, *Indexing, *Great Lakes, Agriculture, Forestry, Geology, Mapping, Instrumentation, Aircraft, Geophysics, Water management(Applied), Data processing, Information exchange, Aerial photography, Satellites(Artificial), Natural resources, Hydrology, Minerals, Environment, Oceanography, Ice, Glaciers, River basins, Estuaries, Estuarine environment, Cities.
Identifiers: Earth resources program, Spacecraft, Mineral resources.

The bibliography listed 4930 reports, articles, and other documents introduced into the NASA scientific and technical information system between March and December 1973. Subject matter was grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and mineral resources, oceanography and marine resouces, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. The publication was issued in two sections: Section 1, Abstracts; and Section 2, Indexes. Each entry in the Abstract section contains a citation and an abstract. The Index section contains five indexes--subject, author, source, contract and report number. (See also W77-09344) (Froehlich-ISWS)
W77-09345

RS77-1-520

REMOTE SENSING OF EARTH RESOURCES: (1970-1973 SUPPLEMENT) A LITERATURE SURVEY WITH INDEXES, SECTION 1, ABSTRACTS.
National Aeronautics and Space Administration, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as N-75-25235, Price codes: A99 in paper copy, A01 in microfiche. NASA SP-7036(01) February 1975. 654 p.

Descriptors: *Great Lakes, *Information retrieval, *Indexing, *Bibliographies, *Remote sensing, *Abstracts, Agriculture, Forestry, Geology, Mapping, Instrumentation, Aircraft, Geophysics, Water management(Applied), Data processing, Information exchange, Aerial photography, Satellites(Artificial), Natural resources, Hydrology, Minerals, Environment, Oceanography, Ice, Glaciers, River basins, Estuaries, Estuarine environment, Cities.
Identifiers: Earth resources program, Spacecraft, Mineral resources.

The bibliography listed 4930 reports, articles, and other documents introduced into the NASA scientific and technical information system between March 1970 and December 1973. Subject matter was grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, oceanography and marine resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. The publication was issued in two sections: Section 1, Abstracts; and Section 2, Indexes. Each entry in the Abstract section contains a citation and an abstract. The Index section contains five indexes--subject, author, source, contract, and report number. (See also W77-09345) (Froehlich-ISWS)
W77-09344

RS77-1-521

EARTH RESOURCES--A CONTINUING BIBLIOGRAPHY WITH INDEXES.
National Aeronautics and Space Administration, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-17445, Price codes: A07 in paper copy, A01 in microfiche. NASA SP-7041(05), October 1975. 150 p.

Descriptors: *Bibliographies, *Great Lakes, *Documentation, *Information retrieval, *Indexing, *Remote sensing, *Abstracts, Agriculture, Forestry, Geology, Mapping, Instrumentation, Aircraft, Geophysics, Water management(Applied), Data processing, Information exchange, Aerial photography, Satellites(Artificial), Natural resources, Hydrology, Minerals, Environment, Oceanography, Ice, Glaciers, River basins, Estuaries, Estuarine environment, Cities.
Identifiers: Earth resources program, Spacecraft, Mineral resources.

This bibliography listed 601 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1975 and March 1975. Emphasis was 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 was 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. (Froehlich-ISWS)
W77-09346

RS77-1-522

REMOTE SENSING METHODS AND PROBLEM OF NATURAL RESOURCE INVENTORY, (IN RUSSIAN),
Desert Inst., Ashkhabad (USSR).
N. G. Kharin.
Probl Osvoeniya Pustyn'. 3, p 3-7, 1974.

Descriptors: *Aerial photography, *Remote sensing, Data processing, *Natural resources, Radar, Spectroscopy, X-ray analysis, *Surveys, Electromagnetic wave,.

Modern inventory of natural resources is based in aerial photography. Remote sensing is a valuable aid, using wide band registration of electromagnetic waves and data processing. For this purpose multispectral, thermal and radar systems should be used. Special regional centers for inventoring natural resources should be organized, all the resources of the region being estimated at one time.—Copyright 1975, Biological Abstracts, Inc.
W77-09311

RS77-1-523

AD-A039 578/0GA **PC A11/MF A01**
Analytics Inc Willow Grove Pa
Simulation of Advanced Integrated Reconnaissance Systems. Volume I. Analytical Model.
Final rept.,
Stephen W. Leibholz, and Sydney F. Martin. 4 Apr 69, 238p Rept no. 1004-1
Contract N62269-68-C-0441

Descriptors: *Aerial reconnaissance, *Tactical reconnaissance, *Computer programs, Airborne, Advanced systems, Integrated systems, Computerized simulation, Infrared reconnaissance, Radar reconnaissance, Photographic reconnaissance, Simulation.
Identifiers: AIRS computer program.

This volume describes the AIRS (Airborne Integrated Reconnaissance System) Performance Model, an analytic-simulation tool for specifying and evaluating future airborne tactical reconnaissance systems. The model is also used for studying multiple sensor systems and their interactions in the context of an integrated reconnaissance system. Performance is analyzed by computing for each sensor the detectability, identifiability, and localizability (CEP) of each target in a scenario, including the effects of interactions with other sensors. Incorporated in the model are provisions for defining scenarios and missions. Variable parameters are used to specify the characteristics of targets, backgrounds, terrain, weather, equipment, reliability, and data integration and transmission. The model then integrates the performance of all sensors to give total system performance as a function of timelate, and evaluates the marginal contribution of each sensor. (Author)

RS77-1-524

AD-A041 805/3GA **PC A02/MF A01**
Texas Univ At Austin Dept of Electrical Engineering
Interactive Computer Analysis of Aerial Color Infrared Photographs,
S. A. Underwood, and J. K. Aggarwal. 8 Sep 75, 25p AFOSR-TR-77-0701
Contract F44620-71-C-0091, Grant NSF-GK-42790
Original contains color plates: All DDC and NTIS reproductions will be in black and white.
Availability: Pub. in Computer Graphics and Image Processing, v6 p1-24 1977.

Descriptors: *Aerial photographs, *Image processing, *Infrared photography, Interactive graphics, Digital systems, Color photography, Computer applications, Surface truth, Reprints.

Aerial photography using color infrared film has proved to be successful for the detection of insect infestations in citrus orchards by human interpretation. The chlorophyll in vegatation reflects in the infrared region of the spectrum, and produces a red image on the film. The paper describes an interactive digital computer system that uses a three-color film digitizer to measure the color of individual trees to detect the presence of insect infestation. The input to the computer is an aerial color infrared photograph. The computer locates the outline of each individual tree and measures the color characteristics of each spatial point within the tree outline. Each tree within the photograph is analyzed interactively on the computer, and the output shows the degree of infestation present. (Author)

RS77-1-525

AD-A039 356/1GA **PC A03/MF A01**
Air Force Academy Colo
Determination of True Elevations from Aerial Photographs.
Final rept.,
Charles L. Smith. Mar 77, 27p Rept no. USAFA-TR-77-3

Descriptors: *Aerial photographs, Elevation, Parallax computers, Corrections, Computer programs, Accuracy, Tilt, Stereoscopic map plotters.
Identifiers: Parallax bar.

There are many problems involved in the determination of accurate elevations from tilted photographs. Plotting machines such as the Wild A-7 are able to compensate for tilt and provide accurate elevations, however, these machines are expensive and not available to many researchers. This report describes a set of procedures and a computer program for the determination of ground elevations to the same general degree of accuracy as that obtained with plotting machines. The procedures involve parallax measurements and location of points within a stereoscopic model. (Author)

RS77-1-526

E77-10137 PC A04/MF A01
Zurich Univ. (Switzerland). Dept. of Geography.
Snow Mapping and Land Use Studies in Switzerland.
Final rept.,
Harold Haefner. Jan 77, 55p NASA-CR-152631
Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Ave., Sioux Falls, S.D. 57198.

Descriptors: *Snow, Mapping, *Switzerland, *Land use, Earth Resources program, Algorithms, Classifications.

The author has identified the following significant results. A system was developed for operational snow and land use mapping, based on a supervised classification method using various classification algorithms and representation of the results in maplike form on color film with a photomation system. Land use mapping under European conditions was achieved with a stepwise linear discriminant analysis by using additional ratio variables. On fall images, signatures of built-up areas were often not separable from wetlands. Two different methods were tested to correlate the size of settlements and the population with an accuracy for the densely populated Swiss Plateau between +2 or -12%.

RS77-1-527

E77-10138 PC A02/MF A01
Atomic Energy Commission, Dacca (Bangladesh).
Investigations Using Data from LANDSAT-2.
Quarterly rept. Oct-Dec 76,
Anwar Hossian. Feb 77, 5p NASA-CR-152632

Descriptors: *Bangladesh, Coasts, Forests, *Drainage patterns, Earth Resources program, Land use, Salinity, Surface water.

The author has identified the following significant results. New lands for forestation were set aside in the coastal area of Bangladesh, based on LANDSAT mosaics (Chittagong - 195,000 acres, Noakhali - 450,000 acres, Barisal - 360,000 acres, and Patuakhali - 225,000 acres). LANDSAT imageries were used for identification of drainage patterns in both the old and new Comilla district.

RS77-1-528

36855 Extension of Eklundh's matrix transposition algorithm and its application in digital image processing. Twogood, R.E.; Ekstrom, M.P. (Univ. of California, Livermore). *IEEE Trans. Comput.;* 950-952(Sep 1976).

Eklundh's fast matrix transposition algorithm for transposing a 2/sup n/ x 2/sup n/ matrix is extended to the general case where 2/sup j/ (j greater than or equal to 1) of its rows will fit into primary storage. The performance characteristics of the extension are described and subsequently compared with those of Eklundh, and its use in a two-dimensional image filtering routine is described. 1 figure.

RS77-1-529

30749 **Smistad, O. (coordinator).** Proceedings of the NASA Earth resources survey symposium, Houston, Texas, June, 1975; First comprehensive symposium on the practical application of Earth resources survey data: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168, 435 p., illus., 1975. *Individual papers within scope of this Bibliography are cited under the separate authors.*

RS77-1-530

38340 **Smedes, H. W.; Hulstrom, R. L.; and Ranson, K. J.** The mixture problem in computer mapping of terrain; improved techniques for establishing spectral signatures, atmospheric path radiance, and transmittance: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services),* p. 1099-1159, illus., 1975. *NASA Earth resources survey symposium.*

RS77-1-531

22909 **Kover, A. N.; and Williams, R. S., Jr.** Remote sensing: Geotimes, Vol. 22, No. 1, p. 39-41, illus., 1977.

RS77-1-532

38289 **Krohn, J. P.** A view of the southern California area through the "eyes" of remote sensing [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 7, No. 3, p. 336-337, 1975. *The Geological Society of America, Cordilleran Section, 71st annual meeting.*

RS77-1-533

38342 **Swain, P. H.; Wu, C. L.; Landgrebe, D. A.; *et al.*** Layered classification techniques for remote sensing applications: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services),* p. 1087-1097, illus. (incl. table), 1975. *NASA Earth resources survey symposium.*

RS77-1-534

38228 **Cannon, P. J.** The application of radar imagery to specific problems of interior Alaska: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services),* p. 761-767, illus., 1975. *NASA Earth resources survey symposium.*

RS77-1-535

30751 **Stoney, W.** Remote sensing and applications: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-A, Plenary-summaries)*, p. 7-9, 1975.

RS77-1-536

30748 **Sizer, J. E.** Remote sensing in Minnesota; evaluation of programs and current needs: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 340-350, illus., 1975. *With discussion.*

RS77-1-537

26606 **Schagen, P.** Some recent developments in remote sensing: Nature, Vol. 266, No. 5599, p. 223-228, illus. (incl. table), 1977.

RS77-1-538

26627 **Smith, D. P.** ERTS satellite images: Calif. Geol., Vol. 28, No. 6, p. 137-139, illus. (incl. table, sketch map), 1975.

RS77-1-539

30741 **Schweickart, R. L.** Future remote-sensing programs: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-A, Plenary-summaries)*, p. 79-82, 1975.

RS77-1-540

25791 **Sarkany, J.** Legifenykepen es terkepen mert tavolsag-, magassag- es dolesszog-szamitasok osszehasonlito vizsgalatanak ertekelese [Comparative studies based on distance and elevation measurements and angle-inclination calculations on aerial photographs and maps]: Hung., Foeldt. Intez., Evi Jel., Vol. 1974, p. 395-407 (incl. English sum.), tables, sketch map, 1976.

RS77-1-541

26577 **Preble, D. M.; Friedman, J. D.; and Frank, D.** Electronic thermal sensor and Landsat data collection platform technology: U. S. Geol. Surv., Open-File Rep., No. 77-87, 64 p., illus. (incl. tables, sketch map), 1977.

RS77-1-542

38265 **Hankins, D. B.** Space technology; putting it in the educational perspective: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1221-1223, 1975. *NASA Earth resources survey symposium.*

RS77-1-543

30772 **Watkins, A. H.** Data availability and the role of the Earth Resources Observation Systems data center: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 372-378, illus. (incl. tables, sketch map), 1975.

RS77-1-544

38354 **Washkurak, S.** Meteorological satellites aid airborne operations in remote regions: Can., Geol. Surv., Pap., No. 77-1A *(Report of activities, Part A)*, p. 93-94, illus., 1977.

RS77-1-545

30774 **Wells, J.** Remote-sensing applications for Texas: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 297-299, 1975. *With discussion.*

RS77-1-546

30776 **Winikka, C. C.; and Adams, R. E.** Remote sensing in Arizona: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 300-314, illus. (incl. sketch maps), 1975. *With discussion.*

RS77-1-547

38355 **Whitley, S. L.** Low-cost data analysis systems for processing multispectral scanner data: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1355-1375, illus. (incl. table), 1975. *NASA Earth resources survey symposium.*

RS77-1-548

22922 **Ogrosky, C. E.** Photomechanical density modification of ERTS imagery: Assoc. Pac. Coast Geogr., Yearb., Vol. 38, p. 87-97, illus. (incl. sketch maps), 1976.

RS77-1-549

30688 **Leone, F.** Remote sensing in the State of Ohio; II, System development: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 352-355, 1975. *With discussion.*

RS77-1-550

38305 **Monget, J.-M.; and Roux, P.** An unsupervised classification of multispectral scanner data using correspondence analysis (CLAMS): U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1237-1244, illus. (incl. table), 1975. *NASA Earth resources survey symposium.*

RS77-1-551

26533 **Kroeck, D.** Everyone's space handbook; a photo/imagery source manual: 175 p., illus. (incl. tables), Pilot Rock, Inc., Arcata, Calif., United States, 1976.

RS77-1-552

31103 **Heaslip, G. B.** Satellites viewing our world; the NASA Landsat and the NOAA SMS/GOES: Environ. Manage., Vol. 1, No. 1, p. 15-29, illus., 1976. *Including procedures for acquiring NASA data.*

RS77-1-553

30663 **Hitchcock, H. C.; Baxter, F. P.; and Cox, T. L.** User requirements for project-oriented remote sensing: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 319-325, illus., 1975. *With discussion.*

RS77-1-554

30648 **Goesling, P.** Remote sensing in the State of Ohio; I, Public policy: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 351-352, 1975. *With discussion.*

RS77-1-555

38318 **Rifman, S. S.; Simon, K. W.; and Caron, R. H.** Second generation digital techniques for processing Landsat and MSS data: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1161-1175, illus., 1975. *NASA Earth resources survey symposium.*

RS77-1-556

38274 **Jensen, M. L.; and Laylander, P.** Summary of space imagery studies in Utah and Nevada: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 673-712, illus. (incl. geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-1-557

37757 **Jensen, J. R.** The orthophoto and orthophotomap; characteristics, development and aspects of cartographic communication: 176 p., Doctoral, 1976, Univ. of California, Los Angeles, Calif. (Diss. Abstr. Int., Vol. 37, No. 10, p. 4956B-4957B, 1977).

RS77-1-558

23176 **Jaetzold, R.** Luftbild; Die verschuettete Stadt Yungay, Peru [Aerial photograph; the buried town of Yungay, Peru]: Erde, Vol. 102, No. 2-3, p. 108-117, illus. (incl. plates, sketch maps), 1971.

RS77-1-559

38268 **Hittel, A.** Canadian cooperative satellite programs [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 7, No. 6, p. 782, 1975. *The Geological Society of America, North-central Section, 9th annual meeting.*

RS77-1-560

38250 **Fontanel, A.; Blanchet, C.; and Lallemand, C.** Enhancement of Landsat imagery by combination of multispectral classification and principal component analysis: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 991-1012, illus. (incl. tables), 1975. *NASA Earth resources survey symposium.*

RS77-1-561

38248 **Fischer, W. A.; Angsuwathana, P.; Carter, W. D.; et al.** Surveying Earth and its environment from space: Am. Assoc. Pet. Geol., Mem., No. 25, p. 63-72, illus. (incl. sketch maps), 1976. *Circum-Pacific energy and mineral resources.*

RS77-1-562

38246 **England, A. W.; and Johnson, G. R.** Microwave brightness spectra of layered media: Geophysics, Vol. 42, No. 3 *(Special issue on remote sensing)*, p. 514-521, illus., 1977.

RS77-1-563

38598 **Cheeseman, C. E.; and Keller, D. W.** The total Earth resources system of the 1980's; a view of the future: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B. Geology-information systems and services)*, p. 1451-1472, illus., 1975. *NASA Earth resources survey symposium.*

RS77-1-564

38209 **Anuta, P. E.** Computer-assisted analysis techniques for remote sensing data interpretation: Geophysics, Vol. 42, No. 3 *(Special issue on remote sensing)*, p. 468-481, illus. (incl. tables), 1977.

RS77-1-565

38247 **Erickson, J. D.** Advances in automatic extraction of Earth resources information from multispectral scanner data: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1245-1274, illus. (incl. tables), 1975. *NASA Earth resources survey symposium.*

RS77-1-566

23317 **Holtmeier, F.-K.** Luftbild, Kevo, Nordfinnland [Aerial photograph; Kevo, northern Finland]: Erde, Vol. 103, No. 2, p. 105-115, illus. (incl. sketch maps), 1972.

RS77-1-567

25663 **Avery, T. E.** Interpretation of aerial photographs, 3rd edition: 392 p., illus. (incl. tables), Burgess Publ. Co., Minneapolis, Minn., United States, 1977. *First edition 1962, second 1968.*

RS77-1-568

30659 **Hall, J. L.** Alaska's needs in remote sensing: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 315-318, 1975. *With discussion.*

RS77-1-569

30604 **Bankston, P. T.** Remote-sensing applications in the State of Mississippi: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 282-290, illus. (incl. table, sketch maps), 1975. *With discussion.*

RS77-1-570

ID NO.- EI770967420 767420
PROCEEDINGS SEM DASHS ANNUAL OFFSHORE TECHNOLOGY CONFERENCE, 9TH, VOLUMES 1 THROUGH 4, 1977.
Anon
AIME, New York, NY
Offshore Technol Conf 9th Annu, Proc, Houston, Tex, May 2-5 1977. Sponsored by AIME, New York, NY, 1977 4 vol, 2335 p CODEN: OSTCBA
DESCRIPTORS: *OFFSHORE STRUCTURES, OCEAN ENGINEERING, PRODUCTION PLATFORMS, HYDRODYNAMICS, MINERAL EXPLORATION,
IDENTIFIERS: OFFSHORE TECHNOLOGY
CARD ALERT: 512, 472, 631, 501
This conference contains 316 paper by various authors in 4 volumes. The topics discussed in volume 1 include: Hydrocarbon potential offshore; geological formations; earthquake problems; environmental impact studies; remote sensing; blowout and production control; deep ocean mining; marine seismic signatures; soil mechanics; hydrodynamic and wind effects on structures; and seawater corrosion. Volume II covers navigation systems; offshore production systems and marine terminals; marine exploration; piles and piledriving; oceanographic design criteria; offshore safety; welding; and telemetry and positioning; Volume III covers mooring dynamics of ships, structures and cables; plate tectonics; seafloor foundation stability; dynamics and vibrations of structures; pipeline lay barge operations; drilling operations; wire rope technology; marine geology and geochemistry exploration techniques; and arctic environmental conditions and processes. Volume IV covers production platforms; pipeline stresses; diving; gravity structure analysis; corrosion control; wave loading and dynamic analysis structures; and salvage and underwater repair. Individual papers are indexed separately.

RS77-1-571

ID NO.- EI771075123 775123
LINEARIZED COLLINEARITY EQUATIONS FOR SCANNED DATA
Baker, James R.
Fort Lewis Coll, Durango, Calif
ASCE J Surv Mapp Div v 103 n 1 Sep 1977 p 25-35 CODEN: JSUEAX
DESCRIPTORS: (*MATHEMATICAL TECHNIQUES, *Linearization), MATHEMATICAL MODELS, MAPS AND MAPPING,
IDENTIFIERS: GEOMETRY, LEAST SQUARES METHOD
CARD ALERT: 405, 921
The collinearity equations, based upon modification of those common in conventional photogrammetry, must accommodate the continuous dynamic nature of the exterior orientation elements. Therefore, some types of functional behavior (polynomials, harmonics, etc.) must be assumed for those orientation elements. In order to investigate image and object point coordinate deformations, and to perform space resection utilizing the method of least squares, it is desirable to generate linear approximations for these collinearity equations. The technique presented for this linearization utilizes a Taylor's series expansion about some approximations for the variables involved. The functions assumed to approximate the dynamic nature of the orientation elements are included in the linearization through the use of matrix premultipliers. The resulting linearized form of analytic expressions may be used to analyze the geometric aspects of scanned imagery. 14 refs.

RS77-1-572

ID NO.- EI770967973 767973
ANALYTICAL PHOTOGRAMMETRY APPLIED TO SURVEY POINT CO-ORDINATION.
Smith, G. L.
Aust Surv v 28 n 5 Mar 1977 p 263-272 CODEN: AUSUAK
DESCRIPTORS: (*PHOTOGRAMMETRY, *Interpretation), (SURVEYING, Triangulation),
IDENTIFIERS: ANALYTICAL PHOTOGRAMMETRY
CARD ALERT: 405, 742
It is stressed that analytical photogrammetry has become an accurate method for coordinating ground stations. Improvements in accuracy can be attributed to improved methods of correcting for systematic errors and to the use of sophisticated computer adjustment techniques. The author describes how analytical photogrammetry can be applied to cadastral and engineering coordination. The increased accuracy being achieved will also benefit mapping programs, by permitting economies to be achieved in aerial triangulation. 2 refs.

RS77-1-573

ID NO.- EI770862095 762095
REMOTE SENSING USE BY SOUTH DAKOTA STATE AGENCIES.
Sonmer, Fred A.; Isakson, Robert E.
SD State Univ, Brookings
Pap ASAE For Winter Meet, Chicago, Ill, Dec 14-17 1976 Pap 76-3508 17 p CODEN: AAEPCZ
DESCRIPTORS: (*WATER POLLUTION, *Water Quality), (IRRIGATION, Remote Sensing), (SATELLITES, Telemetering),
CARD ALERT: 453, 821, 732, 655
A brief summary of a resource management study funded by the State of South Dakota and NASA is presented. The primary objective is to assist state agencies in evaluating remote sensing as a cost effective data source in operational programs.

RS77-1-574

ID NO.- EI770858433 758433
RADIOMETRIC INTERPRETIVE LEGEND FOR LANDSAT DIGITAL THEMATIC MAPS.
Robinove, Charles J.
US Geol Surv, Reston, Va
Photogramm Eng Remote Sensing v 43 n 5 May 1977 p 593-594 CODEN: PERSDV
DESCRIPTORS: *MAPS AND MAPPING, REMOTE SENSING,
CARD ALERT: 405
A legend is suggested for use with computer-generated thematic maps made from Landsat digital data that designates some of the radiometric characteristics of each thematic map unit as well as the described terrain attributes of each map unit. The relationship between spectral band and radiance for each map unit is shown by a two-dimensional polygon with the four Landsat multispectral scanner bands plotted on the ordinate and radiance levels on the abscissa. The resulting shape is colored to correspond with the map unit color, thus facilitating the recognition and understanding of the computer-generated map units.

RS77-1-575

ID NO.- EI771075032 775032
WHAT IS THE FUTURE FOR COMMERCIAL MAPPING FIRMS?
Anderson, Edward G.
Bovay Eng, Inc, Albuquerque, NM
ASCE J Surv Mapp Div v 103 n 1 Sep 1977 p 1-6 CODEN: JSUEAX
DESCRIPTORS: *MAPS AND MAPPING, AERIAL PHOTOGRAPHY, REMOTE SENSING.
CARD ALERT: 405, 732, 742
Historically, the traditional demarcation between government mapping and commercial mapping has been at the 1:24,000 scale topographic map. Larger scale mapping for commercial, city, county, and state purposes has traditionally been the responsibility of the commercial mapping firms. Recent advances in high altitude remote sensing and photography, together with the government mapping elements obtaining newer equipment with greater efficiencies and capabilities provides for a concern that the government will break from the traditional scale demarcation and provide urban mapping at scales from 1:1,000 to 1:10,000. This poses an even greater and more critical question of the future role of the commercial mapping firms. The writer foresees a rapidly growing demand for current and accurate mapping, and that budget and personnel limitations being placed on the government will result in increased use of commercial mapping firms to meet routine mapping requirements.

RS77-1-576

ID NO.- EI770857620 757620
DESIGN OF AN IMAGE DATABASE.
Lien, Y. Edmund: Utter, Donald F. Jr.
Univ of Kans, Lawrence
Proc of the Workshop on Pict Data Descr and Manage, Chicago, Ill, Apr 21-22 1977 Publ by IEEE (Cat n 77 CH1187-4 C), New York, NY, 1977 p 131-136
DESCRIPTORS: *IMAGE PROCESSING, (DATA BASE SYSTEMS, Design).
CARD ALERT: 723
This paper presents the design of an interactive database which allows users to store, retrieve and manipulate images. Concepts of database management are incorporated into an image processing system; the result is an image database system which differs significantly from the usual commercial database systems. The images in the database include LANDSAT satellite images and images generated by digitization of maps. The user interacts with the database through an interactive query language. The primary functions in the query language include: overlaying images, editing images, coloring images, displaying images, pixel value transformation and statistical operations. 13 refs.

Section 2

GEOLOGY AND HYDROLOGY

Mineral and Petroleum Resources, Geomorphology,
Geological Exploration, Polar Studies,
River-basin Hydrology, Mapping

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RS77-2-615

N77-25605*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.
SNOWPACK GROUND TRUTH DONNER PASS SITE, SODA SPRINGS, CALIFORNIA Mission Report, 18 Jan. 1977
E. Bruce Jones Feb. 1977 14 p Original contains color illustrations
(Contract NAS5-22312)
(NASA-CR-152522) Avail: NTIS HC A02/MF A01 CSCL 08L

Ground truth data taken near Soda Springs, California, on January 18, 1977, in support of the NASA Airborne Instrumentation Research Program are presented. Ground truth data taken in support of this mission were as follows: (1) snow depths were taken every 400 feet; (2) snow densities were taken every 1,200 feet; (3) two snowpits were dug, and limited density, vertical layer classifications, and soil observations were taken; and (4) temperatures of the upper 6 inches of the snowpack were taken at one location. Author

RS77-2-616

N77-23590# Particle Measuring Systems, Boulder, Colo.
THE RESPONSE OF OPTICAL ARRAY SPECTROMETERS TO ICE AND SNOW: A STUDY OF 2-D PROBE AREA-TO-MASS RELATIONSHIPS Final Report, 22 Mar. - 30 Jun. 1976
Robert G. Knollenberg 8 Nov. 1976 36 p refs
(Contract F19628-75-C-0141; AF Proj. 627A)
(AD-A034741; AFGL-TR-76-0273) Avail: NTIS HC A03/MF A01 CSCL 20/6

Theoretical and field data analysis were performed to determine area-to-mass relationships for the response of 2-D Optical Array Spectrometers to snow crystals. A single theoretical relationship was found adequate to correct the measured area to true area for all but stellar dendrites and needles. Area-to-mass relationships established from the analysis of field data were found to be well behaved. The application of software without complete habit definition is discussed and shown to be potentially feasible. GRA

RS77-2-617

N77-27466*# Colorado School of Mines, Golden.
REMOTE SENSING OF GEOLOGIC MINERAL OCCURRENCES FOR THE COLORADO MINERAL BELT USING LANDSAT DATA Final Report, 1 Jul. 1975 - 30 Sep. 1976
Robert H. Carpenter, Principal Investigators and David W. Trexler 30 Sep. 1976 161 p refs ERTS
(Contract NAS5-20955)
(E77-10176; NASA-CR-153274) Avail: NTIS A08/MF A01 CSCL 08G

The author has identified the following significant results. LANDSAT imagery was examined as a practical and productive tool for mineral exploration along the Colorado Mineral Belt. An attempt was made to identify all large, active and/or abandoned mining districts on the imagery which initially were discovered by surface manifestations. A number of strong photolinements, circular features, and color anomalies were identified. Some of these form a part of the structural and igneous volcanic framework in which mineral deposits occur. No specific mineral deposits such as veins or porphyries were identified. Promising linear and concentric features were field checked at several locations. Some proved to be fault zones and calderas; others were strictly topographic features related to stream or glacial entrenchment. The Silverton Caldera region and the Idaho Springs-Central City district were chosen and studied as case histories to evaluate the application of LANDSAT imagery to mineral exploration. Evidence of specific mineralization related to ore deposits in these two areas were observed only on low level photography.

RS77-2-618

N77-26572*# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
APPLICATION OF STANDARD PHOTOGEOLOGIC TECHNIQUES TO LANDSAT IMAGERY FOR MINERAL EXPLORATION IN THE BASIN AND RANGE PROVINCE OF UTAH AND NEVADA Final Report
Laurence H. Lattman, Principal Investigator Jun. 1977 243 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20955)
(E77-10170; NASA-CR-153229) Avail: NTIS HC A11/MF A01 CSCL 08G

The author has identified the following significant results. Standard photogeologic techniques were applied to LANDSAT imagery of the basin and range province of Utah and Nevada to relate linear, tonal, textural, drainage, and geomorphic features to known mineralized areas in an attempt to develop criteria for the location of mineral deposits. No consistent correlation was found between lineaments, mapped according to specified criteria, and locations of mines, mining districts, or intrusive outcrops. Tonal and textural patterns were more closely related to geologic outcrop patterns than to mineralization. A statistical study of drainage azimuths of various length classes as measured on LANDSAT showed significant correlation with mineralized districts in the length class of 3-6 km. Alignments of outcrops of basalt, a rock type highly visible on LANDSAT imagery, appear to be colinear with acidic and intermediate intrusive centers in some areas and may assist on the recognition of regional fracture systems for mineral exploration.

RS77-2-619

N77-27474*# Kanner (Leo) Associates, Redwood City, Calif.
LANDSAT (ERTS) USED AS A BASIS FOR GEOLOGICAL VOLCANOLOGICAL MAPPING IN THE CENTRAL ANDES
S. Kussmaul and C. E. Brockman Washington NASA Jul. 1977 19 p refs Transl. into ENGLISH from Geol. Jahrb. (Hanover, W. Germany), v. A33, 1976 p 133-144
(Contract NASw-2790)
(NASA-TM-75024) Avail: NTIS HC A02/MF A01 CSCL 08G

LANDSAT images of the central Andes (N-Chile, W-Bolivia) were effectively used for volcanological mapping of an area about 160,000 km. The map shown exhibits more and better details than the older small scale geological maps of that area. Even on a scale of 1:1,000,000 details greater than 200 m in size are recognizable. The interpretation of LANDSAT images makes it possible to establish relative age sequences of strato-volcanoes. Finally, the images will also be helpful in prospecting for mineral deposits and geothermal sources. Author

RS77-2-620

N77-25610# Colorado State Univ., Fort Collins. Environmental Resources Center.
DETERMINATION OF SNOW DEPTH AND WATER EQUIVALENT BY REMOTE SENSING Final Report
Harold W. Steinhoff and Albert H. Barnes Jun. 1976 21 p
(Contracts DI-14-31-0001-3806; D1-14-31-0001-4006)
(PB-264229/6; W77-05104; OWRT-A-019-COLO(2)) Avail: NTIS HC A02/MF A01 CSCL 08L

By measuring the melt date and environmental variables, one could predict snow depth and water equivalent, once these equations were established for a given area. Melt date can be measured by observation from two aerial flights at three-day intervals in early spring. It is concluded that determination of snow depth and water equivalent by remote sensing from aircraft is possible. GRA

RS77-2-621

N77-25607*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING INPUTS TO LANDSCAPE MODELS WHICH PREDICT FUTURE SPATIAL LAND USE PATTERNS FOR HYDROLOGIC MODELS
Lee D. Miller, Craig Tom, and Kaew Nualchawee May 1977 49 p refs Sponsored in part by the US Dept. of Interior, the United Nations, Colo. State Univ., and Kasetsart Univ., Bangkok, Thailand
(NASA-TM-X-71330; X-923-77-115) Avail: NTIS HC A03/MF A01 CSCL 08B

A tropical forest area of Northern Thailand provided a test case of the application of the approach in more natural surroundings. Remote sensing imagery subjected to proper computer analysis has been shown to be a very useful means of collecting spatial data for the science of hydrology. Remote sensing products provide direct input to hydrologic models and practical data bases for planning large and small-scale hydrologic developments. Combining the available remote sensing imagery together with available map information in the landscape model provides a basis for substantial improvements in these applications. Author

RS77-2-622

N77-27632 Ohio State Univ., Columbus.
MONITORING OF CRUSTAL MOVEMENTS IN THE SAN ANDREAS FAULT ZONE BY A SATELLITE-BORNE RANGING SYSTEM Ph.D. Thesis
Muneendra Kumar 1976 152 p
Avail: Univ. Microfilms Order No. 77-2439

The Close Grid Geodynamic Measurement System is conceived as an orbiting ranging device with a ground base grid of reflectors or transponders (spacing 1.0 to 30km), which are projected to be of low cost (maintenance free and unattended), and which will permit the saturation of a local area to obtain data useful to monitor crustal movements in the San Andreas fault zone. A station network of 75 stations covering an area between 36 deg N and 38 deg N latitudes, and 237 deg E and 239 deg E longitudes is envisioned, with roughly half of the stations on either side of the faults. Laser radar is considered to be the main ranging system pending final selection from many possible candidates. Geometric and short arc modes are the two main methods for handling ranges and solution/adjustment of the system. Dissert. Abstr.

RS77-2-623

N77-28549 Columbia Univ., New York.
SPECTRORADIOMETRIC DETECTION AND MAPPING OF AREAS ENRICHED IN FERRIC IRON MINERALS USING AIRBORNE AND ORBITING INSTRUMENTS Ph.D. Thesis
William Collins 1976 129 p
Avail: Univ. Microfilms Order No. 77-8248

An airborne spectroradiometer system was developed to take simultaneous 500 channel measurements of ground targets in the spectral regions between 4,250 A and 10,000 A. Survey flights with the instrument over an exposed hydrothermal alteration zone prove the value of high resolution aircraft measurements to compliment LANDSAT surveys. The high resolution data are necessary for determining the spectral properties of target materials, for establishing that these spectral properties are unique and will remain unique in the low spectral resolution LANDSAT data, and for accurately determining the nature and magnitude of spectral differences among targets under the broadband configuration. Field measurements from the aircraft are spatially integrated over contiguous 18 meter square fields of view along flight lines planned to cover both background and altered rock assemblages. Dissert. Abstr.

RS77-2-624

N77-28551*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT Final Report, Mar. 1975 - May 1977
Orville R. Russell, Principal Investigator, David A. Nichols, and Richard Anderson May 1977 77 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21998)
(E77-10184; NASA-CR-153916) Avail: NTIS HC A05/MF A01 CSCL 08I

The author has identified the following significant results. Evaluation of LANDSAT imagery indicates severe limitations in its utility for surface mine land studies. Image stripping resulting from unequal detector response on satellite degrades the image quality to the extent that images of scales larger than 1:125,000 are of limited value for manual interpretation. Computer processing of LANDSAT data to improve image quality is essential; the removal of scanline stripping and enhancement of mine land reflectance data combined with color composite printing permits useful photographic enlargements to approximately 1:60,000.

RS77-2-625

N77-26577*# Stanford Research Inst., Menlo Park, Calif.
MICROWAVE PROPERTIES OF ICE FROM THE GREAT LAKES Final Report
R. S. Vickers Jan. 1975 36 p refs
(Contract NAS3-19092; SRI Proj. 3571)
(NASA-CR-135222) Avail: NTIS HC A03/MF A01 CSCL 08L

The increasing use of radar systems as remote sensors of ice thickness has revealed a lack of basic data on the microwave properties of fresh-water ice. A program, in which the complex dielectric constant was measured for a series of ice samples taken from the Great Lakes, is described. The measurements were taken at temperatures of -5, -10, and -15 C. It is noted that the ice has considerable internal layered structure, and the effects of the layering are examined. Values of 3.0 to 3.2 are reported for the real part of the dielectric constant, with an error bar of + or - 0.01. Author

RS77-2-626

N77-26584*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
THE USE OF REMOTE SENSING IN SOLVING FLORIDA'S GEOLOGICAL AND COASTAL ENGINEERING PROBLEMS Status Report, 1 Jul. 1976 - 31 Mar. 1977
H. K. Brooks, B. E. Ruth, Y. H. Wang, and R. L. Ferguson (General Electric, Daytona Beach, Fla.) 31 Mar. 1977 28 p refs Original contains color illustrations
(Grant NsG-7236)
(NASA-CR-153286; SR-1) Avail: NTIS HC A03/MF A01 CSCL 08C

LANDSAT imagery and NASA high altitude color infrared (CIR) photography were used to select suitable sites for sanitary landfill in Volusia County, Florida and to develop techniques for preventing sand deposits in the Clearwater inlet. Activities described include the acquisition of imagery, its analysis by the IMAGE 100 system, conventional photointerpretation, evaluation of existing data sources (vegetation, soil, and ground water maps), site investigations for ground truth, and preparation of displays for reports. Author

RS77-2-627

N77-25616# Army Engineer Topographic Labs., Fort Belvoir, Va.
PHOTO ANALYSIS OF A DESERT AREA
Judy Ehlen Apr. 1976 74 p refs
(DA Proj. 4A1-61102-B-52D)
(AD-A035481; ETL-0068) Avail: NTIS HC A04/MF A01 CSCL 08/6

Information derived from 1:9,600 scale stereoscopic aerial photography of a desert area near Yuma, Arizona, is presented. Physiography, geology, climate, landform, drainage, erosional aspects, vegetation, and cultural features are considered in the context of local and regional environmental, engineering, and military considerations. The second part of this report presents a field verification of the general geology, geomorphology, and vegetation in the study area with a list of selected references.
Author (GRA)

RS77-2-628

N77-28555*# Kentucky Dept. of Natural Resources and Environmental Protection, Frankfort.
A FEASIBILITY ANALYSIS OF THE EMPLOYMENT OF SATELLITE IMAGERY TO MONITOR AND INSPECT SURFACE MINING OPERATIONS IN WESTERN KENTUCKY. VOLUME 2: APPENDICES Final Report
Birney R. Fish, Principal Investigator Jan. 1977 115 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 51798 ERTS
(E77-10190; NASA-CR-153919) Avail: NTIS HC A06/MF A01 CSCL 08I

There are no author-identified significant results in this report.

RS77-2-629

N77-27483*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL REMOTE OBSERVATIONS OF HYDROLOGIC FEATURES ON THE NORTH SLOPE OF ALASKA
Dorothy K. Hall and M. Leonard Bryan (JPL, Pasadena, Calif.) May 1977 46 p refs Submitted for publication
(NASA-TM-X-71351; X-913-77-124) Avail: NTIS HC A03/MF A01 CSCL 08H

Visible and near-infrared satellite data and active and passive microwave aircraft data are used to analyze some hydrologic features in Arctic Alaska. The following features have been studied: the small thaw lakes on the Arctic Coastal Plain (oriented lakes), Chandalar Lake in the Brooks Range, several North Slope rivers, surface water on the tundra, and snowcover on the North Slope and in the Brooks Range. Passive microwave brightness temperatures (T sub b) as seen on Electrically Scanned Microwave Radiometer (ESMR) imagery are shown to increase with increasing ice thickness on all of the lakes studied. Aufeis, an important hydrologic parameter in the Arctic, is observable in the Sagavanirktok River channel on April ESMR imagery. LANDSAT imagery with better (80 m) resolution is useful for measuring aufeis extent using band 5 imagery obtained just after snowmelt in June. It is shown that the extent of aufeis (as measured on LANDSAT imagery) varies with meteorological conditions and, therefore, may be a useful indicator of annual climate fluctuations on the North Slope. Snow and ice breakup has been traced from the Brooks Range Mountains to the Arctic Ocean Coast using LANDSAT band 7 imagery in May when melting begins in the mountains.
Author

RS77-2-630

N77-28554*# Kentucky Dept. of Natural Resources and Environmental Protection, Frankfort.
A FEASIBILITY ANALYSIS OF THE EMPLOYMENT OF SATELLITE IMAGERY TO MONITOR AND INSPECT SURFACE MINING OPERATIONS IN WESTERN KENTUCKY. VOLUME 1 *Final Report*
Birney R. Fish, Principal Investigator Jan. 1977 196 p refs Sponsored by NASA ERTS
(E77-10189; NASA-CR-153918) Avail: NTIS HC A09/MF A01 CSCL 08I.

The author has identified the following significant results. Surface mining violation estimates were scaled by scores assigned by ten inspectors from western Kentucky to each violation. A sensitivity analysis was made by varying the violation costs; costs were varied by using three different average durations. These durations were: (1) best estimated duration; (2) longest possible duration as restricted by the one year permit renewal and bond release regulations, and (3) shortest possible duration when inspections were made. If a social cost cannot be reduced, then the value of the social cost is irrelevant. Indications from the increased inspection rate of 1975 were that the total amount of fines collected per year remains constant independent of the increased detection rate.

RS77-2-631

N77-27464 Purdue Univ., Lafayette, Ind.
DIGITAL PROCESSING OF SATELLITE MULTISPECTRAL SCANNER DATA FOR HYDROLOGIC APPLICATIONS Ph.D. Thesis
Luis Alberto Bartolucci-Castedo 1976 251 p
Avail: Univ. Microfilms Order No. 77-1682

The development of computer-aided procedures to extract useful hydrologic information from satellite digital multispectral data for applications to surface water inventory and snowcover mapping in mountainous regions is presented. LANDSAT MSS and SKYLAB S-192 multispectral data were utilized. The results indicated that the smallest water body that can be reliably identified using computer-aided multispectral classification of LANDSAT data should be at least three hectares (approximately equal to or larger than 8 acres in size). Smaller water bodies can be identified only in particular cases in which at least one spatial resolution entirely covers the water surface. Use of a mixture spectral class, however, allows reliable identification of water bodies as small as one hectare (approximately equal to 2.5 acres) in size.
Dissert. Abstr.

RS77-2-632

N77-27468*# Milan Univ. (Italy).
GEOMORPHIC AND LANDFORM SURVEY OF NORTHERN APPENNINE RANGE (NAR) *Final Report*
C. M. Marino, Principal Investigator and E. Zilioli Jun. 1977 30 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E77-10178; NASA-CR-153276) Avail: NTIS HC A03/MF A01 CSCL 08G

The author has identified the following significant results. An approach to landslide hazard detection was developed through the analysis of satellite imagery (LANDSAT 2) showing many landslide areas that occur on marine silts and clays in northern Appennine Range in Italy. A landslide risk score was given for large areas by narrowing and extending well defined areas, whose behavior and reflectivity variation was due to upper surface changes. Results show that this methodology allows evolution pattern of clay outflows to be distinguished.

RS77-2-633

N77-28559# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOIUZ-22: A NEW CONTRIBUTION TO SPACE GEOGRAPHY
V. V. Ivanov and E. D. Sulidi-Kondrat'ev [1977] 2 p Transl. into ENGLISH from Priroda (Moscow), no. 3, 1977 p 21
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Ill. 60616

The use of space photographs in the detection of earth resources and discontinuous tectonics is evaluated. I.M.

RS77-2-634

N77-24555*# Department of the Environment, Ottawa (Ontario).
HYDROLOGIC DATA RELAY BY SATELLITE FROM REMOTE AREAS
R. A. Halliday, Principal Investigator 1977 22 p refs Presented at Technical and Sci. Sessions on Water Resources World Water Conf., Mar del Plata, Argentina, 14-25 Mar. 1977 Sponsored by NASA ERTS
(E77-10160; NASA-CR-153045) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. Experimental use of LANDSAT data collection system and the GOES system has demonstrated the feasibility of using this technology to relay hydrologic data from remote areas on a near real time basis. The system has proved to be accurate, reliable, and cost effective.

RS77-2-635

A77-36434 ***Energy and aerospace* /Sixty-fifth Wilbur and Orville Wright Memorial Lecture/.** R. C. Seamans, Jr. (ERDA, Washington, D.C.). *Aeronautical Journal*, vol. 81, Apr. 1977, p. 147-169. 92 refs.

Some ways that aerospace science can contribute to conserving or obtaining energy are discussed. Developments leading to increased fuel efficiency and the possibility of using alternative fuels for aviation are considered, as is the use of fuel-efficient lighter-than-air vehicles for transporting heavy cargo. It is suggested that remote aircraft and spacecraft sensing can be used to prospect for fossil fuels, geothermal resources, and uranium, and that data obtained from earth resources satellites can be used for planning and monitoring energy activities. The prospect of capturing solar energy in space and transmitting it for use on earth is also examined. M.L.

RS77-2-636

A77-33652* **Field measurements of the spectral response of natural waters.** L. A. Bartolucci, B. F. Robinson, and L. F. Silva (Purdue University, West Lafayette, Ind.). *Photogrammetric Engineering and Remote Sensing*, vol. 43, May 1977, p. 595-598. 11 refs. Contract No. NAS9-13301.

The spectral response (air-water interface reflectance and water-volume scattering) of turbid river water (99 mg/liter suspended solids) and relatively clear lake water (10 mg/liter suspended solids) was measured in situ with a field spectroradiometer. The influence of the river bottom on the spectral response of the water also was determined by using a modified Secchi disc approach. The results indicated that turbid river water had a higher spectral response than clear lake water (about 6 percent) in the red (0.6-0.7 micron) and near-infrared (0.7-0.9 micron) portions of the spectrum. Also, the reflectance characteristics of the river bottom did not influence the spectral response of the turbid river water when the water was deeper than 30 cm. (Author)

RS77-2-637

A77-36283 # **Interpreting aerial and space photographs in investigations of seepage flow (Deshifrirovanie aero- i kosmicheskikh snimkov pri izuchenii podzemnogo stoka).** R. G. Dzhamalov, I. S. Zektser, and Iu. L. Ob'edkov (Akademiia Nauk SSSR, Institut Vodnykh Problem, Moscow, USSR). *Razvedka i Okhrana Nedr*, Jan. 1977, p. 45-52. 9 refs. In Russian.

Methods of interpreting photographs taken from aircraft and spacecraft to aid hydrogeological investigations are reviewed. Such problems as investigation of the underground water resources of a given location, determination of the depth and degree of mineralization of underground water, study of the character and extent of interrelationship between subterranean and surface waters and of the effects of natural and artificial factors on underground seepage flow are discussed. The possibility of using space and aerial photos to study the conditions of formation of underground waters is examined. C.K.D.

RS77-2-638

A77-34596 # **Pulse-echo method of measuring ice cover thickness (Radiolokatsionnyi impul'snyi metod izmereniia tolshchiny ledianogo pokrova).** A. N. Chizhov, V. G. Glushnev, and B. D. Slutsker (Gosudarstvennyi Gidrologicheskii Institut, Leningrad, USSR; Rizhskii Institut Grazhdanskoi Aviatsii, Riga, Latvian SSR). *Meteorologiia i Gidrologiia*, Apr. 1977, p. 90-96. 5 refs. In Russian.

The theory of a pulse-echo method for measuring ice thicknesses on lakes, rivers, and water reservoirs is outlined. The parameters and characteristics of an ice thickness measuring facility which uses shock excitation of meter and decimeter wavelength transmitting antennas to generate nanosecond pulses are described, and results obtained from airborne measurements are examined. V.P.

RS77-2-639

A77-36123 **Meteorite impact crater discovered in Central Alaska with Landsat imagery.** P. J. Cannon (Alaska, University, Fairbanks, Alaska). *Science*, vol. 196, June 17, 1977, p. 1322-1324. 9 refs.

Several supporting observations indicate that Sithylemenkat Lake, Alaska, occupies a meteorite impact crater formed near the end of the Wisconsinan glaciation. The initial identification with Landsat imagery is attributed to the unique perspective provided by such imagery. (Author)

RS77-2-640

A77-35456 # **Moraine and outwash plains.** W. M. McKinney (Wisconsin, University, Stevens Point, Wis.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Jan. 1977, p. 42-45.

An aerial photograph on a scale of 1:20,000 over Portage County, Wisconsin, a region of postglacial topography, is analyzed. The contours of the terminal moraine and outwash plains are identified, as is an alluvial fan formed by a flow of glacial meltwater. Land use patterns are pointed out and related to topographical features. C.K.D.

RS77-2-641

DELINEATION OF THE BOUNDARIES OF A BURIED PRE-GLACIAL VALLEY WITH LANDSAT-1 DATA,
Purdue Univ., Lafayette, Ind.
J. B. Peterson, F. E. Goodrick, and W. N. Melhorn.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 97-103, September 1975. 4 fig, 6 ref. NASA NAS 9-14016, NASA NGL 15-005-186.

Descriptors: *Soil surveys, *Indiana, *Remote sensing, *Glaciation, Pleistocene epoch, Soil classification, Land use, Soil types, Prairie soils, Glacial drift, Aquifers, Geomorphology, Satellites(Artificial).
Identifiers: LANDSAT, Udoll soils, Udalfs, Timber soils.

The continuity of a narrow meandering strip of Udoll (prairie) soils running east and west for approximately 40 miles across north central Indiana in an area predominantly of Udalfs (timber soils) was apparent in LANDSAT-1 (ERTS-1) data. The dark Udoll soils ocur in predominantly flat topography, contrasting sharply in satellite imagery from surrounding light colored Udalf soils in the characteristically rolling, undeveloped landscape of the late Wisconsin till plains. This dark stretch of prairie soil is believed to have formed in the heavy textured, poorly drained glacial debris which filled a major pre-glacial tributary of the Teays River system. This valley was apparently re-occupied and partly re-excavated by surface drainage during intergialcial times, following retreat of the Kansan and Illinoisan age ice invasions. Final filling of the valley occurred during retreat of the East White sublobe of the Wisconsin stage ice. The origin and the continuity of this meandering stretch of prairie was not recognized by soil scientists who, over a 60 year period, mapped the three counties which encompass it. Furthermore, geologists who had been searching for the exact location of this buried valley had been unsuccessful until the LANDSAT data provided an adequate synoptic view. Ready identification and location of the valley has significance to soil survey and land classifiction people as a guide to soil classification and land use and to geologists as a guide to location of a potentially economically significant aquifer. (See also W77-08408) (Humphreys-ISWS)
W77-08415

RS77-2-642

TROPHIC STATUS OF INLAND LAKES FROM LANDSAT,
Wisconsin Univ., Madison. Inst. for Environmental Studies.
L. T. Fisher, and F. L. Scarpace.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM-X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 443-450, September 1975. 3 fig, 1 tab, 2 ref.

Descriptors: *Lakes, *Water quality, *Wisconsin, *Remote sensing, *Data processing, Analytical techniques, Data storage and retrieval, Costs, Surface waters, Trophic level, Eutrophication, Satellites(Artificial).
Identifiers: LANDSAT.

A cooperative program involving university researchers and natural resource managers utilized LANDSAT data to produce an economical trophic status assessment of 3,000 Wisconsin lakes. Computer programs were developed which allow easy, rapid access to LANDSAT data and which can be used by non-research personnel for production data extraction. Capital expenses were low, and operating costs were very reasonable compared to expenses to acquire on-site data of comparable quality. (See also W77-08408) (Humphreys-ISWS)
W77-08434

RS77-2-643

SNOW SURVEY FROM SPACE, WITH EMPHASIS ON THE RESULTS OF THE ANALYSIS OF SKYLAB EREP S192 MULTISPECTRAL SCANNER DATA,
Environmental Research and Technology, Inc., Concord, Mass.
J. C. Barnes, and M. D. Smallwood.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2643-2659, September 1975. 7 fig, 2 tab, 12 ref. NASA NAS 9-13305.

Descriptors: *Snow surveys, *Remote sensing, *Mapping, *Nevada, *Utah, Data processing, Snow cover, Snow, Snowmelt, Analytical techniques, Satellites(Artificial), Surveys, Reflectance.
Identifiers: *Sierra Mountains, *White Mountains, *Wasatch Mountains, Skylab.

The Skylab EREP S192 Multispectral Scanner data have provided, for the first time, an opportunity to examine the reflectance characteristics of snowcover in several spectral bands extending from the visible into the near-infrared spectral region to about 2 micrometers. The analysis of the S192 imagery and digital tape data from five EREP passes, two from the SL-2 mission and three from the SL-4 mission, indicated a sharp drop in reflectance of snow in the near-infrared, with snow becoming essentially non-reflective in Bands 11 (1.55-1.75 micrometers) and 12 (2.10-2.35 micrometers). The results were in good agreement with the results of laboratory experiments. Two potential applications to snow mapping of measurements in the near-infrared spectral region are possible: (1) the use of a near-infrared band in conjunction with a visible band to distinguish automatically between snow and water droplet clouds; and (2) the use of one or more near-infrared bands to detect areas of melting snow. (See also W77-08062) (Humphreys-ISWS)
W77-08082

RS77-2-644

APPLICATION OF THERMAL SCANNING TO THE STUDY OF TRANSVERSE MIXING IN RIVERS,
Wisconsin Univ., Madison.
J. W. Eheart.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, Houston, Texas, p 2317-2324, September 1975. 32 fig, 1 tab, 1 ref, 1 append.

Descriptors: *Remote sensing, *Model studies, *Rivers, *Mixing, Mathematical models, Water temperature, Thermal pollution, Dispersion, Analytical techniques, Water pollution, Biochemical oxygen demand, Application methods.
Identifiers: Heat transport, Mass transport.

It was considered desirable to study and to predict the two-dimensional movement of pollutants in the region just downstream of a pollutant discharge point. While many of the more common pollutants do not exhibit a spectral signature, it was shown that the temperature difference between the pollutant and the receiving water could be successfully exploited by applying a mathematical model of mass transport processes to heat transport and then testing and calibrating it with thermal scanning data. (See also W77-08062) (Humphreys-ISWS)
W77-08071

RS77-2-645

THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION,
Army Engineer District, Waltham, Mass. New England Div.
S. Cooper, P. Bock, J. Horowitz, and D. Foran.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2443-2522, September 1975. 25 fig, 5 tab, 3 ref.

Descriptors: *Remote sensing, *Water management(Applied), *New England, *Surface waters, Water resources, Floods, Instrumentation, Management, Operations, Networks, Satellites(Artificial), Hydrologic data, Data processing, Monitoring, Surveys, Mapping, Photography, Ice, Snow cover, Lakes, Rivers, Water quality, Evaluation.
Identifiers: *Data collection systems, *Data collection platforms, LANDSAT.

The New England Division (NED), Corps of Engineers has experimented with the LANDSAT-1 Data Collection and Imaging Systems for more than two years following the launch of the satellite in July 1972. The purpose of this experiment has been to evaluate the future usefulness of data products received from satellites such as LANDSAT in the day-to-day operation of the NED water resources systems used to control floods. NED concluded that data collection by orbiting satellite relay is both reliable and feasible. Using standard photo equipment, experience in this investigation has indicated that LANDSAT photo imagery may be enlarged about five times, or to a scale of 1:200,000. This is sufficient for only rather large-scale or gross feature patterns to be represented with the accuracy necessary for flood control reservoir regulation purposes. This study has indicated technological feasibility, albeit with the expectation of further advances in imaging systems and products. Pilot project test and evaluation demonstrations under quasi-operational conditions were recommended. (See also W77-08062) (Humphreys-ISWS)
W77-08076

RS77-2-646

FLOODING FREQUENCE OF HYPERSALINE COASTAL ENVIRONMENTS DETERMINED BY ORBITAL IMAGERY: GEOLOGIC IMPLICATIONS,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
S. P. Vonder Haar, and D. S. Gorsline.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A024 588, Price codes: A02 in paper copy, A01 in microfiche. Southern California University Report USC-GEOL 76-04, April 1976. Reprinted from: Science, Vol 190, p 147-149, 10 October 1975. 5 p, 2 fig, 12 ref. ONR-N00014-76-C-0061.

Descriptors: Flooding, *Sedimentation, *Coasts, Geology, Geography, Frequency, *Mexico, *Monitoring, *Remote sensing.
Identifiers: *Coastal environments, Orbital imagery, *Baja California.

Available satellite imagery in the infrared and near-infrared wavelengths provides a simple, rapid, and low-cost method for monitoring the extent and duration of the flooding of coastal ecosystems. Hypersaline environments in Baja California, Mexico are flooded as a result of complex interactions between the higher of the two spring tides each month and local winds. Such flooding necessitates a reappraisal of ideas on rhythmic lamination in algal mats, stromatolites, and evaporite sediments preserved in the geologic record. (Sinha-OEIS)
W77-07751

RS77-2-647

QUANTITATIVE WATER QUALITY WITH LANDSAT AND SKYLAB.
Kansas Univ., Lawrence.
H. L. Yarger, and J. R. McCauley.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 347-370, September 1975. 21 fig, 2 tab, 16 ref.

Descriptors: *Water quality, *Remote sensing, *Kansas, *Surface waters, Reservoirs, Water temperature, Dissolved solids, Suspended solids, Secchi disks, Phosphates, Potassium, Nitrates, Analysis, Monitoring, Satellites(Artificial), Chlorophyll, Measurement.
Identifiers: LANDSAT, Skylab.

LANDSAT Multispectral Scanner (MSS) reflectance levels are useful for quantitative measurement of suspended solids up to at least 900 ppm. MSS band ratios derived from computer-compatible tape (CCT) can measure suspended solids with 67% confidence level accuracy of 12 ppm over the range 0-80 ppm, and 35 ppm over the range 0-900 ppm. Suspended solids contour maps can be easily constructed from CCT's for water bodies larger than approximately 100 acres. Rationing suppresses MSS reflectance level dependence on seasonal sun angle variation and permits measurement of suspended load the year round in the middle latitudes. These LANDSAT results are based on correlation studies between MSS CCT's and 170 water samples taken from three large Kansas reservoirs coincident with 16 different LANDSAT passes over a period of 13 months. Skylab imagery, S190A and S192, from a single pass over three reservoirs, compared favorably to LANDSAT results up to 100 ppm. No samples were obtained with suspended solids greater than 100 ppm during the Skylab overpass. Typical mid-continent values for variables such as sun angle, wind speed, and temperature, do not significantly affect the correlation between satellite band ratios and suspended solids. The relatively high inorganic suspended solids, characteristic of mid-continent reservoirs, dominate the reflected energy present in the satellite spectral bands. Dissolved solids concentrations up to 500 ppm and algal nutrients up to 20 ppm are not detectable. The RED/GREEN ratio may have a weak negative correlation with total chlorophyll above about 8 micrograms/l. (See also W77-08408) (Humphreys - ISWS)
W77-08431

RS77-2-648

HYDROGEOLOGICAL APPLICATIONS OF EARTH RESOURCES TECHNOLOGY SATELLITE LANDSAT 1 IMAGERY,
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
J. E. Charron.
Scientific Series No. 62, (English and French), 1976, 9 p., 9 fig., 5 ref.

Descriptors: *Remote sensing, Hydrology, *Geography, *Land resources, *Satellites, Technology, Groundwater recharge, Artesian wells, Freshwater, Mapping, *Canada.
Identifiers: *ERTS, *LANDSAT 1, Imagery, Manitoba, Ottawa, Ontario, Montreal, Quebec, Winnipeg.

A correlation of LANDSAT I imagery with various hydrogeological and surficial geology features in the Winnipeg area, Manitoba, and the Ottawa (Ontario)-Montreal (Quebec) area of Canada is presented. The study includes the identification of groundwater recharge and discharge areas and artesian zones; areas of freshwater discharge into surface-water bodies; and the identification and mapping of various types of surficial deposits. (WATDOC)
W77-07339

RS77-2-649

THE LANDSAT-1 MULTISPECTRAL SCANNER AS A TOOL IN THE CLASSIFICATION OF INLAND LAKES,
National Eutrophication Survey, Corvallis, Oreg.
D. H. P. Boland, and R. J. Blackwell.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations. Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 419-442, September 1975. 13 fig, 3 tab, 11 ref.

Descriptors: *Classification, *Lakes, *Water quality, *Remote sensing, *Minnesota, *Michigan, *New York, *Wisconsin, Surface waters, Eutrophication, Trophic level, Data processing, Monitoring, Surveys, Analytical techniques, Satellites(Artificial), Phosphorous, Chlorophyll, Nitrogen, Conductivity.
Identifiers: LANDSAT.

This study focused on relationships between LANDSAT-1 multispectral scanner (MSS) data and the trophic status of a group of lakes located in the north-northeastern part of the United States. MSS data were used to predict the magnitudes of two trophic state indicators, to estimate lake position on a multivariate trophic scale, and to automatically classify lakes according to their trophic state. Initially, principal component ordiantion was employed to ascertain the trophic state of 100 lakes using the indicators: chlorophyll a, conductivity, inverse of Secchi transparency, total phosphorus, total organic nitrogen, and productivity as measured by a standard algal assay yield test. The resultant PC1 values were indicative of the lakes' positions on a multivariate trophic scale. MSS data for some 20 lakes were extracted from computer-compatible tapes (CCT's) using a binary marking technique. Output was in the form of descriptive statistics and photographic concatenations. MSS color ratios were incorporated into regression models for the prediction of Secchi disc transparency, chlorophyll a, and lake position on the trophic scale. Lake trophic state-MSS relationships were also examined using three-dimensional color ratio models. Automatic image processing techniques were used in conjunction with MSS data and trophic state index values to classify each lake pixel-by-pixel. Classification products included both gray scale and color-coded photographic prints. It appears that the LANDSAT-1 MSS has the capability of providing supplemental data relating to water quality in inland lakes. Further refinement in the sensor and the data processing techniques should make multispectral imagery collected from space platforms a valued tool in lake survey and monitoring activities. (See also W77-08408) (Humphreys - ISWS)
W77-08433

RS77-2-650

A FURTHER COMPARISON OF GLACIER VELOCITIES MEASURED BY RADIO-ECHO AND SURVEY METHODS,
British Antarctic Survey, Cambridge (England).
C. S. M. Doake, M. Gorman, and W. S. B. Paterson.
Journal of Glaciology, Vol. 17, No. 75, p 35-38, 1976. 1 fig, 7 ref.

Descriptors: *Ice, *Surveys, *Glaciology, *On-site tests, *Arctic, On-site investigations, Velocity, Glaciers, Measurement, Instrumentation, Radar, Remote sensing, Drill holes, Evaluation, Sounding.
Identifiers: *Devon Island Ice Cap(Canada), Ice cap, Radio-echo survey.

A comparison was made between ice velocities that were measured by the radio-echo technique and ice velocities measured by a survey method on the Devon Island ice cap, Arctic Canada. Results were 2.58 + or - 0.11 m/a by radar and 2.17 + or - 0.20 m/a by survey. The discrepancy between the two measurements is within the limits of statistical significance, and the methods were considered to give comparable results. (Humphreys-ISWS)
W77-08228

RS77-2-651

REMOTE SENSING INPUTS TO WATER DEMAND MODELING,
California Univ., Santa Barbara. Geography Remote Sensing Unit.
J. E. Estes, J. R. Jensen, L. R. Tinney, and M. Rector.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2585-2620, September 1975. 8 fig, 8 tab, 4 ref.

Descriptors: *Model studies, *Hydrologic budget, *California, *Remote sensing, Water demand, Data processing, Mapping, Crops, Land use, Water balance, Agriculture, Irrigation, Census, Saline soils, Aerial photography.
Identifiers: *Kern County(Calif), LANDSAT.

Water resource managers require timely, accurate, and cost-effective data to model hydrologic dynamics in arid agricultural environments. In an attempt to determine the ability of remote sensing techniques to economically generate data required by water demand models, a water model was developed for Kern County Water Agency (KCWA), California. The model is currently being refined. Based upon an analysis of the KCWA model, listings of all external quantities that serve as inputs to the model were compiled and analyzed in the following manner: (1) all data inputs were precisely defined; (2) related data inputs were grouped and categorized; (3) present sources of input data were identified; and (4) preliminary determinations were made as to which inputs could possibly be generated more efficiently utilizing remote sensing technology. As a result of this analysis, it was determined that agricultural cropland inventories utilizing both high altitude photography and LANDSAT imagery can be conducted cost-effectively. In addition, by using average irrigation application rates in conjunction with cropland data, estimates of agricultural water demand can be generated. Techniques developed are considered economical, accurate, and timely in comparison to conventional methods. (See also W77-08062) (Humphreys-ISWS)
W77-08080

RS77-2-652

THE AFGWC SNOW COVER ANALYSIS MODEL,
Air Force Global Weather Central, Offutt AFB, Nebr.
S. A. Luces, S. J. Hall, and J. D. Martens.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A017 942, Price codes: A03 in paper copy, A01 in microfiche. Report AFGWCTM 75-1, June 1975. 22 p, 1 tab, 12 ref, 3 append.

Descriptors: *Snow cover, *Mathematical models, *Computer programs, Analytical techniques, Numerical analysis, Weather data, Remote sensing, Satellites(Artificial), Snow, Sea ice, Climatology, Data collections, Climatic data, Computers, Weather, Model studies, Meteorology.
Identifiers: *Snow cover analysis.

This report documented the Air Force Global Weather Central (AFGWC) Automated Snow Cover Analysis Model. It described the data input, analysis procedures, problems, possible improvements, and potential uses of the model. The hemispheric model became operational in March 1975. It uses hourly surface synoptic data, meteorological satellite video brightness data, and climatological data to determine the depth and age of snow on the ground on a hemispheric grid with 25 nautical miles spacing. The resulting daily analyses provide a Northern Hemisphere data base which is stored on high speed computers and is available for many meteorological and other scientific applications. (Sims-ISWS)
W77-08223

RS77-2-653

HYDROLOGY.
Geological Survey, Reston, Va. Water Resources Div.
L. A. Heindl.
Encyclopedia Britannica Book of the Year, Earth Sciences, (Chicago), p 264-265, 1977.

Descriptors: *Water resources development, *Water supply, *Water pollution control, *United States, Reviews, Remote sensing, Satellites(Artificial), Aerial photography, Waste disposal, Surface waters, Groundwater, Ice, Snow management.

This review of water-resources problems in the United States summarizes the increasing demands for water supplies, hazards of water pollution, and measures being taken to cope with these problems. Withdrawal of groundwater doubled in the U.S. in the past 20 years. By 1976 groundwater provided between one-quarter and one-third of all water used for all purposes, and about half the people in the U.S. depended on it for their domestic supplies. The emphasis of investigations during the year was on the maintenance of groundwater quality. This is particularly a problem where wastes are being injected into the subsurface. Widespread concern for the continuing supply of clean fresh water resurrected interest in the use of mineralized and saline waters for nonpotable domestic, industrial, and agricultural purposes. The use of combinations of data from Landsat 1 and 2 and other satellites demonstrated the practicality of using remote sensing from satellites and high-flying aircraft for preliminary hydrological assessments of the water regimens of large areas. Reports of working groups of the U.S. National Committee for the International Hydrological Decade stressed the need in the United States for better coordination of research in snow-and-ice hydrology, increased application of already proven nuclear techniques in field studies and investigations, more realistically structured programs for drainage-basin research, and additional emphasis on basis hydrology in the university curricula of future water resources experts. (Woodard-USGS)
W77-07494

RS77-2-654

REMOTE SENSING OF TURBIDITY PLUMES IN LAKE ONTARIO,
Geological Survey, Reston, Va. Water Resources Div.
E. J. Pluhowski.
Meeting Preprint 2602 presented at the American Society of Civil Engineers National Convention, held in Denver, Colorado, November 3-7, 1975. 28 p, 13 fig, 6 ref.

Descriptors: *Turbidity currents, *Lake Ontario, *Remote sensing, *Satellites(Artificial), *Photography, Littoral drift, Sediments, Thermal stratification.
Identifiers: *LANDSAT images, *Turbidity plumes, Thermal bar.

Space imagery and high-altitude photography provide an effective method of monitoring the dynamics of turbidity plumes in Lake Ontario. The Niagara River plume, as much as 200 square miles (518 sq km) in area, is by far the largest turbidity feature in the lake. Plume analyses corroborate the presence of a prevailing eastward flowing longshore current along the entire south shore of the lake. This current is most persistent at the Oswego River outlet but is quite variable in the Rochester embayment, where rapid shifts in water movement were detected occasionally in LANDSAT images. The position of the spring thermal bar, a zone of maximum density water corresponding to the 4 deg C isotherm, was located near the Niagara River outlet in images obtained during April 1973. (Woodard-USGS)
W77-08752

RS77-2-655

HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA,
Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
W. Kruck, and W. Kantor.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2183-2197, September 1975. 6 fig, 3 ref.

Descriptors: *Hydrogeology, *Remote sensing, *Surveys, Evaluation, Terrain analysis, Water supply, Water resources, Surface waters, Soil types, Foreign countries, Foreign waters, Foreign research.
Identifiers: *Argentinian Pampa, *Bajos, LANDSAT, Skylab.

In large areas of the Argentinian Pampa, the salinization of groundwater creates water supply difficulties. Investigations of satellite imagery (Landsat-1 and Skylab), which were based on an extensive ground survey, revealed that differences in the vegetation cover are closely related to depth and salinity of groundwater. Narrow elongated depressions called 'bajos' are often the only indication of fresh groundwater. They can easily be detected on the imagery. Due to their high resolution, Skylab photos allow a quantitative estimation of fresh groundwater situated below the bajos. In general, however, Landsat-1 imagery sufficed for evaluation. In the area of the Rio Tercero, a fossil drainage pattern was discovered, and in Corrientes province, soil types could be discriminated and compared to the SOIL MAP OF THE WORLD. It was concluded that the use of satellite imagery in the future will reduce the number of observation points for hydrogeological reconnaissance mapping by up to 75% in areas with similar hydrogeological conditions. (See also W77-08062) (Humphreys-ISWS)
W77-08064

RS77-2-656

TEST OF LANDSAT-BASED URBAN HYDROLOGIC MODELING,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
T. J. Jackson, R. M. Ragan, and W. N. Fitch.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. WR1, Proceedings paper No. 12950, May 1977, p 141-158. 8 fig, 6 tab, 18 ref.

Descriptors: *Watersheds(Basins), *Areial photography, *Computer models, *Remote sensing, Hydraulics, Hydrology, Water resources, Systems analysis, Planning.
Identifiers: Urban planning, Urban development, Cost-effectiveness.

Many of the models designed to support the hydrologic studies associated with urban water resources planning require input parameters that are defined in terms of land cover. Estimating the land cover is a difficult and expensive task and any innovation that can reduce these problems should be of significant value to the water resources planning community. The purpose of the reported investigation was to compare conventional and Landsat-based methods for determining the land cover inputs of hydrologic planning and design models. Comparisons were based on a case study of the Fourmile Run Watershed in Virginia. Results of the study indicated that for planning model studies, the Landsat-based approach is highly cost-effective. However, in the design model investigations, the errors encountered when the Landsat data are used were unacceptable. (See also W77-07527) (Bell-Cornell)
W77-07528

RS77-2-657

FACTORS AFFECTING SNOW ASSESSMENT FROM LANDSAT DATA.
National Environmental Satellite Service, Washington, D.C.
D. F. McGinnis, Jr., M. C. McMillan, and D. R. Wiesnet.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2661-2668, September 1975. 3 fig, 31 ref.

Descriptors: *Snow, *Monitoring, *Remote sensing, Snow surveys, Snow cover, Satellites(Artificial), Mapping, Optical properties, Reflectance, Physical properties, Evaluation, Forests, Radiation, Measurement.
Identifiers: LANDSAT.

LANDSAT imagery has been used to map snow extent with great accuracy. Present orbit and sensor characteristics, however, restrict LANDSAT as a snow monitoring satellite. A better understanding of the complexities affecting the radiation reflected by a snowpack will enhance the usefulness of remote sensing of snow from aircraft and satellites. Problems of aspects and slopes may hinder thematic mapping of snow but can be resolved with available solar tables. Detection of snow in forested areas via satellite is a problem still under study. LANDSAT-1 and -2 have revealed the potential for multispectral studies of snow. With minor modifications of sensor and orbit, future spacecraft could become 'SNOWSTAT's'. Raising the detector saturation threshold and extending the upper spectral limit of the MSS will not only improve mapping of snow extent, but also will provide the likelihood of monitoring some aspects of the physical condition of the snowpack. (See also W77-08062) (Humphreys-ISWS)
W77-08083

RS77-2-658

THE USE OF LANDSAT-1 IMAGERY FOR WATER QUALITY STUDIES IN SOUTHERN SCANDINAVIA,
Lund Univ., (Sweden). Dept. of Physical Geography.
U. Hellden.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 451-468, September 1975. 12 fig, 15 ref.

Descriptors: *Lakes, *Water quality, *Remote sensing, *Foreign countries, Surface waters, Water pollution, Satellites(Artificial), Data processing, Analytical techniques, Instrumentation.
Identifiers: *Sweden, LANDSAT, Densitometer.

In order to find out the possibilities of using LANDSAT-1 images for environmental studies, with special references to water quality studies, test areas in southern Scandinavia were selected. The MSS images of different bands were compared under the magnification of an Interpretoscope, and densitometric analyses were performed in a Schnellphotometer. The possibility of tracing pollution plumes was studied in the Oresund outs de Copenhagen. The effect of different sewers and the circulation of the polluted water was analyzed in various situations. The variation in reflectivity of a great number of lakes in South and Middle Sweden was studied by means of densitometric analyses, and significant regional differences were found. The correlation with with in situ measurements of water quality of the sampled lakes was fairly good. (See also W77-08408) (Humphreys-ISWS)
W77-08435

RS77-2-659

FLOOD HAZARD STUDIES IN CENTRAL TEXAS USING ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY,
Texas Univ., Austin. Dept. of Geological Sciences.
V. R. Baker, R. K. Holz, and P. C. Patton.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2253-2294, September 1975. 27 fig, 2 tab, 30 ref, 1 append. NAS 9-13312.

Descriptors: *Remote sensing, *Mapping, *Geomorphology, *Texas, *Floods, Watersheds(Basins), Flood plains, Hydrographs, Satellites(Artificial), Small watersheds, Channel morphology, Distribution patterns, Channels, Drainage density, Topography.
Identifiers: Skylab, *Colorado River(Tex).

One approach to flood hazard evaluation in the central Texas area is a parametric model which relates flood hydrograph characteristics to quantitative geomorphic properties of the drainage basins. The study evaluted the network resolution capabilities of the following data formats: (1) large-scale (1:24,000) topographic maps, employing Strahler's method of v's,' (2) standard low altitude black and white aerial photography (1:13,000 and 1:20,000 scales), (3) NASA-generated aerial infrared photography at scales ranging from 1:48,000 to 1:123,000, and (4) Skylab Earth Resources Experiment Package S-190A and S-190B sensors (1:750,000 and 1:500,000 respectively). Resolution, measured as the number of first order streams or as the total channel length identified in small drainage areas, is strongly dependent on basin relief. High-density basins on the Edwards Plateau were poorly depicted on orbital imagery. However, the orbital network definition of low relief basins on the inner Texas Coastal Plain is nearly as accurate as results from large-scale topographic maps. The Skylab earth terrain camera (S-190B) and NASA-generated aerial infrared type 2443 imagery at 1:48,000 scale were found to be useful for botanic soils, and geomorphic flood hazard zonation. Studies of the Colorado river valley near austin, texas, easily distinguished infrequent (100 to 500 year recurrence interval), intermediate (10-30 year), and frequent (1 to 4 year) hazard zones. (See also W77-08062) (Humphreys-ISWS)
W77-08069

RS77-2-660

REMOTE SENSING OF TURBIDITY PLUMES IN LAKE ONTARIO,
Geological Survey, Reston, Va.
E. J. Pluhowski.
Transportation Engineering Journal of ASCE, Proceedings of the American Society of Civil Engineers, Vol. 102, No. TE3, Proceedings paper No. 12306, p 475-488, August 1976. 13 fig, 6 ref.

Descriptors: *Lake Ontario, *Remote sensing, *Currents, *Beach erosion, Lakes, Rivers, Turbidity, Hydrology, Monitoring, Outlets.
Identifiers: *Turbidity plumes.

Space imagery and high-altitude photography provide an effective method of monitoring the dynamics of turbidity plumes in Lake Ontario. The Niagara River Plume, as much as 200 sq miles (520 km) in area, is by far the largest turbidity feature in the lake. Plume analyses corroborate the presence of a prevailing eastward flowing longshore current along the entire south shore of the lake. This current is most persistent at the Oswego River outlet but it is quite variable in the Rochester embayment, where rapid shifts in water movement were occasionally detected. The position of the spring thermal bar, a zone of maximum density water corresponding in the 4 C isotherm, was located near the Niagara River outlet in images obtained during April, 1973. (Bell-Cornell)
W77-07549

RS77-2-661

APPLICATION OF EREP, LANDSAT AND AIRCRAFT IMAGE DATA TO ENVIRONMENTAL PROBLEMS RELATED TO COAL MINING,
Earth Satellite Corp. Washington, D. C.
R. V. Amato, O. R. Russell, K. R. Martin, and C. E. Wier.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975. Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 309-327, September 1975. 8 fig, 2 tab, 7 ref.

Descriptors: *Coal mines, *Kentucky, *Indiana, *Remote sensing, *Environment, Land use, Strip mines, Mapping, Monitoring, Spoil banks, Mining, Water pollution sources, Surveys, Coal mine wastes, Land management, Land reclamation, Satellites(Artificial), Aerial photography, Evaluation, Topography.
Identifiers: LANDSAT, Skylab.

The synoptic and repetitive views of aerial remote sensing records offer valuable environmental and dynamic change data in areas of both surface and underground coal mining. Depending upon the accuracy of requirements, these data are available through both low and high level aircraft surveys as well as LANDSAT and EREP (SKYLAB) imagery. Remote sensors can provide timely and accurate information on surface mining status and reclamation progress, coal mine refuse piles and slurry ponds, acid water and silation problems, and various aspects of environmental impact. Remote sensing techniques were used to study coal mining sites within the Eastern Interior Coal Basin (Indiana, Illinois, and western Kentucky), the Appalachian Coal Basin (Ohio, West Virginia, and Pennsylvania), and the anthracite coal basins of northeastern Pennsylvania. Airborne sensors included multispectral scanners, multiband cameras, and standard mapping cameras loaded with panchromatic, color, and color infrared films. The research that was conducted in these areas is a useful prerequisite to the development of an operational monitoring system that can be employed periodically to supply state and federal regulatory agencies with supportive data. Further research, however, must be undertaken to systematically examine those mining processes and features that can be monitored cost effectively using remote sensors and for determining what combination of sensors and ground sampling processes provide the optimum combination for an operational system. (See also W77-08408) (Humphreys-ISWS)
W77-08429

RS77-2-662

RIDGES ON ANTARCTIC ICE RISES,
British Antarctic Survey, Cambridge (England).
P. J. Martin.
Journal of Glaciology, Vol. 17, No. 75, p 141-144, 1976. 4 fig, 7 ref.

Descriptors: *Ice, *Antarctic, *Topography, *Model studies, Glaciology, Flow, Deformation, *Remote sensing, On-site investigations.
Identifiers: *Larsen ice shelf, *Spaatz Island, Ice rise, Sand model.

Satellite pictures have revealed the presence of ridges on the summits of ice rises in Antarctica. Because ice does not exhibit a critical stress, it was concluded that the ridges must be produced by a snow accumulation process rather than by ice deformation. A sand-model analog was used to simulate this behavior. The existence of a ridge on an ice rise will produce an increase in the shear stress below it, which in turn will tend to flatten the surface profile. Thus, unlike the sand model, the normal flow behavior of the ice will tend to spread the surface ridge, so producing the very shallow slopes observed. (Humphreys-ISWS)
W77-09120

RS77-2-663

VALUE OF LANDSAT IN URBAN WATER RESOURCES PLANNING,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
T. J. Jackson, and R. M. Ragan.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. WR1, Proceedings paper No. 12906, p 33-46, May 1977. 5 fig, 3 tab, 20 ref.

Descriptors: *Water resources, *Planning, *Decision making, *Watersheds(Basins), *Economic efficiency, *Remote sensing, Hydraulics, Hydrology, Hydrologic data, Economics, Value, Simulation analysis, Optimization, Flood frequency, Flood control, Flood damage, Equations, Mathematical models, Systems analysis, Probability, Risks, Virginia.
*Identifiers: *Urban areas, *Economic analysis, *Bayesian decision theory, Information theory, Opportunity loss matrix, Cost-effectiveness, Benefit maximization, *Fourmile Run watershed(Va), *Landsat data.*

Bayesian decision theory was used to study the economic value of Landsat data in urban water resources planning. The investigation focused upon a case study of the Fourmile Run watershed in the Virginia suburbs of Washington, D. C. Land cover data were required to aid in the selection of an optimal level of onsite detention storage to mitigate flood damages. The problem was to determine the level of flood control that maximized the difference between annual benefit and annual cost, the difference being the annual net benefit which was used in calculating the opportunity losses. An estimate of the percentage of impervious area was needed to determine theparameters of the hydrologic simulation model utilized in generating the flood frequency information. Preposterior Bayesian analysis indicated that computer-aided analysis of Landsat data was a highly cost-effective method for determining the percentage of impervious area.(See also W77-07528), (Bell-Cornell)
W77-07527

RS77-2-664

UTILIZATION OF LANDSAT DATA FOR WATER QUALITY SURVEYS IN THE CHOPTANK RIVER,
General Electric Co., Beltsville, Md.
J. M. Johnson, P. Cressy, and W. C. Dallam.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2325-2350, September 1975. 15 fig, 3 tab, 4 ref.

Descriptors: *Water quality, *Monitoring, *Maryland, *Rivers, *Remote sensing, Surveys, Satellites(Artificial), Water analysis, Analytical techniques, Data processing, Chlorophyll, Sediment load, Reflectance.
Identifiers: *LANDSAT, *Choptank River(Md), Spectral analysis.

Computer processing of LANDSAT-1 multispectral digital data demonstrated the applicability of remoteiy sensed data to water quality survey in the Choptank River, Maryland. Water classes derived by automated analysis correlate to river nuisance levels of chlorophyll a and sediment loading as defined by the Maryland Department of Water Resources and the Corps of Engineers. Results indicated that an increase in chlorophyll a concentration corresponds, relative to MSS 5, to decreases in 4 and increases in 6 relative to the trends with increasing sediment load. It appears that for the purpose of water quality analysis, under favorable atmospheric conditions, only MSS 4, 5, and 6 are necessary. (See also W77-08062) (Humphreys-ISWS)
W77-08072

RS77-2-665

IMPROVING ESTIMATES OF STREAMFLOW CHARACTERISTICS USING LANDSAT-1 (ERTS-1) IMAGERY,
Geological Survey, Nashville, Tenn. Water Resources Div.
E. F. Hollyday.
Journal of Research of the U S Geological Survey, Vol 4, No 5, p 517-531, September-October 1976. 3 fig, 6 tab, 11 ref.

Descriptors: Streamflow forecasting, *Remote sensing, *Satellite(Artificial), *Aerial photography, *Photogrammetry, Equations, Methodology, Evaluation, Regression analysis, Statistical models, Watersheds(Basins), Delaware, Maryland, Virginia.
Identifiers: *Delmarva Peninsula, Landsat-1.

Imagery from the first Earth Resources Technology Satellite (renamed Landsat-1) was used to discriminate physical features of drainage basins in an effort to improve equations used to estimate streamflow characteristics at gaged and ungaged sites. Records of 20 gaged basins in the Delmarva Peninsula of Maryland, Delaware, and Virginia were analyzed for 40 statistical streamflow characteristics. Equations relating these characteristics to basin characteristics were obtained by a technique of multiple linear regression. A control group of equations contains basin characteristics derived from maps. An experimental group of equations contains basin characteristics derived from both maps and imagery. Comparison of equations in the control group with corresponding equations in the experimental group reveals that for 12 out of 40 equations the standard error of estimate was reduced by more than 10 percent. It is concluded that data from Landsat imagery can substantially improve the accuracy of estimates of some streamflow characteristics at sites in the Delmarva Peninsula. (Woodard-USGS)
W77-06972

RS77-2-666

THE USE OF REMOTE SENSING TO DETECT HOW WIND INFLUENCES PLANKTONIC BLUE-GREEN ALGAL DISTRIBUTION,
A. J. Horne, and R. C. Wrigley.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part II, p. 784-971, 1975. 4 fig., 13 ref.

Descriptors: *Cyanophyta, *Remote sensing, *Photometry, *Winds, Algae, Spatial distribution, Anabaena, Aerial photography, California, Pollutant identification.
Identifiers: *Clear Lake(Calif), *Multispectral scanning, Aphanizomenon.

Biological and physical aspects of cyanophyta movements in relaton to prevailing winds over a summer in Clear Lake, California were measured in aerial pictures taken with a multispectral camera with four 100 m F. L. lenses and Kodak Type 2424 film. Images were recorded simultaneously in the near-infrared (730-900nm), red (590-690 nm), green (470-590 nm) and blue (400-470 nm) bands. Winds were measured using a recording anemometer standing some 50 m above the lake surface on a peninsula adjacent to all three arms of the lake. Water samples for phytoplankton and turbidity measurement were collected by simple dip in the upper few centimeters of lake water. Chlorophyll-a was measured using 90% methanol extraction. Results of the study showed that the role of the wind dominates in the production of blue-green algal concentration patterns and together with high light intensities, provides a possible explanation for the seasonally bimodal blooms of Aphanizomenon and Anabaena. Very light nocturnal winds permit surface films which are killed by high sunlight in summer. In the lower light of autumn these films can be windblownk to areas of higher photic zone nutrient concentrations. (Harris-Wisconsin)
W77-06697

RS77-2-667

LAND USE CLASSIFICATION FOR HYDROLOGIC MODELS USING INTERACTIVE MACHINE CLASSIFICATION OF LANDSAT DATA,
Maryland Univ., College Park. Dept. of Civil Engineering.
T. J. Jackson, R. M. Ragan, and R. H. McCuen.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2365-2378, September 1975. 5 fig, 4 tab, 4 ref, 1 append.

Descriptors: *Land use, *Remote sensing, *Hydrologic aspects, *Maryland, Watersheds(Basins), Aerial photography, Surveys, Land classification, Analytical techniques, Forests, Wetlands, Agriculture, Land, Pastures.
Identifiers: *Anacostia River, LANDSAT, Multispectral analysis.

Models designed to simulate the hydrology of urban areas require input parameters describing the land use and degree of imperviousness of the watershed. Unfortunately, the magnitude and spatial distribution of these parameters are rather difficult to estimate when a large watershed is involved. Trade-offs between accuracy of the model parameters and the time or money available for their determination must be made. Because of the necessity of such trade-offs, a study was developed to investigate the use of computer aided analysis of LANDSAT multispectral data in estimating percent of imperviousness and associated land uses needed in urban hydrologic modeling. An interactive computer was used to delineate seven land use classifications in the 342 sq km Maryland portion of the Anacostia River Basin from LANDSAT data. These results compared favorably with those of an earlier study which obtained the same information through analysis of aerial photographs which had a scale of 1:4800. Approximately 94 man days were required to complete the land use analysis using the aerial photographs, while less than three man days were required to accomplish similar tasks using the LANDSAT data. (See also W77-08062) (Humphreys-ISWS)
W77-08074

RS77-2-668

THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE INVENTORY OF PLAYA LAKES IN THE HIGH PLAINS OF TEXAS,
Texas Water Development Board, Austin.
A. W. Wyatt, M. L. Ellis, and A. E. Bell.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2523-2530, September 1975. 16 ref.
Descriptors: *Remote sensing, *Playas, *Texas, *Projects, Data collections, Water management(Applied), *Lakes, Surface waters, Water resources, Programs, Project planning, Water resources development, Surface water availability, Groundwater, Groundwater recharge, Satellites(Artificial).
Identifiers: *High Plains(Tx), LANDSAT.

The Texas Water Development Board is planning a project to determine the feasibility of using LANDSAT digital data to inventory the playa lakes of the High Plains region of Texas. The project will use the Detection and Mapping package developed at NASA-Johnson Space Center. The economy of the High Plains region is dependent on groundwater for irrigation, and the Ogallala aquifer is being depleted faster than it is being recharged. The playa lakes represent a potential source of artificial recharge for the aquifer, and an inventory is the first step in that direction. (See also W77-08062) (Humphreys-ISWS)
W77-08077

RS77-2-669

REMOTE SENSING APPLICATIONS IN WATER RESOURCES MANAGEMENT BY THE CALIFORNIA DEPARTMENT OF WATER RESOURCES,
California State Dept. of Water Resources, Sacramento.
B. Brown.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2531-2560, September 1975. 4 tab.

Descriptors: *Water resources, *Remote sensing, *California, *Data collections, Water resources development, Water, Planning, Mapping, Hydrologic data, Satellites(Artificial), Aerial photography, Surveys, Costs, Land use, Cost comparisons.
Identifiers: LANDSAT.

For nearly 30 years, the California Department of Water Resources has been using remote sensing techniques in all phases of planning, constructing, and operating various features of the California Water Plan. Most of this experience has been with low altitude aerial photography. Recently, the Department has initiated a program to evaluate possible applications of imagery from high altitude aircraft and satellite sensors. Results from seven applications studies, which compared the costs of using high altitude imagery for various purposes to the costs of using conventional data sources, revealed the high altitude imagery to be more cost effective in six cases and equal to conventional data sources in one case. The results also revealed that the imagery provides a level of quality not generally achievable with uncorrected, conventional imagery. Although satellite application studies are not yet complete, preliminary results indicate that some definite possibilities exist for employing satellite imagery on an operational basis within the next few years. (See also W77-08062) (Humphreys-ISWS)
W77-08078

RS77-2-670

RADIO-ECHO SOUNDING OF TEMPERATE GLACIERS: ICE PROPERTIES AND SOUNDER DESIGN CRITERIA,
Geological Survey, Denver, Colo.
R. D. Watts, and A. W. England.
Journal of Glaciology, Vol. 17, no. 75, p 39-48, 1976. 5 fig, 5 ref.

Descriptors: *Glaciers, *Sounding, *Electromagnetic waves, Glaciology, Design criteria, Instrumentation, Theoretical analysis, Mathematical studies, Remote sensing, Radio waves.
Identifiers: *Radio-echo sounding, Temperate glaciers, Scattering theory, Back-scattering.

This is the first paper in a two-part series which describes the design, operation, and testing of a successful 5 MHz radio-echo sounder for temperate glaciers. The first part dealt with the electromagnetic characteristics of temperate glaciers at radio frequencies. Earlier workers' problems in sounding through temperate ice were explained in terms of electromagnetic scattering by water-filled voids. The frequency dependence of the scattering indicates that returns from scatterers diminish rapidly at frequencies below about 10 MHz. A system with the following characteristics was recommended: a transmitted pulse with a center frequency of about 5 MHz, duration of about 1 cycle, and a receiver which is untuned and which measures field intensity rather than power. Spectral methods for studying the size distribution of scatterers were presented. (Humphreys-ISWS)
W77-08229

RS77-2-671

AREAL EXTENT OF SNOW ESTIMATION IN THE NORTHERN SIERRA NEVADA MOUNTAINS USING LANDSAT-1 IMAGERY,
California Univ., Berkeley. Remote Sensing Research Program.
E. F. Katibah.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2621-2641, September 1975. 4 fig, 9 tab, 11 ref, 1 append. NASA NGL 05-003-404.

Descriptors: *Snow cover, *Remote sensing, *Nevada, *Snow surveys, Snow, Watersheds(Basins), Estimating, Satellites(Artificial), Analysis, Analytical techniques, Data processing, Areal, Distribution, Aerial photography, Census, Moisture content.
Identifiers: *Sierra Mountains(Nev), LANDSAT.

Quantification of the surface area of snow covering watersheds is believed to be a useful parameter in estimating snow water content for inclusion in water runoff prediction equations. The paper documented an operational manual interpretation technique which allows fast and accurate estimates to be made of the areal extent of snow parameter using LANDSAT-1 imagery. The analysis procedures, the statistical results, and the associated costs of this research were presented. One of the possible avenues for lowering the expense of estimating snow areal extent is to develop a library of snow cover conditions, in which the appearance of the snow pack is compared between low altitude photography and satellite LANDSAT imagery, along with other relevant data on an image sample unit basis. Scattered cloud cover over snowpack may present some difficulty to present computer analysis; however, the human has little difficulty distinguishing between the two as they appear on LANDSAT-1 imagery. The inventory methods describes for areal extent of snow estimation show great promise for providing fast, economical, and accurate inventories of snowpack extent. (See also W77-08062) (Humphreys-ISWS)
W77-08081

RS77-2-672

PROCEEDINGS OF THE NASA EARTH RESOURCES SURVEY SYMPOSIUM, JUNE 1975, TECHNICAL SESSION PRESENTATIONS, WATER RESOURCES, VOLUME I-D,
National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.
Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, September 1975 (3 Vol.). 535 p. Smistad, O., Coordinator.

Descriptors: *Conferences, *Remote sensing, *Water resources, *Surveys, Satellites(Artificial), Water quality, Land use, Groundwater resources, Surface waters, Runoff, Snow surveys, Water management(Applied), Reservoirs, Rivers, Mixing, Floods, Soil moisture.
Identifiers: LANDSAT, Skylab.

The symposium reported herein combined the utilization and results of data from NASA programs involving LANDSAT, the Skylab Earth resources experiment package, and aircraft as well as information from other data acquisition programs. The primary emphasis was on the practical applications of Earth resources survey technology of interest to a large number of potential users. Also featured were scientific and technological exploration and research investigations with potential applications. Technical sessions presentations were structured to provide governmental and private organizations with a comprehensive picture of various applications in the management and implementation of remote-sensing data use in their own programs. Volume I-D contained technical papers related to water resources and water resources management. (See W77-08063 thru W77-08084) (Humphreys-ISWS)
W77-08062

RS77-2-673

OPERATIONAL WATER MANAGEMENT APPLICATIONS OF SNOWCOVERED AREA OBSERVATIONS,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
R. Rango, V. V. Salomonson, and J. L. Foster.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2669-2685, September 1975. 6 fig, 5 tab, 7 ref. NOAA/NESS NA-776-74.

Descriptors: *Water management(Applied), *Snow, *Remote sensing, *Wyoming, *Hydrologic aspects, Management, Organizations, Snow cover, Snowmelt, Runoff, Watersheds(Basins), Satellites(Artificial), Analytical techniques, Data processing, Streamflow forecasting, Seasonal.
Identifiers: *Wind River Mountains(Wyo), LANDSAT.
Timely and accurate prediction of snowmelt runoff has great value in the Western United States for organizations or individuals involved in power generation, irrigation, flood control, management of domestic and industrial water supplies, and recreation. An effort has been made to evaluate the utility of satellite snowcover observations for seasonal streamflow prediction. On a representative, large watershed (100,000 to 1,000,000 sq km) it was found, based on six years of data, that meteorological satellite observations of snowcover early in the snowmelt season exhibit a relationship to seasonal runoff, having a statistically significant coefficient of determination of 0.92. Analyses of LANDSAT-1 snowcover observations over the Wind River Mountains of Wyoming revealed that for areas with infrequent cloud cover, the extent of snowcover and its change with time can be monitored on watersheds as small as 10 sq km in areal extent. The change in the snowcover with time as observed from LANDSAT-1 is found to reflect major differences in seasonal runoff from high altitude (mean altitude greater than 3 km) and low altitude (less than 3 km) watersheds. There are quantitative indications that LANDSAT observations over small watersheds could be used in a manner similar to that employed for meteorological satellite observations to related the percent of a basin snowcovered on a given date to seasonal runoff. (See also W77-08062) (Humphreys-ISWS)
W77-08084

RS77-2-674

SATELLITE OBSERVATIONS OF WATER QUALITY,
McMaster Univ., Hamilton (Ontario). Dept. of Biology.
G. P. Harris, R. P. Bukata, and J. E. Bruton.
Transportation Engineering Journal of ASCE, Proceedings of the American Society of Civil Engineers, Vol. 102, No. TE3, Proceedings paper No. 12300, p 537-554, August 1976. 16 fig, 28 ref.

Descriptors: *Water quality, Hydrography, *Biomass, *Suspended solids, Limnology, *Remote sensing, *Lake Ontario, Turbidity, *Chlorophyll, Sampling, Equations, *Pollutant identification, Data collections.
Identifiers: *Pattern recognition, Radiance data, *Landsat-1 data.

LANDSAT-1 observations of water quality indicate that hydrography, suspended solids, and chlorophyll a can be measured with MSS bands 4, 5, and 6, respectively. As a summary of both published and unpublished work performed at CCIW and McMaster University in the pattern recognition studies of the LANDSAT-1 digital data collected over the Laurentian Great Lakes, results are reviewed of the physical interpretations ascribed to data of the pattern observed in various combinations of the radiance bands while absent in others. Band-by-band limnological interpretations of the patterns observed in the digital printouts of the LANDSAT-1 apparent radiance data are given. (Bell-Cornell)
W77-07554

RS77-2-675

THE APPLICATION OF ERTS-1 DIGITAL DATA TO WATER TRANSPORT PHENOMENA IN THE POINT PELEE-RONDEAU AREA,
R. P. Bukata, W. S. Haras, and J. E. Bruton.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part I, p. 168-178, 1975. 8 fig., 14 ref.

Descriptors: *Telemetry, *Remote sensing, *Satellites(Artificial), *Land forming, *Sediment transport, *Currents(Water), Sedimentology, Fluid mechanics, *Canada, Digital computers, *Lake Erie, Lakes.
Identifiers: ERTS-1, Point Pelee-Rondeau area(Canada).

Digital data was telemetered from ERTS-1 satellite to develop a conceptual 'mirror-image' model defining the temporal evolution of the Point Pelee-Rondeau landforms on the Canadian shoreline of Lake Erie. Data are given in a 4-band energy response covering the visible and reflected infrared portions of the electromagnetic spectrum from 0.50 micron to 1.1 microns. The Band 5 Multispectral Scanner Subsystem data is directly correlated to surface turbidity and the Band 6 MSS data represent surface biomass concentration. Band 5 digital computer printout data illustrate bifurcating sediment transport, the fluid mechanics flow around Point Pelee and the delineation of the Archimedes spiral/vortex flow pattern. Representations of color-infrared vertical aerial photographs illustrate convergence of relict beach ridges. An illustration of the model shows a 'Quick-Look' ERTS-1 image, which depicts the appearance of geophysical formations east of Point Pelee and West of Rondeau, and the high degree of spring runoff from the Lake Huron-Lake St. Clair-Lake Erie sediment transport system with the northern half of Lake St. Clair being relatively sediment-free, and the sediment deposition extending considerably further into Lake Erie. (Auen-Wisconsin)
W77-07981

RS77-2-676

RIVER BASIN SNOW MAPPING AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE,
National Environmental Satellite Service, Washington, D.C.
S. R. Schneider, D. R. Wiesnet, and M. C. McMillan.
NOAA Technical Memorandum NESS 83, November 1976. 19 p, 8 fig, 1 tab, 17 ref.

Descriptors: *River basins, *Snow surveys, *Mapping, Satellites(Artificial), Snowfall, Snow cover, Meteorology, Meteorological data, Flood forecasting, Data collections.
Identifiers: *National Environmental Satellite Service(NESS), Photo-interpretative techniques, Radiometers, Snow measurement.

The development of the operational river basin snow mapping program at the National Environmental Satellite Service was described. Satellite-derived areal snow cover measurements were provided for over 20 river basins to federal and state agencies around the United States. The snow maps were made, and results were disseminated within 24 hours of a satellite pass over a study basin. The satellite sensors used in snow mapping, the methodology, possible sources of error, and quality control techniques also were described. The key element in the application of snow mapping to hydrological forecasting was the decision to map snow distribution basin by basin. This decision made the data applicable to modeling and to the buildup of data sets of climatic significance. Reliable snow cover data had never before been available to the climatologists and hydrologists. The statistical analysis of such data sets should be a powerful new tool that can be applied to river forecasting in local basins as well as to continental climatic studies. (Roberts-ISWS)
W77-06915

RS77-2-677

APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF EUTROPHICATION IN SAGINAW BAY,
Bendix Aerospace Systems Div. Ann Arbor, Mich.
R. H. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-12434. Price codes: A02 in paper copy, A01 in microfiche. Report BSR 4201, October 1975. 11 p, 4 fig, 4 tab, 7 ref. NASA NAS5-20942.

Descriptors: *Remote sensing, *Water quality, *Lake Huron, Satellites(Artificial), *Mapping, Eutrophication, Nutrients, Chlorophyll, Phosphorus, Water temperature, Correlation analysis, Regression analysis, Data processing.
Identifiers: *LANDSAT, *Saginaw Bay(Mich).

Computer techniques developed for mapping water quality parameters from LANDSAT data were demonstrated, using ground truth collected in an ongoing survey of water quality in Saginaw Bay (Lake Huron), Michigan sponsored by the US Environmental Protection Agency. Chemical and biological parameters were collected at 27 bay stations in concert with LANDSAT overflights. Application on stepwise linear regression to 12 of these parameters and corresponding LANDSAT measurements resulted in relationships that can be applied to map any one of the 12 water quality parameters over the entire bay. The regression correlation coefficients varied from 0.99 for total phosphorus to 0.72 for chlorophyll a corrected. Five of the water quality parameters are best correlated with LANDSAT Band 6 alone. One parameter, temperature, relates to Band 5 alone, and only two bands are justified for mapping the remaining six parameters. (Sims-ISWS)
W77-06665

RS77-2-678

SNOW AND ICE HYDROLOGY IN THE UNITED STATES--CURRENT STATUS AND FUTURE DIRECTIONS,
National Committee for the International Hydrological Decade, Washington, D.C.
Work Groups on Snow and Ice Hydrology, Final Report 1976. 73 p, 86 ref, 2 append.

Descriptors: *International hydrologic decade, *United States, *Snow, *Ice, *Hydrology, Glaciers, *Research priorities, Reviews, Documentation, Research and development, Planning, Instrumentation, Remote sensing, Surveys, *Bibliographies.
Identifiers: *Research needs.

The Work Group on Snow and Ice Hydrology was organized to coordinate U.S. efforts in this field and to promote the development of knowledge in the area. The Work Group identified four major areas in which it could make significant contributions: (1) Identification of research needs and accomplishments; (2) Improvement of the fragmented communications in the U.S. within the field of snow and ice studies; (3) Elimination, wherever possible, of the duplication of effort; and (4) Translation of research results into applications and management techniques. The primary function of this report was to discharge the responsibilities under the first objective. This was done through a critical review of the field of snow and ice hydrology, which resulted in identification of major problems as well as research needs. On the basis of this review, several recommendations were made, which if implemented, will help to satisfy the last three objectives. (Humphreys-ISWS)
W77-07565

RS77-2-679

CLASSIFYING AND MONITORING WATER QUALITY BY USE OF SATELLITE IMAGERY,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
J. P. Scherz, D. R. Crane, and R. H. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-23663. Price codes: A03 in paper copy, A01 in microfiche. Bendix Aerospace Systems Div. Report BSR 4197, September 1975. 26 p. 12 fig, 5 ref. NGL 50-002-127, NAS 5 20942.

Descriptors: *Trophic level, Reflectance, *Remote sensing, *Lake, *Satellites, *Water quality, Spectroscopy, *Monitoring, Wisconsin, Methodology, Turbidity, Color, Algae, Plant pigments, Analytical techniques, Pollutant identification.
Identifiers: LANDSAT.

The technique developed by Bendix Aerospace Systems Division for application to LANDSAT signals to define lake water quality is described. By use of distilled water samples in the laboratory and very clear lakes in the field, atmospheric and surface noise effects can be removed, allowing the residual signal to indicate only the material in the water. When this material is living algae or weeds, its concentration is related to the trophic level of the lake. The Bendix Multispectral Data Analysis System provided a color categorized image of several hundred Wisconsin lakes. These lakes were categorized for tannin or non-tannin waters, and for the degrees of algae, silt, weeds, and bottom effects. The optimum time to categorize lakes was found to be late August, when the algae and weed biomass is at a maximum. (Auen-Wisconsin).
W77-09634

RS77-2-680

HYDROGRAPHIC SURVEYING TURNS TO ELECTRONICS,
Tibbetts Abbett, McCarthy and Stratton, Seattle, Wash.
R. A. Heinz.
Civil Engineering-American Society of Civil Engineers, Vol. 47, No. 4, p 62-65, April 1977. 1 fig, 1 tab.

Descriptors: *Hydrography, *Remote sensing, *Surveys, Bathymetry, Water levels, Depth, Equipment, Boats, Electronic equipment, Underwater, Sounding, Sonar, Sound waves, Microwaves, Radar, Satellites(Artificial), Aerial photography, Surface waters, Coasts, Lakes, Measurement.

The traditional technique for measuring water depth is to use a lead-weighted line. The 'tag line,' stretched along the water surface so that soundings are made in orderly fashion, can be dangerous. Such techniques are being replaced. Now, electronic devices can be used to make both the horizontal measurements (in air) and the vertical (through water). To improve stability of the boat in which the surveying crew operates, multi-hull boats and air-cushion craft are being used or considered. Types of horizontal positioning hardware-including microwave and radar- were described, as were types of water depth measuring gear (among them acoustical, aerial photography, satellite imagery, side-scan sonar, and sub-bottom profiling). (Sims-ISWS)
W77-09105

RS77-2-681

USE OF REMOTE SENSING TO QUANTIFY CONSTRUCTION MATERIAL AND TO DEFINE GEOLOGIC LINEATIONS; DICKEY-LINCOLN SCHOOL LAKES PROJECT, MAINE,
Cold Regions Research and Engineering Lab. Hanover, N.H. Research Div.
H. L. McKim, and C. J. Merry.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-023 276, Price Codes: A03 in paper copy, A01 in microfiche. Special Report 242, Part I, December 1975. 26 p, 19 fig, 5 tab, 11 ref.

Descriptors: *Remote sensing, *Construction materials, *Dam construction, *Maine, Damsites, Earth dams, Dikes, Aerial photography, Satellites(Artificial), Aircraft, Geology, Earthquakes, Geological surveys, Geologic units, Geologic mapping, Geologic formations, Fractures(Geologic), Faults(Geologic), Projects, Reservoirs.
Identifiers: *Geologic lineations, *Dickey-Lincoln School Lake Project(ME).

A potential site for construction of a series of earth dams and dikes with a maximum height of 335 ft, the Dickey-Lincoln School Lakes Project, is being evaluated. The site is located on the St. John River in Aroostook County, Maine, approximately 30 mi west of the town of Ft. Kent. The project is primarily designed to generate hydroelectric power, but it is also intended to provide flood control. During November 1974, a study was initiated to apply state-of-the-art remote sensing techniques to the delineation and quantification of surficial geology units to locate construction material within the headwaters of the St. John River Basin. A photomosaic was prepared from 1966 black and white photography (scale 1:33,600). Fourteen surficial geology units were delineated in an 1100-sq mi area. The areal extent of each surficial geology unit within a 4-mi radius of the 3 dike sites and within a 6-mi radius of the main dam site was quantified using a planimetric color densitometer. The volume of construction material was computed based upon these areal determinations and estimated depths. Considerable time was saved using remote sensing techniques compared with conventional ground surveys. The volume estimates obtained from this investigation were compared with the estimates of required construction material computed during the 1967 initial design phase. The comparison showed that the required construction material could be found within the prescribed area around the dam and dike sites. Because transportation of materials is a major cost in dam construction, the reduction in transportation distances determined from this study could result in considerable savings. (Sims-ISWS)
W77-06888

RS77-2-682

THE USE OF SKYLAB AND LANDSAT IN A GEOHYDROLOGICAL STUDY OF THE PALEOZOIC SECTION, WEST-CENTRAL BIGHORN MOUNTAINS, WYOMING,
Wyoming Univ., Laramie. Dept. of Geology.
B. J. Tomes.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2167-2182, September 1975. 9 fig, 1 tab, 11 ref.

Descriptors: *Remote sensing, *Wyoming, *Surveys, *Hydrogeology, Groundwater recharge, Natural recharge, Base flow, Satellites(Artificial), Terrain analysis, Mapping, Geologic mapping.
Identifiers: *Bighorn Mountains, LANDSAT, Skylab.

Sites of geologic structures were identified using Skylab and LANDSAT imagery, and their relationships to groundwater recharge and discharge were studied. The study area lay along the western slope of the Bighorn Mountains, Wyoming. It was found that runoff flowing from the Precambrian core of the Bighorn Mountains sinks as it flows over outcrops of the Bighorn dolomite. A comparison of photo-geologic maps prepared from Skylab and LANDSAT imagery and a geologic map compiled by Darton (1906) illustrated that photomapping, by itself, cannot supply adequate detail, but it can supplement reconnaissance mapping. Lineation maps were compiled from LANDSAT and Skylab images and compared to similar maps compiled by other investigators. Many of the lineations are expressions of tectonic activity that affect fractures and, consequently, groundwater recharge. Hydrologic features, in the form of sinks and springs, on four creeks in the study area were located on the lineation maps, and their relationships to the lineation were observed. A direct correlation exists between mapped lineations and the hydrologic features. A comparison of the interpretations of other investigators, made independently of the geohydrological study, also showed a direct correlation. This observation indicates direction of movement. The quantity of groundwater recharge and discharge, expressed as fracture concentration, may be estimated by comparing lineation maps to drainage and geologic maps in areas where groundwater movement is fracture controlled. (See also W77-08062) (Humphreys-ISWS)
W77-08063

RS77-2-683

REMOTE SENSING OF MISSISSIPPI RIVER CHARACTERISTICS,
Colorado State Univ., Fort Collins.
J. F. Ruff, M. M. Skinner, B. R. Winkley, D. B. Simons, and D. E. Dorratcague.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2299-2315, September 1975. 9 fig, 4 ref.

Descriptors: *Remote sensing, *Mississippi River, *Hydrography, *On-site data collections, Surveys, Surface waters, Aerial photography, Mapping, On-site investigations, Hydrologic aspects, Currents(Water), Topography, Sediment distribution, Sediment transport, Discharge(Water), Channels, Flow, Evaluation, Analysis, Vegetation, Rivers, Floods.

Aerial infrared photography and thermal infrared imagery from an aircraft platform were obtained over two selected reaches of the Mississippi River. Interpretation of the photography and imagery was performed to identify river characteristics pertaining to the flow, sediment concentration, and geometry. The remotely sensed data, coupled with ground truth data, can give an overview of large rivers that can be used for maintenance and design. Subsurface phenomena can be deduced from features observed at the water surface. Surface flow patterns are evident on all types of photography, but color infrared photography is most effective where suspended material concentration differences exist. Shear zones, mixing zones, regions of high velocity flow, slack water areas, and localized flow patterns can be identified. The effect of man-made structures on the flow patterns is identifiable. Specular reflection indicates the portion of the river that has the most turbulence, the highest velocities, and the highest sediment transport. When using specular reflection as an interpretative key, prudent judgement must be exercised. A 1:20,000 scale provided sufficient detail for interpretation of flow patterns. A qualitative evaluation of the sediment transport and flow can be made at a given stage based upon flow patterns at the surface, the local boundary geometry, and the overall geometry. Mosaics of color infrared prints for reaches of the river are very useful for establishing the planimetric characteristics of the channel, for evaluating the overall effect of structures, for observing the pool-crossing-pool sequence, for locating sources and sinks of sediment, and for documenting and evaluating the general behavior of the river. As flow stage changes, the shifting of the thalweg can be identified. (See also W77-08062) (Humphreys-ISWS)
W77-08070

RS77-2-684

NTIS/PS-77/0676/5GA PC N01/MF N01
National Technical Information Service, Springfield, Va.
Remote Sensing Applied to Geology and Mineralogy (A Bibliography with Abstracts).
Rept. for 1973-Jul 77,
Audrey S. Hundemann. Aug 77, 127p*
Updates NTIS/PS-76/0500 and NTIS/PS-75/104.

Descriptors: *Bibliographies, *Mineral deposits, *Geological surveys, *Remote sensing, Rock properties, Rocks, Soil surveys, Geomorphology, Geological faults, Tectonics, Abstracts.
Identifiers: Terrain analysis, LANDSAT satellites.

The use of LANDSAT satellites (formerly Earth Resources Technology Satellites (ERTS)) and other remote sensing methods in geological and mineralogical applications is discussed. Abstracts cover rock and soil mapping, terrain analysis, direct and indirect mineral exploration, fault tectonics, and general geologic studies of various countries. A few abstracts pertain to equipment and techniques used in the studies. (This updated bibliography contains 121 abstracts, all of which are new entries to the previous edition.)

RS77-2-685

NTIS/PS-77/0677/3GA PC N01/MF N01
National Technical Information Service, Springfield, Va.
Remote Sensing Applied to Hydrology (A Bibliography with Abstracts).
Rept. for 1964-Jul 77,
Audrey S. Hundemann. Aug 77, 161p*
Updates NTIS/PS-76/0500 and NTIS/PS-75/104.

Descriptors: *Bibliographies, *Water resources, *Remote sensing, Water quality, Soil water, Flood plains, Ice reporting, Snow cover, Snowmelt, Aerial photography, Abstracts.

The use of aerial and satellite imagery in 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 156 abstracts, all of which are new entries to the previous edition.)

RS77-2-686

AD-A039 905/5GA PC A02/MF A01
Cold Regions Research and Engineering Lab Hanover N H
Remote Sensing of Accumulated Frazil and Brash Ice in the St. Lawrence River,
Arnold M. Dean, Jr. Apr 77, 24p Rept no. CRREL-77-8

Descriptors: *Ice formation, *Radar, Profilometers, Remote detectors, Rivers, Canada, Accumulation, Ice, Thickness, Determination, Data reduction, Contours, Maps, Broadband, Airborne.
Identifiers: Frazil ice, Brash ice, *Saint Lawrence River, Remote sensing.

A broadbanded impulse radar system was used for aerial detection of accumulated frazil and brash ice in a 9.5-km reach of the St. Lawrence River near Ogden Island. The remote sensing and data reduction system developed for the project provided data suffcient for production of a contour map having 1-ft intervals. With this contour map, the accumulation pattern of frazil and brash ice could be analyzed. Recommendations are given for improving the performance of the aerial profiling system. (Author)

RS77-2-687

AD-A039 904/8GA PC A02/MF A01
Cold Regions Research and Engineering Lab Hanover N H
Numerical Studies to Aid Interpretation of an Airborne VLF Resistivity Survey,
Steven A. Arcone. Apr 77, 18p Rept no. CRREL-77-5

Descriptors: *Electrical resistivity, *Surveying(Geographic), Ground level, Earth(Planet), Mapping, Airborne, Very low frequency, Electromagnetic wave reflections, Ground waves(Electromagnetic), Sky waves, Anomalies, Numerical analysis, Electrical grounding, Gravel, Sand, Permafrost, Site selection.
Identifiers: *Resistivity exploration, *Geological surveys.

Airborne resistivity surveys, which use the wavetilt phenomena of radiowaves, are used as a preliminary exploration technique to find suitable areas for either engineering investigations or geologic reconnaissance explorations. Survey results are usually presented as resistivity flight line profiles or as contour maps from which the interpretation or site selection process must be initiated. To aid in this process and provide additional understanding of the correlation between data obtained from airborne and ground surveys, an analysis was performed to determine a very-low- frequency airborne system's response to modelled resistivity anomalies assumed to occur at the surface of an idealized flat earth. Some of the assumptions used to simplify the analysis were based on the results of past surveys. The influences of survey altitude, anomaly size, and average ground resistivity upon airborne resistivity patterns were analyzed. The results show that the average resistivity of a region plays an important role in suppressing large resistivity contrasts for anomalies of approximately 1 sq. km. area. Curves are presented to separate the effects of resistivity contrast and anomaly size, and two examples are given to demonstrate how these curves may be applied to the results of actual surveys. (Author)

RS77-2-688

PB-267 504/9GA PC A04/MF A01
Environmental Research and Technology, Inc., Concord, Mass.
Study of Near-Infrared Snow Reflectance Using Skylab S192 Multispectral Scanner Data.
Final rept.,
James C. Barnes, and Clinton J. Bowley. Mar 77, 54p ERT-1474-F, NOAA-77041905
Contract NOAA-6-35201

Descriptors: *Snow cover, *Infrared detection, *Remote sensing, Reflectance, Optical scanners, Meteorological data, Near infrared radiation, Cloud cover, Digital techniques.
Identifiers: Multiband spectral reconnaissance, Multispectral band scanners, Skylab program, Western Region(United States).

Digital tape data (computer-compatible tapes) from the Skylab S192 Multispectral Scanner are analyzed to examine further the characteristics of snow reflectance in the near-infrared portion of the spectrum. The tapes used in the study are from four Skylab passes crossing mountainous terrain in the western United States, three in the winter from the Skylab-4 mission and one in the late spring from the Skylab-2 mission. In each case the snow conditions are assessed through interpretation of the accompanying Skylab photography, snow reports and meteorological data. The results of the investigation show that the reflectance over a uniform snowpack is significantly lower in the near-infrared than in the visible or red-infrared portions of the spectrum. The results of the analysis of one case also demonstrate further the potential of using near-infrared data to distinguish automatically between cloud and snow.

RS77-2-689

PB-266 769/9GA PC A04/MF A01
Bureau of Mines, Pittsburgh, Pa. Pittsburgh Mining and Safety Research Center.
Methods of Determining the Orientations of Bedrock Fracture Systems in Southwestern Pennsylvania and Northern West Virginia.
Rept. of investigations 1977,
B. M. Bench, W. P. Diamond, and C. M. McCulloch. 1977, 52p BuMines-RI-8217

Descriptors: *Aerial photography, *Coal mines, *Geological surveys, *Photointerpretation, Mining geology, Geological folds, Fracture zones, Geologic structures, Stereoscopy, Exploration, Safety, Pennsylvania, West Virginia.
Identifiers: Mine safety.

Photolineaments from stereoscopic examination of vertical aerial photographs, and those found by the Ronchi grating study of aerial photoindex sheets are described and discussed. They are compared with the trends of oriented fracture systems procured by measuring the compass direction of joints in bed rock. The relative reliability of the methods is shown, and the results are presented in graphical, tabular, and written form. Analyses of field measurements of strikes of bedrock joints in the project area indicate for the most part two intersecting sets of major joints oriented N 76 degrees W - N 15 degrees E, and N 57 degrees W - N 27 degrees E. The analyses of lineaments determined by stereoscopic examination of aerial photographs show dominant trends of lineament zones of weakness to be an average of N 65 degrees W - N 20 degrees E. Analysis of lineaments found by Ronchi grid viewing of aerial photoindex sheets indicate dominant trends of N 70 degrees W - N 27 degrees E. The three methods described and used gave similar findings, and verify the work of previous authors. These features are significant in the study of areas of underground coal mining since they indicate patterns of weakness that may extend into the subsurface coalbeds. The presence of lineaments has a direct relationship to and thus has a bearing on mining problems including roof instability and the emission of methane gas.

RS77-2-690

PB-267 063/6GA PC A05/MF A01
State Univ. of New York. Coll. of Environmental Science and Forestry, Syracuse.
Satellite Remote Sensing of Snowcover in the Adirondack Mountains.
Final rept.,
Douglas E. Meisner. 15 Mar 77, 100p NOAA-77041118
Grant NOAA-04-5-158-43

Descriptors: *Adirondack Mountains, *Snow cover, *Spaceborne photography, Meteorological satellites, Remote sensing, Snowfields, Infrared mapping, New York.
Identifiers: NOAA-4 satellite.

The intent of the research reported was to assess the potential of mapping snow from NOAA-4 imagery in the heavily forested Adirondack Mountains of northern New York State. This effort entailed the acquisition and analysis of conventional snow survey data, radiometer observations acquired from tower platforms over open snow fields and various forest canopies, low altitude photography, high altitude photography, Landsat imagery and NOAA-4 imagery. Digital data from visible band NOAA-4 satellite imagery were compared to ground data collected at 20 snow survey sites. Low correlations were found between image brightness and measurements of snow depth and descriptions of site characteristics. Even sites of uniform cover type demonstrated no systematic influence of vegetation on image brightness. This research indicated Landsat observations over forested sites which did not show a decrease in reflected infrared response over snow covered areas. This is apparently due to the density of forest cover in the area studied. (Color illustrations reproduced in black and white.)

RS77-2-691

37288 The world is a bit cracked. Norman, J. (Imperial Coll., London); Chukwu-Ike, M. *New Sci.;* 73: No. 1038, 320-322(10 Feb 1977).

Lineaments detected in satellite pictures of the earth show evidence of crustal fractures and possible sources of minerals and thermal energy. Examples of lineaments in Nigeria are illustrated and discussed. (JGB)

RS77-2-692

38393 (PB—261579) **Correlation of mathematical models for water temperature with aerial infrared water temperature surveys.** Cataldo, J.C.; Zavesky, R.R.; Goodman, A.S. (Polytechnic Inst. of Brooklyn, N.Y. (USA)). Dec 1976. 70p. Q 04/MF A01.

A feasibility study to predict subsurface temperatures from given surface temperatures obtained by remote sensing of a thermal plume was performed. A phenomenological model based on field measurements of heated surface discharges into Lake Michigan and Ontario and an analytic dispersion-type far field model were investigated. A predictive model was developed for phenomenological relationships for surface areas within isotherms. A series of exponential equations relating the surface area to the subsurface area was formulated which can predict subsurface temperatures within 1 degree C to at least ten feet below the surface. A far field hydrothermal analytic model considering longitudinal advection and dispersion in the transverse and vertical direction was also developed.

RS77-2-693

38391 (PB—255591) **Remote sensing report, Lake Ontario. A study of thermal discharges from Ginna Nuclear Power Station, Oswego Steam Power Station, and Nine Mile Point Nuclear Power Station.** (National Field Investigations Center-Denver, Colo. (USA)). Apr 1975. 88p. (EPA—330/3-75/002). NTIS $5.00.

An airborne remote sensing study of thermal discharges into Lake Ontario, from powerplants on its southeast shore was conducted. Thermal infrared imagery of the lakeshore in the vicinity of the three existing plants was obtained with the thermal channel of an internally calibrated multispectral scanner mounted in a research aircraft. During each flight, water temperatures were measured at the three powerplants by ground crews. The airborne imagery and water temperature data were used to characterize the recorded thermal fields or plumes. Color illustrations reproduced in black and white. (GRA)

RS77-2-694

25772 Onesti, J. E.; Castillo, J.; and Onesti, N. J. Metodo para confeccionar mosaicos aerofotograficos compensados por medio de cinco puntos planimetricos de apoyo de campo para planos base fotogeologicos [Method for making aerial photographic compensated mosaics by using five planimetric field support points for photogeologic base maps]: *in* II Congreso Ibero-Americano de geologia economica; La geologia en el desarrollo de los pueblos; Tomo VI (Anonymous), p. 243-252 (incl. Portuguese, English sum.), illus., Dep. Arg. Sci. Publ., Buenos Aires, Argentina, 1975.

RS77-2-695

38304 Mitra, S. N. Remote sensing in search for minerals: Indian Miner., Vol. 28, No. 3, p. 61-67, 1974.

RS77-2-696

37894 **Merifield, P. M.; and Lamar, D. L.** Active and inactive faults in southern California viewed from Skylab: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 779-797, illus. (incl. geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-2-697

39947 **Miller, J. B.** Landsat image studies as applied to petroleum exploration in Kenya: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 605-624, illus. (incl. geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-2-698

22917 **Moore, B. R.; and Wuchs, T. C.** New low altitude infra red photo techniques successfully applied to drilling subsurface manganese deposits; Mulga Downs, Western Australia [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 8, No. 6, p. 1016, 1976.

RS77-2-699

23671 **Nadji, M.** Luftbild, Kanate in der Ebene von Kashan, Iran [Aerial photograph; ganats in the Kashan Plain, Iran]: Erde, Vol. 103, No. 3-4, p. 209-215, illus. (incl. sketch map), 1972.

RS77-2-700

23342 **Olson, E. P.; Fleming, R. W.; and Schuster, R. L.** Photographic history of movement of the landslide at Manti, Utah [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 8, No. 6, p. 1035-1036, 1976.

RS77-2-701

38309 **Offield, T. W.** Line-grating diffraction in image analysis; enhanced detection of linear structures in ERTS images, Colorado Front Range: Mod. Geol., Vol. 5, No. 2, p. 101-107, illus. (incl. geol. sketch map), 1975.

RS77-2-702

30707 **Oelsner, Ch.** Possibilities and limitations of infrared surface geothermics: *in* Geoelectric and geothermal studies (East-Central Europe, Soviet Asia) (Adam, A., editor), p. 25-37, illus., Akad. Kiado, Budapest, Hungary, 1976.

RS77-2-703

38310 **Offield, T. W.; Abbott, E. A.; Gillespie, A. R.; *et al.*** Structure mapping on enhanced Landsat images of southern Brazil; tectonic control of mineralization and speculations on metallogeny: Geophysics, Vol. 42, No. 3 *(Special issue on remote sensing)*, p. 482-500, illus. (incl. geol. sketch map), 1977.

RS77-2-704

38311 **O'Leary, D. W.; and Simpson, S. L.** Remote sensor applications to tectonism and seismicity in the northern part of the Mississippi Embayment: Geophysics, Vol. 42, No. 3 *(Special issue on remote sensing)*, p. 542-548, illus. (incl. sketch maps), 1977.

RS77-2-705

23362 **Pan, Y.-S.** Remote sensing and X-ray fluorescence analysis in successful explorations of disseminated tin deposits [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 8, No. 6, p. 1040-1041, 1976.

RS77-2-706

38308 **Normark, W. R.** Photographic study of the zone of crustal accretion of the East Pacific Rise crest at the mouth of the Gulf of California [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 7, No. 3, p. 358, 1975. *The Geological Society of America, Cordilleran Section, 71st annual meeting.*

RS77-2-707

25777 **Pohn, H. A.** A comparison of Landsat images and Nimbus thermal-inertia mapping of Oman: J. Res. U. S. Geol. Surv., Vol. 4, No. 6, p. 661-665, illus. (incl. geol. sketch map), 1976.

RS77-2-708

22206 **Preusser, H.** Luftbild; Vulkanausbruch auf Heimaey, Island [Aerial photograph; volcanic eruption on Heimaey, Iceland]: Erde, Vol. 104, No. 3-4, p. 193-199, illus. (incl. sketch maps), 1973.

RS77-2-709

39656 **Krohn, M. D.; and Gold, D. P.** Application of satellite photographic and MSS data to selected geologic and natural resource problems in Pennsylvania; II, Relation of lineaments to sulfide deposits; Bald Eagle Mountain, Centre County, Pennsylvania: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 951-957, illus., 1975. *NASA Earth resources survey symposium.*

RS77-2-710

38317 **Regan, R. D.; and Watson, K. (editors).** Geophysics; special issue on remote sensing: Geophysics, Vol. 42, No. 3, p. 467-712, illus. (incl. tables, sketch maps), 1977. *Individual papers are cited in this Bibliography under the separate authors.*

RS77-2-711

30722 **Ramseier, R. O.; Campbell, W. J.; Weeks, W. F.; *et al.*** Ice dynamics in the Canadian archipelago and adjacent Arctic Basin as determined by ERTS-1 observations: Can. Soc. Pet. Geol., Mem., No. 4, p. 853-877, illus. (incl. table, sketch maps), 1975.

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38324 **Rowan, L. C.; Goetz, A. F. H.; and Ashley, R. P.** Discrimination of hydrothermal altered and unaltered rocks in visible and near infrared multispectral images: Geophysics, Vol. 42, No. 3 *(Special issue on remote sensing)*, p. 522-535, illus. (incl. tables, sketch map), 1977.

RS77-2-713

38322 **Rosenman, H. L.** Estudio geologico de dos imagenes provistas por el satelite ERTS [Geological study of two ERTS satellite images]: Asoc. Geol. Argent., Rev., Vol. 30, No. 2, p. 151-160 (incl. English sum.), illus. (incl. table; geotect. map 1:1,574,800), 1975.

RS77-2-714

30738 **Sabins, F. F., Jr.; Rowan, L. C.; Short, N. M.; *et al.*** Geology: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. III. Summary reports)*, p. 21-28, sketch map, 1975. *Applications of remote sensing to geology.*

RS77-2-715

22446 **Oluic, M.** Tektonska analiza granicnog podrucja SR Hrvatske i SR Slovenije, izvrsena na snimcima napravljenim iz satelita ERTS-1 [Tectonic analysis of the border area of Croatia and Slovenia, based on ERTS-1 imagery]: Geol. Vjesn. (Zagreb), Vol. 28, p. 87-96 (incl. English sum.), illus. (incl. plate; struct. geol. map 1:100,000), 1975.

RS77-2-716

38357 **Zall, L. S.** Photo-geology and remote sensing systems for locating ore deposits [abstr.]: 227 p., Doctoral, 1976, Cornell Univ., Ithaca, N.Y. (Diss. Abstr. Int., Vol. 37, No. 10, p. 5299B, 1977).

RS77-2-717

37659 **Kronberg, P.; Schoenfeld, M.; and Guenther, R.** Small scale mapping in Ethiopia, Somalia and Yemen using field data, aerial photographs and ERTS-1 imagery: *in* Geoscientific studies and the potential of the natural environment, p. 60-62, geol. sketch maps, Deutsche UNESCO-Komm., Koeln, Verlag Dok. Muenchen, Munich, Germany, Federal Republic of, 1975.

RS77-2-718

37924 **Rose, W. I., Jr.; Johnson, D. J.; Hahn, G. A.; *et al.*** Skylab photography applied to geologic mapping in northwestern Central America: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B. Geology-information systems and services)*, p. 869-884, illus. (incl. geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-2-719

37877 **Kronberg, P.** ERTS-1 shows buried structures: *in* Geoscientific studies and the potential of the natural environment, p. 122, illus. (incl. geol. sketch map), Deutsche UNESCO-Komm., Koeln, Verlag Dok. Muenchen, Munich, Germany, Federal Republic of, 1975.

RS77-2-720

37876 **Kowalik, W. S.** Application of satellite photographic and MSS data to selected geologic and natural resource problems in Pennsylvania; III, Comparison of Skylab and Landsat lineaments with joint orientations in Northcentral Pennsylvania: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 958-969, illus. (incl. geol. sketch map), 1975. *NASA Earth resources survey symposium.*

RS77-2-721

38296 **Lamar, D. L.; and Merifield, P. M.** Application of ERTS images to study of active and potentially active faults, Santa Barbara area, California [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 7, No. 3, p. 339, 1975. *The Geological Society of America, Cordilleran Section, 71st annual meeting.*

RS77-2-722

30588 **Abrosimov, I. K.; Bogorodskiy, S. M.; and Vostokova, Ye. A.** Landshaftnyye vzaimosvyazi i ikh ispol'zovaniye pri deshifrirovanii materialov ayero- i kosmicheskikh sbemok dlya izucheniya glubinnogo stroyeniya zapadnoy chasti Turanskoy plity [Landform correlation and its utilization for interpreting data from aerial and satellite surveys by studying the deep structure in the western part of the Turanian Platform]: Issled. Prir. Sredy Kosm. Sredstvami; Geol. Geomorfol., Vol. 2, p. 59-71, illus. (incl. tables, plates, geol. sketch maps), 1974.

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31315 Komarov, V. B.; Nomokonova, V. F.; and Uglev, Yu. V. Metody fil'tratsii fotoizobrazheniy i vozmozhnosti ikh primeneniya v geologii [Methods for filtering photo-images and the possibilities of their application in geology]: Issled. Prir. Sredy Kosm. Sredstvami; Geol. Geomorfol., Vol. 2, p. 107-110, 1974.

RS77-2-724

38301 Longshaw, T. G. Application of an analytical approach to field spectroscopy in geological remote sensing: Mod. Geol., Vol. 5, No. 4, p. 201-210, illus. (incl. tables), 1976.

RS77-2-725

39655 Kowalik, W. S.; and Gold, D. P. Application of satellite photographic and MSS data to selected geologic and natural resource problems in Pennsylvania: I, Lineaments and mineral occurrences in Pennsylvania: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 933-950, illus. (incl. tables), 1975. *NASA Earth resources survey symposium.*

RS77-2-726

30737 Sabins, F. F., Jr. Geology; summary: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-A, Plenary-summaries)*, p. 99-111, illus. (incl. geol. sketch maps), 1975. *Applications of remote sensing to geological studies.*

RS77-2-727

38328 Sawatzky, D. L.; Prost, G.; Lee, K.; *et al.* Geological significance of features observed in Colorado from orbital altitudes: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 713-760, illus. (incl. geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-2-728

39706 Schmidt, R. G.; Clark, B. B.; and Bernstein, R. A search for sulfide-bearing areas using Landsat-1 data and digital image-processing techniques: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1013-1027, illus. (incl. tables, sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-2-729

37716 Sims, J. D.; and Frizzell, V. A., Jr. Preliminary photointerpretation map of landslide and other surficial deposits of the Mount Vaca, Vacaville, and parts of Courtland, Davis, Lake Berryessa, and Woodland 15-minute quadrangles, Napa and Solano counties, California: U. S. Geol. Surv., Misc. Field Stud. Map, No. MF-719, geomorph. map 1:62,500, 1976.

RS77-2-730

22243 Smith, A. F.; and Baker, R. N. Application of digitally processed Landsat images for geological mapping [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 8, No. 6, p. 1111, 1976.

RS77-2-731

30740 Schmidt, R. G.; Clark, B. B.; and Bernstein, R. A search for sulfide-bearing areas using Landsat-1 data and digital image-processing techniques: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-A, Plenary-summaries)*, p. 112-121, illus. (incl. tables, sketch maps), 1975.

RS77-2-732

39978 Siegal, B. S.; Kahle, A. B.; Goetz, A. F. H.; *et al.* Detectability of geothermal areas using Skylab X-5 data: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 625-640, illus. (incl. geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

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RS77-2-735

27246 Turner, H. A comparison of some methods of slope measurement from large-scale air photos: Photogrammetria, Vol. 32, No. 6, p. 209-237, illus. (incl. tables), 1977.

RS77-2-736

31213 Simons, D. B. Water resources: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. III, Summary reports)*, p. 41-46, illus., 1975. *Applications of remote sensing to the management of water resources.*

RS77-2-737

30766 **U. S., National Research Council, Committee on Remote Sensing Programs for Earth Resource Surveys.** Resource and environmental surveys from space with the thematic mapper in the 1980's: 122 p., illus., 1976. (Rep. No. NRC/CORSPERS-76/1) *available from:* NTIS, Springfield, Va., United States.

RS77-2-738

38334 **Short, N. M.; and Marrs, R. W.** The anatomy of an anomaly: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 641-663, illus. (incl. sketch maps), 1975. *NASA Earth resources survey symposium. Beaver Creek oil field, Wyoming.*

RS77-2-739

30064 **Steiner, D.; and Kirby, M. E.** Geometrical referencing of Landsat images by affine transformation and overlaying of map data: Photogrammetria, Vol. 33, No. 2, p. 41-75, illus. (incl. tables, sketch maps), 1977.

RS77-2-740

38950 **Stow, W. K.; and Andryczyk, R. W.** Earth resources survey and the space shuttle: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1473-1482, illus. (incl. table), 1975. *NASA Earth resources survey symposium.*

RS77-2-741

38356 **Wing, R. S.; and Mueller, J. C.** SLAR reconnaissance, Mimika-Ellanden Basin, Southern Trough of Irian Jaya: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 599-604, 1975. *NASA Earth resources survey symposium.*

RS77-2-742

30171 **Lofthouse, S. T.** Photogeological and structural interpretation of a portion of Ulster County, New York [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 8, No. 2, p. 221, 1976.

RS77-2-743

25938 **Lamar, D. L.; and Merifield, P. M.** Application of Skylab and ERTS imagery to fault tectonics and earthquake hazards of Peninsular Ranges, southwestern California, July 1975; final report: 66 p., illus. (incl. sketch maps), 1975. (Rep. No. 75-2) *available from:* Calif. Earth Sci. Corp., Santa Monica, Calif., United States.

RS77-2-744

39585 **Abdel-Gawad, M.; and Tubbesing, L.** Mineral target areas in Nevada from geological analysis of Landsat-1 imagery: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1059-1078, illus. (incl. tables, geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-2-745

38297 **Lawrence, G. R.** Remotely-sensed data in geoscientific studies; an interpretation procedure [abstr.]: Geol. Soc. Am., Abstr. Programs, Vol. 7, No. 6, p. 806, 1975. *The Geological Society of America, North-central Section, 9th meeting.*

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30166 **Lavreau, J.** Etude photogeologique de la region Djugu-Mahagi-lac Mobutu (Zaire nord-oriental et Uganda) [Photogeologic study of the Lake Mobutu-Mahagi and Djugu region, northeastern Zaire and Uganda]: Mus. Roy. Afr. Cent., Dep. Geol. Mineral. Rap. Ann., Vol. 1975, p. 113-121 (incl. English, Flemish sum.), illus. (incl. table, geol. sketch map), 1976.

RS77-2-748

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RS77-2-751

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RS77-2-752

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RS77-2-753

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RS77-2-754

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RS77-2-755

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RS77-2-756

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RS77-2-757

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RS77-2-761

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RS77-2-763

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RS77-2-765

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RS77-2-766

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RS77-2-771

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RS77-2-774

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RS77-2-776

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RS77-2-780

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RS77-2-781

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RS77-2-782

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RS77-2-783

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RS77-2-784

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RS77-2-785

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RS77-2-786

38653 **Gagnon, H.** Aerial evaluation of landslide risks in Quebec [abstr.]: Colloq. Quat. Que., Resumes Commun., No. 3, p. 28-29, 1976.

RS77-2-787

30676 **Kahle, A. B.** A simple thermal model of the Earth's surface for geologic mapping by remote sensing: J. Geophys. Res., Vol. 82, No. 11, p. 1673-1680, illus. (incl. table), 1977. (Paper No. 6B0892).

RS77-2-788

39203 **Jost, H.; and Herz, R.** Use of Skylab imagery for Quaternary geology of SE Brazil coastal areas [abstr.]: Bol. Parana. Geocienc., No. 33, p. 60-61, 1975. *International symposium on the Quaternary.*

RS77-2-789

ID NO.- EI771076048 776048
SEMI-QUANTITATIVE GEOLOGICAL INTERPRETATION OF PHOTOLINEAMENTS.
Anderson, D. T.
Univ of Manit, Winnipeg
Can Min J v 98 n 6 Jun 1977 p 50, 52 CODEN: CAMJA9
DESCRIPTORS: (*PHOTOGRAMMETRY, *Mining Applications),
CARD ALERT: 405, 742, 501
Photolineaments or photolinears consist of well-defined linear elements related to the overall concept of photo patterns. These procedures produce a simple and practical representation of the essential features of the frequency and directions of lineal elements on aerial photographs or imagery. These thematic maps may be combined directly with the available geological information (i. e., ground truth) and additional inferences regarding structure and lithology may be readily drawn from them. These procedures are amenable to automation by computer techniques. 4 refs.

RS77-2-790

ID NO.- EI770968686 768686
REMOTE SENSING OF ACCUMULATED FRAZIL AND BRASH ICE IN THE ST. LAWRENCE RIVER.
Dean, Arnold M. Jr.
US Army Cold Reg Res & Eng Lab, Hanover, NH
CRREL Rep n 77-8 Apr 1977 19 p CODEN: XCRPAP
DESCRIPTORS: (*RIVERS, *Ice Formation), ICE, REMOTE SENSING, (RADAR, Meteorological),
IDENTIFIERS: COLD REGIONS RESEARCH, RADAR PROFILOMETERS, FRAZIL ICE
CARD ALERT: 407, 443, 444, 716, 732
A broadbanded impulse radar system was used for aerial detection of accumulated frazil and brash ice in a 9. 5-km reach of the St. Lawrence River near Ogden Island. The remote sensing and data reduction system developed for the project provided data sufficient for production of a contour map having 1-ft intervals. With this contour map, the accumulation pattern of frazil and brash ice could be analyzed. Recommendations are given for improving the performance of the aerial profiling system. 7 refs.

RS77-2-791

ID NO.- EI771074280 774280
AIRBORNE INFRARED SCANNER RESEARCH AT COLORADO STATE UNIVERSITY.
Skinner, Maurice M.
Colo State Univ, Fort Collins
Proc of the Bienn Infrared Inf Exch, 3rd, St. Louis, Mo, Aug 24-26 1976 Publ by AGA Corp, Secaucus, NJ, 1977 p 145-148
DESCRIPTORS: *HYDROLOGY, INFRARED IMAGING,
CARD ALERT: 444, 471, 741
An AGA 680 thermovision system and a Texas Instruments RS25 line scanner flown in conjunction with color infrared photography for locating groundwater recharge/discharge to the Madison limestone formation in the Powder River basin of Wyoming are described. Magnetic tape records of selected reaches are presented. Conclusions and recommendations for future work in the area are described. 23 refs.

RS77-2-792

ID NO.- EI770970324 770324
URANIUM EXPLORATION WITH COMPUTER-PROCESSED LANDSAT DATA.
Vincent, Robert K.
Geospectra Corp, Ann Arbor, Mich
Geophysics v 42 n 3 Apr 1977 p 536-541 CODEN: GPYSA7
DESCRIPTORS: (*URANIUM DEPOSITS, *Spectrum Analysis), (SATELLITES, Computer Applications), (URANIUM MINES AND MINING, Wyoming), GRANITE,
CARD ALERT: 414, 504, 944, 655, 723, 482
A spectral signature is constructed for an oxidized topsoil found in the vicinity of near-surface uranium deposits in porous, arkosic sandstones of the Wind River Basin, Wyoming. A new type of contour map, created from Landsat computer compatible tapes, designed to connect regions of equal percentage of ground area covered by a specified target of interest, is applied to a Landsat frame covering the entire basin. The resulting maps show relatively high percentages of ground cover by this particular topsoil in regions adjacent to open pit uranium mines in the Gas Hills region, as well as on or near known uranium prospects (as yet undisturbed) in the basin interior. A 10,000-pixel test area west of Lander, Wyoming is found to contain only one [illegible] 0.01 percent recognition rate) identified as the topsoil of interest. A whole-frame recognition map produces a much higher (0.58 percent) recognition rate, indicating that the false alarm rate for this signature is still significantly high, although better than what can be expected from photointerpretation of single ratio images or color composite ratio images. This $left double quote$ signature $right double quote$ has been applied to Landsat frames in other geographical areas with known uranium mines in porous sandstone, and oxidized topsoil has been recognized near these mines. 8 refs.

RS77-2-793

ID NO.- EI770967678 767678
STRUCTURE MAPPING ON ENHANCED LANDSAT IMAGES OF SOUTHERN BRAZIL: TECTONIC CONTROL OF MINERALIZATION AND SPECULATIONS OF METALLOGENY.
Offield, Terry W.; Abbott, Elsa A.; Gillespie, Alan R.; Loguercio, Sabino O.
US Geol Survy, Denver, Colo
Geophysics v 42 n 3 Apr 1977 p 482-500 CODEN: GPYSA7
DESCRIPTORS: (*ORE DEPOSITS, *Remote Sensing), (SATELLITES, Computers), (MINERAL EXPLORATION, Computer Applications), (GEOPHYSICS, Exploratory), (GEOLOGY, Tectonics),
CARD ALERT: 481, 504, 732, 655, 723, 501
Computer enhancement, particularly contrast-stretching, reveals a previously unnoticed east-west structural zone across a Landsat image of the southern Brazilian Precambrian shield. In this zone occur the only known economic or near-economic deposits of gold, tin, and copper. Such deposits are typically localized by small east-west structural elements. Noneconomic copper occurrences elsewhere in the region appear to be related to major northeast- and northwest-trading lineaments mapped on Landsat images. Mineral exploration should be primarily directed at the main east-west lineament, but two other possible east-west zones might be worthwhile targets also. The major east-west lineament projects through a break in the continental shelf, across the Atlantic along a large transoceanic fracture zone and into the African continent along a mapped tectonic trend that goes through an area that produces copper, gold, and tin. Global geophysical data suggest that the mapped east-west trend in South America is a surface reflection of structures that developed in the tectosphere in Precambrian time and that have persisted until the present. 33 refs.

RS77-2-794

ID NO.- EI770969529 769529
HIGH SENSITIVITY GAMMA-RAY SPECTROMETRY $EM DASH$ STATE OF THE ART AND TRIAL APPLICATION OF FACTOR ANALYSIS.
Duval, Joseph S.
US Geol Surv, Denver, Colo
Geophysics v 42 n 3 Apr 1977 p 549-559 CODEN: GPYSA7
DESCRIPTORS: *SPECTROMETERS, GAMMA RAY, RADIATION DETECTORS, (MATHEMATICAL TECHNIQUES, Applications), (GAMMA RAYS, Detection),
CARD ALERT: 622, 944, 921, 932
The remote sensing of terrestrial gamma rays has application in geologic mapping, mineral exploration, reactor site monitoring, location of lost radioactive sources, measurement of the water equivalence of snow, and soil mapping. There is a need to reexamine the use of detectors other than thallium activated sodium iodide detectors (e. g. , plastic scintillators) to improve the corrections used for altitude variations and to present the data as apparent concentrations of potassium, uranium, and thorium rather than as counts per unit of time. In an attempt to improve data analysis, the technique known as factor analysis is applied to airborne gamma-ray spectrometric data from a survey in South Texas. This analysis technique allows the geologist/geophysicist to perform a coordinate transformation from the four count rates $left bracket$ potassium (K), equivalent uranium (eU), equivalent thorium (eTh), and total count $right bracket$ and the three ratios, (eU/K, eU/eTh, eTh/K) to a system of three independent coordinates. These three coordinates are constrained to reproduce the total variance of the original data, and the data can be separated into groups using the criterion that similar data points have similar coordinates. The distribution of the separated groups can be mapped for comparison with other information such as the mapped geology. This map of the groups represents a synthesis of all of the radiometric data. 22 refs.

RS77-2-795

ID NO.- EI770967056 767056
APPLICATION OF PLANE TABLE PHOTOGRAMMETRY TO OPEN PIT MAPPING.
McCarter, M. K.
Kennecott Copper Corp, Bingham Canyon, Utah
AIME $EM DASH$ Soc of Min Eng, Monogr 1 on Rock Mech Appl in Min, Pap presented at Symp on Rock Mech, 17th, Snowbird, Utah, Aug 1976 Publ by AIME $EM DASH$ Soc of Min Eng, New York, NY, 1977 p 93-98
DESCRIPTORS: (*MINES AND MINING, *Open Pit), (PHOTOGRAMMETRY, Mining Applications), MAPS AND MAPPING,
IDENTIFIERS: PLANE TABLE PHOTOGRAMMETRY
CARD ALERT: 502, 742, 405
The difficulties encountered in open pit mapping can be substantially reduced by utilizing a modified form of plane table photogrammetry. This technique employs photographs taken from the ground as the base upon which details are recorded. The information is later transferred to plan maps using the plane table principal of location by intersection. Any change in topography can be accommodated by simply taking additional photographs. Proper spatial representation in plan view can be dtermined later when updated maps and surveyed control are available. In addition, horizontal photographs from the ground portray vertical surfaces as they are normally viewed thus providing maximum area for recording details. Any detail which can be identified on the photograph can be located correctly even though the actual feature is physically inaccessible.

RS77-2-796

ID NO.- EI770967862 767862
SHALLOW CARBONATE-BANK-MARGIN GROWTH AND STRUCTURE, LITTLE BAHAMA BANK, BAHAMAS.
Hine, Albert C.; Neumann, A. Conrad
Univ of NC, Chapel Hill
AAPG Bull v 16 n 3 Mar 1977 p 376-406 CODEN: AAPGBS
DESCRIPTORS: (*PETROLEUM GEOLOGY, *Subaqueous), (PETROLEUM PROSPECTING, Offshore), (GEOPHYSICS, Seismic),
CARD ALERT: 481, 512, 484
Extensive high-resolution seismic profiling and bottom sampling of the shallow northern margin of Little Bahama Bank have revealed a complexity and diversity in structure, facies, and growth history that cannot be encompassed within any single model. Cores, aerial photographs, LANDSAT imagery, and SCUBA diving observations provided supplemental data. Five bank-margin types have been identified. The dominant processes responsible for the variability of these bank-margin types are discussed. 67 refs.

RS77-2-797

ID NO.- EI770854179 754179
PROPOSED RESEARCH CAPABILITIES OF THE NAE CONVAIR 580.
Hardwick, C. D.
Natl Res Counc of Can, Natl Aerounaut Establ, Ottawa, Ont
Natl Res Counc Can Div Mech Eng Q Bull DME/NAE 1976 (4) 1976 p 37-45 CODEN: QBMEAJ
DESCRIPTORS: (*AIRCRAFT, *Electronic Equipment), GEOLOGICAL SURVEYS, MAGNETOMETERS, (COMPUTERS, Aerospace Applications), (AIR NAVIGATION, Research), (RADAR, Surveillance Application),
CARD ALERT: 652, 715, 481, 942, 723, 431
In addition to a number of new roles, the Convair 580 will be taking over the research functions which were carried out until recently by the NOrth Star aircraft. The North Star was used primarily for aeromagnetic research using an extremely sensitive, oriented, optically pumped, cesium vapour magnetometer which was originally developed at NAE. The research projects based upon the use of the magnetometer included submarine detection and long-range geological surveys. The new research functions of the Convair aircraft include magnetic detection, navigation research, satellite communications, acoustic detection (e. g. , precision stores dropping to accomodate active acoustic devices), search and rescue beacon evaluation, and general-purpose digital laboratory capability including control of some research functions. In addition, the Department of National Defence has requested time on the aircraft for advanced development of side-looking radar (SLAR) and for evaluation of electronic surveillance techniques.

RS77-2-798

ID NO.- EI770857193 757193
COMPARISON OF LANDSAT IMAGES AND NIMBUS THERMAL-INERTIA MAPPING OF OMAN.
Pohn, Howard A.
J Res US Geol Surv v 4 n 6 Nov-Dec 1976 p 661-665 CODEN: JRGSAW
DESCRIPTORS: (*GEOLOGICAL SURVEYS, *Oman), (SATELLITES, Imaging Techniques),
IDENTIFIERS: LITHOLOGY, THERMAL INERTIA MAPPING
CARD ALERT: 481, 655
Thermal-inertia maps can be used in conjunction with Landsat photographs to resolve ambiguous identification of lithologies in remote areas. 3 refs.

RS77-2-799

ID NO.- EI770965523 765523
REMOTE SENSOR APPLICATIONS TO TECTONISM AND SEISMICITY IN THE NORTHERN PART OF THE MISSISSIPPI EMBAYMENT.
O'Leary, Dennis W.; Simpson, Shirley L.
US Geol Surv, Denver, Colo
Geophysics v 42 n 3 Apr 1977 p 542-548 CODEN: GPYSA7
DESCRIPTORS: (*GEOLOGY, *Tectonics), (SATELLITES, Remote Sensing), SEISMOLOGY.
CARD ALERT: 481, 655, 732, 484
A comparative study of Landsat images, SLAR image strips, and Skylab photographs made to help develop a regional tectonic model and to evaluate the seismic hazards of the northern part of the Mississippi embayment as far south as the Ouachita front is described. The geomorphic character and distribution of lineaments reflects the structure and tectonics of the area. The fairly consistent trends of northwest-oriented lineaments suggest the influence of jointing, whereas the variable north- and northeast-trending groups suggest a variety of influences including jointing, faulting, and surficial factors that control stream orientation. Anomaly trend distribution show some correlation with the azimuth frequency diagrams of lineaments in the embayment. These data suggest basement control along gradients of magnetic anomalies where they parallel mapped lineaments. The tectonics pattern of the area is generally revealed in the landscape, of which the lineaments seem to be a particularly important part. 5 refs.

RS77-2-800

ID NO.- EI770967003 767003
RTUTNAYA GEOKHIMICHESKAYA AEROS''EMKA. $left bracket$ Geochemical Aerial Surveying Based on Measurements of Mercury Vapor Concentration $right bracket$.
Abramovskii, B. P.; Ionov, V. A.; Nazarov, I. M.; Fursov, V. Z.
Inst of Appl Geophys (GUGMS), USSR
Razved Okhr Nedr n 1 Jan 1977 p 30-33 CODEN: RZONAV
DESCRIPTORS: (*MINERAL EXPLORATION, *Remote Sensing), (CHEMICAL ANALYSIS, Mercury Determination).
CARD ALERT: 501, 732, 801, 549
The results of aircraft measurements of the mercury vapor concentration in the atmospheric boundary layer over various types of soils in the USSR during flight at various altitudes are analyzed. 4 refs. In Russian.

RS77-2-801

ID NO.- EI770858432 758432
METHOD OF SMOOTHING DIGITAL THEMATIC MAPS.
Davies, W. A.; Peet, F. G.
Univ of Alberta, Edmonton
Remote Sensing Environ v 6 n 1 1977 p 45-49 CODEN: RSEEA7
DESCRIPTORS: *MAPS AND MAPPING, REMOTE SENSING.
CARD ALERT: 405, 742
A method has been developed for the smoothing of digital thematic maps such as those derived from LANDSAT data. The method permits one to specify a minimal area for each feature represented on the map. After application of the method all the regions belonging to any given feature have areas equal to or greater than the minimum for the feature. In this report the results are presented for a particular example. 7 refs.

RS77-2-802

ID NO.- EI770966001 766001
SATELLITE POTENTIALS IN SNOWCOVER MONITORING AND RUNOFF PREDICTION.
Rango, A.; Itten, K. I.
Goddard Space Flight Cent, Greenbelt, Md
Nord Hydrol v 7 n 4 1976 p 209-230 CODEN: NOHYBB
DESCRIPTORS: (*HYDROLOGY, *Remote Sensing), (SATELLITES, Applications), (SNOW AND SNOWFALL, Monitoring), RUNOFF.
CARD ALERT: 444, 471, 655
Earth resources satellites have provided a means for the timely, efficient, and accurate monitoring of watershed snowcovered area. Several techniques are available for analysing the data ranging from simple photointerpretation to automated digital methods. Although photointerpretation methods are completely suitable and recommended for many applications, it is believed that a highly interactive digital processing system, when combined with a skilled remote sensing applications specialist, will provide maximum operational use of satellite snowcover observations. Several studies have shown that satellite-observed snowcovered area is significantly related to various expressions of seasonal streamflow. The results indicate that snowcovered area could be incorporated into conventional snowmelt runoff prediction methods as an additional index parameter for improving streamflow estimates. Refs.

RS77-2-803

ID NO.- EI770856777 756777
HYDROGEOMORPHIC METHODS FOR THE REGIONAL EVALUATION OF FLOOD HAZARDS.
Baker, Victor R.
Univ of Tex, Austin
Environ Geol v 1 n 5 1976 p 261-281 CODEN: ENGEDC
DESCRIPTORS: (*FLOODS, *Mathematical Models), (GEOLOGY, Geomorphology), HYDROLOGY, (WATERSHEDS, Analysis).
IDENTIFIERS: FLOOD HAZARD EVALUATION
CARD ALERT: 442, 481, 444, 921, 723
The $left double quote$ upstream $right double quote$ approach to flood hazard evaluation involves the estimation of hydrologic response in small drainage basins. This study demonstrates the application of geomorphology to such studies in a region of unusually intense flooding in central Texas. One approach to flood hazard evaluation in this area is a parametric model relating flood hydrograph characteristics to quantitative geomorphic properties of the drainage basins. A preliminary model uses multiple regression techniques to predict potential peak flood discharge from basin magnitude, drainage density, and ruggedness number. After mapping small catchment networks from remote sensing imagery, input data for the model are generated by network digitization and analysis by a computer-assisted routine of watershed analysis. Refs.

RS77-2-804

ID NO.- EI770963995 763995
APPLICATION OF PLANE TABLE PHOTOGRAMMETRY TO OPEN PIT MAPPING.
McCarter, M. K.
Kennecott Copper Corp, Bingham Canyon, Utah
Proc Symp Rock Mech 17th, Prepr: Site Charact, Snowbird, Utah, Aug 25-27 1976. Publ by Univ of Utah, Utah Eng Exp Stn, Salt Lake City, 1976 Sess 2B Pap 6, 6 p CODEN: PSRMA6
DESCRIPTORS: (*COPPER MINES AND MINING, *Open Pit), (PHOTOGRAMMETRY, Mining Applications), ROCK MECHANICS,
CARD ALERT: 504, 502, 483, 405, 742, 501
Mining activity and basic geometry of open-pit mines represent major obstacles in geotechnical mapping. A modified form of plane table photogrammetry is described here that can be utilized to substantially reduce the difficulties encountered in open-pit mapping. This technique employs pnotograpns taken from the ground as the base upon which details are recorded. The plane table photogrammetric method has proven to be a practical tool for detailed investigation of potentially unstable areas and routine geological mapping. 8 refs.

RS77-2-805

ANDERSON, A.T./SCHULTZ, D.T./BUCHMAN, N.

1975

LANDSAT INVENTORY OF SURFACE-MINED AREAS USING EXTENDIBLE DIGITAL TECHNIQUES.

GODDARD SPACE FLIGHT CENTER, GREENBELT, MARYLAND. 21 P.

SURFACE MINED AREAS/MONITORING/REMOTE SENSING/DISTURBED LANDS/MAPS/MARYLAND/INFORMATION RETRIEVAL/SURFACE ENVIRONMENT

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Section 3

AGRICULTURE AND FORESTRY

Soils Studies, Crop-disease Detection, Range Resources, Forest-fire Monitoring, Wildlife Studies

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RS77-3-243

N77-27481*# ECON, Inc., Princeton, N.J.
A DISTRIBUTION BENEFITS MODEL FOR IMPROVED INFORMATION ON WORLDWIDE CROP PRODUCTION. VOLUME 1: MODEL STRUCTURE AND APPLICATION TO WHEAT
John Andrews 30 Jun. 1976 99 p refs
(Contract NASw-2558)
(NASA-CR-153903; Rept-76-104-1A) Avail: NTIS HC A05/MF A01 CSCL 02B

The improved model is suitable for the study of benefits of worldwide information on a variety of crops. Application to the previously studied case of worldwide wheat production shows that about $103 million per year of distribution benefits to the United States would be achieved by a satellite-based wheat information system meeting the goals of LACIE. The model also indicates that improved information alone will not change world stock levels unless production itself is stabilized. The United States benefits mentioned above are associated with the reduction of price fluctuations within the year and the more effective use of international trade to balance supply and demand. Price fluctuations from year to year would be reduced only if production variability were itself reduced. Author

RS77-3-244

N77-27482*# ECON, Inc., Princeton, N.J.
A DISTRIBUTION BENEFITS MODEL FOR IMPROVED INFORMATION ON WORLDWIDE CROP PRODUCTION. VOLUME 2: APPLICATION TO VARIOUS CROPS Final Report
John Andrews 30 Jun. 1976 126 p refs
(Contract NASw-2558)
(NASA-CR-153902; Rept-76-104-1B) Avail: NTIS HC A07/MF A01 CSCL 02B

ECON's distribution benefits model has been applied to worldwide distribution of corn, rye, oats, barley, soybeans, and sugar, and to domestic distribution of potatoes. The results indicate that a LANDSAT system with thematic mapper might produce benefits to the United States of about $119 million per year, due to more efficient distribution of these commodities. The benefits to the rest of the world have also been calculated, with a breakdown between trade benefits and those associated with internal use patterns. By far the greatest part of the estimated benefits are assigned to corn, with smaller benefits assigned to soybeans and the small grains (rye, oats, and barley). Author

RS77-3-245

N77-24560*# Battelle Columbus Labs., Ohio.
BENEFITS OF AN IMPROVED WHEAT CROP INFORMATION SYSTEM Final Report
Ivan L. Kinne Dec. 1976 39 p refs
(Contract NASw-2800)
(NASA-CR-153006; BCL-OA-TFR-76-12) Avail: NTIS HC A03/MF A01 CSCL 02C

The ECON work and the results of the independent reviews are summarized. Attempts are made to put this information into layman's terms and to present the benefits that can realistically be expected from a LANDSAT-type remote sensing system. Further the mechanisms by which these benefits can be expected to accrue are presented. The benefits are given including the nature of expected information improvements, how and why they can lead to benefits to society, and the estimated magnitude of the expected benefits. A brief description is presented of the ECON models, how they work, their results, and a summary of the pertinent aspects of each review. The ECON analyses show that substantial benefits will accrue from implementation of an improved wheat crop information system based on remote sensing. Author

RS77-3-246

N77-25606*# Kansas State Univ., Manhattan.
RESPONSE OF WINTER AND SPRING WHEAT GRAIN YIELDS TO METEOROLOGICAL VARIATION Final Report
Arlin M. Feyerherm, Edward T. Kanemasu, and Gary M. Paulsen
Feb. 1977 142 p refs
(Contract NAS9-14282)
(NASA-CR-151429) Avail: NTIS HC A07/MF A01 CSCL 02C

Mathematical models which quantify the relation of wheat yield to selected weather-related variables are presented. Other sources of variation (amount of applied nitrogen, improved varieties, cultural practices) have been incorporated in the models to explain yield variation both singly and in combination with weather-related variables. Separate models were developed for fall-planted (winter) and spring-planted (spring) wheats. Meteorological variation is observed, basically, by daily measurements of minimum and maximum temperatures, precipitation, and tabled values of solar radiation at the edge of the atmosphere and daylength. Two different soil moisture budgets are suggested to compute simulated values of evapotranspiration: one uses the above-mentioned inputs, the other uses the measured temperatures and precipitation but replaces the tabled values (solar radiation and daylength) by measured solar radiation and satellite-derived multispectral scanner data to estimate leaf area index. Weather-related variables are defined by phenological stages, rather than calendar periods, to make the models more universally applicable. Author

RS77-3-247

N77-27461 California Univ., Los Angeles.
WOODY VEGETATION PATTERNS IN THE CONIFEROUS FOREST ZONE OF THE SOUTHERN SIERRA NEVADA Ph.D. Thesis
Paul Harvey Leskinen 1976 239 p
Avail: Univ. Microfilms Order No. 77-1643

The composition of various types of woody vegetation under different ecological conditions in the Southern Sierra Nevada was compared. Open slope vegetation in two traverses across the Sierra was sampled in a series of short transects grouped around stations at 500 foot (150 m) contour intervals. It was found that altitudinal zonation is not well defined in the Southern Sierra Nevada. Overall the most significant changes in vegetation occur from east to west at any given altitude, rather than from north to south, with climate, topography, the frequency of lightning fires, and, to a minor extent, lithology as the main environmental variables. There is no way to handle properly the spatial distribution of the woody plant species in terms of the traditional 'association.' Selection of dominant species would be purely arbitrary. The various plant species are present in response to individual edaphic and climatic requirements. Dissert. Abstr.

RS77-3-248

N77-26592*# Prairie View Agricultural and Mechanical Coll., Tex.
MEASUREMENT OF GROWTH, MEASUREMENT AND BIDIRECTORAL SCATTERING PARAMETERS OF WHEAT Final Report
Jan. 1977 28 p
(Grant NsG-9006)
(NASA-CR-151351) Avail: NTIS HC A03/MF A01 CSCL 02C

This project was conducted to measure ambient air temperatures at standard 2 meter heights and surface radiative temperatures (thermal infrared radiation) over a maturing winter wheat canopy and bare sandy soil. The purpose of the project was to relate ground truth measurements to satellite derived surface radiative temperatures. The goal was to develop models from which satellite-derived measurements could be used to predict wheat growth patterns and yields. As a corollary advantage, the data for soil moisture and temperature, wind velocity, relative humidity, canopy characteristics and yields were also collected and added to the agronomic data bank used to develop practices which would enhance yields of grain in South Texas. Author

RS77-3-249

N77-24557*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
WHEAT SIGNATURE MODELING AND ANALYSIS FOR IMPROVED TRAINING STATISTICS Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, W. A. Malila, R. C. Cicone, and J. M. Gleason May 1976 170 p refs EREP
(Contract NAS9-14123)
(E77-10162; NASA-CR-150997; ERIM-109600-66-F) Avail: NTIS HC A08/MF A01 CSCL 02C

The author has identified the following significant results. The spectral, spatial, and temporal characteristics of wheat and other signatures in LANDSAT multispectral scanner data were examined through empirical analysis and simulation. Irrigation patterns varied widely within Kansas; 88 percent of wheat acreage in Finney was irrigated and 24 percent in Morton, as opposed to less than 3 percent for western 2/3's of the State. The irrigation practice was definitely correlated with the observed spectral response; wheat variety differences produced observable spectral differences due to leaf coloration and different dates of maturation. Between-field differences were generally greater than within-field differences, and boundary pixels produced spectral features distinct from those within field centers. Multiclass boundary pixels contributed much of the observed bias in proportion estimates. The variability between signatures obtained by different draws of training data decreased as the sample size became larger; also, the resulting signatures became more robust and the particular decision threshold value became less important.

RS77-3-250

N77-28557*# Kanner (Leo) Associates, Redwood City, Calif.
TAXONOMIC CLASSIFICATION OF SOILS USING DIGITAL INFORMATION FROM LANDSAT DATA. HUAYLLAMARCA AND EUCALIPTUS AREAS M.S. Thesis - Bolivia Univ.
Samuel Quiroga Quiroga Washington NASA Jul. 1977 96 p refs Transl. into ENGLISH of "Clasificacion Taxonomica de Suelos Utilizando Inform. Digital de Datacs LANDSAT-Area Huayllamarca y Eucaliptus", Cochabamba (Bolivia).
(Contract NASw-2790)
(NASA-TM-75029) Avail: NTIS HC A05/MF A01 CSCL 08M

The applicability of LANDSAT digital information to soil mapping is described. A compilation of all cartographic information and bibliography of the study area is made. LANDSAT MSS images on a scale of 1:250,000 are interpreted and a physiographic map with legend is prepared. The study area is inspected and a selection of the sample areas is made. A digital map of the different soil units is produced and the computer mapping units are checked against the soil units encountered in the field. The soil boundaries obtained by automatic mapping were not substantially changed by field work. The accuracy of the automatic mapping is rather high. Author

RS77-3-251

N77-26689*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE: A LOOK TO THE FUTURE
R. B. MacDonald and F. G. Hall 29 Apr. 1977 38 p refs Presented at 11th Intern. Symp. on Remote Sensing of Environ., Ann Arbor, Mich., 25-29 Apr. 1977
(NASA-TM-74623; JSC-11685) Avail: NTIS HC A03/MF A01 CSCL 08B

The Large Area Crop Inventory Experiment (LACIE) is described. The experiment's approach to production monitoring is described briefly, and its status is reviewed as of the conclusion of 2 years of successful operation. Examples of acreage and yield monitoring in the Soviet Union are used to illustrate the experiment's approach. Author

RS77-3-252

N77-27469*# Environmental Research Inst. of Michigan, Ann Arbor.
THE USE OF UNSUPERVISED CLUSTERING AS A CLASSIFIER FOR LACIE MSS DATA
Alex P. Pentland, Principal Investigator Oct. 1975 12 p refs EREP
(Contract NAS9-14123)
(E77-10179; NASA-CR-151329; ERIM-109600-39-R) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. This classification method appears to give accurate field center results and to give practical, statistically consistent and accurate estimates of crop proportions. The accuracy of this method is attributable to certain qualities of the particular clustering algorithm. These qualities are freedom from assumptions about Gaussian data, and the continual updating of distribution estimates, including updating the number of modes. This method is relatively tolerant of errors in the determination of crop type, as crop identity is used only for identifying clusters, and not for computing signatures.

RS77-3-253

N77-26588*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
REMOTE SENSING OF WETLANDS
Norman E. G. Roller Mar. 1977 165 p refs
(Grant NGR-23-005-522)
(NASA-CR-153282; ERIM-193400-14-T) Avail: NTIS HC A08/MF A01 CSCL 14E

The concept of using remote sensing to inventory wetlands and the related topics of proper inventory design and data collection are discussed. The material presented shows that aerial photography is the form of remote sensing from which the greatest amount of wetlands information can be derived. For extensive, general-purpose wetlands inventories, however, the use of LANDSAT data may be more cost-effective. Airborne multispectral scanners and radar are, in the main, too expensive to use - unless the information that these sensors alone can gather remotely is absolutely required. Multistage sampling employing space and high altitude remote sensing data in the initial stages appears to be an efficient survey strategy for gathering non-point specific wetlands inventory data over large areas. The operational role of remote sensing insupplying inventory data for application to several typical wetlands management problems is illustrated by summary descriptions of past ERIM projects. Author

RS77-3-254

N77-23585# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
THE SPECTRAL DIRECTIONAL REFLECTANCE OF ROW CROPS. PART 1: CONSEQUENCES OF NON-LAMBERTIAN BEHAVIOUR FOR AUTOMATIC CLASSIFICATION. PART 2: MEASUREMENTS ON WHEAT AND SIMULATIONS BY MEANS OF A REFLECTANCE MODEL FOR ROW CROPS
W. Verhoef and N. J. J. Bunnik Jun. 1976 144 p refs
(NIWARS-Publ-35) Avail: NTIS HC A07/MF A01

The one-layer Suits model for canopy reflectance was applied to simulate a multispectral scanning flight over an agricultural area. Non-Lambertian behavior and misclassification were studied on the basis of unprocessed and preprocessed data from the reflectance simulations. A new experimental model for the calculation of the directional reflectance of row crops, based on the one-layer Suits model, is presented. This model was applied to simulate measurements of the spectral directional reflectance on mechanically sowed wheat at several growth stages in the summer of 1974. In general, input and output data of both model and field data agree well. Specular reflection at leaves, not incorporated in the present model, appears to be a significant factor for crop reflectance. Author (ESA)

RS77-3-255

N77-23567*# Texas A&M Univ., College Station. Remote Sensing Center.
APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Final Report, Feb. 1975 - Dec. 1976
John W. Rouse, Jr., Principal Investigator, D. W. Deering, R. H. Haas, R. I. Welch, J. C. Harlan, and P. R. Whitney Jan. 1977 235 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20796)
(E77-10153; NASA-CR-152699; RSC-3018-6) Avail: NTIS HC A11/MF A01 CSCL 08F

The author has identified the following significant results. LANDSAT 2 has shown that digital data products can be effectively employed on a regional basis to monitor changes in vegetation conditions. The TV16 was successfully applied to an extended test site and the Great Plains Corridor in tests of the ability to assess green forage biomass on rangelands as an index to vegetation condition. A strategy for using TV16 on a regional basis was developed and tested. These studies have shown that: (1) for rangelands with good vegetative cover, such as most of the Great Plains, and which are not heavily infested with brush or undesirable weed species, the LANDSAT digital data can provide a good estimate (within 250 kg/ha) of the quantity of green forage biomass, and (2) at least five levels of pasture and range feed conditions can be adequately mapped for extended regions.

RS77-3-256

N77-23584# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
A MODEL STUDY ON THE RELATIONS BETWEEN CROP CHARACTERISTICS AND CANOPY SPECTRAL REFLECTANCE. PART 1: DEDUCTION OF CROP PARAMETERS FROM CANOPY SPECTROREFLECTANCE DATA. PART 2: DETECTABILITY OF VARIATIONS IN CROP PARAMETERS BY MULTISPECTRAL SCANNING
W. Verhoef and N. J. J. Bunnik Dec. 1975 101 p refs
(NIWARS-Publ-33) Avail: NTIS HC A06/MF A01

The canopy reflectance model developed by G. H. Suits was used to establish relationships between canopy reflectance and agricultural crop parameters. These relationaships were calculated for perpendicular view and a fixed sun angle. Attempts to find methods of deduction of crop parameters from canopy spectroreflectance data, based on the Suits model, have not yet led to satisfactory results. This is mainly due to the variability of leaf and soil optical characteristics. The detectability of variations in certain crop parameters was studied by identifying the scanner's noise equivalent reflectance difference with a canopy reflectance difference caused by variation of a crop parameter. The results obtained should be used in an indicative way. Author (ESA)

RS77-3-257

N77-27460 Kansas Univ., Lawrence.
EXAMINATION AND ANALYSIS OF VEGETATION BOUNDARY ZONES USING AERIAL AND ORBITAL DATA SOURCES Ph.D. Thesis
Norman Edward Hardy 1976 124 p
Avail: Univ. Microfilms Order No. 77-2221

Parts of four areas: Texas, Kansas, Wyoming and Alberta, have been selected as test sites. Environmental variations have been shown to exist between the four independent test areas. Climates, geology, soils and vegetation have been discussed at length and variations between sites have been considered.
Dissert. Abstr.

RS77-3-258

N77-27465*# Agricultural Research Service, Weslaco, Tex.
SOIL, WATER, AND VEGETATION CONDITIONS IN SOUTH TEXAS Final Report, 13 Jan. 1975 - 13 Jun. 1977
Craig L. Wiegand, Harold W. Gausman, Ross W. Leamer, Arthur J. Richardson, James H. Everitt, and Alvin H. Gerbermann, Principal Investigators Jun. 1977 120 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-53876-AG)
(E77-10175; NASA-CR-153273) Avail: NTIS HC A06/MF A01 CSCL 08F

The author has identified the following significant results. The best wavelengths in the 0.4 to 2.5 micron interval were determined for detecting lead toxicity and ozone damage, distinguishing succulent from woody species, and detecting silverleaf sunflower. A perpendicular vegetation index, a measure of the distance from the soil background line, in MSS 5 and MSS 7 data space, of pixels containing vegetation was developed and tested as an indicator of vegetation development and crop vigor. A table lookup procedure was devised that permits rapid identification of soil background and green biomass or phenological development in LANDSAT scenes without the need for training data.

RS77-3-259

N77-27480*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RESULTS OF LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) DROUGHT ANALYSIS (SOUTH DAKOTA DROUGHT 1976)
David R. Thompson Sep. 1976 39 p Original contains color illustrations
(NASA-TM-74760; LACIE-00437; JSC-11666) Avail: NTIS HC A03/MF A01 CSCL 08H

LACIE using techniques developed from the southern Great Plains drought analysis indicated the potential for drought damage in South Dakota. This potential was monitored and as it became apparent that a drought was developing, LACIE implemented some of the procedures used in the southern Great Plains drought. The technical approach used in South Dakota involved the normal use of LACIE sample segments (5 x 6 nm) every 18 days. Full frame color transparencies (100 x 100 nm) were used on 9 day intervals to identify the drought area and to track overtime. The green index number (GIN) developed using the Kauth transformation was computed for all South Dakota segments and selected North Dakota segments. A scheme for classifying segments as drought affected or not affected was devised and tested on all available 1976 South Dakota data. Yield model simulations were run for all CRD's Crop Reporting District) in South Dakota. Author

RS77-3-260

N77-27463 Kansas Univ., Lawrence.
VARIABILITY OF THE ACCURACY OF DELINEATING AGRICULTURAL FIELD BOUNDARIES FROM SATELLITE IMAGES OF THE UNITED STATES Ph.D. Thesis
David Eugene Schwarz 1976 204 p
Avail: Univ. Microfilms Order No. 77-2275

A study of agricultural land use and its interpretation from satellite images indicates that the same level of accuracy of agricultural land use data cannot be extracted from comparably high quality satellite images from diverse environments in the southern United States. The agricultural landscapes were analyzed in terms of the interpretability of the primary segments which compose them- agricultural fields or their equivalent, such as woodlots. The degree to which interpreted field boundaries conformed with actual field boundaries was evaluated both qualitatively and quantitatively, including optical data processing.
Dissert. Abstr.

RS77-3-261

N77-26580*# Kansas State Univ., Manhattan. Evapotranspiration Lab.
ESTIMATED WINTER WHEAT YIELD FROM CROP GROWTH PREDICTED BY LANDSAT Final Report, Mar. 1976 - Mar. 1977
Edward T. Kanemasu May 1977 181 p refs
(Contract NAS9-14899)
(NASA-CR-151431) Avail: NTIS HC A09/MF A01 CSCL 02C

An evapotranspiration and growth model for winter wheat is reported. The inputs are daily solar radiation, maximum temperature, minimum temperature, precipitation/irrigation and leaf area index. The meteorological data were obtained from National Weather Service while LAI was obtained from LANDSAT multispectral scanner. The output provides daily estimates of potential evapotranspiration, transpiration, evaporation, soil moisture (50 cm depth), percentage depletion, net photosynthesis and dry matter production. Winter wheat yields are correlated with transpiration and dry matter accumulation. Author

RS77-3-262

N77-26596# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
ANALYSIS OF SIGNIFICANCE WITHIN CROP-SPECTRA: A COMPARISON STUDY OF DIFFERENT MULTISPECTRAL SCANNERS
J. N. P. Beers May 1975 46 p refs
(NIWARS-Publ-30) Avail: NTIS HC A03/MF A01

In order to study the spectral signatures of vegetation canopies, reflectance data of 11 crops were gathered during the 1973 growing season using the NIWARS double beam type spectrometer. Using the spectra obtained, it was possible to determine for each crop or group of crops the part of the spectrum which is most significant. From this knowledge the use of the channels of different multispectral scanners is concluded in relation to the relative information content of the channels. This information summary leads to quick classification, resulting in a comparison of the multispectral scanners. Author (ESA)

RS77-3-263

N77-23569*# Geological Survey, Reston, Va.
DETECTION OF SHORT-TERM CHANGES IN VEGETATION COVER BY USE OF LANDSAT IMAGERY Final Report, 1 Jul. 1972 - 30 Jun. 1974
Raymond M. Turner, Principal Investigator and Frederick M. Wiseman Jun. 1975 52 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10165; NASA-CR-152666) Avail: NTIS HC A04/MF A01 CSCL 02C

The author has identified the following significant results. By using a constant band 6 to band 5 radiance ratio of 1.25, the changing pattern of areas of relatively dense vegetation cover was detected for the semiarid region in the vicinity of Tucson, Arizona. Electronically produced binary thematic masks were used to map areas with dense vegetation. The foliar cover threshold represented by the ratio was not accurately determined but field measurements show that the threshold lies in the range of 10 to 25 percent foliage cover. Montana evergreen forests with constant dense cover were correctly shown to exceed the threshold on all dates. The summer active grassland exceeded the threshold in the summer unless rainfall was insufficient. Desert areas exceeded the threshold during the spring of 1973 following heavy rains; the same areas during the rainless spring of 1974 did not exceed threshold. Irrigated fields, parks, golf courses, and riparian communities were among the habitats most frequently surpassing the threshold.

RS77-3-264

N77-25604*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
A PRELIMINARY TRAINING GUIDE FOR UTILIZING HIGH-ALTITUDE, COLOR-INFRARED PHOTOGRAPHY IN COMPILING SOIL MAPS
J. E. Weaver, W. H. Parkhurst, J. F. Ward, and R. H. Almond Apr. 1977 113 p refs
(Contract NAS9-15200)
(NASA-CR-151420; LEC-8283) Avail: NTIS HC A06/MF A01 CSCL 08B

Instruction for acquiring and analytically processing small-scale color-infrared photography to perform a soil resources inventory over forests of the southern U.S. is provided. Planning the project; acquiring aerial photography, materials, equipment and supplemental data; and preparing the photography for analysis are discussed. The procedures for preparing ancillary and primary component overlays are discussed. The use of correlation charts and dichotomous keys for mountain landforms, water regime, and vegetation is explained. Author

RS77-3-265

N77-24565*# Scientific Translation Service, Santa Barbara, Calif.
THE INVESTIGATION OF THE ENVIRONMENT BY SPACE MEANS: GEOBOTANICS, GEOMORPHOLOGY, SOIL SCIENCE AGRICULTURAL LAND, AND LANDSCAPE SCIENCE
S. V. Zoni, L. A. Vedeshin, and A. M. Grinberg Washington NASA May 1977 309 p refs Transl. into ENGLISH of collection of papers presented at the Methods of Utilizing Aerospace Data Meeting, Moscow, 17-24 Nov. 1975
(Contract NASw-2791)
(NASA-TT-F-17529) Avail: NTIS HC A14/MF A01 CSCL 05B

Collection of papers presented at the Methods of Utilizing Aerospace Data Meeting in Moscow. Topics covered include all aspects of the interpretation of aerial photographs from satellites for agriculture and related fields. Author

RS77-3-266

N77-28582*# Operations Research, Inc., Silver Spring, Md.
AGRICULTURE AVIATION STUDY AND PROGRAM PLAN. VOLUME 1: PROJECT SUMMARY Final Report
6 Jun. 1976 51 p 2 Vol.
(Contract NASw-2880)
(NASA-CR-153283) Avail: NTIS HC A04/MF A01 CSCL 02C

An assessment of the impact of agricultural aviation on agricultural productivity, and the technology needs of agricultural aviation are presented. Author

RS77-3-267

A77-41178 **Scattering of radio waves by an underlying surface covered with vegetation.** V. A. Andrianov, N. A. Armand, and I. N. Kibardina. *(Radiotekhnika i Elektronika,* vol. 21, Sept. 1976, p. 1816-1821.) *Radio Engineering and Electronic Physics,* vol. 21, Sept. 1976, p. 12-16. 7 refs. Translation.
(For abstract see issue 04, p. 560, Accession no. A77-15728)

RS77-3-268

A77-41255 **Surface temperature and vegetation distribution in Freiburg im Breisgau - Two-component pictures as an aid in the evaluation of MSS data (Oberflächentemperatur und Vegetationsverteilung in Freiburg i. Br. - Zweikomponentenbilder als Hilfsmittel bei der Auswertung von MSS-Daten).** H. Gossmann and W. Nübler (Freiburg, Universität, Freiburg im Breisgau, West Germany). *Bildmessung und Luftbildwesen,* vol. 45, July 1, 1977, p. 105-113. 16 refs. In German.

The thermal differentiation of an urban area during the midday heating phase is considered and related to an image of vegetation distribution. This approach makes it possible to estimate the effect of vegetation-cover differences on the maxima of surface and air temperature. The data concerning the vegetation cover were obtained with the aid of a multispectral line-scanning device which was carried by an aircraft. Surface and air temperatures were measured at 50 ground-control points. The reported investigation involved a point-wise superposition of the temperature and the vegetation maps as a basis for a study of the significance of the vegetation for the thermal budget of the considered urban area. G.R.

RS77-3-269

A77-42015 * **Theory for passive microwave remote sensing of near-surface soil moisture.** E. G. Njoku (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.) and J.-A. Kong (MIT, Cambridge, Mass.). *Journal of Geophysical Research,* vol. 82, July 10, 1977, p. 3108-3118. 19 refs. NSF Grant No. 76-01654; Contracts No. JPL-95324; No. NAS7-100.

The theory of microwave thermal emission from a nonscattering half-space medium is developed for application to regions with nonuniform subsurface soil-moisture and temperature variations. A coherent stratified model is presented which is valid for nonuniform temperature profiles and rapidly varying moisture profiles, under which conditions the commonly used emissivity and radiative-transfer approaches become inaccurate. For naturally occurring profiles the stratified model gives more accurate results than the other approaches at frequencies below about 4 GHz. Experimental results from ground-based radiometric observations of a controlled target area compare systematically with brightness temperatures predicted from the theoretical model to within approximately 10 K. Results of dielectric-constant measurements of the sand are given at seven frequencies in the microwave range and for moisture contents in the range from 0% to 30% by volume. By using this model, the thermal microwave emission spectrum is computed for a number of representative moisture and temperature profiles in the frequency range from 0.25 to 25 GHz. (Author)

RS77-3-270

A77-34628 * # **Remote sensing techniques applied to multispectral recognition of the Aranjuez pilot zone (Técnicas de teledetección aplicadas a un reconocimiento multiespectral de la zona piloto de Aranjuez).** G. L. Lemos (Instituto Geográfico y Catastral, Madrid, Spain), J. Salinas (Madrid, Universidad Politécnica, Madrid, Spain) and M. Rebollo (Madrid, Universidad Autónoma, Madrid, Spain). *IAA/Ingeniería Aeronáutica y Astronáutica,* vol. 29, Mar. 1977, p. 13-30. In Spanish. NASA-supported research.

A rectangular (7 x 14 km) area 40 km S of Madrid was remote-sensed with a three-stage recognition process. Ground truth was established in the first phase, airborne sensing with a multispectral scanner and photographic cameras were used in the second phase, and Landsat satellite data were obtained in the third phase. Agronomic and hydrological photointerpretation problems are discussed. Color, black/white, and labeled areas are displayed for crop recognition in the land-use survey; turbidity, concentrations of pollutants and natural chemicals, and densitometry of the water are considered in the evaluation of water resources. R.D.V.

RS77-3-271

A77-37591 # **Microwave remote sensing of productive moisture reserves in the soil (Mikrovolnovaia distantsionnaia indikatsiia zapasov produktivnoi vlagi v pochve).** K. Ia. Kondrat'ev, Iu. I. Rabinovich, E. M. Shul'gina, and V. V. Melent'ev (Glavnaia Geofizicheskaia Observatoriia, Leningrad, USSR). *Akademiia Nauk SSSR, Doklady,* vol. 233, Apr. 11, 1977, p. 828-830. 6 refs. In Russian.

The paper describes a procedure for aircraft remote sensing of moisture reserves in agricultural soil from microwave radiation. To compute reserves of productive and total moisture in a 1-m-thick surface layer, a two-parameter model of the moisture profile is proposed, based on the correlation between the moisture profile and the profile of the least field moisture capacity. As one of the parameters, the moisture of the layer 5-10 cm is used, determined from radiometric measurements at 18 cm wavelength. The second parameter is the gradient of the average profile of the least field moisture capacity of the given soil type. Experimental testing of the procedure in northern Kazakhstan is described. P.T.H.

RS77-3-272

A77-43804 * **Radar system specifications for hydrology and agriculture.** F. T. Ulaby, P. P. Batlivala, and T. F. Bush (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: Western Electronic Show and Convention, Los Angeles, Calif., September 14-17, 1976, Technical Papers. (A77-43801 20-33) North Hollywood, Calif., Western Periodicals Co., 1976, p. 4/3-1 to 4/3-12. 12 refs. Contracts No. NAS9-10261; No. NAS9-14052.

Using truck-mounted radar spectrometers, an experimental program was conducted from 1971 to 1976 to define radar system specifications for hydrological and agricultural applications. Data were acquired over the 1-18 GHz region, 0 deg (nadir) to 70 deg range and for all linear polarization combinations. The discussion here concerns radar parameters for crop classification and for soil moisture determination. B.J.

RS77-3-273

A77-34519 **An equation for potential evaporation from soil, water, and crop surfaces adaptable to use by remote sensing.** S. B. Idso, R. J. Reginato, and R. D. Jackson (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Geophysical Research Letters,* vol. 4, May 1977, p. 187, 188. 5 refs.

The paper examines a technique for estimating rates of daily evaporation from bare soils that appears readily adaptable to remote sensing. The technique requires knowledge of daily solar radiation, moist surface albedo, and maximum and minimum surface and air temperatures. New data is presented for four vegetative surfaces from three different locations and for a water surface that indicate that the technique may also apply to crop and water surfaces. B.J.

RS77-3-274

A77-36432 * **Soil spectra contributions to grass canopy spectral reflectance.** C. J. Tucker and L. D. Miller (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Photogrammetric Engineering and Remote Sensing,* vol. 43, June 1977, p. 721-726. 10 refs. NSF Grants No. GB-7824; No. GB-31862X; No. GB-31862X2; No. GB-41233X; No. BMS-73-02027A02.

The soil or background spectra contribution to grass canopy spectral reflectance for the 0.35 to 0.80 micron region was investigated using in situ collected spectral reflectance data. Regression analysis was used to estimate accurately the unexposed soil spectral reflectance and to quantify maxima and minima for soil-green vegetation reflection contrasts. (Author)

RS77-3-275

A77-35458 # **Atchafalaya wetlands mapping exercise.** W. T. Mealor, Jr. (Southern Mississippi, University, Hattiesburg, Miss.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Jan. 1977, p. 64-70.

An applications-oriented exercise using aircraft-generated color infrared photography is presented. Students apply knowledge of the edaphic and spectral characteristics of vegetation as surrogates to infer the dynamic ecological conditions in a wetlands area in the Atchafalaya River Basin. Four broadly-defined vegetation communities are used to identify areas of recently accreted land, relatively well-drained natural levees, and potential sites of increased land accretion. Surface turbidity features are also explored. Finished products are a map of vegetation and water turbidity and a land-type map. The amount of area in each classification is determined. C.K.D.

RS77-3-276

USEFULNESS OF LANDSAT DATA FOR MONITORING PLANT DEVELOPMENT AND RANGE CONDITIONS IN CALIFORNIA'S ANNUAL GRASSLAND,
Geological Survey, Sioux Falls, S. Dak. EROS Data Center.
D. M. Carneggie, S. D. DeGloria, and R. N. Colwell.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168, Symposium held June 9-12, 1975, Houston, Texas, p 19-41, September 1975. 5 fig, 10 ref, 3 plate.

Descriptors: *Range management, *Grasslands, *Remote sensing, *California, Monitoring, Ranges, Land use, Vegetation, Growth rates, Growth stages, Mapping, Forages, Plant growth, Data processing, Satellites(Artificial).
Identifiers: LANDSAT.

LANDSAT imagery and magnetic tapes were analyzed to determine their utility for monitoring and assessing range condition within the annual grassland in California. LANDSAT data, forage samples at selected range sites, and ground spectral reflectance data were all examined in order to verify the usefulness of LANDSAT imagery (1) for determining range condition and growth stage, and (2) for assessing relative forage production. The results of ground spectral reflectance data compared with green forage production data showed a close correspondence between spectral reflectance ratios and green biomass. Changes in ground spectral reflectance data also correspond with observed changes in growth stage and condition of the forage species. Moreover, LANDSAT spectral reflectance data provides quantitative signals of significant growth stages in the development of annual forage species. Relative differences in forage production are also indicated by the LANDSAT spectral radiance data. Provided that cloud-free LANDSAT coverage is available during critical growth stages of the annual plants, LANDSAT data can be used to: (1) assess differences in range condition on a regional basis; (2) compare differences in production between grazing regions for a given year; and (3) compare differences in condition and production for a given site between years. Moreover, the length of the green feed period can be determined; and this information, along with ground samples of forage production and climatic data, can provide the inputs to simple models for estimating forage production or for determining the remaining length of the green feed period beyond a definable threshold date late in the growth cycle of the annuals. (See also W77-08408) (Humphreys-ISWS)
W77-08411

RS77-3-277

REMOTE SENSING TECHNIQUES FOR PREDICTION OF WATERSHED RUNOFF,
Texas A and M Univ., College Station.
B. J. Blanchard.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2379-2406, September 1975. 5 fig, 1 tab, 5 ref.

Descriptors: *Remote sensing, *Runoff coefficient, *Watersheds(Basins), *Oklahoma, Runoff forecasting, Runoff, Land classification, Analytical techniques, Analysis, Aerial photography, Satellites(Artificial), Small watersheds, Agricultural watersheds.
Identifiers: *Chickasha(Okla), LANDSAT.

The advent of new remote sensing devices developed in the past decade offers the possibility that watershed characteristics, such as vegetative cover, soils, soil moisture, etc., may be quantified rapidly and economically. Experiments with visible and near infrared data from the LANDSAT-1 multispectral scanner have indicated that a simple technique for calibration of runoff equation coefficients is feasible. When tested on 10 watersheds in the Chickasha, Oklahoma area, the technique using LANDSAT data produced more accurate runoff coefficients than conventional methods. A similar approach was used to relate passive microwave antenna temperatures to runoff equation coefficients by using data from the Passive Microwave Imaging System mounted in the NASA P3A aircraft. Eight highly instrumented watersheds in the Chickasha study area were used. Study of these data and the data systems indicated that passive microwave antenna temperatures may be more effective throughout the year for calibration of watershed runoff coefficients than systems using visible and near infrared light. (See also W77-08062) (Humphreys-ISWS)
W77-08075

RS77-3-278

THE CORRELATION OF SKYLAB L-BAND BRIGHTNESS TEMPERATURES WITH ANTECEDENT PRECIPITATION,
Oklahoma Univ., Norman.
M. J. McFarland.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168, Symposium held June 9-12, 1975, Houston, Texas, p 2243-2252, September 1975. 5 fig, 21 ref. NAS 9-13360.

Descriptors: *Remote sensing, *Soil moisture, *Satellites(Artificial), Measurement, Evaluation, Microwaves, Radiation, Antecedent precipitation, Antecedent moisture content, Soil moisture, Moisture content.
Identifiers: Skylab.

The S194 L-band radiometer flown on the Skylab mission measured terrestrial radiation at the microwave wavelength of 21.4 cm. The terrain emissivity at this wavelength is strongly dependent on the soil moisture content, which can be inferred from antecedent precipitation. For the Skylab data acquisition pass from the Oklahoma panhandle to southeastern Texas on 11 June 1973, the S194 brightness temperatures were highly correlated with antecedent precipitation from the preceding eleven day period, but very little correlation was apparent for the preceding five day period. The correlation coefficient between the averaged antecedent precipitation index values and the corresponding S194 brightness temperatures between 230 K and 270 K, the region of apparent response to soil moisture in the data, was -0.97. The equation of the linear least squares line fitted to the data was: API (cm) = 31.99 - 0.114 T, where API is the antecedent precipitation index and T is the S194 brightness temperature. (See also W77-08062) (Humphreys-ISWS)
W77-08068

RS77-3-279

TIMBER TYPE SEPARABILITY IN SOUTHEASTERN UNITED STATES ON LANDSAT-1 MSS DATA,
Lockheed Electronics Co., Inc. Houston, Tex.
E. P. Kan, and R. D. Dillman.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 135-157, September 1975. 7 fig, 3 tab, 19 ref. NASA NAS 9-12200.

Descriptors: *Forest management, *Pulp and paper industry, *Remote sensing, *Southeast U.S., *Texas, Mapping, Lumber, Lumbering, Softwood, Hardwood, Classification, Data processing, Analytical techniques, Photogrammetry, Forestry, Forests, Land use, Industrial crops, Satellites(Artificial), Vegetation regrowth.
Identifiers: LANDSAT.

A quantitative, computer-aided study was made on the spectral separability of timber types and condition classes in the Southeastern United States, using LANDSAT-1 multispectral scanner data. Conclusions were obtained on accuracies at different levels of mapping detail and the choice of parameters affecting mapping accuracies, such as spectral bands, number of bands, and seasons of data. It was concluded that LANDSAT-1 could be used effectively to discriminate the gross forest features of softwood, hardwood, and regeneration. The only significant detectable age difference would be between an established forest and a young (or denuded) forest, i.e., regeneration. The red or near infrared bands would be better for discrimination; phenological early and late spring data would be better than winter (summer and autumn data were not available for analysis). A temporal analysis would be superior to single-season analysis. Lastly, two spectral bands would be most cost effective for computer analysis. The study site, Sam Houston National Forest of East Texas, is a typical forest in the Flatwoods Zone, Southern Region, U.S. Forest Service. The widely accepted computer scheme of training-field, maximum likelihood classifier was employed, while cross-classification accuracies and divergence measures were computed to evaluate timber type separability. (See also W77-08408) (Humphreys-ISWS)
W77-08418

RS77-3-280

CURRENT METHODS USED IN THE SOIL CONSERVATION SERVICE TO ESTIMATE SEDIMENT YIELD,
Soil Conservation Service, Fort Worth, Tex.
E. C. Nicholas.
Paper No. 76-2532, American Society of Agricultural Engineers 1976 Winter Meeting, Chicago, Illinois, December 14-17, 1976. 8 p, 2 fig, 7 ref.

Descriptors: *Sediment yield, *Sedimentation rates, *Soil conservation, *Estimating, Forecasting, Equations, Erosion, Soil erosion, Suspended load, Deposition(Sediments), Methodology, Reservoirs, Land management, Farm management, Aerial photography, Curves.
Identifiers: *Universal soil loss equation, Gross erosion, Sediment delivery ratio.

The four basic procedures currently used in the Soil Conservation Service to estimate sediment yield depending on the environment and available data are: (1) gross erosion and sediment delivery ratio estimates, (2) predictive equations, (3) suspended sediment load measurements, and (4) sediment accumulation measurements. For verification, it is desirable to use more than one method. (Visocky-ISWS)
W77-06657

RS77-3-281

ARE CLEAR-CUT AREAS ESTIMATED FROM LANDSAT IMAGERY RELIABLE,
Pacific Forest Research Centre, Victoria (British Columbia).
Y. J. Lee.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 105-114, September 1975. 7 fig, 1 tab, 3 ref.

Descriptors: *Clear-cutting, *Lumbering, *Canada, *Remote sensing, Forest management, Areal, Estimating, Data processing, Satellites(Artificial), Mapping, Surveys.
Identifiers: LANDSAT.

The reliability of LANDSAT imagery for estimation of clear-cut areas was evaluated by comparison with data obtained from high-altitude photos, logging historical maps, and from field inspections. A mature forest, owned by Pacific Logging Company, was selected as a test site because of its continuous clear-cut operation. The forest is about 50 km northwest of Victoria, British Columbia, Canada, and consists of 9092 ha. Ground truth was based on high-altitude photos and the Pacific Logging Company Logging History Map for 1973, with a scale of 1:63,360. LANDSAT imagery from band 5, recorded by multispectral scanner, was obtained on September 4, 1972 and on August 12, 1973. Areas clear-cut within the past year were overestimated by 12.9% (105 ha), those clear-cut 1-year or more by 2.2% (76 ha), whereas uncut mature timber was underestimated by 3.6% (176 ha). Three clear-cut areas were missed in the company map and two in the LANDSAT enhancement. The difference between area estimates was significant when all 26 areas were included, but not when 2 overestimated areas were excluded from the analysis. The ability to identify the status and to estimate the size of current and past clear-cutting activity has been definitely established. The acreages for clear-cut and uncut mature timber determined from LANDSAT imagery are reliable, and the LANDSAT color enhancement technique is a useful tool in up-dating clear-cut areas for long-term planning in forest management. (See also W77-08408) (Humphreys-ISWS)
W77-08416

RS77-3-282

MONITORING VEGETATION CONDITIONS FROM LANDSAT FOR USE IN RANGE MANAGEMENT,
Texas A and M Univ., College Station.
R. H. Haas, D. W. Deering, J. W. Rouse, Jr., and J. A. Schell.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 43-52, September 1975. 1 fig, 1 tab.

Descriptors: *Range management, *Remote sensing, *Vegetation, *Texas, *Great Plains, Monitoring, Growth stage, Forages, Plant growth, Analytical techniques, Mapping, Ranges, Satellites(Artificial), Statistics.
Identifiers: LANDSAT.

A summary of the LANDSAT Great Plains Corridor projects and the principal results were presented. Emphasis was given to the use of satellite acquired phenological data for range management and agri-business activities. A convenient method of reducing LANDSAT MSS data to provide quantitative estimates of green biomass on rangelands in the Great Plains was explained. A Transformed Vegetation Index (TVI6), which is useful for detection and quantitative assessment of green biomass differences, was developed. Detailed statistical analysis showed that the TVI6 parameter, along with limited weather data, is adequate to quantatively assess rangeland feed conditions. The ability to estimate green biomass in increments of 250 to 300 kg/ha with a 95% probability from TVI6 data and readily available weather data was indicated. (See also W77-08408) (Humphreys-ISWS)
W77-08412

RS77-3-283

OPERATIONAL CONSIDERATIONS FOR THE APPLICATION OF REMOTELY SENSED FOREST DATA FROM LANDSAT OR OTHER AIRBORNE PLATFORMS,
Saint Regis Paper Co., Jacksonville, Fla. Southern Timberlands Div.
G. R. Barker, and T. P. Fethe.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 115-133, September 1975, 6 fig, 2 tab, 10 ref.

Descriptors: *Forest management, *Pulp and paper industry, *Remote sensing, *Lumbering, *Southeast U.S., Mapping, Forests, Trees, Pine trees, On-site investigations, Analytical techniques, Data processing, Sampling, Surveys, Photogrammetry, Land use, Satellites(Artificial), Aerial photography.
Identifiers: LANDSAT.

The forest data base requirements necessary to manage efficiently a large, timber based forest industry of the 1970's have transcended by a considerable margin those data required two decades ago. These data demands have grown, both in quantitative terms and in the level of precision acceptable to successfully undertake the multiple decision making processes required. From the traditional generation of area/volume and frequency tables used in immediate planning for harvest and cultural activity, data are now subjected to the rigors of long-range planning manipulations, as these data represent the major input to such planning models. To be effective in such planning activity, the data must be provided in a timely manner. Concurrent with the increase in data demand and the speed of preparation, has been the ever increasing difficulty in securing and reducing these data within the timetables demanded. Remote sensing techniques at all levels seemed to offer the most promising prospect in satisfying the data requirements and in alleviating the difficult task of collecting the data. After a thorough review of the technology of remote sensing and the state of the art of interpretation, it was realized that the best hope for a practical, implementable scheme was to approach the problem in three phases, all interrelated, but independent enough to allow for the progressive modular development of a multilevel sampling system. At each stage, operational feasibility will be evaluated so that necessary revisions can be integrated into the system as needed. (See also W77-08408) (Humphreys-ISWS)
W77-08417

RS77-3-284

HYDROLOGIC LAND USE CLASSIFICATION OF THE PATUXENT RIVER WATERSHED USING REMOTELY SENSED DATA,
General Electric Co., Beltsville, Md.
W. C. Dallam, A. Rango, and L. Shima.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2351-2364, September 1975. 7 fig, 1 tab, 7 ref.

Descriptors: *Land use, *Remote sensing, *Hydrologic aspects, *Maryland, *Watersheds(Basins), Aerial photography, Surveys, *Classification, Analytical techniques, *Land classification, Forests, Surface waters, Wetlands, Pastures, Urban mapping, Evaluation, Flood plains.
Identifiers: *Patuxent River, LANDSAT, Multispectral analysis.

The Patuxent River Watershed, located in central Maryland between Baltimore and Washington, D.C. is approximately 2330 sq kn in area and 175 km long. This region is not at a critical point because of concerns such as water management and quality, flooding, and land use within the watershed. Data from the NASA-directed LANDSAT and Earth Resources Aircraft Programs have been used to provide a new dimension in information collection and processing for the management of watersheds. Digital data from LANDSAT-1, ID number 1260-15201, were analyzed along with selected IR photography from U-2 flight number 74-060B taken 28 April 1974, which was digitized in three channels. Processing of the data was accomplished using a multispectral analysis system. Land use themes consisting of surface water, wetlands, forest, residential, cropland/pasture, urban, and extractive were developed and delineated through the watershed. Area measurements of watershed themes were obtained and will serves as a calibration input to a deterministic hydrologic model on a sub-watershed. Using the derived residential and urban theme areas from LANDSAT, an estimated basin imperviousness was also calculated. Thematic maps were produced at 1:62,500 scale. Floodprone areas were also classified and delineated at a scale of 1:24,000. Comparison with standard floodprone area maps at the same scale has indicated a few areas of discrepancy. Such information can be used for updating or checking floodprone area boundaries as well as monitoring changes in floodplain areas. This cooperative study has provided participating state and local agencies with remote sensing information as applied to hydrologic problems and has resulted in a technology exchange. (See also W77-08062) (Humphreys-ISWS)
W77-08073

RS77-3-285

DELINEATION OF DECIDUOUS WETLAND FORESTS IN NORTHEASTERN CONNECTICUT,
Connecticut Univ., Storrs. Inst. of Water Resources.
P. H. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 662, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, 1977. 123 p, 19 fig, 15 tab, 7 append, 86 ref. OWRT A-058-CONN(1), 14-31-0001-4007.

Descriptors: *Wetlands, *Freshwater, *Boundaries, *Soil types, *Soil water, *Remote sensing, *On-site investigations, Plant populations, Topography, *Connecticut, *Forests.
Identifiers: *Inland wetland identification, *Delineation methodology, *False color infrared imagery, *Biological-physical gradients, *Wetland-upland transition, Zones, Deciduous wetland forests, Index of abundance, Ground truth, Soil pH, Crown cover.

Inland wetlands in Connecticut, presently defined by soil type, are delineated according to the National Cooperative Soils Survey of the U.S.D.A. Soil Conservation Service, a method which can produce many discrepancies in the location of inland wetland boundaries. This study examining alternate delineation methods, was designed to (1) investigate vegetation distribution and selected physical and chemical properties of wetland soils and bordering uplands and the interface between the two, and (2) provide the ground truth necessary for the identification and delineation of deciduous wetland forests using false color infrared (FCIR) imagery. In study sites located within the Town of Mansfield, Connecticut, line transects were laid out across wetland to upland transition zones, with plant species and layers identified, their positions recorded, and crown cover determined. Discriminant analysis applied to abundance data showed which members of plant species best separate wetlands from uplands and which were representative of natural plant associations. Results from the soil studies reveal that the wetland soil to upland soil gradient changes significantly in soil pH and in soil water content. Soil water and topographic position govern plant distribution along these gradients, accounting for the distinct separation of wetland and upland plant associations. Of the criteria studied, vegetation distribution and crown cover, soil water content, and relief are the most useful for delineating deciduous wetland forests and are valuable in using remote sensing imagery. (de Lara-Connecticut)
W77-08194

RS77-3-286

THE RATIONALE FOR ATTEMPTING TO DEFINE SALT MARSH MOSQUITO-BREEDING AREAS IN GALVESTON COUNTY BY REMOTE SENSING THE ASSOCIATED VEGETATION.

Lockheed Electronics Co., Houston, Tex.
G. K. Arp.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 289-299, September 1975. 2 tab, 23 ref.

Descriptors: *Salt marshes, *Insect control, *Mosquitos, *Remote sensing, *Texas, Mapping, Environment, Grasses, Vegetation, Marsh plants, Aerial photography, Entomology, Surveys, Wetlands, Aquatic plants.
Identifiers: *Galveston County(Tex).

This paper concerned the rationale for attempting to define salt marsh mosquito breeding areas in Galveston County, Texas. It concluded a botanical survey of the marsh plant communities, their relationship to flooding, and their exposure to salt water. Particular emphasis was given to Distichilis spicata, a widespread marsh grass. Evidence suggests that breeding areas of Aedes sollicitans, salt marsh mosquitos, are associated with Distichlis, and that both species respond to similar ecological conditions in the salt marsh. Analysis of the Galveston salt marsh community revealed five major plant associations, ranging from sea level to 91 cm (3 ft) in elevation. The associations are Spartina alterniflora, Distichlis spicata, Spartina patens, salt flats, and Spartina spartinae. From aircraft overflights at various altitudes, characteristics that identify Distichlis spicata and Spartina patens were defined. These characteristics may be used in identifying the associated mosquito-breeding areas either visually or by remote sensing. (See also W77-08408) (Humphreys-ISWS)
W77-08428

RS77-3-287

COMPUTER ANALYSIS AND MAPPING OF GYPSY MOTH DEFOLIATION LEVELS IN PENNSYLVANIA USING LANDSAT-1 DIGITAL DATA.

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

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 167-181, September 1975. 3 fig, 1 tab, 22 ref.

Descriptors: *Forest management, *Pennsylvania, *Mapping, *Remote sensing, Insects, Data processing, Surveys, Forests, Entomology, Spatial distribution, Satellites(Artificial), Foliar, Leaves.
Identifiers: *Defoliation, LANDSAT, *Gypsy moths defoliation.

The purpose of this study was to investigate the effectiveness of using LANDSAT-1 multispectral digital data and imagery, supplemented by ground truth and aerial photography, as a new method of surveying gypsy moth (Porthetria dispar (L.) (Lepidoptera; Lymantriidae) defoliation, which has greatly increased in Pennsylvania in recent years. Since the acreage and severity of gypsy moth defoliation reaches a peak from mid-June through the first few days of July, the July 8, 1973, LANDSAT-1 scene was chosen for analysis. Results indicated that LANDSAT-1 data can be used to discriminate between defoliated and healthy vegetation in Pennsylvania, and that digital processing methods can be used to map the extent and degree of defoliation. (See also W77-08408) (Humphreys-ISWS)
W77-08420

RS77-3-288

MAPPING OF THE WILDLAND FUEL CHARACTERISTICS OF THE SANTA MONICA MOUNTAINS OF SOUTHERN CALIFORNIA.

ESL, Inc., Sunnyvale, Calif. Earth Resources Technology Applications.
J. D. Nichols.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 159-166, September 1975. 3 tab.

Descriptors: *Forest management, *California, *Remote sensing, *Forest fires, *Mapping, Analytical techniques, Analysis, Satellites(Artificial), Data processing, Trees, Grasses, Brush, Fuels, Vegetation, Classification.
Identifiers: LANDSAT, *Wildland fuels.

LANDSAT digital MSS data were successfully used to map and evaluate the wildland fuels of the Santa Monica Mountains in Southern California. A mixed classification scheme was used where training areas of known vegetation types were entered, and the maximum likelihood classifier run, followed by an evaluation of the results and an unsupervised retraining of the classifier using an image of the probability of misclassification. Estimation of maturity class and crown closure percents of the major cover types were assigned to each computer class by associating the photo interpretation of 159 large-scale photo samples, with the resultant computer classes using analysis of variance and analysis of categorized data. The result of the computer classification and statistical analysis was then transformed from the LANDSAT Coordinate California State Plane Coordinate system for use in a digital format in the FIRESCOPE data retrieval and fire modeling system. (See also W77-08408) (Humphreys-ISWS)
W77-08419

RS77-3-289

COMPUTER IMPLEMENTED CLASSIFICATION OF VEGETATION USING AIRCRAFT ACQUIRED MULTISPECTRAL SCANNER DATA.

National Aeronautics and Space Administration, Bay Saint Louis, Miss. Earth Resources Lab.
W. G. Cibula.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 183-201, September 1975. 11 fig, 3 tab, 8 ref.

Descriptors: *Forest management, *Remote sensing, *Mapping, *Mississippi, Aerial photography, Forests, Vegetation, Spatial distribution, Land use, Plant groupings, Classification, Trees, Canopy, Analytical techniques, Training.

The use of aircraft 24-channel multispectral scanner data in conjunction with computer processing techniques to obtain an automated classification of plant species associations was discussed. The classification of various plant species associations was related to information needed for specific applications. In addition, the necessity of multiple selection of training fields for a single class in situations where the study area consists of highly irregular terrain was detailed. It was mentioned that a single classification will be illuminated differently in different areas, resulting in the existence of multiple spectral signatures for a given class. These different signatures result because different qualities of radiation upwell to the detector from portions that have differing qualities of incident radiation. Techniques of training field selection were outlined, and a classification obtained from a natural area in Tishomingo State Park in north Mississippi was presented. (See also W77-08408) (Humphreys-ISWS)
W77-08421

RS77-3-290

PRACTICAL APPLICATION OF REMOTE SENSING IN AGRICULTURE.
Anderson, Clayton and Co., Houston, Tex.
R. A. Phelps.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 239-242, September 1975. 10 ref.

Descriptors: *Remote sensing, *Agriculture, *Mapping, *Crops, *Arizona, Cotton, Aerial photography, Farm management, Vegetation, Spatial distribution, Molds, Satellites(Artificial).
Identifiers: LANDSAT.

During the past few years, Anderson, Clayton and Company has utilized in their remote sensing program imagery from several types of platforms from light aircraft to the LANDSAT (ERTS) satellites. Inexpensive imagery was preferred over expensive magnetic tapes. Emphasis was on practical application of remote sensing data to increase crop yield by decreasing plant stress, disease, weeds, and undesirable insects, and by improving irrigation. Imagery obtained from low altitudes via aircraft provided the necessary resolution and complements but did not replace data from high altitude aircraft, Gemini and Apollo spacecraft, Skylab space station, and LANDSAT satellites. Federal government centers are now able to supply imagery within about thirty days from date of order and deserve to be commended. Nevertheless, if the full potential of space imagery in practical agricultural operations is to be realized, the time span from date of imaging to user application needs to be shortened from the current several months to not more than two weeks. (See also W77-08408) (Humphreys-ISWS)
W77-08425

RS77-3-291

PROCEEDINGS OF THE NASA EARTH RESOURCES SURVEY SYMPOSIUM, JUNE 1975, VOLUME I-A, TECHNICAL SESSION PRESENTATIONS, AGRICULTURE-ENVIRONMENT.
National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.
Available from the National Technical Information Service, Springfeild, VA 22161 as N76-17588, Price codes: A23 in paper copy, A01 in microfiche. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, September 1975 (3 Vol.). 595 p. Smistad, O., Coordinator.

Descriptors: *Conferences, *Remote sensing, *Agriculture, *Environment, Satellites(Artificial), Land use, Water quality, Mapping, Range management, Land management, Marshes, Wetlands, Data processing, Monitoring, Forests, Vegetation, Revegetation, Resources, Land resources.
Identifiers: *LANDSAT, Skylab.

The reported symposium combined with utilization and results of data from NASA programs involving LANDSAT, the Skylab Earth resources experiment package, and aircraft, as well as information from other data acquisition programs. The primary emphasis was on the practical applications of Earth resources survey technology, which is of interest to a large number of potential users. Also featured were scientific and technological exploration and research investigations with potential promising applications. Technical sessions were structured to provide governmental and private organizations with a comprehensive picture of various applications in the management and implementation of remote-sensing data use in their own programs. Volume I-A contained technical papers related to agriculture and environment. (See W77-08409 thru W77-08438) (Humphreys-ISWS)
W77-08408

RS77-3-292

AN EVALUATION OF TOTAL SOLAR REFLECTANCE AND SPECTRAL BAND RATIOING TECHNIQUES FOR ESTIMATING SOIL WATER CONTENT.
Agricultural Research Service, Phoenix, Ariz. *Water Conservation Lab.*
R. J. Reginato, J. F. Vedder, S. B. Idso, R. D. Jackson, and M. B. Blanchard.
Journal of Geophysical Research, Vol. 82, No. 15, p 2101-2104, May 20, 1977. 5 fig, 12 ref.

Descriptors: *Remote sensing, *Soil moisture, *Solar radiation, *Arizona, Reflectance, Soils, Irrigation, *Moisture content, *Soil water, Microwaves, Radiation, Infrared radiation, Measurement, Drying, Soil science, Estimating, Evaluation.
Identifiers: Pyranometers, Multispectral scanners.

For several days in March of 1975, reflected solar radiation measurements were obtained from smooth and rough surfaces of wet, drying, and continually dry Avondale loam at Phoenix, Arizona, with pyranometers located 50 cm above the ground surface and a multispectral scanner flown at a 300-m height. The simple summation of the different band radiances measured by the multispectral scanner proved to be as good as the pyranometer data for estimating surface soil water content if the multispectral scanner data were standardized with respect to the intensity of incoming solar radiation or the reflected radiance from a reference surface, such as the continually dry soil. Without this means of standardization, multispectral scanner data are most useful in a spectral band ratioing context. The results indicated that, for the bands used, no significant information on soil water content could be obtained by band ratioing. Thus the variability in soil water content should insignificantly affect soil-type discrimination based on identification of type-specific spectral signatures. Therefore, remote sensing, conducted in the 0.4-to 1.0 micrometer wavelength region of the solar spectrum, would seem to be much more suited to identifying crop and soil types than to estimating of soil water content. (Sims-ISWS)
W77-09957

RS77-3-293

AGRICULTURAL APPLICATIONS OF REMOTE SENSING--A TRUE LIFE ADVENTURE.
General Electric Co., Beltsville, Md.
E. S. Schaller.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 233-238, September 1975.

Descriptors: *Remote sensing, *Agriculture, *Mapping, *California, Crops, Spatial distribution, Classification, Census, Vegetation, Farm management, Cotton, Aerial photography, Satellites(Artificial).
Identifiers: *San Joaquin Valley(Calif), LANDSAT.

In mid-1973, General Electric undertook a study of agricultural applications of remote sensing with a major agricultural firm. The study continued for eighteen months and covered the areas of crop monitoring and management as well as large-scale crop inventories. Pilot programs in the application of aircraft remote sensing and LANDSAT data were conducted. An operational aircraft survey program for ranch management has subsequently been implemented by the agricultural firm. LANDSAT data were successfully used to produce a 97% accurate inventory of cotton over 4.8 million acres of California's San Joaquin Valley. (See also W77-08408) (Humphreys-ISWS)
W77-08424

RS77-3-294

SOIL MOISTURE DETECTION FROM SKYLAB,
Kansas Univ., Lawrence.
J. R. Eagleman, and W. C. Lin.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2233-2241, September 1975. 8 fig, 5 ref.

Descriptors: *Remote sensing, *Soil moisture, *Satellites(Artificial), Measurement, Evaluation, Aerial photography, Microwaves, On-site investigations, Basic data collections, Surveys, Moisture content.
Identifiers: Skylab, Nimbus-5.

An investigation was designed for the Skylab satellite to determine the feasibility of remote sensing of the soil moisture content of the surface from various microwave sensors. Skylab data for the experiment were collected during passes 5, 10, 16, and 38 across the two test sites selected in eastern Kansas and western Texas. Pass 38 covered both test sites, giving five data sets for the analysis. As Skylab data were being taken, the moisture content of the soil was sampled by ground crews for each 2.5 centimeter depth from the surface to 15 centimeters at interval of about 6 kilometers along two different routes in the test sites. Skylab data were collected by passive microwave radiometers at wavelengths of 2.1 and 21 cm by the S193 and S194 microwave sensors. An active microwave system also collected scatterometer data at a wavelength of 2.1 cm. Aircraft underflights and a Nimbus-5 satellite provided additional data from microwave sensors corresponding to the Skylab passes. The analysis of microwave data revealed that the longer wavelength L-Band passive radiometer gave the best correlation with soil moisture content of the upper 2.5 cm depth of soil. These correlations were quite good and were apparently influenced very little by other factors such as terrain, vegetation, and cloud cover, with the only major disadvantage of the L-Band radiometer being the size of the resolution cell. The shorter wavelength radiometers were influenced more by cloud cover and vegetation, but they did have the advantage of a smaller size of resolution cell. The relationship between the soil moisture content and the radiometric antenna temperature was used to calculate soil moisture levels from satellite altitudes with several applications suggested by this capability. (See also W77-08062) (Humphreys-ISWS)
W77-08067

RS77-3-295

EVALUATION OF THERMAL X/5-DETECTOR SKYLAB S-192 DATA FOR ESTIMATING EVAPOTRANSPIRATION AND THERMAL PROPERTIES OF SOILS FOR IRRIGATION MANAGEMENT,
South Dakota State Univ., Brookings. Remote Sensing Institute.
D. G. Moore, M. L. Horton, M. J. Russell, and V. I. Myers.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2561-2583, September 1975. 7 fig, 5 tab, 14 ref. NASA NAS 9-13337.
Descriptors: *Evapotranspiration, *Remote sensing, *Data processing, *Texas, Data collections, Evaluation, Analysis, Land use, Irrigated land, Soil moisture, Soil temperature, Management, Energy budget, Satellites(Artificial), Aerial photography.
Identifiers: Skylab.

An energy budget approach to evaluating the SKYLAB X/5-detector S-192 data for prediction of soil moisture and evapotranspiration rate was pursued. A test site which included both irrigated and dryland agriculture in Southern Texas was selected for the SL-4 SKYLAB mission. Both vegetated and fallow fields were included. Data for a multistage analysis, including ground, NC-130B aircraft, RB-57F aircraft, and SKYLAB altitudes, were collected. Ground data were used to characterize energy budgets and to evaluate the utility of an energy budget approach for determining soil moisture differences among twelve specific agricultural fields. It was concluded that: (1) Wavelengths greater than 1.5 micrometers were required to spectrally distinguish between wet and dry fallow surfaces. (2) The thermal data provided a better estimate of soil moisture than did the reflective bands. (3) Thermal data was dependent on soil moisture, but not on the type of agricultural land use. (4) The emittance map, when used in conjunction with existing models, did provide an estimate of evapotranspiration rates. (5) Surveys of high soil moisture areas can be accomplished with space-altitude thermal data. If both soil moisture and land use are to be surveyed, at least one reflective channel must be included in the analysis. (6) Thermal data will provide a reliable input into irrigation scheduling. (7) The thermal and spatial resolution of the S-192 X/5 detector SKYLAB data is appropriate for monitoring soil moisture and for irrigation scheduling. (8) The time of data collection for soil moisture surveys should be close to midday. (See also W77-08062) (Humphreys-ISWS)
W77-08079

RS77-3-296

THE USE OF SKYLAB DATA TO STUDY THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY AND DISTRIBUTION OF HOST PLANTS,
Agricultural Research Service, Weslaco, Tex. Southern Region Citrus Insects Research.
W. G. Hart, S. J. Ingle, and M. R. Davis.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 203-219, September 1975. 8 fig, 5 ref.

Descriptors: *Vegetation, *Plant groupings, *Texas, *Remote sensing, Insects, Infection, Classification, Spatial distribution, Citrus fruits, Satellites(Artificial), Aerial photography, Instrumentation, Agriculture, Mapping, Photography.
Identifiers: *Insect infestations, *Host plants, Skylab.

A study of the detection of insect infestations and the density and distribution of host plants was undertaken, using Skylab data, aerial photography, and ground truth, simultaneously. Additional ground truth and aerial photography was acquired between Skylab passes. For the evaluation of S-190B data, two 100 square-mile areas within the task site were selected. Area 1, of high density citrus, was located northwest of Mission, Texas. Area 2, located 20 miles north of Weslaco, Texas, contained different varieties of citrus, winter vegetables, sugarcane, irrigated pastures, and brush-covered land. Skylab S-190A data was also evaluated for similar information over the entire Rio Grande Valley and adjacent areas of Mexico. Satellite data such as that obtained from Skylab S-190B offers promise for detection of some insect pests and the distribution of host plants of various insect pests. With comparative observations of film types and seasonal influences on reflectance characteristics, many crop varieties can be identified with Skylab S-190B data. Vegetative patterns in border areas can be detected with Skylab S-190A and S-190B data. This information can be useful in detection avenues of entry of pest species and areas of stress that require greater vigilance in stopping the spread of destructive species. The influence of some environmental factors on crops thay may be confused with pest injury or related factors can be detected and identified with Skylab S-190B data. (See also W77-08408) (Humphreys-ISWS)
W77-08422

RS77-3-297

A STUDY OF THE UTILIZATION OF EREP DATA FROM THE WABASH RIVER BASIN,
Purdue Univ., Lafayette, Ind. Lab for Applications of Remote Sensing.
L. F. Silva.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-19508, Price codes: A08 in paper copy, A01 in microfiche. Final Report, Project SR397, 1976. 143 p, 48 fig, 53 tab, 28 ref, 1 append. NASA NAS9-13301, NASA NGL15-005-112.

Descriptors: *Remote sensing, *Satellites(Artificial), *Instrumentation, *Indiana, Vegetation, Crops, Forests, *Land use, Water resources, Cities, Urbanization, Atmosphere, Classification, Soil classification, Analytical techniques, Radiation, Photography.
Identifiers: *Skylab, *LANDSAT, *Wabash River Basin(Ind).

Data from the Earth Resource Experiment Package (EREP) on Skylab were used to study the utilization of these data in the Wabash River Basin. The study of the spacecraft multispectral data sets indicated that better land use delineation using machine processing techniques can be obtained with data from multispectral scanners than digitized S190A photographic sensor data. Better results were obtained for both a late spring scene and, to a much more significant degree, a winter scene. Comparable results were obtained from the LANDSAT 1 and Skylab S192 scanners for the late spring scene even though the S192 scanner contained channels with a broader spectral range and smaller spectral resolutions. The results of the multi-emulsion photographic data set were a little better than the multiband photographic data set. The results of the comparison of the interim and filtered S192 data indicated that the data were improved some for machine processing techniques. It is questionable, however, whether the improvement obtained was worth the time and resources spent in the filtering effort. The results of the S192 X-5 detector array studies over a wintertime scene indicated that a good quality far infrared channel can be very useful. The results of the S191 spectroradiometer study indicated that the data from the S191 was usable, and it was possible to estimate the path radiance. The results of the channel significance study indicated that channel 11, a middle infrared band, was very useful in all three data sets. Based on these studies, it was recommended that future space earth resource systems include multispectral scanners which contain channels in the middle infrared and the far infrared in addition to channels in the visible and near infrared. (Sims-ISWS)
W77-06670

RS77-3-298

MICROWAVE REMOTE SENSING OF SOIL MOISTURE,
Kansas Univ., Lawrence.
F. T. Ulaby, P. P. Batlivala, J. Cihlar, and T. Schmugge.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2207-2232, September 1975. 24 fig, 12 ref.

Descriptors: *Remote sensing, *Soil moisture, *Vegetation effects, *Kansas, *California, Moisture content, Soil temperature, Aerial photography, Evaluation, Measurement, Satellites(Artificial), Corn(Field), Soybeans, Microwaves, Radiation.
Identifiers: Nimbus-5.

Plant growth, partitioning of rainfall into surface runoff and infiltration components, and evaporation loss to the atmosphere, among other processes, all depend on the amount of water present in the soil. This paper examined the potential application of microwave remote sensing devices in estimating soil moisture content over extended areas. Experimental measurements involving both active and passive microwave sensors acquired from a variety of platforms were presented. Evaluation of the total available experimental data acquired by microwave sensors from ground-based, airborne, and spaceborne platforms revealed that, under the majority of surface cover conditions, microwave sensors are capable of detecting soil moisture variations. The accuracy associated with a quantitative determination of moisture content is, however, subject to the choice of sensor parameters (frequency, incidence angle, and polarization) and to ground conditions (surface roughness, vegetation cover, and soil temperature). It was concluded that continued work towards an operational satellite soil moisture mapping system involves the establishment of optimum sensor (active and passive)/sensor parameter combination(s) and testing over a wide range of terrain characteristics. (See also W77-08062) (Humphreys-ISWS)
W77-08066

RS77-3-299

ESTIMATING VEGETATIVE BIOMASS FROM LANDSAT-1 IMAGERY FOR RANGE MANAGEMENT,
Nebraska Univ., Lincoln. Conservation Survey Div.
P. M. Seevers, J. V. Drew, and M. P. Carlson.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 1-8, September 1975. 1 fig, 2 tab, 6 ref.

Descriptors: *Estimating, *Range management, *Nebraska, *Remote sensing, *Vegetation regrowth, Vegetation, Agriculture, Measurement, *Biomass, Management, Land use, Mapping, Vegetation establishment, Data processing, Ranges, Grasses, Range grasses, Satellites(Artificial).
Identifiers: *LANDSAT.

Evaluation of LANDSAT-1, band 5 data for use in estimation of vegetative biomass for range management decisions was carried out for five selected range sites in the Sandhills region of Nebraska. Analysis of sets of optical density-vegetative biomass data indicated that comparisons of biomass estimation could be made within one frame, but not between frames without correction factors. There was high correlation among sites within sets of radiance value-vegetative biomass data and also between sets, indicating that comparisons of biomass could be made within one frame, but not between frames without correction factors. There was high correlation among sites within sets of radiance value-vegetative biomass data and also between sets, indicating that comparisons of biomass could be made within and between frames. LANDSAT-1 data were shown to be a viable alternative to currently used methods of determining vegetative biomass production and stocking rate recommendations for Sandhills rangeland. To be of maximum benefit, however, LANDSAT data must be available to decision makers within seven to ten days after acquisition. (See also W77-08408) (Humphreys-ISWS)
W77-08409

RS77-3-300

WILDLIFE MANAGEMENT BY HABITAT UNITS--A PRELIMINARY PLAN OF ACTION,
C. D. Frentress, and R. G. Frye.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 245-262, September 1975. 4 fig, 34 ref, 2 append.

Descriptors: Wildlife habitats, *Remote sensing, *Texas, *Land use, Mapping, Vegetation, Trees, Classification, Management, Wildlife management, Environment, Maps, Spatial distribution, Oak trees, Juniper trees, Aerial photography, Satellites(Artificial), Analytical techniques.
Identifiers: *Travis County(Tex), LANDSAT.

The Texas Parks and Wildlife Department recognizes the need for managing populations of wildlife species by defined area units. A data stratification scheme is required to investigate species populations for the purpose of identifying unit boundaries. Vegetation type maps are commonly used to stratify data collection points and, subsequently to delineate boundaries of homogeneous populations. Procedures for yielding vegetation type maps were developed, using LANDSAT data and a computer assisted classification analysis (LARSYS) developed by Purdue University. Ground cover in Travis County, Texas, was classified on two occasions, using a modified version of the unsupervised approach to classification. The first classification produced a total of 17 classes. Examination revealed that further grouping was justified. A second analysis produced 10 classes which were displayed on printouts which were later colorcoded. The final classification was 82% accurate. While the classification map appeared to satisfactorily depict the existing vegetation, two classes were determined to contain significant error. A review of the procedures indicated that the major sources of error could have been eliminated by stratifying cluster sites more closely among previously mapped soil associations that are identified with particular plant associations. This could have served as a safeguard to prevent overlooking a vegetational class. (See also W77-08408) (Humphreys-ISWS)
W77-08426

RS77-3-301

UTILIZATION OF LANDSAT IMAGERY FOR MAPPING VEGETATION ON THE MILLIONTH SCALE,
Kansas Univ., Lawrence, Space Technology Labs.
D. L. Williams, and J. C. Coiner.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 53-65, September 1975. 4 fig, 14 ref. NASA NGL 17-004-024.

Descriptors: *Mapping, *Vegetation, *Remote sensing, *Natural resources, Land use, Areal, Satellites(Artificial), Distribution patterns, Forests, Classification, Surveys.
Identifiers: *LANDSAT, *Unesco, Physiognomic.

The United Nations Education, Scientific and Cultural Organization (UNESCO) has recently published a vegetation classification system. This system, based on the physiognomy of the vegetation, is designed to provide a comprehensive framework for the preparation of vegetation maps of any part of the world at scales of 1:1,000,000 or less. The utility of the system lies in the fact that optimal agricultural land uses are always related to the natural vegetation. The system is designed for use with maps covering large areas. The large map area, however, poses a severe problem in uniform data collection, especially if large-scale imagery is employed as a mapping base. Since LANDSAT images have a basic utilization scale of 1:1,000,000, identical to that of the projected maps, they would serve as a uniform base for all parts of the world if they contained the information necessary to delimit vegetation formations. To determine if the information content of the imagery is sufficient to permit mapping according to the Unesco classification, a series of test sites was examined. These sites included examples from the humid tropics, arid and semi-arid subtropics, and temperate zones. In every case, the feasibility of this application of LANDSAT imagery was verified. The imagery may, therefore, be used as a mapping base for the preparation of vegetation maps on the millionth scale. (See also W77-08408) (Humphreys-ISWS)
W77-08413

RS77-3-302

LANDSAT-1 DATA, ITS USE IN A SOIL SURVEY PROGRAM,
South Dakota State Univ., Brookings. Dept. of Plant Science; and South Dakota State Univ., Brookings. Remote Sensing Inst.
F. C. Westin, and C. J. Frazee.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 67-95, September 1975. 16 fig, 2 tab, 6 ref. NASA 5-21774, NASA 42-003-007.

Descriptors: *Soil surveys, *South Dakota, *Mapping, *Remote sensing, Soils, Maps, Surveys, Soil relief, Soil texture, Land use, Data processing, Satellites(Artificial), Analysis, Analytical techniques, Synoptic analysis, Distribution patterns, Soil types.
Identifiers: LANDSAT, Thematic soil maps.

The three objectives for this study were: (1) to investigate the unique characteristics of LANDSAT imagery as they aid in recognizing soil survey boundaries; (2) to explore the use of LANDSAT imagery for low intensity soil surveys; and (3) to investigate LANDSAT imagery as a base map for publishing thematic soil maps. Using many of the characteristics of LANDSAT imagery, a low intensity soil survey of Pennington County, South Dakota, was completed in 1974. LANDSAT-1 color composite transparencies, single band transparencies, and enlargement prints were interpreted to produce a soilscape map for 400,000 hectares. Areas of similar photographic characteristics were delineated on mylar over a color composite using a light table and a three-power magnifying glass. The field checking was done by a resource team of soil, geology, and range science specialists. The color composite transparency was adequate for locating most of the boundaries between soilscape areas. The soilscape map was interpreted to give general guidelines for land evaluation. It was concluded that a LANDSAT photographic background for soil-related information greatly enhances its use since much can be deduced about hydrology and land use. (See also W77-08408) (Humphreys-ISWS)
W77-08414

RS77-3-303

DISCRIMINATING COASTAL RANGELAND PRODUCTION AND IMPROVEMENTS WITH COMPUTER AIDED TECHNIQUES.
Lockheed Electronics Co., Inc., Houston, Tex. Aerospace Systems Div.
C. A. Reeves, and D. P. Faulkner.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 9-17, September 1975. 4 fig, 4 ref.

Descriptors: *Range management, *Remote sensing, *Texas, *Coasts, Coastal marshes, Land use, Vegetation, Classification, Data processing, Satellites(Artificial), Ranges, Mapping, Measurement, Computers.
Identifiers: LANDSAT.

This study successfully demonstrated that broad rangeland types can be accurately separated to acceptable levels on LANDSAT bulk data with a computer aided classification procedure. Although this was a pilot study, the output classification could be used by land managers as an input to their rangeland inventory. It was also determined that this first step just 'scratched the surface' in extracting inventory information. A second step to further refine the classification is needed to differentiate improved pastures from the native rangelands. A third step would be to monitor changes as native rangelands are converted to improved pastures and as climatic or seasonal aspects influence these lands. These steps are necessary for the development of a dynamic model based on inputs from remotely sensed data and to predict variations in carrying capacity of rangelands as affected by seasonal variations and range improvement practices. This model could take advantage of the unique multispectral and repeat coverage characteristics of the LANDSAT type satellites. The product of this model have the potential of aiding the range manager to become a more efficient and more accurate decision maker at lower cost. (See also W77-08408) (Humphreys-ISWS)
W77-08410

RS77-3-304

SATELLITE MICROWAVE OBSERVATIONS OF SOIL MOISTURE VARIATIONS.
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
T. J. Schmugge, J. M. Meneely, A. Rango, and R. Neff.
Water Resources Bulletin, Vol. 13, No. 2, p 265-281, April 1977. 11 fig, 1 tab, 7 ref.

Descriptors: *Remote sensing, *Soil moisture, *Central U.S., Soils, Vegetation, Vegetation effects, Satellites(Artificial), Aircraft, Microwaves, Rainfall, Antecedent precipitation, Precipitation(Atmospheric), Soil water, Crops, Soil moisture meters, Measurement, Monitoring, Water resources, Agriculture.
Identifiers: *Microwave radiometers.

Results from studies in the Illinois-Indiana and Texas-Oklahoma areas indicated that satellite microwave observations at the 1.55 cm wavelength are responsive to relative moisture variations in the near surface layer of the soil. Because significant vegetation cover absorbs the 1.55 cm microwave emission from the soil, the target area must be predominately bare soil or low density vegetation cover for meaningful measurements to result. The 25 km resolution of the satellite sensor limits application of the microwave techniques to large areas such as watersheds or agricultural districts rather than individual fields. In general, at 1.55 cm, there is an inverse relationship between microwave brightness temperature and changes in soil moisture levels (as indicated by antecedent rainfall) in agricultural regions before planting of crops or during the early growing season when vegetation cover is sparse. Even early season observations should be of great value in deciding on the time and type of crop planting and for initial irrigation scheduling when the root zone is still in close proximity to the surface. (Sims-ISWS)
W77-09335

RS77-3-305

AD-A039 994/9GA PC A02/MF A01
Illinois Univ At Urbana-Champaign
Automatic Soil Identification from Remote Sensing Data.
Kam W. Wong, T. H. Thornburn, and M. A. Khoury. 1976, 9p ARO-11597.1-GS
Grant DAAG29-74-G-0135
Availability: Pub. in Photogrammetric Engineering and Remote Sensing, v43 n1 p73-80 Jan 77.

Descriptors: *Soil classification, Remote detectors, Digital systems, Erosion, Statistical analysis, Identification, Reprints.
Identifiers: Remote sensing.

A reliable method of automatic soil identification can be developed by the combined application of remote sensing and digital terrain data. Research results have demonstrated that small differences in soil types can be distinguished by the use of quantitative terrain factors which are computed from digital terrain data. Continuing research effort is directed towards the improvement of the terrain factors, the development of statistical prediction techniques, and testing the effectiveness of these factors in the identification of soils. (Author)

RS77-3-306

AD-A041 859/0GA PC A02/MF A01
Army Electronics Command Fort Monmouth N J
Analysis of Observed Soil Skin Moisture Effects on Reflectance.
Research and development technical rept.,
S. E. Taylor, J. M. Davis, and J. B. Mason. Jun 77, 21p Rept no. ECOM-5822

Descriptors: *Soils, Moisture, *Reflectance, Soil classification, Calibration, Surface truth, Images, Scientific satellites, Texture, Modification, Acceptance tests.
Identifiers: *Soil moisture, Ground truth, *Remote sensing.

A light reflectance device has been applied to various soil surfaces, and the results have been correlated to independent measurements of skin moisture content. Results show that for the configuration used moisture effects are masked by those of surface texture. Modifications are recommended. (Author)

RS77-3-307

PB-267 822/5GA PC A06/MF A01
Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
Analysis of Multispectral Data Using Computer Techniques: Virginia Test Site.
Interim rept. Jan 73-Jun 74,
Ray L. Frederking; Terry R. West, and Christopher J. Stohr. Nov 74, 119p LARS-196200-1-T-VTS, FHWA/RD-75-15
Contract DOT-FH-11-7565
See also PB-267 821.
Also available in set of 5 reports PC E10, PB-267 819-SET.

Descriptors: *Remote sensing, *Soils, *Terrain, Highways, Digital techniques, Statistical analysis, Topography, Infrared detection, Mapping, Photogrammetry, Virginia.
Identifiers: Multiband spectral reconnaissance, Ground truth, Imagery, Computer aided analysis, Augusta County(Virginia).

Multispectral remote sensing data were collected over the Virginia Test Site during the spring and fall of 1970 (April 7-8 and December 14-15). The Virginia Test Site is located in northwestern Virginia in Augusta County near the town of Stauton. Twelve miles in length, the flight line trends northwestward at right angles to the prominent structural trends of the Appalachian Mountain System. Soils consist of residual material formed by weathering of the parent bedrock. Local relief ranges from 100 to 600 feet and the elevation from 250 to 1950 feet above sea level. Presumably because of the relatively steep slopes in the area, a large percentage of the surface was covered either by forest or pasture growth with only a minor fraction used for row-crop production. Geologically, the Virginia site consists of folded Cambrian and Ordovician age sedimentary rocks with minor amounts of Quaternary alluvium, accumulated along the stream channels. The purpose of the research was to analyze multispectral data from the Virginia Test Site using the current capabilities of the LARS computer-assisted analyses techniques.

RS77-3-308

E77-10139 PC A02/MF A01
Delaware Univ., Newark. Center for Remote Sensing.
Variability of Wetland Reflectance and Its Effect on Automatic Categorization of Satellite Imagery,
V. Klemas, and P. Bartlett. 10 Jan 77, 3p NASA-CR-152633
Contract NAS5-20983

Descriptors: *Wetlands, Spectral reflectance, Delaware, Earth Resources program, Automata theory, Multispectral band scanners, Classifications.
Identifiers: *Land use, Mapping.

The author has identified the following significant results. Land cover categorization of data from the same overpass in four test wetland areas was carried out using a four category classification system. The tests indicate that training data based on in situ reflectance measurements and atmospheric correction of LANDSAT data can produce comparable accuracy of categorization to that achieved using more than four wetlands cover categories (salt marsh cordgrass, salt hay, unvegetated, and water tidal flat) produced overall classification accuracies of 85% by conventional and relative radiance training and 81% by use of in situ measurements. Overall mapping accuracies were 76% and 72% respectively.

RS77-3-309

E77-10150 PC A11/MF A01
Bureau of Land Management, Denver, Colo.
A LANDSAT Study of Ephemeral and Perennial Rangeland Vegetation and Soils.
Final rept. 1 Mar 75-1 Dec 76,
R. Gordon Bentley, Jr., Bette C. Salmon-Drexler, William J. Bonner, and Robert K. Vincent. 1 Dec 76, 232p BLM/YA/300-1700-1012, NASA-CR-152650
NASA Order S-53966-A
Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Ave., Sioux Falls, S.D. 57198.

Descriptors: *Vegetation, *Soils, *Rangeland, *Montana, *Arizona, Earth Resources program, Maximum likelihood estimates, Mapping, Multispectral band scanners.

The author has identified the following significant results. Several methods of computer processing were applied to LANDSAT data for mapping vegetation characteristics of perennial rangeland in Montana and ephemeral rangeland in Arizona. The choice of optimal processing technique was dependent on prescribed mapping and site condition. Single channel level slicing and ratioing of channels were used for simple enhancement. Predictive models for mapping percent vegetation cover based on data from field spectra and LANDSAT data were generated by multiple linear regression of six unique LANDSAT spectral ratios. Ratio gating logic and maximum likelihood classification were applied successfully to recognize plant communities in Montana. Maximum likelihood classification did little to improve recognition of terrain features when compared to a single channel density slice in sparsely vegetated Arizona. LANDSAT was found to be more sensitive to differences between plant communities based on percentages of vigorous vegetation than to actual physical or spectral differences among plant species.

RS77-3-310

E77-10168 PC A03/MF A01
South Dakota State Univ., Brookings. Remote Sensing Inst.
Investigation of Remote Sensing Techniques as Inputs to Operational Resource Management Models.
Interim rept. 11 Jun-10 Dec 76,
F. A. Olschmer, R. E. Isakson, and J. C. Eidenshink. Feb 77, 32p SDSU-RSI-77-01, NASA-CR-152669
Contract NAS5-20982
Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Ave., Sioux Falls, S.D. 57198.

Descriptors: *Resources management, *South Dakota, Cost effectiveness, Models, Trees(Plants), Agriculture, Remote sensing, Earth Resources program, Mapping, Digital data, Drainage.

The author has identified the following significant results. Successful operational applications of LANDSAT data were found for level 1 land use mapping, drainage network delineation, and aspen mapping. Visual LANDSAT interpretation using 1:125,000 color composite imagery was the least expensive method of obtaining timely level 1 land use data. With an average agricultural/rangeland interpretation accuracy in excess of 80%, such a data source was considered the most cost effective of those sources available to state agencies. Costs do not compare favorably with those incurred using the present method of extracting land use data from historical tabular summaries. The cost increase in advancing from the present procedure to a satellite-based data source was justified in terms of expanded data content.

RS77-3-311

RUNOFF POTENTIAL BY MICROWAVE TECHNIQUES Final Report
Bruce J. Blanchard 1 Jun. 1977 37 p refs
(Contract NAS9-14898)
(NASA-CR-151426; RSC-3345) Avail: NTIS HC A03/MF A01 CSCL 08H

Characteristics such as storage capacity of the soil, volume of storage in vegetative matter, and volume of storage available in local depressions are expressed in empirical watershed runoff equations as one or more coefficients. Conventional techniques for estimating coefficients representing the spatial distribution of these characteristics over a watershed drainage area are subjective and produce significant errors. Characteristics of the wear surface are described as a single coefficient called the curve number.
Author

RS77-3-312

39412 Nieuwenhuis, E. Una investigacion sobre la utilidad de las imagenes de radar en la clasificacion de tierras [Utilization of radar images in classification of soils]: *in* Primer seminario Latinoamericano FAO/PNUD sobre la evaluacion sistematica de los recursos tierras y aguas (1 SELESTA), *Mexico, D.F., 8-14 Noviembre*, 1971 (Flores Mata, G., chairperson), p. 265-284, illus. (incl. tables, sketch maps), Secr. de Recursos Hidraulicos, Mexico, 1971.

RS77-3-313

ID NO.- EI771077436 777436
RELAXATION MODELS FOR MOIST SOILS SUITABLE AT MICROWAVE FREQUENCIES.
Bhagat, P. K.; Kadaba, P. K.
Univ of Ky, Lexington
Mater Sci Eng v 28 n 1 Apr 1977 p 47-51 CODEN: MSCEAA
DESCRIPTORS: (*SOILS, *Moisture), (MICROWAVES, Remote Sensing), MATHEMATICAL MODELS, (MATERIALS, Electric Properties),
CARD ALERT: 483, 711, 922
Relaxation models based on modifications of the P. Debye equation have been used in analysis of the complex dielectric constant results on various types of soils at microwave frequencies. A computer-based algorithm has been developed to provide accurate analysis through complex curve fitting. Results of this study suggest that K. Bergmann modification of the Debye equation seems to fit experimental data on 12% moisture content soils. Below 1 GHz one may need to consider phenomena such as residual surface effects and intermediate forms of bound water. 11 refs.

RS77-3-314

ID NO.- EI771076900 776900
LANDSAT AGRICULTURAL LAND-USE SURVEY.
Richardson, A. J.; Wiegand, C. L.; Torline, R. J.; Gautreaux, M. R.
Tex A&M Univ, Weslaco
Photogramm Eng Remote Sensing v 43 n 2 Feb 1977 p 207-216 CODEN: PERSDV
DESCRIPTORS: *REMOTE SENSING, AGRICULTURAL ENGINEERING.
CARD ALERT: 405, 742, 821, 901
Multispectral scanner (MSS) data collected by the first Earth Resources Technology Satellite (LANDSAT-1) on January 21 and May 27, 1973, were used for classification and acreage estimation studies of crop and soil categories in Hidalgo County, Texas. Classification results, based on approximately 1400 fields, improved, using fields larger than 15 acres, with more than 25 percent plant cover, and with plants taller than 30 cm in both January and May 1973. Ground and LANDSAT acreage estimates for citrus, combined cotton and sorghum, and idle cropland categories were not significantly different for the respective dates of January, May, and January. Results indicate a potential for an agricultural LANDSAT survey system for land-use categories like citrus, combined cotton and sorghum, idle cropland, and vegetables. 15 refs.

RS77-3-315

ID NO.- EI771076899 776899
REMOTE SENSING SURVEY OF MELALEUCA.
Capehart, Barney L.; Ewel, John J.; Sedlik, Barry R.; Myers, Ronald L.
Univ of Fla, Gainesville
Photogramm Eng Remote Sensing v 43 n 2 Feb 1977 p 197-206
CODEN: PERSDV
DESCRIPTORS: *REMOTE SENSING,
CARD ALERT: 405, 742
Remote sensing was used to attempt to define the areal extent of the introduced tree Melaleuca quinquenervia in selected portions of south Florida. It was possible to identify some areas occupied by Melaleuca, but not with adequate precision for purposes of detailed mapping. Efforts using the GE IMAGE-100 Pattern Recognition System were largely unsuccessful in identifying a unique signature for Melaleuca because the tree is found on a wide variety of sites, it occurs in various degrees of mixture with other species, and in widely varying densities and size classes. 6 refs.

RS77-3-316

ID NO.- EI770856592 756592
VEGETATION CHANGES ASSOCIATED WITH BARRIER-DUNE CONSTRUCTION ON THE OUTER BANKS OF NORTH CAROLINA.
Schroeder, P. Michael; Dolan, Robert; Hayden, Bruce P.
Univ of Va, Charlottesville
Environ Manage v 1 n 2 1976 p 105-114 CODEN: EMNGDC
DESCRIPTORS: (*ENVIRONMENTAL ENGINEERING, *Management), (COASTAL ENGINEERING, Management), AGRICULTURAL ENGINEERING,
CARD ALERT: 901, 912, 472, 821
Manmade dunes are used to stabilize the barrier islands of the mid-Atlantic coast of the United States so that they are more amenable to development. Although this strategy has stabilized extensive sections of the barrier-island substrate, it has also caused significant ecological changes. The rate and pattern of the resulting vegetation changes along the Outer Banks of North Carolina were determined using sequential aerial photography. Successional trends have been altered in favor of more stable wood communities. 10 refs.

RS77-3-317

Large-Area Resource Inventory of the Sudd Region in Sudan Using Landsat Data. D.G. Moore*, A.A. Klingebiel, B.K. Worcester, and V.I. Myers, Remote Sensing Institute, South Dakota State University.

A reconnaissance resource inventory of 160,000 km^2 of the Sudd region of southern Sudan was conducted. Portions of 12 LANDSAT scenes were photographically contrast stretched and tone matched to prepare 1:500,000 scene-matched mosaics of wet- and dry-season black and white (Band 7--0.8 - 1.1 mm) and false-color infrared imagery. The mosaic was used as a base map to summarize historical resource data and for mapping photo-landscape units. Aircraft flights at 1000-m altitude above ground level were conducted to further describe the landscape, especially in regions that were inaccessible on the ground. Ground surveys were conducted where communication paths permitted. Seven months were required to conduct surveys and prepare a preliminary soil map with a legend based upon soil landscape units. Guides for planning and conducting large-area surveys are outlined. The multitemporal and multispectral LANDSAT data are normally available for any region of the world and are of suitable spatial and spectral resolution for reconnaissance inventories.

RS77-3-318

Reduction of Variability in Large Area Crop Inventories by Use of Agrophysical Units. G. A. May*, J. M. Downs, J. D. Murphy, and R. L. Packard. USDA LACIE Project Office, Johnson Space Center, Houston, Texas.

During the Large Area Crop Inventory Experiment (LACIE) 1975-76 crop year, agrophysical units (APU's) were developed and tested. Each unit is a unique geographical area having definable agronomic and physical characteristics. APU's were derived from interpreting and synthesizing Landsat imagery, soil maps, and meteorological data. These units developed over the Great Plains reduced the number of sample segments needed to meet a coefficient of variation of 5 percent. Wheat yields were found to be more homogeneous within an APU than yields within a CRD. Other benefits included a high correlation between historical acreage and APU's and improved methods for monitoring episodal events.

RS77-3-319

Applications of Machine Processed Satellite Data to Soil Survey Operations in the Arid Southwest. E. H. Horvath, D. F. Post, W. Lucas, L. H. Humphrey, and R. A. Weismiller, Univ. of Arizona, USDI-BLM, and Purdue Univ.

Machine processed multispectral scanner satellite data for a 200,000 hectares study area in southeastern Arizona was evaluated to determine its use for an ongoing soil survey. The area is rangeland with desert shrubs, desert grassland and chaparral vegetation, and Ustollic, Lithic, and Typic Haplargid, Typic Calciorthid, and Lithic Torriorthent type soils. Four representative training sites about 4,000 hectares in size were selected and computer processed spectral class maps at 1:24,000 produced. After field studies of the training areas were completed spectral classification maps for the entire survey area were generated and used in in-field mapping operations in conjunction with standard soil survey procedures. Significant time savings, more consistent differentiation of similar soil mapping units, identification of inclusions within mapping units, and an unbiased statistical analysis of soil mapping accuracy are possible benefits of this technology to the soil survey program.

RS77-3-320

Winter Wheat Yield Estimation from Landsat and Simulated Landsat Follow-On Data J.C. Harlan and W.D. Rosenthal*, Remote Sensing Center, Texas A&M University

In support of the Large Area Crop Inventory Experiment (LACIE), regression equations were developed, using Landsat and simulated Landsat Follow-On helicopter-borne spectrometer data to estimate wheat yields and determine crop condition. Spectral data of wheat fields in Texas, Kansas, and North Dakota were transformed into field-by field "vegetation index" values. Regression analysis was applied with yield as the dependent variable and "vegetation index" values from two or more biophases as the independent variables. R^2 values of .70 or higher were achieved for each location. Although vegetation indices from both Landsat and Follow-On sensor data resulted in similar yield determination ability, the Follow-On sensor bands provided additional information concerning crop condition, not attainable by Landsat. Separate regression analysis was applied with the simulated Landsat Follow-On values as dependent variables and stand quality, canopy height, growth state or percent ground cover as independent variables. Correlations predicted from laboratory research were verified.

RS77-3-321

Interpretation of Remote Sensing Products to Detect Saline Seeps. K. J. Dalsted, Remote Sensing Institute, South Dakota State University.

Saline seeps have been appearing on Northern Great Plains landscapes with increasing frequency in recent years. Remote sensing techniques were investigated as a means of locating saline seeps in various developmental stages. Two low-altitude flights (September 9, 1975 and May 19, 1976) collected color infrared photography (CIRP) (.51-.90 μm) and thermal infrared imagery (8.7-11.5 μm) over 22 sections in Stark County, North Dakota. A thorough ground survey of the study area provided baseline data; this data was compared to imagery-derived seep delineations by two unbiased photo-interpreters. The CIRP proved to be an efficacious medium which provided sufficient contrast for the accurate location of mature seeps. Thermal imagery used in conjunction with CIRP did not significantly increase the accuracy of seep location. Thermal infrared imagery did provide the only means of locating young seeps (or seeps which are just forming); however, other similar temperature-related anomalies necessitated field checking with the imagery 'in-hand'.

RS77-3-322

Procedures for Evaluating Second Generation Soil Surveys. M. E. Collins,* and T. E. Fenton, Iowa State Univ.

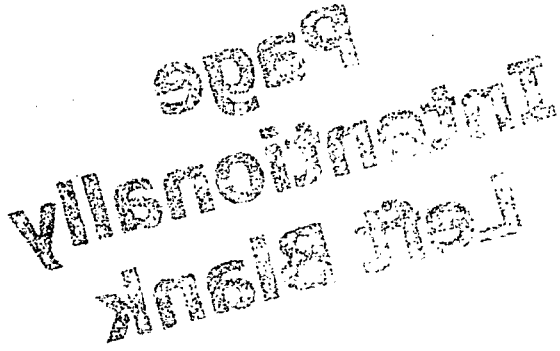
Second generation soil surveys in most Iowa counties are those mapped in the 1930's and 1940's on a plane table base map. Field work on Tama County's latest survey was completed in 1937-39 and published in 1950. This survey has been considered a modern soil survey, but is not based on the standards demanded today. This research involved determining if there is a need for a new soil survey. Study areas were located along the Iowa River floodplain and the Wolf Creek watershed. Mapping was done on color infrared photography at a scale of 1:15840. A legend was developed and modifications in this legend were made as necessary. Thirty-three soil profiles were studied and samples collected to determine the physical and chemical properties. Laboratory analyses included particle size distribution, hydrogen ion activity, available phosphorus, total phosphorus, exchange acidity, and total carbon content. Field investigations and lab analyses indicated that a new soil survey is needed in Tama County, Iowa.

RS77-3-323

Relation of Crop Canopy Variables to the Multispectral Reflectance of Small Grains. J.S. Ahlrichs*, C.S.T. Daughtry, M.E. Bauer, Purdue University.

Reflectance spectra of spring and winter wheat canopies over the wavelength range of 0.4 to 2.5 μm were acquired during each of their major growth stages with truck-mounted spectrometers. Data from replicated, factorial experiments were acquired in 1975 and 1976 for winter wheat at Garden City, Kansas and spring wheat at Williston, North Dakota. The treatments included, planting date, nitrogen fertilization, variety, and soil moisture. Agronomic characterization of the wheat canopies included measurements of growth stage, plant height, fresh and dry biomass, leaf area index, and percent ground cover. Observations of surface soil moisture, color, and roughness were also made. Correlation and regression analyses were used to relate the agronomic variables to reflectance.

Leaf area index, as well as the other measures of the amount of vegetation present, was highly correlated with reflectance in the chlorophyll absorption and near infrared portions of the spectrum. Reflectance at these wavelengths accounted for at least 85% of the variation in leaf area index.



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Section 4

MARINE SCIENCES

Sea-surface, Estuarine and Nearshore Studies

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RS77-4-231

N77-26576*# Texas Univ., Austin.
DEVELOPMENT AND APPLICATION OF OPERATIONAL TECHNIQUES FOR THE INVENTORY AND MONITORING OF RESOURCES AND USES FOR THE TEXAS COASTAL ZONE Quarterly Report, Jun. 1976 - Feb. 1977
Peggy Harwood, Principal Investigator (General Land Office, Austin, Tex.), Patricia Malin (General Land Office, Austin, Tex.), Robert Finley, Samuel McCulloch, David Murphy, Bill Hupp, and John A. Schell (Texas A and M Univ., College Station) May 1977 101 p refs ERTS
(Contract NAS5-20986)
(E77-10174; NASA-CR-153262) Avail: NTIS HC A06/MF A01 CSCL 05A

The author has identified the following significant results. Four LANDSAT scenes were analyzed for the Harbor Island area test sites to produce land cover and land use maps using both image interpretation and computer-assisted techniques. When evaluated against aerial photography, the mean accuracy for three scenes was 84% for the image interpretation product and 62% for the computer-assisted classification maps. Analysis of the fourth scene was not completed using the image interpretation technique, because of poor quality, false color composite, but was available from the computer technique. Preliminary results indicate that these LANDSAT products can be applied to a variety of planning and management activities in the Texas coastal zone.

RS77-4-232

N77-23573*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESULTS FROM THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION REMOTE SENSING EXPERIMENTS IN THE NEW YORK BIGHT, 7-17 APRIL 1975
John B. Hall, Jr., comp. and Albin O. Pearson, comp. Apr. 1977 190 p refs
(NASA-TM-X-74032) Avail: NTIS HC A09/MF A01 CSCL 05B

A cooperative operation was conducted in the New York Bight to evaluate the role of remote sensing technology to monitor ocean dumping. Six NASA remote sensing experiments were flown on the C-54, U-2, and C-130 NASA aircraft, while NOAA obtained concurrent sea truth information using helicopters and surface platforms. The experiments included: (1) a Radiometer/Scatterometer (RADSCAT), (2) an Ocean Color Scanner (OCS), (3) a Multichannel Ocean Color Sensor (MOCS), (4) four Hasselblad cameras, (5) an Ebert spectrometer; and (6) a Reconafax IV infrared scanner and a Precision Radiation Thermometer (PRT-5). The results of these experiments relative to the use of remote sensors to detect, quantify, and determine the dispersion of pollutants dumped into the New York Bight are presented.
Author

RS77-4-233

N77-24561*# ECON, Inc., Princeton, N.J.
AN EVALUATION OF SEASAT-A CANDIDATE OCEAN INDUSTRY ECONOMIC VERIFICATION EXPERIMENTS Final Report
1 Apr. 1977 249 p refs
(Contract NASw-3047)
(NASA-CR-153009; Rept-76-242-1) Avail: NTIS HC A11/MF A01 CSCL 05C

A description of the candidate economic verification experiments which could be performed with SEASAT is provided. Experiments have been identified in each of the areas of ocean-based activity that are expected to show an economic impact from the use of operational SEASAT data. Experiments have been identified in the areas of Arctic operations, the ocean fishing industry, the offshore oil and natural gas industry, as well as ice monitoring and coastal zone applications. Author

RS77-4-234

N77-26600# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
MICROWAVE RADIOMETER THEORY AND MEASUREMENTS OF SEA ICE CHARACTERISTICS Project Sea Ice 1975
Martti Tiuri, Martti Hallikainen, and Antti Laaperi 1976 49 p *refs Sponsored by the Fin.n-Swed. Board for Winter Navigation* Res.
(Rept-S-89; ISBN-951-750-742-9) Avail: NTIS HC A02/MF A01

A project for studying the relation between the physical properties and microwave brightness temperature of sea ice in the Bay of Bothnia in 1975 is described. The results of the experiments and the theory for obtaining the brightness temperature of the sea ice are given. The results indicate that the brightness temperature measured at 600 MHz is related to the thickness of ice. During the experiments the ice temperature was fairly close to the melting point and hence the brightness temperature at 4.7 GHz can be correlated within the ice thickness for thin ice only. For ice ridges the 600 MHz radiometer shows thick ice and the 4.7 GHz radiometer thin ice. This can be employed for detecting ice ridges. The theory predicts that for ice thinner than about 30 cm the brightness temperature oscillates as a function of ice thickness. Hence a radiometer operating on a narrow band-width probably cannot be used for determining the thickness of thin ice. Author (ESA)

RS77-4-235

N77-26585*# Virginia Inst. of Marine Science, Gloucester Point.
APPLICATIONS OF REMOTE SENSING TO ESTUARINE MANAGEMENT Annual Report
John C. Munday, Jr., Hayden H. Gordon, and Harold F. Hennigar Jun. 1977 74 p refs
(Grant NGL-47-022-005)
(NASA-CR-153287; AR-5) Avail: NTIS HC A04/MF A01 CSCL 05A

Remote sensing was used in the resolution of estuarine problems facing federal and Virginia governmental agencies. A prototype Elizabeth River Surface Circulation Atlas was produced from photogrammetry to aid in oil spill cleanup and source identification. Aerial photo analysis twice led to selection of alternative plans for dredging and spoil disposal which minimized marsh damage. Marsh loss due to a mud wave from a highway dyke was measured on sequential aerial photographs. An historical aerial photographic sequence gave basis to a potential Commonwealth of Virginia legal claim to accreting and migrating coastal islands. Author

RS77-4-236

N77-28566# National Environmental Satellite Service, Washington, D. C.
NOAA PROGRAM DEVELOPMENT PLAN FOR SEASAT-A RESEARCH AND APPLICATIONS
Mar. 1977 97 p refs
(PB-265414/3; NOAA-77030210) Avail: NTIS HC A05/MF A01 CSCL 22B

A program development plan is written for marine applications of NASA's SEASAT-A spacecraft, designed for launch in 1978. SEASAT-A is the first space research platform dedicated to ocean science and application. Specific objectives are: (1) explore, map, and chart the global ocean and its living resources; (2) manage, use, and conserve those resources; (3) describe, monitor, and predict conditions in the atmosphere, ocean, sun, and space environment;(4) issue warnings against impending destructive natural events; (5) develop beneficial methods of environmental modification; and (6) assess the consequences of inadvertent environmental modification over a period of time. GRA

RS77-4-237

N77-24553*# Army Engineer District, San Francisco, Calif.
CALIFORNIA COASTAL PROCESSES STUDY, LANDSAT 2 Final Report, Feb. 1975 - Jan. 1977
Douglas M. Pirie (Earth Science Consulting and Technology, Costa Mesa, Calif.) and David D. Steller, Principal Investigators Apr. 1977 164 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (NASA Order S-54062A)
(E77-10158; NASA-CR-153043) Avail: NTIS HC A08/MF A01 CSCL 08J

The author has identified the following significant results. By using suspended sediments as tracers, objectives were met by qualitative definition of the nearshore circulation along the entire coast of California with special study sites at Humboldt Bay, the mouth of the Russian River, San Francisco Bay, Monterey Bay, and the Santa Barbara Channel. Although LANDSAT primarily imaged fines and silts in the surface waters, the distribution of sediments allowed an examination of upwelling, convergences and coastal erosion and deposition. In Monterey Bay and Humboldt Bay, these coastal phenomena were used to trace seasonal trends in surface currents.

RS77-4-238

N77-23587# Environmental Research Inst. of Michigan, Ann Arbor.
BASIC INVESTIGATIONS FOR REMOTE SENSING OF COASTAL AREAS Quarterly Report, 16 Jul. - 15 Oct. 1976
R. A. Shuchman, D. R. Lyzenga, and F. J. Thomson 1976 6 p refs
(Contract N00014-74-C-0273)
(AD-A032447; ERIM-108900-8-L) Avail: NTIS HC A01/MF A01 CSCL 17/8

During the quarterly period 16 July - 15 October 1976, three principle activities took place. The second year interim report was printed and distributed. Work was completed on obtaining critical optical properties of beach minerals to be used as inputs into the Beach and Environment Models. In the water modeling area, the water-atmosphere model was tested and used in a study for the Naval Coastal Systems Lab., and analysis of model results in the context of MRA development has begun. In connection with this task, a letter was sent to the Editor of Applied Optics on the reflectance of a flat ocean in the limit of zero water depth. GRA

RS77-4-239

N77-26591# Naval Oceanographic Office, Washington, D. C.
AERIAL ICE RECONNAISSANCE AND SATELLITE ICE INFORMATION MICROFILM FILE
Peter A. Mitchell Aug. 1976 39 p refs
(AD-A037300; NOO-RP-17) Avail: NTIS HC A03/MF A01 CSCL 08/12

Interest in the polar regions has increased manyfold in recent years principally due to the newly developing economic incentives and revived military significance of the Arctic and the continuing scientific research in the Antarctic. Improvement and further development of operational sea ice forecasting techniques that allow our naval forces to operate safely in these areas depend heavily upon the maintenance of historical ice data files. The Aerial Ice Reconnaissance and Satellite Ice Information Microfilm File effectively substitutes for the terminated Oceanographic Office annual reports of the Arctic and Antarctic ice observing and forecasting programs. This publication provides the researcher with listings of available microfilm in one of the Navy's more extensive ice data files and describes the procedures to follow to obtain copies of the original chart analyses of aerial ice reconnaissance and satellite ice data. Author (GRA)

RS77-4-240

N77-28564*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
REMOTELY SENSED AND LABORATORY SPECTRAL SIGNATURES OF AN OCEAN-DUMPED ACID WASTE
Beverly W. Lewis and Vernon G. Collins Washington Jul. 1977 38 p refs
(NASA-TN-D-8467; L-11373) Avail: NTIS HC A03/MF A01 CSCL 13B

An ocean-dumped acid waste plume was studied by using a rapid scanning spectrometer to remotely measure ocean radiance from a helicopter. The results of these studies are presented and compared with results from sea truth samples and laboratory experiments. An ocean spectral reflectance signature and a laboratory spectral transmission signature were established for the iron-acid waste pollutant. The spectrally and chemically significant component of the acid waste pollutant was determined to be ferric iron. Author

RS77-4-241

N77-23583# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
REMOTE SENSING OF OIL POLLUTION AT THE SEA SURFACE 2. DAMPING OF WATER WAVES BY AN OIL LAYER AS A POSSIBLE INDICATOR FOR SLAR OBSERVATIONS Ph.D. Thesis - Univ. of Technol.
A. C. Pronk Jul. 1975 12 p refs
(NIWARS-Publ-22) Avail: NTIS HC A02/MF A01

The damping action of oil pollution on sea waves is discussed in view of observation from the air. It is found that oil layers of all thicknesses damp a part of the wave spectrum. Only in the case of thicker layers is the damping related to the nature of the oil. The distance over which the sea waves damp out after an oil slick has entered seems a useful indicator for the oil properties. Author (ESA)

RS77-4-242

N77-24562*# Old Dominion Univ. Research Foundation, Norfolk, Va.
THE USE OF SKYLAB IN THE STUDY OF PRODUCTIVITY ALONG THE EASTERN SHELF WATERS OF THE UNITED STATES Final Report
Harold G. Marshall and David E. Bowker Mar. 1976 28 p refs
(Contract NAS1-11707)
(NASA-CR-152848) Avail: NTIS HC A03/MF A01 CSCL 08A

Data sampling from the Rappahannock River and Assateague Island areas are discussed correlating Skylab and ground based measurements. At all sampling stations, information was obtained on composition and density of phytoplankton, total chlorophyll, salinity and water temperature. The results of the water analysis are presented in tables. M.C.F.

RS77-4-243

N77-23582# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
REMOTE SENSING OF OIL POLLUTION AT THE SEA SURFACE 1. REVIEW OF REMOTE SENSING METHODS EMPHASIZING RADAR
J. vanKuilenburg Jul. 1975 29 p refs
(NIWARS-Publ-21) Avail: NTIS HC A03/MF A01

The problem of monitoring oil pollution is described and the remote sensing methods applicable for that purpose are reviewed. A detailed discussion is presented on radar observations of oil slicks and of the surrounding sea surface. A selected bibliography is given. Author (ESA)

RS77-4-244

N77-26750# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
CLASSIFICATION OF COASTAL ENVIRONMENTS
Bruce Hayden and Robert Dolan Jan. 1977 101 p refs
(Contract N00014-69-A-0060-0006; N00014-75-C-0480; NR Proj. 389-158; NR Proj. 389-170)
(AD-A036770; TR-13; TR-14; TR-15; TR-16; TR-17; TR-18)
Avail: NTIS HC A06/MF A01 CSCL 08/6

Contents: Crescentic Coastal Landforms; Classification of Coastal Landforms of the Americas; Recent Secular Variations in Mid-Atlantic Winter Extratropical Storm Climate; Storm Wave Climates at Cape Hatteras, North Carolina; Recent Secular Variations; Multivariate and Spectral Analyses of Some Seasonal Aspects of Wave Climates; and January-Thaw Singularity and Wave Climate Along the Eastern Coast of the U.S.A. GRA

RS77-4-245

A77-34148 * # **The N.A.S.A. earth and ocean dynamics programme.** F. O. Vonbun (NASA, Goddard Space Flight Center, Greenbelt, Md.). *(Royal Society, Discussion on Methods and Applications of Ranging to Artificial Satellites and the Moon, London, England, Feb. 26, 27, 1976.) Royal Society (London), Philosophical Transactions, Series A,* vol. 284, no. 1326, May 11, 1977, p. 607-619. 15 refs.

Practical applications of NASA space systems, science, and technology to the study of oceans and solid earth are discussed. Goals involving earth dynamics include earthquake hazard assessment and alleviation, and global surveying and mapping, while goals involving ocean dynamics include the determination of ocean currents and circulation, and the monitoring of ocean surface conditions. Satellites used to obtain data are described, and projects such as the study of open ocean tides and earth motion determination are reviewed, with consideration given to the techniques (e.g., laser ranging, satellite-to-satellite track) used in these studies. Several physical phenomena, the extent to which they presently can be measured, and possible future requirements for more accurate measurements are examined. M.L.

RS77-4-246

A77-36573 **Recent progress in the remote sensing of ocean surface currents.** G. A. Maul (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla.). *Marine Technology Society Journal,* vol. 11, no. 1, 1977, p. 5-13. 24 refs.

Major ocean currents have surface manifestations that make them observable by spacecraft sensors. Under certain conditions, any one or a combination of the following may be used to identify the current's boundary: changes in sea surface temperature, salinity, color, sea state, sea surface topography, wave refraction patterns, and modifications to the lower atmosphere. Infrared sensors have been used most extensively to study ocean circulation; however, new instruments such as passive and active microwave sensors can sense temperature, salinity, sea state, and surface topography, and multispectral visible scanners and spectroradiometers are providing new information on ocean color and sea state. Man's role as an observer and photographer provides the highest spatial resolution to date for describing visible changes across boundaries as well as sea and swell patterns. (Author)

RS77-4-247

A77-33653 * **Remote sensing of estuarine fronts and their effects on pollutants.** V. Klemas and D. F. Polis (Delaware, University, Newark, Del.). *Photogrammetric Engineering and Remote Sensing,* vol. 43, May 1977, p. 599-612. 16 refs. NSF Grant No. GI-41896; Contracts No. NAS5-21937; No. NAS5-20983.

Estuarine fronts represent regions of extremely high gradient or discontinuity in various parameters of physical interest, the most important being the water velocity and density fields. Such fronts strongly influence pollutant dispersion by capturing oil slicks and other pollutants concentrated in surface films and drawing them down into the water column. Aircraft and boats were combined to study the behavior of different types of fronts in Delaware Bay and their effect on pollutants in order to provide a basis for improving an oil drift and spreading model. Imagery from the Landsat satellites provided the most effective means of determining the location and extent of frontal systems over all portions of the tidal cycle. This information is being used to modify the oil drift and spreading model. (Author)

RS77-4-248

A77-39875 # **Surveying and remote sensing techniques for coasts and seas (Vermessungs- und Fernerkundungsverfahren an Küsten und Meeren).** G. Konecny (Hannover, Technische Universität, Hanover, West Germany). *Hannover, Technische Universität, Zeitschrift,* vol. 4, no. 1, 1977, p. 3-10. In German.

Problems of geoid determination in regions of the sea and in coastal regions are considered. The basic measurements concerning the various types of angles, distances, and altitude differences are related to the direction of the gravity force. A description of surveying procedures for the determination of the location and altitude of fixed points is presented, taking into account the approaches used to overcome the special problems related to position determinations in coastal regions and in regions of the sea. The determination of coastal and sea topography is discussed and attention is given to remote sensing techniques which attempt to obtain object information on the basis of the spectrum of electromagnetic waves. G.R.

RS77-4-249

A77-34520 **Satellite observation of internal wave refraction in the South China Sea.** R. Fett and K. Rabe (U.S. Navy, Naval Environmental Prediction Research Facility, Monterey, Calif.). *Geophysical Research Letters,* vol. 4, May 1977, p. 189-191. 7 refs.

A visible image for May 21, 1973 obtained from the DMSP satellite suggests the occurrence of internal waves refracting around the Pratas Islands in the South China Sea. Arguments are presented suggesting that the waves are tidally forced along the density interface prevalent for that area during the spring season. (Author)

RS77-4-250

A77-40815 # **Use of ultrasound for the investigation of small-scale turbulence in the ocean (O primenenii ul'trazvuka dlia issledovaniia melkomasshtabnoi turbulentnosti v okeane).** A. V. Volkova. *Morskie Gidrofizicheskie Issledovaniia,* no. 4, 1976, p. 112-118. 8 refs. In Russian.

An expression is obtained for acoustic scattering on turbulent inhomogeneities of temperature and velocity of turbulent flow in the ocean. Semiempirical hypotheses are used to establish the functional relationship between acoustic scattering and mean gradients of temperature and velocity. The development of a probe of ocean turbulence using principles of ultrasonic scattering is discussed. B.J.

RS77-4-251

A77-35457 # **The San Antonio Bay test site in the Texas coastal zone.** R. Holz (Texas, University, Austin, Tex.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Jan. 1977, p. 52-63.

Information and field data gathered in the course of an investigation of techniques for using Landsat data for inventory and monitoring of Texas coastal zone areas are used in a laboratory exercise in the interpretation of satellite imagery. An area on the San Antonio Bay was selected for its varied landscape in which land use and ecological patterns are being actively modified by dynamic physical processes (formation of an extensive delta by the San Antonio and Guadaloupe Rivers) and human enterprises (shell dredging). The use of maps to enhance interpretation techniques and aid in object identification is suggested. C.K.D.

RS77-4-252

A77-35698 # **Investigation of the optical emission of the sea (K voprosu issledovaniia opticheskogo izlucheniia moria).** V. V. Polovinko. *Geodeziia i Aerofotos'emka*, no. 6, 1976, p. 109-114. 5 refs. In Russian.

An experiment was conducted during March 1975 to determine the relation between the optical emission of the Caspian Sea and the turbilization and pollution of the sea surface by oil. The measuring instrumentation consisted of a radiometer with variable field for measuring the energetic characteristics of the emission in the 0.4-1.2 micron range, a scanner for operation in the 0.4-1.8 micron range, and an ellipsometer for measuring the polarization characteristics of the emission. The GM-61 wave-graph was used to measure wave excitation. B.J.

RS77-4-253

A77-35475 # **The use of laser radar for determining the pollution of the sea surface by oil products (O primenenii lazernoi lokatsii dlia opredeleniia zagriazneniia poverkhnosti moria nefteproduktami).** O. I. Abramov, V. I. Evemin, L. I. Lobov, and V. V. Polovinko (Vsesoiuznyi Elektrotekhnicheskii Institut, Moscow; Gosudarstvennyi Okeanograficheskii Institut, USSR). *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana*, vol. 13, Mar. 1977, p. 331-334. 5 refs. In Russian.

A backscattering lidar technique using a laser emitting at a wavelength of 0.3472 micron was used to study the pollution of the sea surface by oil products. Backscattering spectra were obtained under laboratory conditions and for the Bosphorus region, and used to determine the thickness of oil-product films on the water surfaces. B.J.

RS77-4-254

A77-36985 # **Some results of the interpretation of high resolution imagery data from NOAA spacecraft.** P. R. S. Salter (Meteorological Office, Bracknell, Berks., England). *Weather*, vol. 32, June 1977, p. 208-216. 7 refs.

A method is described for estimating sea-surface temperatures from infra-red high-resolution imagery obtained from very-high-resolution radiometer sounding data. Since visible-spectrum data is not required, the method can be equally applied to both day-time and night-time imagery and at high latitudes in winter. Although precise determinations of temperature are not obtained by this approach, the accuracy of the results is considered sufficiently good so that the method can be used in conjunction with vertical temperature profile radiometer sounding data for better retrieval of upper air temperature. M.L.

RS77-4-255

A77-40514 * **Determination of ocean wave heights from synthetic aperture radar imagery.** A. Jain (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div., Pasadena, Calif.). *Applied Physics*, vol. 13, Aug. 1977, p. 371-382. 24 refs. Contract No. NAS7-100.

A calculation is presented for the cross-correlation of the radar images obtained by processing the same signal data over different portions of the chirp spectrum bandwidth as a function of the center frequency spacings for these portions. This is shown to be proportional to the square of the product of the characteristic function for ocean wave heights and the pupil function describing the chirp spectrum bandwidth used in the processing. Measurements of this function for ocean wave imagery over the coast of Alaska, the North Atlantic, and Monterey Bay, California, and correlation with the significant wave heights reported from ground truth data indicate that the synthetic aperture radar instrument can be used for providing wave height information in addition to the ocean wave imagery. (Author)

RS77-4-256

A77-38244 **Remote sensing of ocean color.** W. A. Hovis (NOAA, National Environmental Satellite Service, Washington, D.C.) and K. C. Leung (Computer Sciences Corp., Silver Spring, Md.). *Optical Engineering*, vol. 16, Mar.-Apr. 1977, p. 158-166. 7 refs.

Investigations with aircraft were conducted during 1971 and 1972 to determine the feasibility of an observation of subtle changes in ocean reflectance through the entire atmosphere. The investigations employed a nadir viewing spectrometer scanning the range from 400 to 700 nanometers. It was found that there was sufficient information in the backscattered energy emerging from the top of the atmosphere to determine the color of the ocean to a sufficient degree to remotely sense areas of chlorophyll concentration. A spatially scanning, multispectral radiometer was built to carry out further investigations. A description is presented of ocean color scanner studies which were conducted with the new instrument. A U-2 aircraft flying at an operating altitude of 19.8 km was employed in the studies. G.R.

RS77-4-257

A77-36795 **Sea surface temperature during MODE-1.** A. Voorhis and E. Schroeder (Woods Hole Oceanographic Institution, Woods Hole, Mass.). *Oceanus*, vol. 19, Spring 1976, p. 82-86.

Long-term variations in mean sea-surface temperature are studied to obtain information about energy exchange between ocean and atmosphere, and thereby to learn more about past and future world climate patterns. The contours of the mean March 1973 sea surface temperatures in the western Atlantic and the Caribbean Sea are compared to the contours representing the surface dynamic topography relative to 1500 decibars that was computed from the location pattern of temperature and salinity lowerings. It is concluded that, in at least some parts of the ocean, surface currents from large-scale eddies are responsible for large-scale, slowly changing patterns in the sea-surface temperature, and that these varying temperature patterns introduce an additional uncertainty into the use of surface temperature data, measured by satellite or rapid ship surveys, for gaining an understanding of long-term changes in the mean sea surface. M.L.

RS77-4-258

A77-36429 **Landsat goes to sea.** J. C. Hammack (U.S. Defense Mapping Agency, Hydrographic Center, Washington, D.C.). *Photogrammetric Engineering and Remote Sensing*, vol. 43, June 1977, p. 683-691. 16 refs.

Attention is called to the inadequacies of current surveys and charts of the world's oceans, and the main directions of national and international efforts to improve the quantity, currency, and accuracy of worldwide hydrographic survey data are examined. In particular, the use of Landsat MSS film imagery in pursuing this goal is singled out. Landsat high-gain imagery has been found to be helpful in detecting and mapping shoals in clear water to depths equal to or greater than those required for most surface shipping. A project consisting in the revision of the Chagos Archipelago chart is described, revealing that the extents of banks and reefs as revealed by Landsat can be significantly different from what they are shown to be on current charts. P.T.H.

RS77-4-259

Analysis of Synthetic Aperture Radar Ocean Wave Data Collected at Marineland and Georges Bank.
Final rept.,
Robert A. Shuchman, Robert F. Rawson, and Eric S. Kasischke. Apr 77, 171p 123000-11-F, NOAA-77052503
Grant NOAA-04-6-158-44078

Descriptors: *Ocean waves, *Radar cross sections, Synthetic aperture radar, Sea state, Backscattering, Remote sensing, Algorithms.
Identifiers: Gulf Stream, Georges Bank.

A program involving the processing and analysis of SAR data collected by the ERIM X-L Imaging Radar at Georges Bank and Marineland has been carried out. The purpose of this work was to extract useful information about ocean waves. A focusing algorithm was developed and backscatter measurements were made using an optical processor. A number of interesting conclusions have been made, including (1) the 180 degrees wave-direction ambiguity can be resolved by a study of defocusing in the processor, (2) non-linear wave refraction does not occur across the Gulf Stream boundary, (3) the modulation depth is greater for X-band than for L-band and greater for range-direction waves than for azimuth-direction waves, and (4) X-band (HH), L-band (HH), and L-band (HV) produce significant backscatter and discernible images while X-band (HV) produces little backscatter.

RS77-4-260

THE CITIZEN'S GUIDE TO NORTH CAROLINA'S SHIFTING INLETS.
North Carolina State Univ. at Raleigh. Center for Urban Affairs and Community Services.
S. Baker.
North Carolina University Sea Grant Publication No. UNC-SG-77-08, March 1977. 32 p. Also as Center for Urban Affairs and Community Services Information Report No. 2. Chiefly aerial photos. SG-04-6-058-44054.

Descriptors: *Aerial photography, *Inlets(Waterways), *Barrier islands, *North Carolina, Erosion, Coasts, Sedimentation, *Maps.

This pamphlet is intended for the use of citizens who do not have a scientific or engineering background. Aerial photographs are marked to show the numerous significant changes in the position and size of barrier island and inlets caused by various coastal processes. (NOAA)
W77-09327

RS77-4-261

RELATIVE REFLECTANCE AND COMPLEX REFRACTIVE INDEX IN THE INFRARED FOR SALINE ENVIRONMENTAL WATERS.
Missouri Univ.-Kansas City. Dept. of Physics.
M. R. Querry, W. E. Holland, R. C. Waring, L. M. Earls, and M. D. Querry.
Journal of Geophysical Research, Vol. 82, No. 9, p 1425-1433, March 20, 1977. 8 fig, 3 tab, 14 ref. OWRT A-091-MO(2), USGS 14-08-0001-12636.

Descriptors: *Saline water, *Reflectance, *Refractivity, *Infrared radiation, *Great Salt Lake, *Pacific Ocean, *Atlantic Ocean, Optical properties, Sea water, Aqueous solutions, Laboratory tests, Salinity, Salts, Lakes, Oceans, Phosphates, Mine water, Effluents, Remote sensing, Chemical analysis, Data processing, Analytical techniques.
Identifiers: *Dead Sea(Israel), *San Francisco Bay(Calif).

By using distilled water as the standard reflector, relative specular reflectance spectra in the 2- to 20-micrometer wavelength region of the infrared were measured for surface water samples collected from the San Francisco Bay, the Pacific Ocean, the Atlantic Ocean, the Great Salt Lake (Utah), the Dead Sea (Israel), and an effluent pit of a phosphate mine in central Florida. Phase difference spectra and spectral values of the complex refractive index were computed for each water sample by applying a Kramers-Kronig analysis to the relative reflectance spectra. Spectral values for the complex refractive index suitable for Mie scattering calculations were tabulated for each water sample. The reflectance spectra of the natural saline waters bore great similarity to spectra for individual aqueous solutions containing NACl, K2S04, NH4H2P04, NaNo3, and NaHC03. Chemical analyses of the water samples also were presented in tabular form. (Sims-ISWS)
W77-08215

RS77-4-262

TESTING OF A TECHNIQUE FOR REMOTELY MEASURING WATER SALINITY IN AN ESTUARINE ENVIRONMENT.
National Aeronautics and Space Administration, Bay Saint Louis, Mo. Earth Resources Lab.
G. C. Thomann.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-22634, Price codes: A03 in paper copy, A01 in microfiche. Report No. 118, January 1975. 37 p, 11 fig, 8 tab, 4 ref.

Descriptors: *Salinity, *Remote sensing, *Estuarine environment, *Resources development, Baseline studies, Environmental effects, Estuaries, Mississippi.
Identifiers: *Outer Continental Shelf, *Mississippi Coast.

An aircraft experiment was flown on November 7, 1973 to test a technique (Thomann, 1973) for remote water salinity measurement. Apparent temperatures at 21 cm and 8-14 micro m wave lengths were recorded on eight runs over a line along which the salinity varied from 5 to 30 o/oo. Boat measurements were used for calibration and accuracy calculations. Overall RMS accuracy over the complete range of salinities was 3.6 o/oo. Overall RMS accuracy for salinities greater than o/oo, where the techniques is more sensitive, was 2.6 o/oo. Much of this error is believed to be due to in ability to exactly locate boat and aircraft positions. The standard deviation over the eight runs for salinities approximately 10 o/oo is 1.4 o/oo; this error contains a component due to mislocation of the aircraft also. It is believed that operational use of the technique is possible with accuracies of 1-2 o/oo under conditions specified in the paper. (Sinha-OEIS)
W77-08903

RS77-4-263

COMPARISON OF REMOTELY SENSED CONTINENTAL-SHELF WAVE SPECTRA WITH SPECTRA COMPUTED BY USING A WAVE REFRACTION COMPUTER MODEL,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
L. R. Poole.
National Aeronautics and Space Administration, Technical Note NASA TN D-8353, December 1976. 43 p, 10 fig, 12 ref.

Descriptors: *Remote sensing, *Continental shelf, *Computer models, *Refraction(Water waves), Geophysics, Shoals, Energy.
Identifiers: *Wave spectra, Wave refraction, Mid-Atlantic Ocean.

An initial attempt was made to verify the Langley Research Center and Virginia Institute of Marine Science mid-Atlantic continental-shelf wave refraction model. The model was used to simulate refraction occurring during a continental-shelf remote sensing experiment conducted on August 17, 1973. Simulated wave spectra compared favorably, in a qualitative sense, with the experimental spectra. However, it was observed that most of the wave energy resided at frequencies higher than those for which refraction and shoaling effects were predicted. In addition, variations among the experimental spectra were so small that they were not considered statistically significant. In order to verify the refraction model, simulation must be performed in conjunction with a set of significantly varying spectra in which a considerable portion of the total energy resides at frequencies for which refraction and shoaling effects are likely. (Sinha-OEIS)
W77-08911

RS77-4-264

SEDIMENT MEASUREMENT IN ESTUARINE AND COASTAL AREAS,
EG and G Washington Analytical Services Center, Inc., Rockville, Md.
P. E. Shelley.
Available from the National Technical Information Service, Springfield, VA 22161 as NASA CR-2769, Price codes: A06 in paper copy, A01 in microfiche. National Aeronautics and Space Administration, Wallops Flight Ctr., Wallops Island, Va., Contractor Report No. NASA CR-2769, December 1976. 102 p, 17 fig, 6 tab, 60 ref. NASA-NAS6-2325.

Descriptors: *Estuaries, *Coasts, *Sediment transport, *Sediments, *Measurement, Management, *Remote sensing.

A survey of uses of estuarine and coastal areas is given. Problems associated with these uses are discussed, and data needs for intelligent management of these valuable areas are outlined. Suspended sediment measurements are seen to be one of the greatest needs. To help understand the complexity of the problem, a brief discussion of sediment mechanics is given, including sediment sources, characteristics, and transport. The impact of sediment mechanics on its direct measurement (sampling and analysis) is indicated, along with recommendations for directly obtaining representative data. Indirect measurement of suspended sediment by remote sensors is discussed both theoretically and in the light of some recent experiences. The need for an integrated, multidisciplinary program to solve the problem of quantitatively measuring suspended sediment with remote sensors is stressed, and several important considerations of such a program and benefits to be derived therefrom are briefly addressed. It is recommended that the present, very preliminary look be expanded into a full-blown program plan for developing a timely and affordable solution to the problem. (Sinha-OEIS)
W77-07748

RS77-4-265

RECTILINEAR LEADS AND INTERNAL MOTIONS IN THE ICE PACK OF THE WESTERN ARCTIC OCEAN,
Department of the Environment, Victoria (British Columbia). Inst. of Ocean Sciences.
J. R. Marko, and R. E. Thomson.
Journal of Geophysical Research, Vol 82, No 6, p 979-987, February 20, 1977. 9 fig, 1 tab, 14 ref.

Descriptors: *Sea ice, *Arctic Ocean, *Ice cover, *Remote sensing, Satellites(Artificial), Rock mechanics, Movement, Winds, Water circulation, Currents(Water), Stress, Shear stress, Cold regions, Arctic.
Identifiers: *Ice leads, Faults(Ice), Fractures(Ice), Rectilinear leads, Brittle fracture, LANDSAT, *Ice packs.

Large-scale (100 km) rectilinear lead patterns are a common feature of the Arctic Ocean ice cover. It was shown that many of the characteristics of these patterns can be explained by analogy with rock mechanics. In particular, the existence of two intersecting lead sets, the typical intersection angles of 28 deg, and the observed relative shearing motions are consistent with faulting associated with semibrittle failure. Further support for this explanation has been obtained by using NOAA and Landsat satellite imagery over an approximately 100-km-square area of the Beaufort Sea. These data provided coverage of 2 days of ice deformation prior to the formation of a lead at 14 deg to the axis of compression. Strains of 4% over the 2-day period were within the range attributed to rock distortion preceding semibrittle failure. It was suggested that the range from brittle to plastic type behavior is feasible within the Arctic Ocean sea ice, depending upon the applied rate of strain and/or the ambient confining pressures. (Sims-ISWS)
W77-07373

RS77-4-266

SATELLITE AND CURRENT DROGUE STUDIES OF OCEAN-DISPOSED WASTE DRIFT,
Delaware Univ., Newark. Center for Remote Sensing.
V. Klemas, G. R. Davis, and R. D. Henry.
Journal Water Pollution Control Federation, Vol. 49, No. 5, p 757-763, May 1977. 3 fig, 1 tab, 13 ref. NASA NAS5-20983.
Descriptors: *Currents(Water), *Ocean currents, *Waste disposal, *Remote sensing, *Atlantic Ocean, Satellites(Artificial), Circulation, Water circulation, Ocean circulation, Aircraft, Dye releases, Tracers, Coasts, Continental shelf, Monitoring, Water pollution, *Path of pollutants, Oceans.
Identifiers: Current drogues.

The mounting interest in extracting oil and other resources from the continental shelf and continuing use of shelf waters for waste disposal is creating a need for cost-effective, synoptic means of determining currents and monitoring pollutants in the shelf regions. A satellite-aircraft-drogue approach was developed which employs remotely tracked expendable drogues together with satellite and aircraft observations of waste plumes and current tracers, such as dyes or suspended sediment. Tests conducted on the continental shelf and in Delaware Bay indicated that the system provides a cost-effective means of studying current circulation, oil slick movement, and ocean waste dispersion under a wide range of environmental conditions. (Sims-ISWS)
W77-09358

RS77-4-267

VERIFICATION BY REMOTE SENSING OF AN OIL SLICK MOVEMENT PREDICTION MODEL,
Delaware Univ., Lewes. Marine Studies Complex.
V. Klemas, G. Davis, and H. Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-12444, Price codes: A02 in paper copy, A01 in microfiche. Report to NASA, Goddard Space Flight Center, Greenbelt, Md., October 1975. 2 p. NAS5-20983.
Descriptors: *Oil pollution, *Remote sensing, *Water pollution sources, Monitoring, *Oil spills, Model studies.
Identifiers: *Prediction models, LANDSAT satellites.

LANDSAT, aircraft, ships and air-dropped current drogues have been deployed to determine current circulation and to track oil slick movement on four different dates in Delaware Bay. The results were used to verify a predictive model for oil slick movement and dispersion. The model predicts the behavior of oil slicks given their size, location, tidal stage (current), weather (wind) and nature of crude. Both LANDSAT satellites provided valuable data on gross circulation patterns and convergent coastal fronts which by capturing oil slicks significantly influence their movement and dispersion. (Sinha-OEIS)
W77-07745

RS77-4-268

AN AERIAL CENSUS OF SPOTTED SEALS, PHOCA VITULINA LARGHA,
Alaska Dept. of Fish and Game, Fairbanks.
J. J. Burns, and S. J. Harbo, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 125-26, November 1976. 03-5-022-53.

Descriptors: *Alaska, *Baseline studies, *Resources development, *Data collections, *Ecological distribution, *Environmental effects, Water resources, Mammals, Sea ice.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Seals(Spotted), *Bering Sea, Seasonal distribution, Phoca vitulina largha.

Determination was made of the seasonal density and distribution of spotted seals, Phoca vitulina largha, in the ice front of eastern Bering Sea. During later winter and early spring, this seal occurs in considerable numbers, within the proposed Bristol Bay, St. George Basin and Navarin Basin lease areas. All data collected have been transcribed from field record forms to computer forms. These forms have been keypundhed and verified. (See also W77.06793) (Sinha-OEIS)
W77-06800

RS77-4-269

PRELIMINARY CATALOG OF SEABIRD COLONIES AND PHOTOGRAPHIC MAPPING OF SEABIRD COLONIES,
Fish and Wildlife Service, Anchorage, Alaska. Office of Biological Services and Coastal Ecosystems.
C. J. Lensink, and J. C. Bartonek.
In: Environmental Assessment of the Alaskan Continental Shelf. Principal Investigators' Reports for the Quarter Ending Sept. 1976, Vol 1. Marine Mammals, Marine Birds, p 485-524, November 1976. 21 fig, 2 tab. 01-5-022-2538/01-06-022-11437.

Descriptors: *Alaska, *Baseline studies, *Resources development, Data collections, *Ecological distribution, *Environmental effects, Water resources, Bird, Distribution patterns, Population, Surveys.
Identifiers: *Outer Continental Shelf, Environmental assessment, Environmental impact, *Bristol Bay(Alas).

This report contains the preliminary catalog of seabird colonies in the Bristol Bay Basin and a summary of other activities during the quarter. The location and relative size of marine bird colonies bounding the Bristol basin are summarized and information is given about their location, composition, size, and amount of land occupied. (See also W77-06793) (Sinha-OEIS)
W77-06816

RS77-4-270

ICE MOVEMENTS IN THE BEAUFORT SEA 1973-1975: DETERMINATION BY ERTS IMAGERY,
Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
L. W. Sobczak.
Journal of Geophysical Research, Vol. 82, No. 9, p 1413-1418, March 20, 1977. 4 fig, 1 tab, 7 ref.

Descriptors: *Sea ice, *Movement, *Winds, *Remote sensing, *Arctic, Ice cover, Polar regions, Cold regions, Satellites(Artificial), Ice, Spring, Data processing, Analytical techniques.
Identifiers: *ERTS, *Beaufort Sea, Sea ice movements.

Remote sensing (ERTS) imagery was used to map the distribution of leads in the sea ice over the Beaufort Sea during late February through early April in 1973, 1974, and 1975. A comparison of the bearings and speeds of ice movements obtained from ERTS-based maps with those of geostrophic winds calculated from average daily and weekly atmospheric pressure charts indicated that the ice drifts at about 1/100 of the speed of the geostrophic winds in a direction about 20 degrees to the left. During early March 1973, before excessive ice breakup, the sea ice moved slowly, about 0.3 km/d, but during periods of rapid ice fracturing (March and April 1975), the sea ice moved at rates as high as 18.2 km/d. (Sims-ISWS)
W77-07769

RS77-4-271

NTIS/PS-77/0532/0GA PC N01/MF N01
National Technical Information Service, Springfield, Va.
Remote Sensing of the Ocean. Part 1. Physical, Chemical, and Geological Properties (A Bibliography with Abstracts).
Rept. for 1970-May 77,
Robena J. Brown. Jun 77, 237p*
Supersedes NTIS/PS-76/0468, and NTIS/PS-75/446, and Updates COM-73-11676.

Descriptors: *Bibliographies, *Oceans, *Remote sensing, Sea ice, Marine biology, Surface temperature, Algae, Tectonics, Geological faults, Aerial photography, Radiosondes, Underwater sound, Radiometry, Infrared mapping, Microwave radiation, Light transmission, Sea water.

The studies describe 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. (This updated bibliography contains 232 abstracts, 36 of which are new entries to the previous edition.)

RS77-4-272

AD-A040 275/0GA PC A04/MF A01
Texas A and M Univ College Station Remote Sensing Center
Radar Studies of Arctic Ice and Development of a Real-Time Arctic Ice Type Identification System.
Final rept.,
J. A. Schell, B. R. Jean, and W. C. Hulse. Jan 76, 69p Rept no. RSC-3005-7
Contract N60921-74-C-0008

Descriptors: *Radar, *Data processing, Signal processing, *Sea ice, *Identification systems, Radar signatures, Classification, Arctic regions, Radar signals, Real time.
Identifiers: *Scatterometers.

The Remote Sensing Center at Texas A and M University is conducting studies for the Naval Surface Weapons Center to develop a real-time, special purpose radar data processor. The purpose of this processing system is to provide ice type identification using radar scatterometer measurements. This document provides information for the operation and maintenance of the developed processor system. (Author)

RS77-4-273

PB-268 674/9GA PC A06/MF A01
Inter-American Tropical Tuna Commission, La Jolla, Calif.
Comparison of NOAA 3-4 VHRR Imagery and LANDSAT Multi-Spectral Scanner Images with Marine Resource Measurements.
Final rept.,
Merritt R. Stevenson, Forrest R. Miller, and Robert G. Kirkham. Dec 76, 124p NOAA-77051117
Grant NOAA-04-6-158-44043

Descriptors: *Oceanographic data, *Meteorological data, *Data processing, *Image processing, Meteorological satellites, Ocean temperature, Surface temperature, Coasts, Color, Infrared scanners, Radiometers, Fisheries, Tunas, Oceanographic surveys, Chlorophylls, Atmospheric temperature, Wind(Meteorology), Water vapor, California Gulf, South Pacific Ocean, Peru, Spaceborne photography.
Identifiers: NOAA satellites, LANDSAT 1 satellite.

A comparison of satellite-derived data with observations made aboard the NMFS research vessel DAVID STARR JORDAN are discussed, particularly the procedures used for processing shipboard data. Meteorological conditions during the month-long cruise are reviewed. Additional results in the analysis of LANDSAT-1 MSS data over the Gulf of California are given. Careful evaluation of MSS data showed the need for further software development and computer programs were written to correct for image skew for both compressed and full resolution imagery. The Commission's participation in a cooperative Coastal Zone Ocean Color Experiment is also reviewed. The details of processing the raw VHRRIR data are discussed, as are the results of a comparison of VHRRIR data and sea truth data. A smaller topic of study was to evaluate VHRR data during a small Nino condition off Peru during 1975. Comments on meteorological conditions together with radiosonde soundings from the R/V MOANA WAVE are included.

RS77-4-274

PB-268 817/4GA PC A05/MF A01
Inter-American Tropical Tuna Commission, La Jolla, Calif.
Computer Processing of LANDSAT-1 MSS Digital Imagery for Marine Studies.
Technical rept.,
Robert G. Kirkham, Merritt R. Stevenson, and Forrest R. Miller. Feb 76, 78p NOAA-77051115
Grant NOAA-04-6-158-44043

Descriptors: *Remote sensing, *Ocean environments, *Image processing, Computer programs, Fortran, California Gulf, Data processing.
Identifiers: LANDSAT 1 satellite, CDC 3600 computers.
A procedure is described in which a series of 15 computer programs were developed to process data from the 4 spectral bands of the Multispectral Scanner System aboard LANDSAT-1 for the central part of the Gulf of California. Methods to specifically produce digital auxiliary tapes of full scenes from the EROS Computer Compatible Tapes (CCT's) and from these tapes to construct digital images using a high speed line printer are discussed. Comparison of prominent surface features in the Gulf with computer generated benchmarks showed the gridding program to be quite accurate in generating geographical benchmarks for the full scene imagery. Additional programs provided for masking land/sea margins. Detailed discussions related to the production of full resolution imagery are also presented. Other programs were written to study calibration data and to determine DN values characteristic of water and land in the different bands. Training areas in both spatially uniform regions and in those possessing horizontal surface gradients were studied to evaluate distribution characteristics of DN values. A listing of the computer programs used in processing MSS data together with documentation, and additional information on processing time and costs estimates are included.

RS77-4-275

PB-268 849/7GA PC A04/MF A01
Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
Spectral Band Positioning for Purposes of Bathymetry and Mapping Bottom Features from Satellite Altitudes.
Technical rept.,
D. R. Lyzenga, C. T. Wezernak, and F. C. Polcyn.
Jan 76. 61p ERIM-115300-5-T, NOAA-77051116
Grant NOAA-04-5-158-58

Descriptors: *Ocean bottom, *Submarine topography, *Remote sensing, Visible spectrum, Marine atmospheres, Atmospheric attenuation, Mapping, Scientific satellites, Bathymetry, Deep water, Oceanographic data, Underwater light, Reflection, Mathematical analysis.
Identifiers: LANDSAT satellites, *Multiband spectral reconnaissance, Atmospheric transmissivity.

An analysis was performed to determine the proper positioning of a 100 nm wide spectral band for purposes of mapping water depth and bottom features using a LANDSAT series satellite. Calculations were performed for the condition of clear marine atmospheres and relatively clear coastal and oceanic waters. The results of the analysis indicate that a shift in the present LANDSAT band 4 (500nm to 600nm) to shorter wavelengths is desirable. Positioning the band to span the spectral region 480 nm to 580 nm would serve to increase the utility of LANDSAT for the specified application.

RS77-4-276

PB-270 323/9GA PC A08/MF A01
Radiometric Technology, Inc., Wakefield, Mass.
Microwave Radiometric Sensing of Surface Temperature and Wind Speed from SEASAT.
Final rept.,
Ronald A. Porter, and Ping-Tong Ho. 22 Feb 77, 167p NOAA-77062710
Contract NOAA-6-35217

Descriptors: *Remote sensing, *Ocean temperature, *Ocean surface, *Surface temperature, *Wind velocity, Accuracy, Radiometers, Microwave frequencies, Emissivity, Dielectric properties, Sea water, Atmospheric models, Algorithms.
Identifiers: SEASAT satellite.

A comprehensive study has been performed to determine the accuracy with which sea surface temperatures and wind speeds can be derived from brightness temperatures to be sensed by the SEASAT SMMR microwave radiometer. This work was based on the use of 2-scale ocean roughness model. An improved 2-section ocean foam model, consisting of white-caps and foam streaks, was applied to the work performed in the study. Eleven microwave frequencies were used in the study, together with 10 atmospheric models, covering Sub-Polar, Mid-Latitude and Tropical regions. All computations were performed at a single antenna beam incidence angle of 48.9 degrees, which is the SEASAT viewing angle. An evaluation was performed on the effects of scattered solar radiation on sea surface brightness temperatures to be measured with a 6.6 GHz radiometer. An algorithm for deriving sea surface temperatures and wind speeds from brightness temperatures, has been developed for use on SEASAT. A set of conclusions and recommendations for further studies are presented.

RS77-4-277

31545 **Sapp, C. D.** Remote measurement of shoreline changes in coastal Alabama: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 224-231, illus. (incl. table, sketch maps), 1975.

RS77-4-278

22865 **Amos, C. L.** Suspended sediment analysis of seawater using Landsat imagery, Minas Basin, Nova Scotia: Can., Geol. Surv., Pap., No. 76-1C, p. 55-60, illus. (incl. table, sketch map), 1976. (Project 740012).

RS77-4-279

26463 **Caston, G. F.** The floor of the North Channel, Irish Sea; a side-scan sonar survey: G. B., Inst. Geol. Sci., Rep., No. 76-7, 16 p. (incl. French, German sum.), illus. (incl. table, sketch maps), 1976.

RS77-4-280

31009 **Bartlett, D.; Klemas, V.; Philpot, W.; *et al.*** Applications of remote-sensing technology to environmental problems of Delaware and Delaware Bay: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 188-194, illus. (incl. geol. sketch map), 1975.

RS77-4-281

31230 **Thomson, K. P. B.; Ross, S.; and Howard-Lock, H. E.** Remote sensing of oil spills: Can. Soc. Pet. Geol., Mem., No. 4, p. 829-840, illus. (incl. tables), 1975.

RS77-4-282

23337 **Miller, G. H.; and Berg, D. W.** An ERTS-1 study of coastal features on the North Carolina coast: 41 p., illus. (incl. tables, sketch map), 1976. (Rep. No. MR 76-2) *available from:* NTIS, Operations Div., Springfield, Va., United States. *Work done for U. S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia.*

RS77-4-283

22157 **Medley, E.; and Luternauer, J. L.** Use of aerial photographs to map sediment distribution and to identify historical changes on a tidal flat: Can., Geol. Surv., Pap., No. 76-1C, p. 293-304, illus. (incl. tables, sketch maps), 1976. (Project 740062).

RS77-4-284

ID NO.- EI770970487 770487
MODELING OF OIL SPILL TRAJECTORIES USING SEQUENTIAL SATELLITE IMAGERY.
McLeod, Wilfred R.; Kennedy, James H.; Hodder, David T.
Marathon Oil Co
Offshore Technol Conf 9th Annu, Proc, Houston, Tex, May 2-5 1977. Sponsored by AIME, New York, NY, 1977 v 1 Pap OTC 2764 p 319-324 CODEN: OSTCBA
DESCRIPTORS: (*WATER POLLUTION, *Oil Spills), (SATELLITES, Remote Sensing),
CARD ALERT: 453, 655
The satellite analysis methods reported in this study offer a valuable alternative to the existing numerical models. On the one hand, they offer a synoptic view of the instantaneous circulation patterns over large portions of the gulf, and secondly, their repetitive nature offers the possibility of timelapse study of suspended sediment boundary movements. From these studies it is possible to quantify actual vector movements experienced under a variety of conditions and for long time periods. Thirdly, the sediment movements inferred actually reflect the integrated light from the top ten meters or so of the water surface, and hence, at least in part, better represent the movement of subsurface spills. The satellite suspended sediment analysis was done by automated image density coding and provides new baseline information on the normal seasonal variation in turbidity over a 5 year period, as well as its geographic distribution. 8 refs.

RS77-4-285

ID NO.- EI771075682 775682
RELATIVE REFLECTANCE AND COMPLEX REFRACTIVE INDEX IN THE INFRARED FOR SALINE ENVIRONMENTAL WATERS.
Querry, Marvin R.; Holland, Wayne E.; Waring, Richard C.; Earls, Leonard M.; Querry, Mary D.
Univ of Mo at Kansas City
J Geophys Res v 82 n 9 Mar 20 1977 p 1425-1433 CODEN: JGREA2
DESCRIPTORS: *OCEANOGRAPHY, (WATER POLLUTION, Water Quality), REMOTE SENSING,
CARD ALERT: 453, 471
By using distilled water as the standard reflector, relative specular reflectance spectra in the 2- to 20- mu m wavelength region of the infrared were measured for surface water samples collected from the San Francisco Bay, the Pacific Ocean, the Atlantic Ocean, the Great Salt Lake (Utah), the Dead Sea (Israel), and an effluent pit of a phosphate mine in central Florida. Phase difference spectra and spectral values of the complex refractive index were computed for each water sample by applying a Kramers-Kronig analysis to the relative reflectance spectra. Spectral values for the complex refractive index suitable for Mie scattering calculations were tabulated for each water sample. The reflectance spectra of the natural saline waters bore great similarity to spectra for individual aqueous solutions containing NaCl, K//2SO//4, NH//4H//2PO//4, NaNO//3, and NaHCO//3. Chemical analyses of the water samples are also presented in tabular form. 14 refs.

RS77-4-286

ID NO.- EI770970460 770460
SATELLITE AND CURRENT DROGUE STUDIES OF OCEAN-DISPOSED WASTE DRIFT.
Klemas, Vytautas; Davis, Gary R.; Henry, Robert D.
Univ of Del, Newark
J Water Pollut Control Fed v 49 n 5 May 1977 p 757-763
CODEN: JWPFA5
DESCRIPTORS: *WATER POLLUTION, WASTE DISPOSAL, (REMOTE SENSING, Environmental Applications).
CARD ALERT: 453, 452, 471
The continuing use of the continental shelf for waste disposal and the extraction of oil and other resources pose an environmental threat to the shelf regions. The offshore-onshore transport rates of pollutants, sediments, and nutrients strongly influence the ecology of the coastal zone. In order to keep the environmental impact within acceptable levels, it is important to understand the circulation and exchange processes on the shelf. Satellites can make synoptic observations of certain large scale processes indicative of pollution transport on the continental shelf. The objective of this study was to determine from LANDSAT imagery the drift and dispersion of plumes generated by the dumping of acid waste and to compare the satellite results with drogue and current meter data. 13 refs.

RS77-4-287

ID NO.- EI771076044 776044
BOTTOM CONFIGURATION AND ENVIRONMENT OF TAMPA BAY.
Rosenshein, J. S.; Goodwin, C. R.; Jurado, Antonio
US Geol Surv, Tampa, Fla
Photogramm Eng Remote Sensing v 43 n 6 Jun 1977 p 693-699
CODEN: PERSDV
DESCRIPTORS: *PHOTOGRAMMETRY,
CARD ALERT: 405, 742
Photogrammetric and other methods have been used successfully to provide detailed information on bottom configuration as part of an evaluation of the hydrology of Tampa Bay. About 200 mi**2 (520 km**2) of bay bottom have been mapped using photogrammetric methods. Detailed information on bottom configuration has played an important part in the calibration of a hydrodynamic model of the bay and in the use of this model to predict effects on circulation resulting from proposed deepening of the ship channel in Tampa Bay. 5 refs.

RS77-4-288

ID NO.- EI771076896 776896
REMOTE SENSING OF SEA ICE BY MICROWAVE RADIOMETRY.
Tiuri, Martti; Hallikainen, Martti; Laaperi, Antti
Helsinki Univ of Technol, Finl
Sahko v 50 n 4 Apr 1977 p 149-152 CODEN: SAEFAV
DESCRIPTORS: *REMOTE SENSING, ICE, RADIOMETERS,
IDENTIFIERS: SEA ICE
CARD ALERT: 443, 732, 941, 944
Remote sensing of sea ice has been studied at the Radio Laboratory at Helsinki University of Technology. In addition to theory this article presents results obtained in measurements in the Gulf of Bothnia using UHF and microwave radiometry. Theory and experiments show that the UHF band is superior to microwave frequencies in the remote sensing of sea ice. It has been theoretically proved that using a 3-channel UHF radiometer the thickness of ice can be measured with sufficient certainty. 5 refs.

RS77-4-289

ID NO.- EI770860020 760020
NOTE ON SAR IMAGERY OF THE OCEAN.
Larson, T. R.; Moskowitz, L. I.; Wright, J. W.
Nav Res Lab, Washington, DC
IEEE Trans Antennas Propag v AP-24 n 3 May 1976 p 393-394 CODEN: IETPAK
DESCRIPTORS: (*RADAR, *Imaging Techniques), OCEANOGRAPHY,
CARD ALERT: 716, 471
Synthetic aperture radar (SAR) image formation of the ocean surface including the Gulf Stream Boundary, is discussed. It is pointed out that images in addition to those due to modulation of surface scatterer strength may result from organized scatterer motions such as those due to currents or wave orbital velocities. The modulation of scattering cross section by large waves is expected to depend on the magnitude and direction of the wind, making the relationship between image strengths and wave amplitudes rather complicated. It is suggested that the effect of wave orbital accelerations upon azimuthal focus might provide a more direct measure of wave amplitude. 5 refs.

RS77-4-290

ID NO.- EI771075689 775689
RECENT PROGRESS IN THE REMOTE SENSING OF OCEAN SURFACE CURRENTS.
Maul, George A.
Natl Oceanic & Atmos Adm, Miami, Fla
Mar Technol Soc J v 11 n 1 1977 p 5-13 CODEN: MTSJBB
DESCRIPTORS: (*OCEANOGRAPHY, *Currents), REMOTE SENSING,
CARD ALERT: 471, 732
Under certain conditions, any one or a combination of the following may be used to identify the current's boundary: changes in sea surface temperature, salinity, color, sea state, sea surface topography, wave refraction patterns, and modifications to the lower atmosphere. Infrared sensors have been used most extensively to study ocean circulation; however, new instruments such as passive and active microwave sensors can sense temperature, salinity, sea state, and surface topography, and multispectral visible scanners and spectroradiometers are providing new information on ocean color and sea state. Man's role as an observer and photographer are described. 24 refs.

RS77-4-291

ID NO.- EI770970486 770486
USE OF LANDSAT DATA FOR THE DETECTION OF MARINE OIL SLICKS.
Deutsch, Morris; Strong, A. E.; Estes, J. E.
US Geol Surv
Offshore Technol Conf 9th Annu, Proc, Houston, Tex, May 2-5 1977. Sponsored by AIME, New York, NY, 1977 v 1 Pap OTC 2763 p 311-318 CODEN: OSTCBA
DESCRIPTORS: (*WATER POLLUTION, *Oil Spills), (SATELLITES, Remote Sensing),
IDENTIFIERS: LANDSAT, OIL DETECTION
CARD ALERT: 453, 655
The capability of Landsat to detect some oil slicks in marine waters has been verified. Reflectance anomalies associated with the slicks have been detected visually on film data, by photo-optical enhancement techniques and by computer processing. Applications of Landsat oil slick data include environmental monitoring of coastal waters and detection of natural seeps such as in the Santa Barbara Channel, which may serve as a worldwide exploration aid. 8 refs.

RS77-4-292

ID NO.- EI770970480 770480
O PRIMENENII LAZERNOI LOKATSII DLYA OPREDELENIYA ZAGRAYZNENIYA POVERKHNOSTI MORYA NEFTEPRODUKTAMI. $left bracket$ Lidars Application for Determination of Sea Suface Pollution by Oil Products $right bracket$.
Abramov, O. I.; Eremin, V. I.; Lobov, L. I.; Polovinko, V. V.
All-Union Electrotech Inst, USSR
Izv Akad Nauk SSSR Fiz Atmos Okeana v 13 n 3 Mar 1977 p 331-334 CODEN: IFAOAV
DESCRIPTORS: (*WATER POLLUTION, *Oil Spills), (RADAR, OPTICAL, Infrared Radiation), (LASER BEAMS, Applications), (OCEANOGRAPHY, Measurements),
IDENTIFIERS: LIDARS
CARD ALERT: 453, 744, 471, 717
Principles of distance laser method applications in marine environments are expounded. Mathematical expressions for laser spectrum analysis are formulated, and laboratory results are compared with those obtained in natural conditions. 5 refs. In Russian.

RS77-4-293

ID NO.- EI770860192 760192
REMOTE SENSING OF ESTUARINE FRONTS AND THEIR EFFECTS ON POLLUTANTS.
Klemas, V.; Polis, D. F.
Univ of Del, Newark
Photogramm Eng Remote Sensing v 43 n 5 May 1977 p 599-612 CODEN: PERSDV
DESCRIPTORS: *REMOTE SENSING, WATER POLLUTION,
CARD ALERT: 405, 453, 742
Estuarine fronts represent regions of extremely high gradient or discontinuity in various parameters of physical interest, the most important being water velocity and density fields. - Such fronts strongly influence pollutant dispersion by capturing oil slicks and other pollutants concentrated in surface films and drawing them down into the water column. Imagery from the Landsat satellites provided the most effective means of determining the location and extent of frontal systems over all portions of the tidal cycle. This information is being used to modify the oil drift and spreading model. 16 refs.

RS77-4-294

ID NO.- EI770857605 757605
STUDY OF THE PROCESSES OF ICE FORMATION BASED ON AIRCRAFT MEASUREMENTS OF RADIOTHERMAL EMISSION.
Bespalova, E. A.; Rabinovich, Yu. I.; Sharkov, E. A.; Shiryaeva, T. A.; Etkin, V. S.
Inst of Space Res, Acad of Sci, USSR
Sov Meteorol Hydrol n 2 1976 p 54-57 CODEN: SMHYDK
DESCRIPTORS: (*ICE, *Remote Sensing), RADIOMETERS, THERMAL VARIABLES MEASUREMENT,
IDENTIFIERS: RADIOTHERMAL EMISSION
CARD ALERT: 443, 941, 944
The results of measurements of the radiothermal emission from the ice-covered surface of the Northern Caspian made from an IL-18 flying-laboratory aircraft in December 1973 with a highly sensitive three-centimeter radiometer are discussed. The high sensitivity of the passive instrument made it possible to distinguish types of ice, to estimate the thickness of the ice at the initial stage of ice formation and the degree of snow coverage, and to determine the onset of icing, which cannot be determined visually or from aerial photographs. The radiometric measurements made it possible to obtain a detailed chart of the ice situation on part of the Northern Caspian under weather conditions unfavorable for visual observations or aerial survey work, and to observe a high growth rate of the ice and formation of a land floe.

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Section 5

URBAN LAND USE

Geography, Environmental and Population Studies,
Lower Tropospheric Meteorology and Land-Use Studies

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RS77-5-215

N77-28562*# Sheffield Univ. (England).
A METHODOLOGY FOR PRODUCING SMALL SCALE RURAL LAND USE MAPS IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY Final Report
J. L vanGenderen, Principal Investigator and B. F. Lock Dec. 1976 313 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(E77-10187; NASA-CR-151173) Avail: NTIS HC A14/MF A01 CSCL 08B

The author has identified the following significant results. Results have shown that it is feasible to design a methodology that can provide suitable guidelines for operational production of small scale rural land use maps of semiarid developing regions from LANDSAT MSS imagery, using inexpensive and unsophisticated visual techniques. The suggested methodology provides immediate practical benefits to map makers attempting to produce land use maps in countries with limited budgets and equipment. Many preprocessing and interpretation techniques were considered, but rejected on the grounds that they were inappropriate mainly due to the high cost of imagery and/or equipment, or due to their inadequacy for use in operational projects in the developing countries. Suggested imagery and interpretation techniques, consisting of color composites and monocular magnification proved to be the simplest, fastest, and most versatile methods.

RS77-5-216

N77-26587*# Florida Univ., Gainesville. Dept. of Geology.
BASIC HYDROGEOLOGIC AND REMOTE SENSING DATA FOR SELECTION OF SANITARY LANDFILL SITES
H. K. Brooks, B. E. Ruth, and J. D. Degner 5 Apr. 1977 28 p refs
(Grant NsG-7236)
(NASA-CR-153280; UFL/COEL-77/002; Rept-1) Avail: NTIS HC A03/MF A01 CSCL 08G

Solid waste disposal were studied in Volusia County to protect the water supply in the area. Highlands in this County are of limited areal extent and, most significantly, the sand hills and ridges are in areas where recharge of the Floridan aquifer occurs. This study proves that well drained soils meeting the current State requirements are of limited areal extent. These areas should not be utilized as sanitary landfill sites! Rather, it is recommended that the Tomoka Farm Road site into the adjacent wetlands be extended. The County site on Rima Ridge recommended by Greenleaf-Telesca as the primary waste burial site in the County should be re-evaluated because of potential danger to the Daytona Beach water supply. Author

RS77-5-217

N77-24563*# Goodwin (Glen), Sun City, Ariz.
BENEFIT AND IMPACT OF THE ARIZONA LAND-USE EXPERIMENT: EXECUTIVE SUMMARY
Glen Goodwin 3 Jan. 1977 16 p
(NASA Order A-23739)
(NASA-CR-151985) Avail: NTIS HC A02/MF A01 CSCL 08B

The benefits and impact of the Arizona Land-Use Experiment on the people of Arizona are examined along with the process of the technology transfer to the political and private sector of the Arizona community. Since the remotely-sensed data in use in Arizona consisted of a blend of spacecraft and aircraft information, it was hoped that the role of the aircraft in the transfer process would be identified and its benefit be determined in a real-world situation. In addition, the role of the institutional arrangements set up in Arizona to facilitate the transfer of remotely-sensed information to the user community was examined. Author

RS77-5-218

N77-26581*# Kentucky Univ. Research Foundation, Lexington. Dept. of Forestry.
REMOTE SENSING OF EFFECTS OF LAND USE PRACTICES ON WATER QUALITY Final Report, 11 Oct. 1974 - 31 May 1977
Donald H. Graves and George B. Colthrap 31 May 1977 170 p refs
(Contract NAS8-31006)
(NASA-CR-150306) Avail: NTIS HC A08/MF A01 CSCL 08H

An intensive study was conducted to determine the utility of manual densitometry and color additive viewing of aircraft and LANDSAT transparencies for monitoring land use and land use change. The relationship between land use and selected water quality parameters was also evaluated. Six watersheds located in the Cumberland Plateau region of eastern Kentucky comprised the study area for the project. Land uses present within the study area were reclaimed surface mining and forestry. Fertilization of one of the forested watersheds also occurred during the study period. Author

RS77-5-219

N77-24668# Herkimer-Oneida Counties Comprehensive Planning Program, Utica, N. Y.
LAND USE INVENTORY UPDATE AND PROJECTION UTICA-ROME AIR QUALITY MAINTENANCE AREA (AQMA) Final Report
Stephen S. Olney Jan. 1977 52 p
(Contract EPA-68-02-2305)
(PB-262906/1; EPA-902/4-77-001) Avail: NTIS HC A04/MF A01 CSCL 13B

The Utica-Rome AQMA consists of 14 Mohawk Valley towns and cities in Herkimer and Oneida Counties, New York. Land uses in the area were inventoried based upon aerial photo measurements of a sample of kilometer squares. Urban land uses are projected to 1980, 1985, 1990, and 2000. GRA

RS77-5-220

N77-25615# Army Engineer Topographic Labs., Fort Belvoir, Va.
CAPABILITIES OF REMOTE SENSORS TO DETERMINE ENVIRONMENTAL INFORMATION FOR COMBAT
Jack N. Rinker, Judy Ehlen, Alan E. Krusinger, Thomas R. Currin, and Ambrose O. Poulin Nov. 1976 247 p
(DA Proj. 4A1-61102-B-52C)
(AD-A035139; ETL-0081) Avail: NTIS HC A11/MF A01 CSCL 15/4

U.S. Army Field and Technical Manuals were used to develop a list of 313 environmental information needs, or factors, required by the Army to accomplish its various tasks. Each factor was evaluated against a list of remote sensing systems to determine the extent to which each system could provide the needed information. Interpretation procedures were restricted to evaluation of imagery by conventional interpretation techniques and equipment. The systems evaluated are LANDSAT (ERTS), radar, thermal infrared, low-level oblique photography, standard photo index sheets, stereo 1:100,000 scale vertical aerial photography, and stereo 1:20,000 scale vertical aerial photography. GRA

RS77-5-221

N77-26701*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IN SITU MEASUREMENTS OF ARCTIC ATMOSPHERIC TRACE CONSTITUENTS FROM AN AIRCRAFT
Gregory M. Reck, Daniel Briehl, and Ted W. Nyland Washington Jun. 1977 64 p refs
(NASA-TN-D-8491; E-9040) Avail: NTIS HC A04/MF A01 CSCL 13B

In situ measurements of the ambient concentrations of several atmospheric trace constituents were obtained using instruments installed on board the NASA Convair 990 aircraft at altitudes up to 12.5 kilometers over Alaska and the Arctic Ocean. Concentration data on ozone, carbon monoxide, water vapor, and particles larger than 0.5 micrometer in diameter were acquired. Author

RS77-5-222

N77-26568* Cornell Univ., Ithaca, N.Y.
REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1976 - 31 May 1977
Ta Liang, Arthur J. McNair, and Warren R. Philipson Jun. 1977 276 p refs
(Grant NGL-33-010-171)
(NASA-CR-153288; SASR-10) Avail: Issuing Activity CSCL 05B

Remotely sensed data obtained by aircraft and satellite were used to assess land suitability for septic tanks, analyze linears for ground water sources, delineate town aquifers, evaluate land for state park development, and assess drainage for an historic building. Projects in progress include environmental analysis of proposed fly ash disposal sites, thermal analysis of building insulation, and an assessment of vineyard-related problems. Spinoff and future projects are briefly described. A.R.H.

RS77-5-223

N77-23580# Geological Survey, Reston, Va.
A LAND USE AND LAND COVER CLASSIFICATION SYSTEM FOR USE WITH REMOTE SENSOR DATA
James R. Anderson, Ernest E. Hardy, John T. Roach, and Richard E. Witmer 1976 31 p refs
(USGS-Circ-671; USGS Professional Paper-964) Avail: NTIS HC A03/MF A01 CSCL 08B

The framework of a national land use and land cover classification system is presented for use with remote sensor data. The classification system was developed to meet the needs of Federal and state agencies for an up-to-date overview of land use and land cover throughout the country on a basis that is uniform in categorization at the more generalized first and second levels and that will be receptive to data from satellite and aircraft remote sensors. The proposed system uses the features of existing widely used classification systems that are amenable to data derived from remote sensing sources. Author

RS77-5-224

N77-26784# Battelle Columbus Labs., Ohio.
***THE TRANSPORT OF OXIDANT BEYOND URBAN AREAS.* COMPILATION OF DATA FOR THE NEW ENGLAND STUDY, 1975 Final Report**
Chester W. Spicer, Darrell W. Joseph, and Gerald F. Ward Nov. 1976 398 p
(Contract EPA-68-02-2241)
(PB-264205/6; EPA-600/3-76-109) Avail: NTIS HC A17/MF A01 CSCL 04B

A study of oxidant transport was conducted in New England for wide area and vertical aerial sampling. The mobile laboratory was equipped to continuously monitor O3, NO, NO2, NOx, CH4, C2H2, C2H4, C2H6, non-methane hydrocarbon, fluorocarbon 11(F-11), CC14, CO, temperature, solar intensity, relative humidity, wind speed, wind direction, and barometric pressure. The airplane was outfitted to continuously monitor ozone, nitric oxide, and temperature and to collect air samples in Teflon bags. The bag samples were analyzed GRA

RS77-5-225

A77-36025 **Evaluation of infrared television /IRTV/ for remote monitoring of stack effluent velocity and SO2 concentrations.** E. F. Cross, J. A. McKay, and R. J. Nichols (Aerospace Corp., El Segundo, Calif.). In: Modern utilization of infrared technology II: Civilian and military; Proceedings of the Seminar, San Diego, Calif., August 26, 27, 1976. (A77-36014 16-35) Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1976, p. 74-83. U.S. Environmental Protection Agency Contract No. 68-02-2242.

Field measurements were carried out to determine the feasibility of using infrared television systems to measure plume characteristics of power plant stack emissions. Emphasis was placed on determining the suitability of these imaging systems for monitoring sulfur dioxide concentrations and effluent velocities in stack emissions. Specific objectives were: (1) to obtain experimental infrared data on stack plume characteristics, (2) to establish optimum infrared television system parameters for detection and measurement of these stack plume emissions, and (3) to determine the feasibility of using the General Electric infrared vidicon to monitor stack plume parameters of interest. This paper describes in detail the test equipment, measurement techniques, and resulting data associated with experiments conducted at the Duke Power Company Riverbend Station. Data on observed infrared emissions from refinery burn-off stacks are also presented for comparison. (Author)

RS77-5-226

A77-37504 * # **Flooding of Monroe County, Michigan - A comparison of three remote sensor data sets.** M. L. Bryan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.; Michigan, Environmental Research Institute, Ann Arbor, Mich.). *Michigan Academician*, vol. 8, Spring 1976, p. 425-440. 8 refs.

During the spring of 1973, three techniques were used to obtain remotely sensed data pertaining to the flooded shoreline of Monroe County, Michigan. Although digitized data from the Earth Resources Technology Satellite were available on magnetic tapes, analysis was based on interpretation methods normally used for aerial photography, since the black and white IR photography and side-looking airborne radar (SLAR) data were available only as images. Using IR photography as the standard, it was found that ERTS-1 Band 7 imagery had a 93% accuracy in detecting areas in the combined category of open water and flooded fields. X(HH) data from SLAR detected that built-up and wet areas were built-up (89 to 100% accuracy), but not that they were wet. It is suggested that these two sensors used in concert from orbital heights could provide information useful to relief organizations in flooded areas. It is considered likely that SLAR data will improve as higher resolution becomes available. M.L.

RS77-5-227

A77-36028 **Remote measurement of gases using discretely tunable infrared lasers.** E. R. Murray (Stanford Research Institute, Menlo Park, Calif.). In: Modern utilization of infrared technology II: Civilian and military; Proceedings of the Seminar, San Diego, Calif., August 26, 27, 1976. (A77-36014 16-35) Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1976, p. 96-104. 14 refs. Research supported by the U.S. Geological Survey and NSF.

Single-ended laser radars using discretely tunable infrared gas lasers have been demonstrated to be capable of high-sensitivity remote measurement of gases. Two systems have been investigated: (1) a deuterium fluoride laser was used for remote measurement of the integrated concentration of HCl, CH4, and N2O between the lidar system and a topographic target; and (2) a CO2 laser was used for range-resolved measurement of water vapor using radiation backscattered from naturally occurring aerosols in the atmosphere. Calculations indicate that range-resolved concentration profiles can be obtained for many gases at a range of 10 km using commercially available components. (Author)

RS77-5-228

A77-36023 * **Remote measurement of pollution from aircraft.** H. G. Reichle, Jr. (NASA, Langley Research Center, Hampton, Va.). In: Modern utilization of infrared technology II: Civilian and military; Proceedings of the Seminar, San Diego, Calif., August 26, 27, 1976. (A77-36014 16-35) Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1976, p. 55-65. 13 refs.

This paper discusses the problem of the remote measurement of tropospheric air pollution from aircraft platforms. Following a discussion of the energy sources available for passive remote sensing and the location of the absorption bands of the gases, it describes the spectral resolution that would be required and the relative merits of the shorter and longer infrared wavelengths. It then traces the evolution of one instrument concept (the gas filter correlation radiometer) to its present state, and describes flight results that show the technique to be capable of measuring carbon monoxide over water. A new instrument is described that will allow the measurements to be extended to areas over land. (Author)

RS77-5-229

A77-36433 **Regional energy availability from conversion of solid waste.** D. Garofalo and K. R. Martin (Earth Satellite Corp., Washington, D.C.). *Photogrammetric Engineering and Remote Sensing*, vol. 43, June 1977, p. 727-738. 12 refs.

Multi-scale remote sensing records, when used in conjunction with suitable waste production and energy usage multipliers derived from ground-based investigations, can contribute useful quantitative and spatial information relating to (1) the generation of solid organic wastes in urban and rural environments; (2) the energy requirements in terms of residual fuel oil of urban/industrial areas; and (3) the collection and transportation of organic wastes to energy conversion and distribution facilities for meeting regional urban/industrial energy needs. (Author)

RS77-5-230

A77-35455 # **Vegetation and land use on the New England upland, in historical perspective.** R. B. Simpson (Dartmouth College, Hanover, N. H.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 4, Jan. 1977, p. 35-41.

Two photographs taken near Hanover, New Hampshire on a scale of about 1:6000 are given as an exercise in interpretation. Special attention is given to identification of features reflecting land use changes over a period of time. Features permitting the identification of trees typical of the Northern Forest area are described, as is a method of estimating the height of trees from the length of their shadows. C.K.D.

RS77-5-231

A77-41749 # **Measurement of the temperature distribution on urban surfaces.** T. Saito, H. Taniguchi, T. Sonoda, Y. Tashiro, and E. Ishida. *Hokkaido University, Faculty of Engineering, Bulletin*, July 1977, p. 27-38. In Japanese, with abstract in English.

This paper presents the results of measurements of the temperature on the surface areas of the City of Sapporo. Measurements were conducted in June-July, 1976, and remote sensing using a multispectral scanner and a thermographic camera provided the temperature distribution. Surface temperatures in the central district of the city were about 20 C higher than in the green zones in the suburbs, although the temperature showed considerable local differences. Systematic arranging of wide green zones in the urban area is found necessary to maintain the comfortable thermal environment for people residing in the city. (Author)

RS77-5-232

LANDSAT-1 DATA AS IT HAS BEEN APPLIED FOR LAND USE AND WATER QUALITY DATA BY THE VIRGINIA STATE WATER CONTROL BOARD,
Virginia State Water Control Board, Richmond. Div. of Surveillance and Field Studies.
P. L. Trexler, and J. L. Barker.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 371-418, September 1975. 22 fig, 7 tab, 7 ref.

Descriptors: *Water quality, *Land use, *Remote sensing, *Virginia, *Monitoring, Reservoirs, Watersheds(Basins), Land management, Land classification, On-site investigations, Water sampling, Surface waters, Census, Turbidity, Secchi disks, Satellites(Artificial), Spatial distribution, Data processing, Analytical techniques.
Identifiers: LANDSAT, Pixels.

In a joint project with the Virginia State Water Control Board and NASA, water quality monitoring possibilities from LANDSAT were demonstrated, both for direct readings of reflectances from the water and for indirect monitoring of changes in use of land surrounding Swift Creek Reservoir. Film products were shown to have insufficient resolution, and all work was done by digitally processing computer-compatible tapes. Perhaps the greatest potential contribution of LANDSAT is through indirect interpretation, by detecting changes in land cover in a watershed. Land cover maps of the 18,000 hectare Swift Creek Reservoir watershed were prepared for two dates in 1974. A significant decrease in the pine cover was observed in a 740 hectare construction site within the watershed. A measure of the accuracy of classification was obtained by comparing the LANDSAT results with visual classification at five sites on a U-2 photograph. Such changes in land cover can alert personnel to watch for potential changes in water quality. (See also W77-08408) (Humphreys - ISWS)
W77-08432

RS77-5-233

REMOTE SENSING APPLICATIONS IN KANSAS,
Kansas Univ., Lawrence. Space Technology Labs.
B. G. Barr, J. C. Coiner, and D. L. Williams.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agricultural-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 569-584, September 1975. 8 fig, 7 ref. NASA NGL 17-004-024.

Descriptors: *Resources development, *Remote sensing, *Kansas, *Land development, Irrigation, Aerial photography, Project planning, Land use, Reservoirs, Highways, Satellites(Artificial), Planning, City planning, Cities, Urban mapping.
Identifiers: LANDSAT.

The Satellite Applications Laboratory of the University of Kansas Space Technology Center has carried out since April 1972 a program designed to assist decision makers in local, state, and regional agencies in the application of remote sensing techniques to their activities. To date, twenty projects have been initiated in support of 29 separate municipal, county, regional, and state agencies or entities. Several data products have been prepared for the use of these agencies based on LANDSAT imagery: high altitude color, color infrared, and multispectral black and white photography; and imagery from a Hasselblad camera cluster flown in the University's aircraft. Projects organized in the six sequential phases of contact, project definition, project initiation, on-going project, project completion, and continuing support were designed to demonstrate the utility of remote sensing in the context of the user agency. After reviewing these phases, four projects were detailed to illustrate the methods and results of applications projects. Two of these projects have resulted in single user decisions during 1974 related to: (1) completion of an interstate highway and cancellation of construction plans for a large reservoir, and (2) zoning changes around a smaller reservoir. Two on-going projects were also discussed: (1) a multi-user project related to the expansion of irrigation in Kansas, and (2) a program of activities leading to incorporation of remote sensing into the data acquisition methods of Kansas City, Kansas. (See also W77-08408) (Humphreys-ISWS)
W77-08437

RS77-5-234

USE OF AERIAL REMOTE SENSORS TO MONITOR DREDGING PROJECTS,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering.
J. L. Machemehl.
In: Proceedings of the Seventh Dredging Seminar; Held November 8, 1974, New Orleans, Louisiana. Sea Grant Report No CDS-181. TAMU-SG-76-105, Texas A and M University, College Station, p 24-28, September 1975. 6 ref.

Descriptors: *Remote sensing, *Dredging, *Monitoring, Aerial photography, Films, Photography, Coasts, Erosion, Estuaries, Currents(Water), Sediment distribution, Estuarine environment, Waves(Water), Water pollution.

Application of aerial remote sensing to the dredging industry was reviewed. The primary aerial remote sensors considered were black and white, black and white infrared, color, color infrared aerial photographs, and multispectral aerial photographs. Remote sensing can be utilized to obtain data for designing, planning, and controlling a dredging project. (See also W77-07342) (Humphreys-ISWS)
W77-07344

RS77-5-235

REMOTE SENSING APPLICATIONS IN THE INVENTORY AND ANALYSIS OF ENVIRONMENTAL PROBLEMS,
Environmental Protection Agency, Warrenton, Va. Environmental Photographic Interpretation Center.
C. E. Howard, Jr., and C. A. Waters, Jr.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 585-598, September 1975. 10 fig.

Descriptors: *Monitoring, *Environment, *Remote sensing, *Census, Water pollution sources, Air pollution, Feed lots, Landfills, Projects, Satellites(Artificial), Aerial photography, Environmental effects.
Identifiers: LANDSAT, Skylab.

The Environmental Protection Agency, through the Environmental Photographic Interpretation Center (EPIC), is actively engaged in the extraction of environmentally related data from both high resolution and multispectral imaging systems. From its inception, the EPIC has researched the various sensing systems available from both a cost effective and information content standpoint. Through interagency agreements and cooperative programs such as the NASA Aircraft Support Program, imagery has been acquired in areas where EPA has operational requirements. Presently, the efforts of EPIC are directed toward the inventory and analysis of many types of pollution sources, both point and non-point. To date (1975), in its brief 1 1/2 year existence, EPIC has found that the nature of its requirements has almost exclusively demanded the use of high resolution photography. (See also W77-08408) (Humphreys-ISWS)
W77-08438

RS77-5-236

URBAN LAND USE: REMOTE SENSING OF GROUNDBASIN PERMEABILITY,
California Univ., Santa Barbara. Geography Remote Sensing Unit.
L. R. Tinney, J. R. Jensen, and J. E. Estes.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2199-2206, September 1975. 3 fig, 3 tab, 4 ref.

Descriptors: *Remote sensing, *California, *Water resources, *Groundwater, Land use, Groundwater recharge, Groundwater resources, Pervious soils, Watersheds(Basins), Groundwater availability, Urbanization, Evaluation, Aerial photography, Permeability.

A remote sensing analysis of the amount and type of permeable and impermeable surfaces overlying an urban recharge basin was discussed. An effective methodology for accurately generating this data as input to a safe yield study was detailed and compared to more conventional alternative approaches. The amount of area inventoried, approximately 10 sq miles, should provide a reliable base against which automatic pattern recognition algorithms, currently under investigation for this task, can be evaluated. If successful, such approaches can significantly reduce the time and effort involved in obtaining permeability data, an important aspect of urban hydrology dynamics. (See also W77-08062) (Humphreys-ISWS)
W77-08065

RS77-5-237

AN OVERVIEW OF THE DEVELOPMENT OF REMOTE SENSING TECHNIQUES FOR THE SCREWWORM ERADICATION PROGRAM.
National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.
C. M. Barnes, and F. C. Forsberg.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Agriculture-Environment, Volume I-A. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 263-287, September 1975. 16 fig, 8 ref.

Descriptors: *Insect control, *Remote sensing, *Environment, *Texas, *Mexico, Land use, Satellites(Artificial), Climatic data, Weather data, Analytical techniques, Environmental effects, Entomology, Air temperature.
Identifiers: Screwworm, *Screwworm eradication.

The paper reported the current status of remote sensing techniques developed for the screwworm eradication program of the Mexican-American Screwworm Eradication Commission. A review of the type of data and equipment used in the program was presented. Future applications of remote sensing techniques were considered. (See also W77-08408) (Humphreys-ISWS)
W77-08427

RS77-5-238

NTIS/PS-77/0674/0GA PC N01/MF N01
National Technical Information Service, Springfield, Va.
Remote Sensing Applied to Environmental Pollution Detection and Management (A Bibliography with Abstracts).
Rept. for 1964-Jul 77,
Audrey S. Hundemann. Aug 77, 138p*
Updates NTIS/PS-76/0500 and NTIS/PS-75/104.

Descriptors: *Bibliographies, *Air pollution, *Water pollution, *Remote sensing, *Environmental surveys, *Environmental engineering, Water resources, Electric power plants, Industrial plants, Estuaries, Noise pollution, Thermal pollution, Eutrophication, Diffusion, Dispersing, Aerosols, Oil pollution, Spaceborne photography, Aerial photography, Abstracts.

Application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarian problems. (This updated bibliography contains 133 abstracts, all of which are new entries to the previous edition.)

RS77-5-239

NTIS/PS-77/0675/7GA PC N01/MF N01
National Technical Information Service, Springfield, Va.
Remote Sensing Applied to Urban and Regional Planning (A Bibliography with Abstracts).
Rept. for 1964-Jul 77,
Audrey S. Hundemann. Aug 77, 65p*
Updates NTIS/PS-76/0500 and NTIS/PS-75/104.

Descriptors: *Bibliographies, *Urban planning, *Regional planning, *Land use, *Remote sensing, Highway planning, Traffic surveys, Quality of life, Natural resources, Spaceborne photography, Aerial photography, Mapping, Abstracts.

Urban and regional planning using aerial photography and satellite remote sensing methods is discussed. Abstracts cover the use of remote sensing in land use mapping, traffic surveys and urban transportation planning, and taking inventories of natural resources for urban planning. Abstracts dealing with land use and residential quality associated with and acting as an influence on health and physical well-being are included. (This updated bibliography contains 60 abstracts, all of which are new entries to the previous edition.)

RS77-5-240

AD-B002 928/0GA PC A03/MF A01
Air Force Armament Lab Eglin AFB Fla
Operation of an Infrared Thermal Scanner for Plume Measurements.
Final rept. 1 Jul 73-Jun 74,
Charles W. Martin, Raymond F. Askew, and Davut B. Ebeoglu. Dec 74, 35p Rept no. AFATL-TR-74-204
Distribution limitation now removed.

Descriptors: (*Infrared signatures, Plumes), (*Exhaust gases, Emissivity), (*Thermal targets, Calibration), (*Aerial targets, Target signatures), Infrared scanning, Infrared images, Signal processing, Photovoltaic effect.
Identifiers: Infrared cameras, Infrared detectors, Intermediate infrared radiation, Data processing, Aircraft exhaust.

A data processing and system calibration effort has been conducted to provide spatially accurate quantitative radiant intensity data on extended infrared sources. This capability has been developed to permit the experimental study of the infrared exhaust plumes of propulsion systems. The objective of this study is to develop realistic infrared signature simulation for aerial targets. This report describes how numerically accurate infrared imagery may be obtained in the 4 to 5.5 micron band with a Bofors infrared imaging camera coupled to an analog/digital data acquisition system. The general procedures established to calibrate the instrument and the data processing now available to the user are described in detail. (Author)

RS77-5-241

PB-266 824/2GA PC A02/MF A01
Environmental Monitoring and Support Lab., Las Vegas, Nev.
Tracking Pollutants from a Distance.
Journal article,
S. H. Melfi, John D. Koutsandreas, and John Moran. 1977, 6p EPA/600/J-77/007
Pub. in Environmental Science and Technology, v11 n1 p36-38 Jan 77.

Descriptors: *Pollution, *Monitors, *Remote sensing, *Optical radar, Particles, Plumes, Trajectories, Laser beams, Fluorescence, Air pollution, Water pollution, Thermal pollution.
Identifiers: Particulates, *Air pollution detection, *Water pollution detection, Reprints.

Describes use of laser techniques and remote sensing for air and water pollution monitoring.

RS77-5-242

PB-266 438/1GA PC A03/MF A01
Environmental Systems Research Inst., Redlands, Calif.
DIMECNV: A System for Converting Scanner-Digitized Mapping Data Tapes to Polygon Format.
20 Dec 76, 35p
Sponsored in part by Geological Survey, Reston, Va. Geography Program.

Descriptors: *Land use, *Mapping, *Computer programs, Computer graphics, Polygons, Plotting.
Identifiers: *DIMECNV computer program, Montgomery County(Maryland), Fairfax County(Virginia), Format conversion.

The U.S. Geological Survey (USGS) contracted with Environmental Systems Research Institute (ESRI) to develop a computer system to convert scanner-digitized land use data to polygon format suitable for use with computer graphic devices. Land use maps, correlative census and county boundary maps, drainage basin maps and geologic maps were produced by the Central Atlantic Regional Ecological Test Site (CARETS) project and digitized by Canada Geographic Information System (CGIS). ESRI reformatted the tapes produced by CGIS to a polygon format suitable for producing a graphic display. To demonstrate the system's capability, color transparencies and black-and-white printouts of the Montgomery County, Maryland and Fairfax County, Virginia land use maps were produced by playing the digitized data through plotting devices. Documentation of the computer conversion program is provided with this project.

RS77-5-243

PB-267 137/8GA PC A03/MF A01
California State Dept. of Transportation, Sacramento. Transportation Lab.
Remote Identification of Geologic Materials by Multispectral Techniques: An Evaluation of Applicability to Highway Planning in California.
Final rept.,
James Gamble. Sep 76, 45p 632117. FHWA-CA-TL-2117-76-57
See also PB-235 991.

Descriptors: *Geological surveys, *Remote sensing, California, Soil classification, Aerial surveys, Engineering geology, Terrain, Highway planning, Feasibility, Geological maps.
Identifiers: Multiband spectral reconnaissance.

The remote classification of terrain features and natural materials at a California test site, obtained by multisensor scanner and computer assisted processing techniques is compared to a detailed geologic map that served as ground truth for evaluating classification accuracy. The purpose of the study was to determine if the multispectral method of remotely discriminating natural materials had practical application for highway and environmental planning, and for route selection. At the present stage of development the method does not obviate aerial photography and field studies to obtain the information of engineering significance required for preconstruction planning.

RS77-5-244

E77-10148 PC A08/MF A01
Cold Region Research and Engineering Lab., Hanover, N.H.
Land Use and Pollution Patterns on the Great Lakes.
Final rept. Apr 72-Mar 75,
R. K. Haugen, H. L. McKim, and T. L. Marlar. Mar 75, 159p NASA-CR-152641

Descriptors: *Land use, *Great Lakes(North America), Wisconsin, Watersheds, Sediments, Earth Resources program, Multispectral band scanners, Multispectral photography.
Identifiers: *Water pollution.

The author has identified the following significant results. The final mapping of the large watersheds of the Manitowoc and the Oconto was done using the 25% sampling approach. Comparisons were made with earlier strip mapping efforts of the Oconto and Manitowoc watersheds. Regional differences were noted. Strip mapping of the Oconto resulted in over estimation of the amount of agricultural land compared to the random sampling method. For the Manitowoc, the strip mapping approach produced a slight underestimate of agricultural land, and an overestimate of the forest category.

RS77-5-245

34430 Airborne measurements of gases and aerosols from volcanic vents on Mt. Baker. Radke, L.F.; Hobbs, P.V.; Stith, J.L. (Univ. of Washington, Seattle). *Geophys. Res. Lett.;* 3: No. 2, 93-96(Feb 1976).

Airborne measurements of gases and aerosols from the recently activated volcanic vents on Mt. Baker were made on March 27 and June 30, 1975. The total rates of emission of gaseous sulfur on these two days were estimated to be 0.35 and 1.3 kg s^{-1}, respectively. The latter rate is comparable to the largest single, industrial source of sulfur in the Pacific Northwest. A significant increase in the emission of sub-micron aerosols was also observed between March 27 and June 30. Small aerosol particles are produced in the plume of effluents, probably by gas-to-particle conversion, at a rate of about 2 x 10^{17} s^{-1}. However, the concentrations of cloud condensation nuclei and ice nuclei in the plume are comparatively small. Aerosols in the plume, greater than about 1 μm in diameter, consist predominantly of Al, Si, S, K and Ca. Some of the aerosols which were collected in the plume on June 30 might have been Pele's hairs, which are a sign of new magmatic activity.

RS77-5-246

40248 (PB—256939) Remote sensing study of steam-electric power plant thermal discharges to Lake Erie, Detroit and St. Clair Rivers, Ohio and Michigan. (National Field Investigations Center-Denver, Colo. (USA); Environmental Protection Agency, Chicago, Ill. (USA). Region V). Mar 1974. 98p. NTIS $5.00.

Prepared in cooperation with Environmental Protection Agency, Chicago, Ill. Region V.

An airborne remote sensing study of thermal discharges to Lake Erie and the Detroit and St. Clair Rivers was conducted on 9 July 1973. The study area encompassed the southern shore of Lake Erie from about 5 km (3 mi) east of Ashtabula, Ohio, to Toledo (Maumee Bay), Ohio, and the western shore of Lake Erie from Toledo to the mouth of the Detroit River. The western shores of the Detroit and St. Clair Rivers were also included in the study area. Thermal infrared imagery of the entire study area was obtained using infrared line scanners mounted in high performance reconnaissance aircraft. Ground measurements of water temperatures were made at most of the power plants. This imagery and the ground truth water temperature data were used to characterize the observed thermal fields or plumes. (GRA)

RS77-5-247

40176 (PB—255886) Airborne LIDAR RAPS studies, February 1974. Environmental monitoring series. Eckert, J.A.; McElroy, J.L.; Bundy, D.H.; Guagliardo, J.L.; Melfi, S.H. (Environmental Protection Agency, Las Vegas, Nev. (USA). Environmental Monitoring and Support Lab.). Jun 1976. 24p. (EPA—600/4-76/028). NTIS $3.50.

During February 1974, an airborne downlooking LIDAR system was flown in support of the Regional Air Pollution Study being conducted by the U.S. Environmental Protection Agency (EPA) in St. Louis, Missouri. The LIDAR system was used primarily to measure mixing layer height over the metropolitan area during the morning and evening transition periods. The flight plan consisted of south to north and west to east traverses with horizontal data resolution of 1.5 kilometers and a vertical resolution of 30 meters. Final data are presented in computer-generated, iso-scattering curves plotted for altitude versus ground-distance along the particular traverse. (GRA)

RS77-5-248

38803 **Lovegreen, J. R.; Prosser, W. J.; and Millet, R. A.** Geologic analyses of Landsat-1 multispectral imagery of a possible power plant site employing digital and analog image processing: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1293-1308, illus. (incl. geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-5-249

31091 **Gordon, J. P.; Schroeder, R. H.; and Cartmill, R. H.** South Louisiana remote-sensing environmental information system: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 217-223, illus. (incl. table, sketch maps), 1975. *With discussion.*

RS77-5-250

38217 **Barrett, E. C.; and Curtis, L. F.** Introduction to environmental remote sensing: 336 p., illus. (incl. plates, tables), John Wiley & Sons, Inc., New York, N.Y., United States, 1976. (A Halsted Press Book).

RS77-5-251

27050 **Fisera, J.** Pouziti fotogrammetrie na stavbe vodniho dila Dalesice [Application of photogrammetry to the dam of Dalesice]: Geol. Pruzkum, Ostrava, Sb. GPO, No. 5, p. 185-187, plate, 1974.

RS77-5-252

39512 **Jackson, T. J.; and Ragan, R. M.** Value of Landsat in urban water resources planning: Am. Soc. Civ. Eng., Proc., J. Water Resour. Manage. Div., Vol. 103, No. WR1, p. 33-46, illus. (incl. tables, sketch map), 1977.

RS77-5-253

30662 **Hessling, A. H.; and Mura, T. G.** The use of satellite data for regional planning: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. II-B, Coastal zone management; state and local users; user services)*, p. 356-358, illus., 1975.

RS77-5-254

38808 **MacDonald, H. C.; and Grubbs, R. S.** Landsat imagery analysis; an aid for predicting landslide-prone areas for highway construction: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 769-778, illus. (incl. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-5-255

38635 **Eggenberger, A. J.; Rowlands, D.; and Rizzo, P. C.** The utilization of Landsat in nuclear power plant siting: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 799-832, illus. (incl. table, geol. sketch maps), 1975. *NASA Earth resources survey symposium.*

RS77-5-256

ID NO.- EI770854166 754166
TALL STACKS. PLUME DISPERSION AND EMISSION CALCULATIONS BY CORRELATION SPECTROSCOPY.
Millan, Millan M.; Hoff, Raymond M.; Gallant, Alan J.
Environ Can, Toronto, Ont
Proc Air Pollut Control Assoc 1976, for Annu Meet, 69th, Portland, Oreg, Jun 27-Jul 1 1976 v 3 Pap 76-26. 4. 18 p
CODEN: PRAPAP
DESCRIPTORS: (*AIR POLLUTION, *Spectroscopic Analysis). FLUE GASES, ENVIRONMENTAL ENGINEERING.
CARD ALERT: 451, 801, 521, 901
The application of existing prediction formulas to plume dispersion from tall stacks requires questionable extrapolations of height-dependent parameters. As a consequence, there exists a strong requirement for relevant data to validate aspects of effluent dispersion from such structures. In situ measurements at the appropriate height in the atmosphere present technical difficulties, however, and the application of ground-based remote-sensing techniques should provide an effective alternative. The Correlation Spectrometer (COSPEC) is one of these techniques and its use for air pollution studies has now been described by a number of authors. This instrument views vertically through the plume, and is constrained to travel in the existing road network. Methodology used and findings are reported. 13 refs.

RS77-5-257

ID NO.- EI771075031 775031
LAND-USE MAPPING BY MACHINE PROCESSING OF LANDSAT-1 DATA.
Odenyo, Victor A. O.; Pettry, David E.
Va Polytech Inst & State Univ, Blacksburg
Photogramm Eng Remote Sensing v 43 n 4 Apr 1977 p 515-523
CODEN: PERSDV
DESCRIPTORS: *MAPS AND MAPPING.
CARD ALERT: 405
Data on computer-compatible tapes of LANDSAT-1 MSS Frame E-1483-15132, of August 30, 1973, were analyzed to generate a land-use map of a portion of the City of Virginia Beach, Virginia. Bands 4, 5, 6, and 7 were used in the supervised approach with the LARSYS software system of Purdue University. A Land-Use/Land-Cover map at a scale of 1:24,000 was obtained. Major functional classes delineated were $left double quote$ Urban $right double quote$, $left double quote$ Agricultural $right double quote$, $left double quote$ Wooded $right double quote$, $left double quote$ Water $right double quote$, $left double quote$ Wetland $right double quote$, and $left double quote$ Bare Land $right double quote$. Twenty-four subdivisions of these classes were spectrally separable. Some of these were subdivisions of Level II of the Inter-Agency Steering Committee on Land-Use Information and Classification. Extent of man-made structures, unit density, and degree of weathering were important in subdividing the Urban class. 26 refs.

RS77-5-258

ID NO.- EI770854107 754107
AIRPORT AIR POLLUTION MONITORING PROGRAM.
Zeller, K. F.; Evans, R. B.
US EPA, Las Vegas, Nev
Proc Air Pollut Control Assoc 1976, for Annu Meet, 69th, Portland, Oreg, Jun 27-Jul 1 1976 v 1 Pap 76-11. 1, 18 p CODEN: PRAPAP
DESCRIPTORS: (*AIR POLLUTION, *Monitoring), (REMOTE SENSING, Environmental Applications), ENVIRONMENTAL ENGINEERING.
CARD ALERT: 451, 941, 901
This paper discusses the fixed base air monitoring network, plans to use new techniques (e. g. Lidar Doppler Velocimeter, the Barringer Correlation Spectrometer and EPA's Remote Optical Sensing of Emissions System) and some additional results of a feasibility study conducted at Williams AFB in April 1975. 8 refs.

RS77-5-259

ID NO.- EI770962512 762512
AIR MONITORING WITH TUNABLE LASERS.
Hinkley, E. David
Laser Anal, Inc, Lexington, Mass
Environ Sci Technol v 11 n 6 Jun 1977 p 564-567 CODEN: ESTHAG
DESCRIPTORS: (*AIR POLLUTION, *Monitoring), LASERS, ENVIRONMENTAL ENGINEERING.
CARD ALERT: 451, 744, 901
It is explained how, because of their unique capabilities, tunable lasers offer an added dimension to air pollution surveillance, especially in remote sensing and in situ monitoring. 5 refs.

RS77-5-260

ID NO.- EI770854025 754025
RELATIVE ACCURACY OF SO//2 MASS EMISSION RATES FROM REMOTE SENSING CORRELATION SPECTROMETERS COMPARED TO REFERENCE METHODS.
Sperling, Roger B.; White, Charles L.
Environ Meas Inc, San Francisco, Calif
Proc Air Pollut Control Assoc 1976, for Annu Meet, 69th, Portland, Oreg, Jun 27-Jul 1 1976 v 3 Pap 76-29. 1, 14 p CODEN: PRAPAP
DESCRIPTORS: (*AIR POLLUTION, *Analysis), (SULFUR DIOXIDE, Spectroscopic Analysis), (REMOTE SENSING, Environmental Applications).
CARD ALERT: 651, 801, 804
Comparative measurements of SO//2 mass emission rates for a selected coal-fired power plant were made with the remote sensing Correlation Spectrometer (COSPEC, manufactured by Barringer Research, Ltd.) and in-stack EPA refrence methods. The purpose was to determine the relative accuracy of the COSPEC as a stack emissions monitor for SO//2. The accuracy of the COSPEC was compared to measurements made using the compliance test methods for SO//2 concentration and for volumetric stack gas flow rate. Three remote sensors were simultaneously tested to determine the internal consistency of the technique. 4 refs.

RS77-5-261

ID NO.- EI771073267 773267
ENVIRONMENTAL MONITORING.
Barth, D. S.; Morgan, G. B.; Schuck, E. A.
Environ Monit & Support Lab, Las Vegas, Nev
Adv Environ Sci Technol v 7. Publ by John Wiley and Sons. New York, NY, 1977 p 279-314 CODEN: AESTC9
DESCRIPTORS: (*ENVIRONMENTAL IMPACT, *Monitoring), (AIR POLLUTION, Particulate Emissions), (WATER POLLUTION, Analysis)

CARD ALERT: 901, 451, 453
The purposes of monitoring and a summary of existing monitoring networks in the United States for monitoring air pollutants, water pollutants, pesticides, and radiation are presented. Future directions in the design of monitoring networks are discussed, including integrated pollutant-oriented, multimedia networks and approaches to optimizing single-medium networks. The potential of remote sensing from airborne platforms are also briefly assessed. The extreme importance of quality assurance to all aspects of environmental monitoring is emphasized. 22 refs.

RS77-5-262

ID NO.- EI770854006 754006
AIR POLLUTION.
Saltzman, Bernard E.; Burg, William R.
Univ of Cincinnati, Ohio
Anal Chem v 49 n 5 (Rev) Apr 1977 p 1R-16R CODEN: ANCHAM
DESCRIPTORS: *AIR POLLUTION.
CARD ALERT: 451
This review covers the literature from late 1974 to late 1976. The authors discuss data pertinent to sampling and data collection, particulates and aerosols, inorganic gases and vapors, organic gases, biological indicators, source analysis, remote sensing, and methods for evaluation, standardization and field studies. 651 refs.

RS77-5-263

AMBIONICS INC., WASHINGTON, D.C.

1974

REMOTE SENSING OF COAL MINE POLLUTION IN THE UPPER POTOMAC RIVER BASIN.

SAME AS AUTHOR, FINAL REPORT. 70 P. AVAILABLE NTIS AS N74-34817/8GA. PAPER COPY 4.25/MICROFICHE 2.25.

COAL MINING/ENVIRONMENTAL EFFECTS/MONITORING/REMOTE SENSING/ACID MINE WASTES/ DRAINAGE/WATER POLLUTION

Section 6

INSTRUMENTATION

Data Systems and Methods of Remote Sensing

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RS77-6-189

N77-26597# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
MULTIDISCIPLINARY LIDAR SYSTEM IN SPACELAB FOR APPLICATION TO ATMOSPHERIC PHYSICS AND REMOTE SENSING Final Report
Wolfgang Englisch (Batteile Inst.), Eberhard Achtermann, Thorstein Halldorsson (MBB, Ottobrunn, West Ger.), Rasmus Beck (Battelle Inst.), Gerhard Lorch, Wolf Wiesemann (Battelle Inst.), Erhard Werdel, and Guenther Wirths Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 314 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-404)
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QS-405-V23)
(BMFT-FB-W-76-23) Avail: NTIS HC A14/MF A01; ZLDI, Munich DM 65.95

Possible applications of a lidar system onboard an airplane or onboard Spacelab were studied. The selection of lasers and detection techniques for the different tasks is discussed and intensity calculations are performed. A combination of an aerosol and a trace gas lidar is proposed for the first Spacelab mission. The aerosol lidar uses pulsed lasers, the trace gas lidar, a CW-CO2-laser and a heterodyne detection technique for the differential absorption method in the IR. The telescope of the Spacelab lidar lies within the 1 m class. An airborne lidar puts minor requirements on its subsystems. It is proposed therefore that this should precede the Spacelab lidar so that experience can be obtained with the technical subsystems, and the scientific benefits can be appraised. Author (ESA)

RS77-6-190

N77-26458*# Morgan State Coll., Baltimore, Md.
THE CALIBRATION OF PHOTOGRAPHIC AND SPECTROGRAPHIC FILMS
Ernest C. Hammond, Jr. 30 Sep. 1976 11 p ref
(Grant NsG-5074)
(NASA-CR-152525) Avail: NTIS HC A02/MF A01 CSCL 14E

Certain techniques and procedures are developed and evaluated for the ascertainment of the relative spectral-photometric characteristics of standard and special spectroscopic films and plates in the visible and UV regions. These films are used in ground based and rocket launched instruments. Two photographic spectral sensitometers were developed. One instrument is a vacuum sensitometer covering a range of 1,000 to 3,000 Angstroms and the other sensitometer is the device this investigator used to study its spectral responses in the visible region of the spectrum through the utilization of a computer microdensitometric and photometric plot and contour routines.
Author

RS77-6-191

N77-28560*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
RADAR SYSTEMS FOR A POLAR MISSION, VOLUME 1
R. K. Moore, J. P. Claassen, R. L. Erickson, R. K. T. Fong, M. J. Komen, J. McCauley, S. B. McMillan, and S. K. Parashar Feb. 1977 89 p refs
(Contract NAS5-22325)
(NASA-CR-152510; RSL-TR-291-2-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 08H

The application of synthetic aperture radar (SAR) in monitoring and managing earth resources is examined. Synthetic aperture radars form a class of side-looking airborne radar, often referred to as coherent SLAR, which permits fine-resolution radar imagery to be generated at long operating ranges by the use of signal processing techniques. By orienting the antenna beam orthogonal to the motion of the spacecraft carrying the radar, a one-dimensional imagery ray system is converted into a two-dimensional or terrain imaging system. The radar's ability to distinguish - or resolve - closely spaced transverse objects is determined by the length of the pulse. The transmitter components receivers, and the mixer are described in details. Author

RS77-6-192

N77-27371# Wyoming Univ., Laramie.
RAPID, LOW-COST, IMAGE ANALYSIS THROUGH VIDEO PROCESSING
Richard A. Levinson, Ronald W. Marrs, and Deborah G. Grantham 1 Sep. 1976 66 p refs
(Contract E(05-1)-1648)
(GJBX-37(76)) Avail: NTIS HC A04/MF A01

The functions, components, and operation of a video system performing image analysis is described. Video capabilities include: color separation, color addition/subtraction, contrast stretch, dark level adjustment, density analysis, edge enhancement, scale matching, image mixing (addition and subtraction), image ratioing, and construction of false color composite images. Rapid input of non-digital image data, instantaneous processing and display, relatively low initial cost, and low operating cost gives the video system a competitive advantage over digital equipment. Complex preprocessing, pattern recognition, and statistical analyses must still be handled through digital computer systems. Potential applications are discussed including uranium exploration, petroleum exploration, tectonic studies, geologic mapping, hydrology sedimentology and petrography, anthropology, and studies on vegetation and wild-life habitat. ERA

RS77-6-193

N77-27462 Wisconsin Univ., Madison.
THEORETICAL AND PRACTICAL RELATIONSHIPS BETWEEN REMOTE SENSING AND CARTOGRAPHY Ph.D. Thesis
Arthur Jon Kimerling 1976 309 p
Avail: Univ. Microfilms Order No. 76-25566

A limited version of a system which combines remote sensing and cartography into a single improved strategy for handling geographic information was developed which in expanded form could serve as a prototype for digitally based thematic mapping systems. The model utilizes a local smoothing operator which is iterative and frequency based to simplify nominal level classified data. A thorough statistical comparison of vegetation maps of the same area created through application of traditional manual methods and produced by these two means increases with each simplification iteration. Guidelines as to the number of iterations, neighborhood size, and reclassification threshold needed to satisfactorily simplify classified data were also determined. The results of this modern mapping experiment illustrate the close relationship that exists between the two fields at the present time and demonstrate the need to combine remote sensing and cartographic activities. Dissert. Abstr.

RS77-6-194

N77-23591# Human Engineering Labs., Aberdeen Proving Ground, Md.
HUMAN ENGINEERING LABORATORY CAMOUFLAGE APPLICATIONS TEST (HELCAT) OBSERVER PERFORMANCE Final Report
John A. Barnes and N. William Doss Nov. 1976 51 p refs
(AD-A034048; HEL-TM-32-76) Avail: NTIS HC A04/MF A01 CSCL 01/3

This study recorded the target-detection ranges achieved by 10 combat-qualified U.S. Army Aviators flown on nap-of-the-earth route reconnaissance against camouflaged tanks, and their target detection times when performing the pop-up maneuver against the camouflaged tanks. On 10 of the 20 day flights the aviators' eye movements and fixation points were recorded, and the aviators wore the AN/PVS-5 night vision goggles on 10 of the 20 night flights. GRA

RS77-6-195

N77-26590*# Lockheed Electronics Co., Houston, Tex.
ADVANCED SENSORS AND APPLICATIONS STUDY (ASAS)
S. B. Chism and C. L. Hughes Nov. 1976 353 p refs
(Contract NAS9-12200)
(NASA-CR-151441; LEC-7790-Rev-A; JSC-10975) Avail: NTIS HC A16/MF A01 CSCL 14B

The present EOD requirements for sensors in the space shuttle era are reported with emphasis on those applications which were deemed important enough to warrant separate sections. The application areas developed are: (1) agriculture; (2) atmospheric corrections; (3) cartography; (4) coastal studies; (5) forestry; (6) geology; (7) hydrology; (8) land use; (9) oceanography; and (10) soil moisture. For each application area. The following aspects were covered: (1) specific goals and techniques. (2) individual sensor requirements including types. bands. resolution, etc.; (3) definition of mission requirements, type orbits, coverages, etc.; and (4) discussion of anticipated problem areas and solutions. The remote sensors required for these application areas include: (1) camera systems; (2) multispectral scanners; (3) microwave scatterometers; (4) synthetic aperture radars; (5) microwave radiometers; and (6) vidicons. The emphasis in the remote sensor area was on the evaluation of present technology implications about future systems. Author

RS77-6-196

N77-25982*# Santa Barbara Research Center, Goleta, Calif.
FURTHER DEVELOPMENT OF AN INDIUM ANTIMONIDE (InSb)CHARGE-COUPLED INFRARED IMAGING DEVICE (CCIRID), 20-ELEMENT LINEAR IMAGER Final Report
15 Apr. 1977 41 p refs
(Contract NAS1-14395)
(NASA-CR-145204) Avail: NTIS HC A03/MF A01 CSCL 20L

Problems encountered in the development of an indium antimonide charge coupled device for infrared imaging and real time signal processing on the focal plane are summarized. A new generation chip is described which contains, 2, 4, and 20-element imagers, a 4-element TDI array, a monolithic gated charge integrator, and test devices. A system study of a future LANDSAT sensor system configured around an InSb TDI array is considered. A.R.H.

RS77-6-197

A77-43803 * **The Seasat-A Synthetic Aperture Imaging Radar System.** R. L. Jordan and D. H. Rodgers (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Western Electronic Show and Convention, Los Angeles, Calif., September 14-17, 1976, Technical Papers. (A77-43801 20-33) North Hollywood, Calif., Western Periodicals Co., 1976, p. 4/2-1 to 4/2-9.

The Seasat-A Synthetic Aperture Imaging Radar System is the first radar system of its kind designed for orbital use. The requirement of this system is to generate continuous radar imagery with a 100-km swath with 25 m resolution from an orbital altitude of 800 km. These requirements impose unique system design problems and a description of the implementation will be given. The end to end data system will be described including interactions of the spacecraft, antenna, sensor, telemetry link, and data processor. The synthetic aperture radar system generates a large quantity of data (110 megabits per second) requiring the use of a dedicated data link. The data link selected for use with the synthetic aperture radar is an analog link with stable local oscillator encoding. The problems associated in telemetering the radar information with sufficient fidelity to synthesize an image on the ground will be described as well as the selected solutions to the problems. The interactions between the antenna attitude control system, rotation of the earth and the data processor will be described as well as proposed solutions, both optical and digital, to generate final imagery with the required 25 m resolution. (Author)

RS77-6-198

A77-36035 **Performance evaluation of infrared sensors and associated processing.** E. M. Winter (IBM Corp., Westlake Village, Calif.). In: Modern utilization of infrared technology II: Civilian and military; Proceedings of the Seminar, San Diego, Calif., August 26, 27, 1976. (A77-36014 16-35) Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1976, p. 165-175. 6 refs.

A simulation approach for the performance evaluation of both scanning and mosaic infrared sensor systems and their associated signal processing is presented. This approach allows a parametric exploration of design alternatives and environmental extremes. Various focal plane geometries and alternative signal processing algorithms can be investigated. The simulation has been implemented for maximum efficiency to allow the evaluation of system probability of detection and false alarm rates. Microscopic effects, such as optical crosstalk, image motion during the dwell, assymetric point spread functions, and platform effects, are modelled. Important models within the simulation are: optics and detector, Time Delay and Integrate (TDI) and Charge Coupled Device (CCD) effects, object motion, and a band pass filter. The output of the simulation can be input to alternative data processing algorithms. Individual algorithms and configurations can be evaluated at several stages in the flow. The simulation has been configured to model both staring mosaics and scanning bar sensors. Data supporting model verification and an example of the application of the simulation to a scanning infrared astronomical satellite are discussed. (Author)

RS77-6-199

A77-39525 # **Aircraft scatterometer.** G. Bommas and G. Deike. *Dornier-Post* (English Edition), no. 2, 1977, p. 63, 64.

An experimental model of a two frequency microwave scatterometer (2FS) containing major system elements of a Spacelab version has been developed and tested. Making use of the fact that microwaves couple with surface waves of the same order of magnitude, the 2FS measures the two-dimensional spectrum of the ocean surface in the long-wave range from beams directed obliquely towards it. By simultaneously transmitting two frequencies, the system measures only the components of the long-wave motion spectrum meeting the Bragg scatter condition for the defined difference in frequency. The full two-dimensional spectrum can be determined by varying the frequency difference and turning the antenna in azimuth. C.K.D.

RS77-6-200

A77-36037 **CCD image simulation.** H. J. Schraibman, J. D. Joseph, and J. R. Parsons (Aerospace Corp., Los Angeles, Calif.). In: Modern utilization of infrared technology II: Civilian and military; Proceedings of the Seminar, San Diego, Calif., August 26, 27, 1976. (A77-36014 16-35) Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1976, p. 188-195. 5 refs.

Charge Coupled Device (CCD) imaging and processing arrays have shown promise in applications requiring integrated focal plane data processing such as found in certain 'smart' sensor and data rate compression designs. This paper presents the results of a computer simulation effort to determine CCD imaging properties in both scanning and area array configurations. The ability to simulate imagery for a variety of array parameters is useful in the design of such imager/processor systems. Results of the study illustrate effects which are both general characteristics of sampled systems and peculiarities of CCDs. Included are resolution loss using computer generated targets, spurious signals due to the relative position of target and sample points, distortions due to linear and sinusoidal smear, effects of target contrast and CCD noise sources. Both tri-bar and highly over-sampled imagery are used in the demonstrations. (Author)

RS77-6-201

A77-36565 **Air route surveillance radar system ARSR-3.** *The Controller*, vol. 15, May 1976, p. 32-35.

Equipment, equipment configurations, and equipment performance characteristics (of systems and components) of the ARSR-3 air route surveillance radar system for detecting false alarms and acting as primary sensor for automated ATC are described. Receivers and transmitters, antenna and pedestal, generators and digital circuitry, and frequency generators of the ARSR-3 are described; important performance data are tabulated and characterized. ARSR-3 diplex operation (two radar channels sharing a single antenna, and each transmitting at different frequency and polarization) is described. Built-in test equipment is described. R.D.V.

RS77-6-202

A77-40873 # **Reducing the effect of granularity noise on the error of measurement of aerial photographic system performance (K voprosu snizheniia vliianiia shuma granuliarnosti na oshibku izmereniia kharakteristik kachestva aerofotosistem).** V. P. Koroleva, A. F. Mel'kanovich, and G. P. Vasil'ev. *Zhurnal Nauchnoi i Prikladnoi Fotografii i Kinematografii*, vol. 22, May-June 1977, p. 199-204. 10 refs. In Russian.

Three techniques are proposed for measuring the scattering functions and frequency transfer functions of photographic systems from the images of the brightness jumps and bright lines distorted by the noise due to the granularity of the photographic film. The techniques are based on using a priori information on the photographic system, and achieve nonlinear filtering of the noise. P.T.H.

RS77-6-203

A77-40665 **Real-time aerial reconnaissance using the return-beam vidicon.** M. J. Cantella and R. J. Gildea. *RCA Engineer*, vol. 22, Apr.-May 1977, p. 30-35. 7 refs. USAF-supported research.

Testing has established the return-beam vidicon (RBV) as a feasible real-time reconnaissance sensor under a variety of flight profiles and visibility conditions, and especially in low-contrast conditions. Advantages of the RBV include: one foot resolution at 10,000 feet; 'snapshot' operation, in which exposure, readout, and erasure time intervals are segregated; slow-scan readout; electronic zoom; and automatic black-level correction, allowing the camera to function in poor visibility. The reconnaissance system consists of an airborne pod, mounted on an RF-4C aircraft, and a ground station to monitor and record data. The ground station includes a cathode ray tube display and a primary recorder using an electron beam to record on 5-inch film. J.M.B.

RS77-6-204

A77-38537 **SPOT - Trial earth observation system (SPOT - Système probatoire d'observation de la terre).** G. Brachet (Centre National d'Etudes Spatiales, Division des Programmes de Recherche, Paris, France) and M. Courtois (Centre National d'Etudes Spatiales, Centre Spatial de Toulouse, Toulouse, France). *L'Aéronautique et l'Astronautique*, no. 64, 1977, p. 37-53. In French.

The SPOT system for satellite remote sensing of the earth is described. The article deals with the general characteristics of the SPOT system, inertial platform, attitude control and recovery subsystem, orbit adjustment subsystem, antenna pointing, and the subsystem for telemetry, remote control, onboard computing, and tracking. Instruments to be carried on the first mission, scanning techniques to be employed in remote sensing work, and the scheduling of project development stages are discussed. R.D.V.

RS77-6-205

A77-38773 * **Thermal inertia mapping - A new view of the earth.** J. C. Price (NASA, Goddard Space Flight Center, Atmospheric and Hydrospheric Applications Div., Greenbelt, Md.). *Journal of Geophysical Research*, vol. 82, June 20, 1977, p. 2582-2590. 12 refs.

The thermal response of a substance to a time-varying surface power input is determined by its thermal inertia. Remote sensing (e.g., from satellites) can be utilized to measure this property, which is related to surface composition or to near-surface soil moisture. An algorithm is developed which relates thermal inertia to remote measurements of surface temperature and reflectance. Application to geosynchronous satellite data illustrates the contrast between irrigated and desert areas in the region north of the Gulf of California. The effect of local weather conditions (latent and sensible heat transfer to the atmosphere) must be estimated before precise values for thermal inertia can be specified. (Author)

RS77-6-206

A77-40813 # **Optimal calibration of remote sensors using time averaging (Optimal'naia kalibrovka distantsionnykh priborov s primeneniem vremennogo osredneniia).** S. V. Dotsenko and L. G. Salivon. *Morskie Gidrofizicheskie Issledovaniia*, no. 4, 1976, p. 92-99. In Russian.

This paper discusses a method for calibrating a remote sensor from the reading of a contact point sensor, this procedure permitting a significant reduction in calibration error. Calibration is performed using time realization of the measured field, obtained with a contact sensor in a specified time interval and corrected. B.J.

RS77-6-207

A77-41795 **Earth studies from satellite-borne sensors.** F. Honey (Commonwealth Scientific and Industrial Research Organization, Perth, Australia). In: Australian Astronautics Convention, Perth, Australia, August 27-30, 1975, Proceedings. (A77-41785 19-12) Perth, Astronautical Society of Western Australia, Inc., 1977, p. 141-143.

The measurement of electromagnetic (optical) properties of terrestrial materials using satellite-borne sensors shows promise in earth resources evaluation and monitoring. Several scanner systems will be described and applications of the data and imagery generated will be discussed. (Author)

RS77-6-208

A77-43564 **Determination of optical transfer functions by direct measurement.** W. C. Martin (USAF, Avionics Laboratory, Wright-Patterson AFB, Ohio). *Photogrammetria*, vol. 33, Aug. 1977, p. 133-144.

The success of using the Modulation Transfer Function (MTF) in characterizing image location and image quality for aerial mapping cameras is dependent upon the ability to successfully and accurately measure this quantity. This paper presents the results of such measurements, made by the Air Force Avionics Laboratory, on two cameras, A Wild RC-8 R-10 and a Zeiss RMK AR 15/23. MTF measurements were made on-axis and at 10, 20, 30, 40, and 45 degrees for both radial and tangential orientations. Through-focus runs at each field position were conducted. All measurements were made in filtered green light at a wavelength of 546.1 nm. (Author)

RS77-6-209

A77-38192 **What can artificial intelligence techniques do for processing of satellite pictures.** R. Bajcsy (Pennsylvania, University, Philadelphia, Pa.). In: Modeling and simulation. Volume 7 - *Proceedings of the Seventh Annual Pittsburgh Conference*, Pittsburgh, Pa., April 26, 27, 1976. Part 1. (A77-38176 17-66) Pittsburgh, Pa., Instrument Society of America, 1976, p. 277-280. 13 refs. NSF Grant No. GJ-43440.

A description is presented of examples which illustrate applications of artificial intelligence techniques in satellite picture processing. A program which recognizes bridges, rivers, and lakes is considered as an example for the use of a three-dimensional model of the world. In this case use is made of the fact that bridges are above the water area. Artificial intelligence techniques take into account that the world has three dimensions although the images are two-dimensional projections of the three-dimensional objects. It is pointed out that the recognition process should provide a description of objects, their properties, and their relationships rather than just a classification of objects. G.R.

RS77-6-210

A77-36431 **Progress in the specification and analysis of image quality.** R. Welch (Georgia, University, Athens, Ga.). *(International Society for Photogrammetry, Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976.) Photogrammetric Engineering and Remote Sensing*, vol. 43, June 1977, p. 709-719. 27 refs.

The paper examines some of the possible objections that can be raised against the use of modulation transfer function (MTF) measurements for evaluating the performance of photogrammetric camera systems. In order, the following sources of error in MTF analyses are considered: (1) errors or variations in the MTF's of lenses and films due to nonstandardized measurement techniques and variable development conditions; (2) nonlinearity of the photographic process; (3) target fidelity; and (4) degradations introduced by the microdensitometer and film granularity. In general, predicted MTF's have been found to correspond to within 10 to 15 per cent of measured values, and this is adequate for system evaluation. The concepts of instantaneous field-of-view end effective instantaneous field-of-view for defining Landsat MSS detector performance are explained. P.T.H.

RS77-6-211

A77-37436 **A variable acuity remote viewing system.** V. E. Diehl (USAF, Avionics Laboratory, Wright-Patterson AFB, Ohio). In: NAECON '76; Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 18-20, 1976. (A77-37352 17-33) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 663-668. 5 refs. USAF-Navy-supported research.

The current emphasis on real time reconnaissance from low flying high-performance aircraft has brought to light a serious deficiency to transmit imagery with both high resolution and wide field of view (FOV). The recent development of a nonlinear foveal optic offers the capability to provide high on-axis resolution, wide FOV and reduced information bandwidth. This paper describes the concept and relevant programs to develop this nonlinear electro-optical sensor. The basic system provides one-third milliradian on-axis resolution with degraded off-optical-axis resolution which follows the acuity function of the human eye. The total FOV is 160 degrees. It is real time, data-linkable in a high threat environment. Growth potential to the far infrared spectrum is currently being investigated. (Author)

RS77-6-212

A77-37463 **The efficient display of electro-optical imagery.** R. A. Gagnon (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). In: NAECON '76; Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 18-20, 1976. (A77-37352 17-33) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 878-881. 12 refs.

Many remote systems require the use of electro-optical sensors and television displays. These systems require a wide bandwidth and a high ratio of picture element transmitted to picture element used. These two requirements exist because of inability of system designers to specify what information in a visual scene is important to the operator. A model of the human visual system (HVS) is used to identify prospective objects of interest in a visual scene. The approach is to use a coarse (peripheral vision) scan of the field of view, apply the HVS model to emphasize prospective objects, and apply a high-resolution (foveal) scan to each prospective object. The procedure was applied to a set of photographs in which 89% of the targets were detected using only 5% of the resolution elements required in a 512-line television system. (Author)

RS77-6-213

A77-37437 ***Common aperture technique for imaging* electro-optical sensors.** D. B. Learish (USAF, Avionics Laboratory, Wright-Patterson AFB, Ohio). In: NAECON '76; Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 18-20, 1976. (A77-37352 17-33) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 669-672.

This paper describes the CATIES targeting and weapon delivery system. CATIES incorporates a Forward Looking Infrared (FLIR) system, an Active Television (ATV) and a laser designator/ranger (LDR). CATIES utilizes a single gimbal for pointing and stabilization and a broadband zinc selenide (ZnSe) window. Included is an overview of the technology developments and rationale that have been the impetus for CATIES. (Author)

RS77-6-214

A77-41635 # **Space methods for investigating the environment (Kosmicheskie metody izucheniia prirodnoi sredy).** B. V. Vinogradov. Moscow, Izdatel'stvo Mysl', 1976. 288 p. 411 refs. In Russian.

Techniques and instrumentation for studying the environment from a variety of space platforms, including ballistic missiles, manned spacecraft and orbiting laboratories and satellites are discussed. Methods used for the analysis of satellite imagery are outlined. The use of remote-sensed information in oceanography, cartography, and meteorology is examined, together with applications in agriculture, pollutant monitoring, and land use planning. C.K.D.

RS77-6-215

PATENT-3 960 [illegible] Not available NTIS
Department of the Army Washington D C
Automatic Exposure Control Circuit for an Image Intensifier Camera.
Patent,
John A. D'Agostino. Filed 4 Apr 74, patented 14 Sep 76, 4p AD-D003 677/2, PAT-APPL-457 867 Supersedes PAT-APPL-457 867-74.
Availability: This Government-owned invention available for U.S. Licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, D. C. 20231 $0.50.

Descriptors: *Patents, *Exposure meters, *Photographic equipment, *Image intensifiers(Electronics), Capacitors, Energy storage, Aerial photography, Response.
Identifiers: PAT-CL-250-213, Automatic exposure control, Control circuits.

This invention relates to automatic exposure control for an image-intensification photographic camera through the employment of a capacitor discharge circuit. The electrical energy stored in a capacitor is discharged to activate an image intensifier tube which forms part of the photographic camera system. The characteristics of the capacitor discharge circuit are chosen to correspond to the energy required for proper exposure time through the image intensifier tube and onto a photographic emulsion. (Author)

RS77-6-216

AD-A040 428/5GA PC A03/MF A01
Grumman Aerospace Corp Bethpage N Y Research Dept
Detection Aspects of an Optical Matched Filter Image Correlator.
Research memo.,
Glenn M. Mehalek. Mar 77, 41p Rept no. RM-628

Descriptors: *Optical correlators, *Optical detection, *Target detection, Optical filters, Matched filters, Spatial filtering, Aerial photography, Photointerpretation, Aerial reconnaissance, Signal to noise ratio, Normalizing(Statistics).

Aerial photography for reconnaissance purposes is currently examined by human photointerpreters - a slow, costly, tedious process. Grumman, however, has developed an Optical Matched Filtered Image Correlation technique for automating the screening of aerial reconnaissance film. For the investigation described in this document, some detection aspects of this system were examined. A set of matched filters was made for an M-60 Army tank. A set of three filters varying in optimized spatial frequency was then selected. Correlation signal-to-noise ratios were obtained, and normalizations of the correlation plane signals to total scene intensity and total correlation plane intensity were performed. A simple thresholding technique was suggested. A point-by-point normalization technique was proposed with the intent of improving the signal-to-noise ratio for the system, and a simple application of this technique was implemented. (Author)

RS77-6-217

AD-A040 426/9GA PC A04/MF A01
Grumman Aerospace Corp Bethpage N Y Research Dept
Baseline Test of a Matched Filter Correlator for Screening Aerial Reconnaissance Film,
Kenneth G. Leib, M. Ronald Wohlers, and Ronald Herold. May 77, 68p Rept no. RE-540

Descriptors: *Target detection, Reconnaissance film, *Optical correlators, Optical filters, Matched filters, Selection, Sampling, Band pass filters, Base lines, Test methods, *Aerial reconnaissance, Target recognition, Accuracy, False targets, Signal to noise ratio, Clutter, Trade off analyses.
Identifiers: Terrain.

An optical matched filter image correlator previously reported upon was used to perform a screening mission on aerial reconnaissance film with limited sampling of various terrain imagery. The sampling was limited to several scans of each image in the correlator plane. The target was generally recognizable when the signal-to-clutter ratio was in the range of one to ten dB depending upon the type of terrain and the band pass characteristics (or order) of the matched filter used. In some cases false alarm detection was experienced and a tradeoff between false alarms or clutter, and probability of detection can be made. The results obtained through the sampling of the correlation plane show that the probability of detection could be 99 percent for the most complex terrain encountered if 10.5 percent false alarm rate are also accepted. Thus, the correlator can perform the screening mission. Predictions on the system detection of targets in various terrain are given. (Author)

RS77-6-218

AD-A039 576/4GA PC A06/MF A01
Analytics Inc Willow Grove Pa
The AIRS CDC-6600 User's Guide.
Final rept.,
Paul L. Lewin, and Sydney F. Martin. 30 May 74, 119p Rept no. 1120-A
Contract N62269-74-C-0692

Descriptors: *Aerial reconnaissance, *Computerized simulation, *Tactical reconnaissance, Multisensors, Executive control programs, Punched cards, FORTRAN, User needs, Computer files, Models, Flow charting, Digital computers.
Identifiers: *Computer models, CDC 6000 computers, AIRS(Airborne Reconnaissance System), *Airborne reconnaissance system, Scenarios.

This report presents the instructions for the use of the AIRS(Airborne Reconnaissance System) Performance Simulation Model on the CDC 6600 Computer. This model uses an expected value approved to determine the performance of a multisensor reconnaissance aircraft operating in a specified target scenario. (Author)

RS77-6-219

AD-A039 577/2GA PC A10/MF A01
Analytics Inc Tinton Falls N J
Improvements and Modifications of the AIRS Performance Model.
Final rept.,
Sydney F. Martin, Stephen Leibholz, Morris Plotkin, Lawrence Rafsky, and Willard Sunstein. 27 Feb 70, 204p Rept no. 1010-1
Contract N62269-69-C-0532

Descriptors: *Tactical reconnaissance, *Computer programs, Integrated systems, Target detection, Aerial reconnaissance, Mathematical models, Algorithms, Computerized simulation, Subroutines, Programming manuals.
Identifiers: AIRS(Airborne Integrated Reconnaissance System), Airborne integrated reconnaissance system.

This report describes improvement which have been made to the AIRS(Airborne Integrated Reconnaissance System) Performance Simulation Model. It also contains the user instructions for the modified computer programs. (Author)

RS77-6-220

PB-267 824/1GA PC A03/MF A01
Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
Analysis of Multispectral Data Using Computer Techniques: Pennsylvania, Kansas, Virginia, and California Test Sites.
Final rept. Jun 70-Dec 74,
Terry R. West, Ray L. Frederking, Christopher J. Stohr, and Stanley M. Woodring. Mar 75, 39p
LARS-196200-1-T-FR, FHWA/RD-77-34
Contract DOT-FH-11-7565
See also PB-267 823.
Also available in set of 5 reports PC E10, PB-267 819-SET.

Descriptors: *Remote sensing, *Soils, *Terrain, *Mapping, Digital techniques, Aerial photography, Infrared detection, Ultraviolet detection, Topography, Agriculture, Optical images, Photogrammetry, Pennsylvania, Kansas, California, Virginia, Highways, Site surveys.
Identifiers: Multiband spectral reconnaissance, Ground truth, Imagery, Computer aided analysis.

This report summarizes analysis of multispectral scanner data collected over FHWA test sites in Pennsylvania; Kansas, Virginia and California. Day and night time imagery collected at aircraft altitudes in discrete bands of ultraviolet through thermal infrared radiation, were analyzed using computer-assisted techniques at the Laboratory for Applications of Remote Sensing (LARS). The overall objective for the test sites studied was to develop techniques for identifying and classifying through computer applications, those surface materials which are significant to highway location and design. Specific accomplishments of the study were (1) mapping surface geology, both unconsolidated and consolidated materials (California); (2) mapping agricultural soils (Pennsylvania); (3) engineering soils mapping (Kansas and to a lesser extent, Pennsylvania); (4) investigation of subsurface caverns (Kansas) and surface depressions (Virginia); (5) evaluating terrain effects on spectral response (California and Virginia and to lesser extent Kansas).

RS77-6-221

25798 **St-Hilaire, C.** Cartographie electromagnetique aeroportee [Airborne electromagnetic cartography]: (incl. English sum.), Master's, 1975, Ecole Polytechnique: Canada.

RS77-6-222

38333 **Seige, P.** Sensor equipment of the German Earth Scientific Airplane Program: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1483-1497, illus. (incl. table, sketch map), 1975. *NASA Earth resources survey symposium.*

RS77-6-223

38329 **Schaller, E. S.; and Towles, R. W.** Image 100; the interactive multispectral image processing system: U. S. Natl. Aeronaut. Space Adm., Tech. Memo., No. X-58168 *(Vol. I-B, Geology-information systems and services)*, p. 1275-1291, illus., 1975. *NASA Earth resources survey symposium.*

RS77-6-224

ID NO.- EI770968546 768546
COMPUTER-ASSISTED ANALYSIS TECHNIQUES FOR REMOTE SENSING DATA INTERPRETATION.
Anuta, Paul E.
Purdue Univ, West Lafayette, Indiana
Geophysics v 42 n 3 Apr 1977 p 468-481 CODEN: GPYSA7
DESCRIPTORS: (*RADIOMETERS, *Computer Applications), (SATELLITES, Remote Sensing), PATTERN RECOGNITION SYSTEMS.
CARD ALERT: 941, 944, 655, 723, 732
Applying airborne and satellite multispectral scanning radiometers, the energy sensed in each band can be used as a parameter in a computer-based, multidimensional-pattern-recognition process to aid in the interpretation of the nature of elements in the scene. Images from each band can also be interpreted visually. Visual interpretation of 5 or 10 multispectral images simultaneously becomes impractical, especially as the area studied increases; hence, great emphasis is placed on machine (computer-assisted) techniques in the interpretation process. A number of other data sets are studied and integrated by digital registration with the multispectral reflectance and radiance phenomena. Topographic data, registered with four-band Landsat multispectral scanner (MSS) data, are being studied to determine relationships between spectral and topographic variables. Geophysical variables, including gamma-ray and magnetic data are registered and studied using the multivariate analysis approach. 22 refs.

RS77-6-225

ID NO.- EI771078153 778153
AUTOMATION IN SURVEYING AND MAPPING: PRESENT AND FUTURE
Thompson, Morris M.
Topogr Div, US Geol Surv, Reston, VA
ASCE J Surv Mapp Div v 103 n 1 Sep 1977 p 15-24 CODEN: JSUEAX
DESCRIPTORS: (*SURVEYING, *Computer Applications), AERIAL PHOTOGRAPHY, MAPS AND MAPPING, PHOTOGRAMMETRY, REMOTE SENSING.
IDENTIFIERS: TERRAIN MODELS
CARD ALERT: 405, 723, 732, 742
Patterns of present-day automation in photogrammetry are examined in seven broad categories: stereoplotter-computer interface; automatic image correlation; offline orthophoto systems; automated image processing; digital terrain data for engineering; ancillary photogrammetric operations; and nondigital automation. Future objectives of surveying and mapping: land data records computerized in a universal coordinate system; a new unified World datum ellipsoid; widespread use of image maps and thematic maps; a central bank of digitized cartographic information. Predicted components of a future surveying and mapping system are: position determination by use of Earth satellites; position and elevation determination by use of an inertial package in a moving vehicle; imaging systems using multispectral scanners and solid-state sensors; automated production of orthophotos, contours, and digital terrain data; automated map-finishing operations; and powerful computer techniques for complex computations and data handling.

RS77-6-226

ID NO.- EI771078154 778154
VERTICAL CONTROL FOR INDEPENDENT MODELS BLOCKS
Faig, Wolfgang; El Hakim, Sabry; Mathew, Thomas
Univ of NB, Fredericton
ASCE J Surv Mapp Div v 103 n 1 Sep 1977 p 37-46 CODEN: JSUEAX
DESCRIPTORS: (*SURVEYING, *Triangulation), PHOTOGRAMMETRY, SURVEYING INSTRUMENTS,
IDENTIFIERS: LEVELING DEVICES
CARD ALERT: 405, 742, 943

In simultaneous block adjustments vertical control points need to be located in dense cross chains if no auxiliary information is available. One additional perimeter control point each between them strengthens the solution, and a further reduction of the vertical block deformation is achieved by normalizing the x-residuals in the projection centers. The use of auxiliary data leads to substantial saving of vertical control points. The interaction between vertical control point distribution, statoscope-, APR-, lake data, and combinations of these is studied with several well-controlled independent model production blocks adjusted with PAT-M-43. The tests indicate that the bridging distance can be increased to the extent that there is virtually no need for control points within the block for small and medium-scale mapping purposes. 13 refs.

Section 7

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CONFERENCES, SYMPOSIA AND SHORT COURSES

February 6-10, 78	Short Course on Remote Sensing Technology and Applications West Lafayette, IN	Continuing Education Business Office Rm 110, Stewart Cntr Purdue University West Lafayette, IN 47907
February 26-March 3, 78	American Society of Photogrammetry Annual Meeting Washington, DC	William J. Kosco U.S. Geological Survey Mail Stop 510 Reston, VA 22092
March 6-10 April 3-7, 78	Short Course on Remote Sensing Technology and Applications West Lafayette, IN	Continuing Education Business Office Rm 110, Stewart Cntr Purdue University West Lafayette, IN 47907
April 10-14, 78	Advanced Topics in the Analysis of Remote Sensing Data	Continuing Education Business Office Rm 110, Stewart Cntr Purdue University West Lafayette, IN 47907