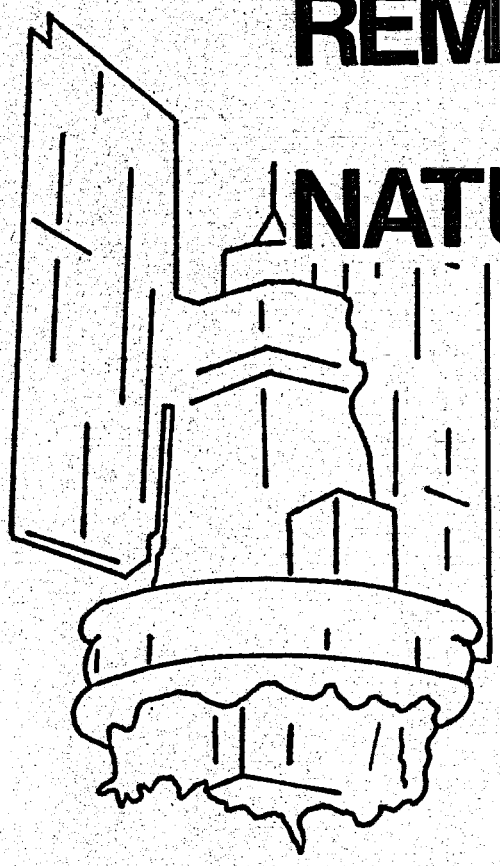
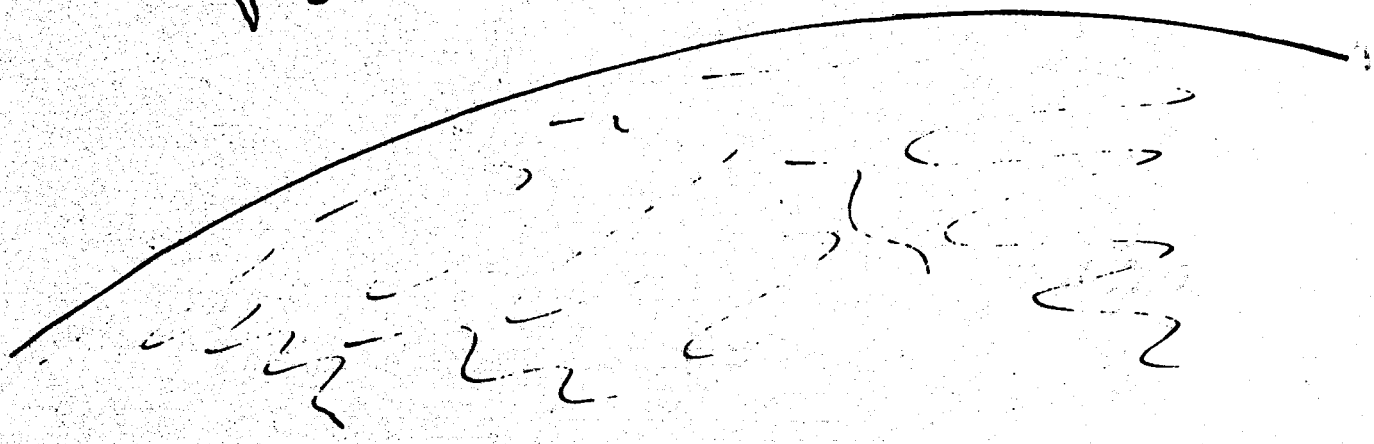
TAC RS 79-001

MASTER
REMOTE SENSING OF NATURAL RESOURCES



A Quarterly Literature Review

JANUARY-MARCH 1979



REMOTE SENSING-NATURAL RESOURCES PROGRAM

TECHNOLOGY APPLICATION CENTER
THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO 87131

NASA

DISCLAIMER

QUARTERLY LITERATURE REVIEW

of the

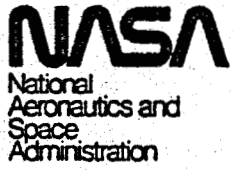
REMOTE SENSING OF NATURAL RESOURCES

FIRST QUARTER 1979
(JANUARY-MARCH 1979)

Compiled and Published by:

Technology Application Center
Institute for Applied Research Services
University of New Mexico
Albuquerque, New Mexico 87131

April 1979



QUARTERLY LITERATURE REVIEW

of the

REMOTE SENSING OF NATURAL RESOURCES

TABLE OF CONTENTS

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.

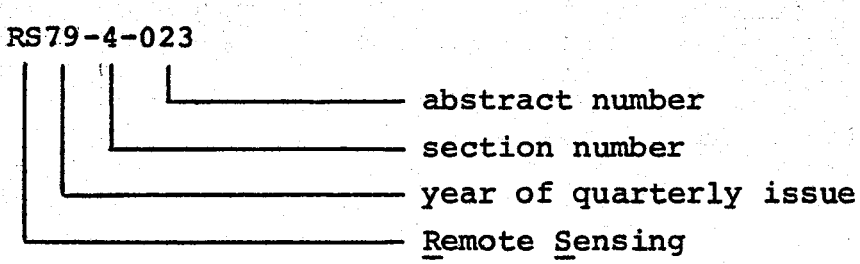
In an attempt to review the literature of remote sensing from among the many hundreds of sources and thousands of documents available, a definition of boundaries was necessary. TAC, reviewing abstracted literature sources (see Information Sources), selects documented data and data gathering techniques which are performed or obtained remotely from space, aircraft or ground-based 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 with 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.

Following the Information Sources 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.

Michael H. Inglis
Editor

USER GUIDE

This Quarterly Literature Review has been divided into nine 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 RS79-4 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.

Each quarterly 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 worldwide 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.

RECENT RELEASES

Processing Multispectral Signals From a Discrete-Sensor Array

Four-color multispectral camera is simpler because of a new technique for handling the electrical signals.

NASA's Jet Propulsion Laboratory, Pasadena, California

A new technique for encoding and decoding color-image signals from an array of discrete sensors simplifies fabrication of a remote-sensing imaging system. Using "matrix encoding," it is not necessary to precisely aline spectral filters with the charge-coupled devices (CCD) that are the discrete elements in the array. The matrix encoding technique treats the elements in groups of four (2×2) to produce an output corresponding to the multispectral image exposed to the elements.

Each element in the group is exposed to more than one spectral bandpass; the only alinement criterion is that each group of elements be exposed to all four of the spectral bands (red, blue, green, and infrared). The calibration matrix is determined by exposing each group to one spectral band at a time. This matrix then is used to decode the information.

The proposed method uses a composite spectral filter (see Figure 1) consisting of a periodic array of four spectral bandpasses. The filter is placed in the image plane of an imaging system so that each sensor element samples a combination of the four colors. Because of physical system constraints, a relay lens is used to project the filtered image onto a sensor located in the second image plane.

In mathematical terms, each sensor element measures an independent linear combination of the four-color brightness when considered in groups of four. If the brightnesses of the four colors are described as red (R), green (G), blue (B), and infrared (IR), then the response (I) of a typical group of detectors is given by

$$\begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = M \times \begin{bmatrix} R \\ G \\ B \\ IR \end{bmatrix}$$

where M is a 4 by 4 transformation matrix that is determined by the particular pattern of the filter over the four sensor elements and the responsivities of those elements. The sensor responses may then be converted into digital numbers in the same way that a typical CCD monochromatic image is encoded. From this step through decommutation of the imaging data in the ground processing, the video signal behaves exactly as does a standard monochromatic video signal.

(continued on next page)

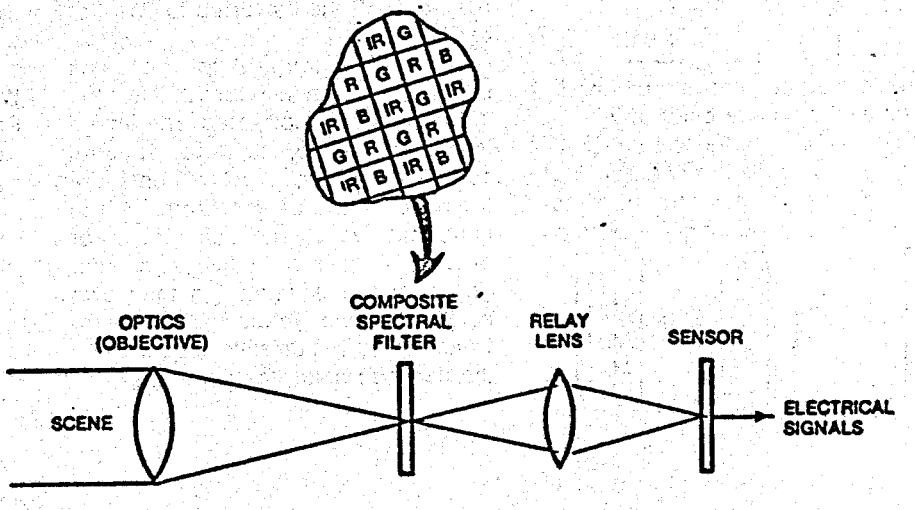


Figure 1. The proposed Image Processing System includes a composite spectral filter that projects image information on a CCD array sensor for image processing. This arrangement simplifies the fabrication of CCD sensor array cameras by relaxing the precision of alinement required between the filter and the sensor. The color pattern of the filter is shown in the insert.

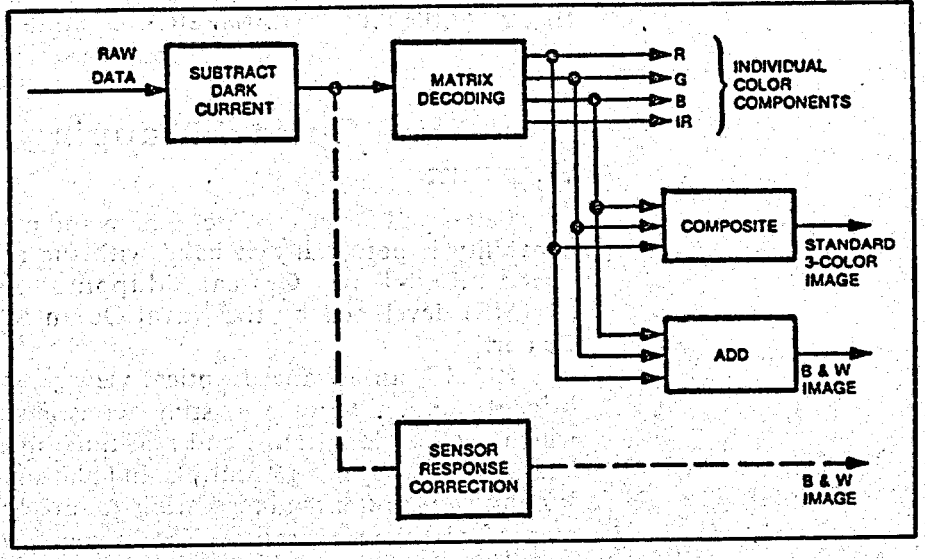


Figure 2. A Matrix Decoding Scheme shows what can be done with the electrical signals that represent image information. For comparison, the dotted portion shows a processing flow for a monochromatic image obtained without the matrix encoding/decoding technique.

Decoding of the four color signals requires knowledge of the M matrix at the decoding station. In general the colors are decoded using the matrix inverse of M:

$$\begin{bmatrix} R \\ G \\ B \\ IR \end{bmatrix} = M^{-1} \times \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix}$$

The M matrices are determined by calibration, using one color at a time. If the camera is exposed to a uniformly illuminated source with a spectral filter matching one of the camera passbands (e.g., red), equation 1 becomes

$$\begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \end{bmatrix} = M \times \begin{bmatrix} R \\ O \\ O \\ O \end{bmatrix} = R \begin{bmatrix} M_{11} \\ M_{21} \\ M_{31} \\ M_{41} \end{bmatrix}$$

Thus, if the brightness of red is known, four matrix elements are determined. This process, which applies to each quadruple of picture elements, is then repeated with the light source filtered to match each of the three remaining spectral filters, thereby determining the remaining matrix elements. The M matrices are then inverted to M^{-1} for decoding.

A block diagram of the decoding process is shown in Figure 2. After the dark current is subtracted, the image is decoded into its four spectral components. These components are then used individually or combined in numerous ways. The standard color product is achieved by displaying red, green, and blue signals in their own colors. A single broadband black-and-white image is achieved by summing the decoded color components.

The amount of computer processing in the matrix decoding process is not large in comparison to standard processing used on existing digital, remote-sensing systems. The matrices have 16 elements each, and there are 800x800 matrices for a total of about 10 million words. An existing system using four cameras employ 9.6 million words per camera.

This work was done by John B. Wellman of Caltech for **NASA's Jet Propulsion Laboratory.**

NAVY TECHNOLOGY TRANSFER FACT SHEET

DECEMBER 1978

Real-Time Optical Mapping System

Better and faster sea-floor search and mapping capability is potentially at hand with the recently tested Real-Time Optical Mapping System (ROMS) developed by the Naval Ocean Systems Center.

ROMS, an advanced optical viewing system, bridges the gap between existing acoustic systems which provide long-range and real-time operation but are limited by low resolution, and photographic systems which offer high resolution but are not capable of real-time operation. The system provides real-time optical pictures of the sea floor at 120-foot depth with a 400-foot swath width.

ROMS can be towed at speeds from zero to five knots, and has applications to close range classification and inspection, extension of vision to remote undersea work systems, mapping of the ocean floor for geological purposes and salvage operations.

COSMIC PROGRAM ABSTRACT

GSC-12374

CLASSPAK - The AOIPS Classification Package
(Computer Sciences Corporation) 05 JAN 79

This multispectral classification package, CLASSPAK, is part of the Atmospheric and Oceanographic Information Processing System, AOIPS, which is being developed by the NASA Goddard Space Flight Center. CLASSPAK is an interactive user oriented software package which can be used to perform a supervised maximum likelihood classification of multispectral image data. The CLASSPAK system provides the user with the capability to input up to 24 bands of image data from tape; displaying selected bands on a display screen; defining training and testing areas from the image; performing a classification of a selected area using up to 8 bands; and producing various forms of output. CLASSPAK offers the user a highly flexible interactive environment for working with image data. CLASSPAK has been used in connection with land cover studies, urban boundary delineation, geological studies, forestry and agriculture investigations, and the development of hydrological models for watershed studies.

The classification method employed in CLASSPAK is based on a maximum likelihood decision rule which assumes that all a priori probabilities are equal and that each class has a Gaussian probability distribution. The mean and covariance matrix for each class may be input directly by the user or computed from a user defined training sample. The user interacts with the CLASSPAK system by means of menu formatted prompts. The CLASSPAK main menu offers the user a selection of 11 options including current image definition and display; definition, modification, and deletion of training and testing data; classification of a master image using previously accumulated class training statistics; display and printing of classification results; and production of gray level dump of selected image areas. When an option is selected from the main menu the associated system functions are initiated and the user is prompted through the use of the selected option by further menus. As a selected option function is completed, control returns to the main menu which prompts the user for further instructions. Visual output of the classification results may be displayed on the terminal video screen or output to a tape in Dicomed format for hard copy generation.

CLASSPAK is written in FORTRAN and ASSEMBLER for interactive execution on a PDP-11/45 using the RSX-11D operating system and supporting a modified GE Image 100 System. CLASSPAK has a central memory requirement of approximately 128K of 16 bit words. Installation of CLASSPAK on systems other than the configuration used at NASA Goddard may require some modification of the program.

LANGUAGE: FORTRAN (95%), PDP ASSEMBLER (5%)

MACHINE REQUIREMENTS: PDP-11/45 with RSX-11D

PROGRAM SIZE: Approximately 23,875 Source Statements

DISTRIBUTION MEDIA: Magnetic Tape Only

PROGRAM NUMBER: GSC-12374

DOCUMENTATION PRICE: $11.50

PROGRAM PRICE: $1,750.00

COSMIC PROGRAM ABSTRACT

ERL-10008

GEOREF Module
(Earth Resources Lab)

26 JAN 79

The GEOREF Module is an image processing software package containing three programs. These programs reformat Landsat-data-derived surface classifications and pictorial representations into a digital array that corresponds to the Universal Transverse Mercator (UTM) grid. Surface classifications and pictorial (map) representations of the Earth are of greater utility if such data can be related to standard geographic referencing systems, such as the UTM grid. The Landsat multispectral scanner system acquires data which can be used to generate surface classifications and pictorial representations of the Earth's surface. The mapping equations which relate Landsat data to the UTM grid are, in general, quite complicated; however, nearly linear approximations are reasonably accurate in local areas. It is the purpose of these three programs to geometrically correct Landsat data to the UTM projection by the use of ground control points. Some additional features of these programs include: a skew correction to compensate for the Earth's rotation and the finite scan time of the scanner, a correction for the inconstant mirror velocity of the scanner, input of both the horizontal and the vertical dimensions of the output pixel size, control point errors printed at the terminal, and execution of the geometric correction program in either foreground or background.

The basic inputs to the programs include the Landsat data to be mapped, the control points, and selected optional data. Output consists of a tape which contains the geometrically corrected data. The nearest neighbor technique is used in the last program to compute the pre-images.

The GEOREF programs are written in Varian Assembler and Varian FORTRAN for batch and interactive processing. It has been implemented on a Varian 70 series computer operating under the Vortex II operating system with a central memory requirement of approxmiately 28K (decimal).

LANGUAGE: Varian Assembler (62%), Varian FORTRAN (38%)

MACHINE REQUIREMENTS: Varian 70 Series

PROGRAM SIZE: Approximately 1872 Source Statements

DISTRIBUTION MEDIA: 9 Track Varian Formatted Tape

PROGRAM NUMBER: ERL-10008

DOCUMENTATION PRICE: $13.00

PROGRAM PRICE: $310.00

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
NASA TP-1371		

4. TITLE AND SUBTITLE	5. REPORT DATE
Eulusmap; an International Land Resources Map Utilizing Satellite Imagery	December 1978
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT #
T. Paludan and E. Csáti*	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. WORK UNIT NO.
George C. Marshall Space Flight Center Marshall Space Flight Center, Alabama 35812	M-271
	11. CONTRACT OR GRANT NO.
	13. TYPE OF REPORT & PERIOD COVERED
12. SPONSORING AGENCY NAME AND ADDRESS	Technical Paper
National Aeronautics and Space Administration Washington, D.C. 20546	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Prepared by Earth Resources Office, Science and Engineering

* Geocartographic Research Department, Institute of Surveying and Mapping, Budapest, Hungary

16. ABSTRACT

In 1972, the International Geographical Union's Commission on World Land Use Survey adopted a project for a land-use map of Europe. Such a map, under the name "Eulusmap," had been started earlier under sponsorship of several government offices in Hungary. Although there was great response from a number of contributors in many countries, it became evident by mid-1974 that the map would contain gaps and some inaccuracies unless additional data sources were utilized. By then, the satellite Landsat-1 had obtained imagery of most of Europe. Using theme extraction techniques, the map was completed in draft form and portions of it displayed at the 23rd International Geographical Congress in Moscow during July 1976. Printing of the completed map was accomplished in May 1978.

A comprehensive standard land-use classification system was established in 1949. A goal of world mapping at a scale of 1:1 million was also set, but remains far from realization. The advent of satellite data makes achievement possible, but only if some compromises are made in the classification system. It is now realistic to map land resources of large areas and regions undergoing rapid change. This is especially important in developing areas of the world.

17. KEY WORDS		18. DISTRIBUTION STATEMENT
Remote Sensing	International Cooperation	STAR Category 43
Satellite Mapping	Space Applications	
Land-Use		
Multispectral Imagery		
Landsat		

19. SECURITY CLASSIF. (of this report)	20. SECURITY CLASSIF. (of this page)	21. NO. OF PAGES	22. PRICE
Unclassified	Unclassified	19	$4.00

MSFC - Form 3292 (Rev December 1972)

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

NASA-Langley, 1978

Section 1

GENERAL

Meetings, Symposia, Proceedings, General
Project Overviews, Legal Studies

RS79-1-001

N78-31509*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SKYLAB S191 SPECTROMETER EXPERIMENT: ANALYSIS OF DATA AND THEIR APPLICATIONS TO THE EARTH SCIENCES
V. R. Wilmarth, D. A. Rainey (Lockheed Electron. Co., Houston, Tex.), and W. R. Johnson (Lockheed Electron. Co., Houston, Tex.) Jul. 1978 69 p refs
(NASA-TM-58208; JSC-13866) Avail: NTIS HC A05/MF A01 CSCL 05B

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

RS79-1-002

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

RS79-1-003

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

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

RS79-1-004

N79-10509# Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.
A SELECTIVE BIBLIOGRAPHY: REMOTE SENSING APPLICATIONS IN LAND USE AND LAND COVER INVENTORY TASKS
William J. Todd Apr. 1978 37 p refs
(Contract DI-14-08-0001-16439)
(PB-283027/1) Avail: NTIS HC A03/MF A01 CSCL 08B

The bibliography contains more than 300 citations of selected publications on the applications of remote sensing techniques to regional and metropolitan land-use and land-cover inventory tasks. Most of the citations were published between January 1968 and June 1977, although some earlier works of continuing interest are included. GRA

RS79-1-005

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

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

RS79-1-006

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

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

RS79-1-007

N78-32530# SRI International Corp., Menlo Park, Calif.
INTERACTIVE AIDS FOR CARTOGRAPHY AND PHOTO INTERPRETATION Semiannual Technical Report, 2 Nov. 1977 - 11 May 1978
G. J. Agin, H. G. Barrow, R. C. Bolles, M. A. Fischler, and T. D. Garvey Jun. 1978 31 p
(Contract DAAG29-76-C-0057; ARPA Order 2894)
(AD-A056355; ARO-14305.1-A-EL) Avail: NTIS HC A03/MF A01 CSCL 14/5

The central scientific goal of the ARPA Image Understanding Project 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 concerned with specific problems that arise in processing aerial photographs for such military applications as cartography, intelligence, weapon guidance, and targeting. A key concept is the use of a generalized digital map to guide the process of image analysis. The objectives, methodology, and current status of the research are described in this report. In the present phase of the program, the primary focus is on developing a 'road expert,' whose purpose is to monitor and interpret road events in aerial imagery. Also described are the details of an innovative procedure for tracking road segments and finding potential vehicles in imagery of approximately 1-3 feet per pixed ground resolution. This work represents an important contribution toward achieving the indicated goals. Author (GRA)

RS79-1-008

N78-33020# Joint Publications Research Service, Arlington, Va.
DIRECTOR OF PRIRODA CENTER STRESSES SIGNIFICANCE OF SPACE PHOTOGRAPHY
Yu. Kiyenko *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 42 (JPRS-71612) 3 Aug. 1978 p 68-71 Transl. into ENGLISH from Pravda (Moscow), 24 Jun. 1978 p 3 (For primary document see N78-33015 23-99)
Avail: NTIS HC A05/MF A01

RS79-1-009

N78-31496*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
PROCEDURES FOR GATHERING GROUND TRUTH INFORMATION FOR A SUPERVISED APPROACH TO A COMPUTER IMPLEMENTED LAND COVER CLASSIFICATION OF LANDSAT ACQUIRED MULTISPECTRAL SCANNER DATA
Armond T. Joyce, Principal Investigator Mar. 1977 83 p refs EREP
(E78-10198; NASA-TM-79742; Rept-163) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

RS79-1-010

N79-10505# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Audrey S. Hundemann Aug. 1978 163 p Supersedes NTIS/PS-77/0674 3 Vol.
(NTIS/PS-78/0789/4; NTIS/PS-77/0674) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B
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 156 abstracts, 23 of which are new entries to the previous edition. GRA

RS79-1-011

N79-10507# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO GEOLOGY AND MINERALOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Jul. 1978
Audrey S. Hundemann Aug. 1978 154 p Supersedes NTIS/PS-77/0676 3 Vol.
(NTIS/PS-78/0791/0; NTIS/PS-77/0676) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B
The use of LANDSAT satellites 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 147 abstracts, 25 of which are new entries to the previous edition. GRA

RS79-1-012

N79-10506# National Technical Information Service, Springfield, Va.
REMOTE SENSING APPLIED TO URBAN AND REGIONAL PLANNING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Audrey S. Hundemann Aug. 1978 70 p Supersedes NTIS/PS-77/0675 3 Vol.
(NTIS/PS-78/0790/2; NTIS/PS-77/0675) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B
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 acting as an influence on health and physical well being are included. This updated bibliography contains 63 abstracts, 3 of which are new entries to the previous edition. GRA

RS79-1-013

N78-31508*# National Aeronautics and Space Administration, Washington, D. C.
A SUMMARY OF THE USERS PERSPECTIVE OF LANDSAT-D AND REFERENCE DOCUMENT OF LANDSAT USERS
A. Donald Goedeke and Alexander J. Tuyahov, Principal Investigator 31 Jan. 1977 330 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10208; NASA-TM-79744) Avail: NTIS HC A15/MF A01 CSCL 05B
There are no author-identified significant results in this report.

RS79-1-014

N78-32519*# Missouri Univ., Columbia.
APPLICATION TRANSFER ACTIVITY IN MISSOURI Final Report, Jan. 1976 - Jun. 1978
David J. Barr and Chris J. Johannsen Sep. 1978 44 p refs (Contract NAS8-31767)
(NASA-CR-150805) Avail: NTIS HC A03/MF A01 CSCL 05B
Experimental demonstrations and workshop instructional courses were conducted to transfer the technology of satellite remote sensing to a wide audience of resource managers. This audience included planning commissions, state agencies, federal agencies, and special councils of the Governor. Some of the experiments and workshops are outlined. J.M.S.

RS79-1-015

N78-31508*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
HIGH ALTITUDE PERSPECTIVE
1978 33 p Original contains color illustrations
(NASA-SP-427) Avail: NTIS MF A01; SOD HC $1.60 CSCL 14E
The capabilities of the NASA Ames Center U-2 aircraft for research or experimental programs are described for such areas as Earth resources inventories; remote sensing data interpretation, electronic sensor research and development; satellite investigative support; stratospheric gas studies; and astronomy and astrophysics. The availability of this aircraft on a cost-reimbursable basis for use in high-altitude investigations that cannot be performed by the private sector is discussed. A.R.H.

RS79-1-016

N79-10497*# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Remote Sensing Programs for Earth Resource Surveys.
MICROWAVE REMOTE SENSING FROM SPACE FOR EARTH RESOURCE SURVEYS
1977 141 p refs
(Contract NASw-3043)
(NASA-CR-157891) Avail: NTIS HC A07/MF A01 CSCL 05B

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

RS79-1-017

N78-31517# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
LANDSAT POLICY ISSUES STILL UNRESOLVED
17 Apr. 1978 34 p
(PB-279701/7; PSAD-78-58) Avail: NTIS HC A03/MF A01 CSCL 08B

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

RS79-1-018

N78-31478*+ National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 18
Aug. 1978 114 p refs
(NASA-SP-7041(18)) Avail: NTIS HC E05 CSCL 05B

This bibliography lists 434 reports, articles, and other documents introduced into the NASA scientific and technical information system between April 1 and June 30, 1978. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

RS79-1-019

A78-53386 Landsat applications in the less-developed areas. W. L. Smith (Michigan, Environmental Research Institute, Arlington, Va.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 279-291. 23 refs.

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

RS79-1-020

A79-11663 A review of the uses of Landsat imagery in Mexico. D. Rodriguez-Bejarano and A. Calderón Acosta (Escuela Nacional de Agricultura, Chapingo, Mexico). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 65-75. 36 refs.

RS79-1-021

A78-48004 Remote sensing on a shoestring. S. L. Richardson. *Photogrammetric Engineering and Remote Sensing*, vol. 44, Aug. 1978, p. 1027-1032. 6 refs.

The paper describes a multispectral photoviewer, based on the principle of additive light, that can be built at a cost of $20. Two photos of the original are viewed simultaneously through two different color filters, and the images are superposed. Materials needed include a beam splitting mirror, a 5 x 5 inch mirror, colored acetate, and possibly some gelatin filters. Although the principle can be extended to three colors, experiments have shown that additional colors do not yield better images or informational content. P.T.H.

RS79-1-022

A78-49654 Landsat data availability from the EROS data center and status of future plans. R. A. Pohl and G. G. Metz (U.S. Geological Survey, EROS Data Center, Sioux Falls, S. Dak.). In: Oceans '77; Annual Combined Conference, 3rd, Los Angeles, Calif., October 17-19, 1977, Conference Record. Volume 1. (A78-49651 22-48) New York, Institute of Electrical and Electronics Engineers, Inc.; Washington, D.C., Marine Technology Society, 1977, p. 9D-1 to 9D-4.

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

RS79-1-023

A79-11753 # Cornell's remote sensing program - Remote sensing for the user. W. R. Philipson, T. Liang, T. L. Erb, and B. L. Markham (Cornell University, Ithaca, N.Y.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 64-73.

A survey of the NASA-sponsored Cornell Remote Sensing Program is presented noting the participating representatives, courses, and facilities available. Projects including assessments of the values of Landsat data for planning in the New York City area, mapping the soils and geology of New York State, and state-wide wetlands inventories are discussed. Brief consideration is given to county- and town-level projects, projects conducted for state agencies, and projects utilizing satellite data. S.C.S.

RS79-1-024

A79-11662 **Internationalization of remote sensing technology.** C. K. Paul (Agency for International Development, Washington, D.C.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 57-64.

The Agency for International Development (AID) began sponsoring international activities in remote sensing in 1971, one year before the launch of Landsat-1, with the Smithsonian Symposium in Remote Sensing. From 1972 to the present, limited technical assistance has been provided to several countries which has led remote sensing investigators in developing countries to be selected by NASA for the Landsat investigation program. In addition, AID has sponsored four regional workshops in remote sensing technology and the U.S. Information Agency has sponsored two seminars in training image analysts to make appropriate choices in selecting those features of the technology suitable for their resource requirements. Recent earth resources problems and past global monitoring experiences with Landsat in the developing countries have maintained interest in the satellite. Attention is given to details regarding AID's program and an evaluation of the advantages of remote sensing technology for the developing countries. G.R.

RS79-1-025

A79-13835 # **The Pacific Northwest Regional Commission's Land Resource Inventory Demonstration Project - The user's experience.** M. J. McCormick (Washington State Planning and Community Affairs Agency, Olympia, Wash.). *American Institute of Aeronautics and Astronautics and NASA, Conference on 'Smart' Sensors, Hampton, Va., Nov. 14-16, 1978, AIAA Paper 78-1719.* 6 p.

RS79-1-026

A78-53379 • **Summary of Landsat applications and results.** E. P. Mercanti (NASA, Goddard Space Flight Center, Communications and Navigation Div., Greenbelt, Md.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 42-72.

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

RS79-1-027

A78-53383 **The role of remote sensing for energy development.** J. E. Johnston (U.S. Geological Survey, Office of Energy, Reston, Va.) and F. J. Janza (California State University, Sacramento, Calif.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 199-234. 20 refs.

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

RS79-1-028

A79-11775 **The unfulfilled promises of remote sensing.** D. A. Mathisen. *New Engineer*, vol. 7, June-July 1978, p. 14, 16, 19 (5 ff.).

It is pointed out that remote sensing technology promises discussed as long ago as 1962 have been only partly fulfilled. The 30-meter resolution provided in the series Landsat-3 is too crude for most purposes. The technology exists for improving the resolution to a level which would make it possible to satisfy most of the existing requirements. However, the technological advances involved are classified and are only used for military applications. There are compelling reasons for keeping the most advanced technological capacities of the military with respect to remote sensing secret. The prospects of getting some of the technological developments declassified are discussed, taking into account the position of the Office of Management and Budget with respect to a decision concerning the resolution limits set for NASA. (Author)

RS79-1-029

A78-53381 • **Earth observations from remote-sensing platforms - Outlook.** R. S. Houston, R. W. Marrs (Wyoming, University, Laramie, Wyo.), N. M. Short, and P. D. Lowman, Jr. (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 99-156. 61 refs.

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

RS78-1-030

A78-53378 **Gap between raw remote-sensor data and resources and environmental information.** B. F. Grossling and J. E. Johnston (U.S. Geological Survey, Reston, Va.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 28-41.

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

RS79-1-031

A79-14155 # **Digital image processing experience at Hannover Institute for Photogrammetry /IPI/.** H. P. Bähr (Hannover, Technische Universität, Hanover, West Germany). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 19-25. 21 refs.

The paper describes the IPI image processing system for image enhancement and geometrical image processing: it consists of a large CDC-Cyber 73/76 computer, an Optronics-P 1700 digital read/write image plotter, and a modular software package. Emphasis is placed on the software package and the geometrical processing technique, and consideration is given to applications of the system to images from: (1) a metric camera; (2) the Hasselblad camera; (3) a multispectral scanner; and (4) Landsat (i.e., water pollution data and water-line-difference data). B.J.

RS79-1-032

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

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

RS79-1-033

A79-14159 # Interrelation between photogrammetry and remote sensing cadastral localizing of cultivation inventory, obtained by remote sensing. B. L. Y. Dubuisson (Ministère de l'Equipement, Paris, France). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz. Technische Universität Graz, 1978, p. 51-55.

RS79-1-034

A79-11657 American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1977. 505 p. $5.00. (For individual items see A79-11658 to A79-11672)

The detection of water pollution from color and infrared color aerial photography is considered along with techniques for land use change detection using Landsat imagery, a review of the uses of Landsat imagery in Mexico, a photogrammetric control survey of a large cooling tower, a simple and rapidly converging orientation and calibration method for nontopographic applications, and the application of high altitude photography in archeological survey. Attention is given to a Landsat forest inventory of the Philippines, the next decade of satellite remote sensing, the application of remote sensing for oil spill prevention, the compensation of systematic image errors using spherical harmonics, an approach for mapping land covers from satellite images, computer software and high speed plotting requirements for automated orthophoto mapping, the internationalization of remote sensing technology, automated stereophotogrammetry of Mars, a new concept in hybrid stereoplotters, future trends in photogrammetric instrumentation, and the Viking Mars Lander stereo analysis system. G.R.

RS79-1-035

A79-11751 American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978. 449 p. Members, $5.00; nonmembers, $10.00. (For individual items see A79-11752 to A79-11761)

Papers are presented on the cost benefits of photobathymetry, the application of satellite remote sensing to local governments and urban technology projects, and computer stereographics. Consideration is given to a color strip recorder for remote sensing data and the digital processing of satellite imagery for geothermal prospecting. Analytical photogrammetry at a Greek archaeological site is described along with the Wetlands Analytical Mapping System and three-dimensional presentations of terrain data. Reviews are presented of the classification of wildland vegetation near Denali, Alaska on the basis of Landsat digital data and instruments for point transfer and marking. Procedures for aerotriangulation with the US-1 analytical plotter are described as well as interactive computations with a digitized stereoplotter. S.C.S.

RS79-1-036

A79-13834 # The role of 'Smart' sensors in earth resources remote sensing programs. L. P. Murphy (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, Va.) and J. W. Jarman (U.S. Army, Office of Chief of Engineers, Washington, D.C.). *American Institute of Aeronautics and Astronautics and NASA, Conference on 'Smart' Sensors, Hampton, Va., Nov. 14-16, 1978, AIAA Paper 78-1717.* 6 p. 9 refs.

In 1977, with the assistance of NASA, the Corps of Engineers has conducted two demonstrations of applications of the use of Landsat data and processing technology on the NASA Applications Systems Verification and Transfer system. The demonstrations showed that the automated extraction of land cover information from Landsat data is useful for Corps drainage basin and special project studies. Current and potential Landsat data uses are considered along with possible onboard processing procedures, taking into account water mapping, river flooding/coastal studies, snow shed runoff studies, and investigations regarding the use of Landsat data for planning the installation of large government facilities and for geological structure studies associated with planning the location of large dams. The suggested forms of onboard processing are related to enhancement processing, onboard data calibration processing, selectable band transmission, data compaction, river/coastline tracking, cloud detection, and multiresolution data. G.R.

RS79-1-037

A79-13836 # Techniques for acquiring earth resource data that will be acceptable and useful to program managers. W. E. Kibler (U.S. Department of Agriculture, Washington, D.C.). *American Institute of Aeronautics and Astronautics and NASA, Conference on 'Smart' Sensors, Hampton, Va., Nov. 14-16, 1978, AIAA Paper 78-1720.* 10 p.

To ensure that newly developed remote sensing technology would fit specific user needs, the U.S. Department of Agriculture established a Remote Sensing User Requirements Task Force made up of representatives from eight Department agencies having significant requirements for earth resource data and information. The Task Force identified and cataloged over 3,000 data elements - basic information needed for the lowest level of discrete decisions. Data elements were described in terms of agency standards for accuracy and time constraints, and requirements for geographic coverage. Agency data needs were consolidated noting identical as well as 'linked' (similar) requirements. Requirements were evaluated by panels of experts as having immediate potential for being satisfied by remote sensing or potential based on additional research and development. The detailed work involving actual users has enabled the Department to establish priority areas of concern and has laid the groundwork for a balanced remote sensing program. (Author)

RS79-1-038

5.0033, REMOTE-SENSING TWENTY YEARS OF CHANGE IN THE HUMAN ENVIRONMENT IN MASSACHUSETTS, 1951-1971

W.P. MACCONNELL, Univ. of Massachusetts, Agric. Experiment Station, Mcintire Stennis Program, *Amherst, Massachusetts* 01002 (0059477; MAS00013)

OBJECTIVE: Use remote-sensing techniques to monitor forest and other environmental changes in Massachusetts from 1951-1971. The maps prepared from 1971 aerial photography will provide ground truth for training in interpretation of Earth Resources Technology Satellite (ERTS) imagery.

APPROACH: Develop and test the use of aerial photogrammetric techniques as a tool for identifying and classifying agricultural, forest and wet lands; mining and waste disposal areas, as well as urban land and outdoor recreation sites. Determine changes in vegetation and land use which have taken place since the state was photographed and mapped in 1951 and 1952 by a similar system. Establish predictions of future rates and patterns of change for major land-use types based on changes over the past 20 years. Population growth and construction of transportation facilities will be used to help predict future change. Provide vegetative cover and land-use maps of the entire state for watershed managers, foresters, wildlife biologists, resource planners and others interested in the environment. Study urban growth and decay, especially the situation in the urban-agriculture or urban-forest interface in Massachusetts.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Massachusetts

RS79-1-039

5.0023, INVENTORYING AND MONITORING OF EARTH RESOURCES BY REMOTE SENSING

M.F. BAUMGARDNER, Purdue University, Agric. Experiment Station, Agronomy, *Executive Bldg., Lafayette, Indiana* 47907 (0008923; IND050020)

OBJECTIVE: Study the relationships between the multispectral radiation characteristics of soils and the physical and chemical properties of soils. Study the relationships between the radiation characteristics of vegetation and the properties of the soils on which the vegetation is growing. Conduct research on the application of remote sensing for determining land use, soil delineations, and vegetation mapping.

APPROACH: Multispectral scanner data obtained from aircraft and spacecraft platforms, aerial multispectral photography, and ground observation data will be used in the preparation of earth resources inventories. Both supervised and non-supervised programs will be used in the computer-implemented analysis of multispectral data. Ground observation data will be used as training sets for computer-implemented analysis and for testing analysis results. These techniques will be used in the preparation of land use inventories, soil surveys, and vegetation maps. Sequential data (multispectral scanner passes over the same site on different dates) will be used to detect and monitor changes.

PROGRESS: Significant progress was achieved in 1975 in defining the relationships between the chemical/physical properties of soils and the multispectral reflectance (0.5-2.37 microns) from surface soils and determining the utility of LANDSAT (satellite) multispectral data for identifying and delineating meaningful soils boundaries. The soil properties having the highest correlation with spectral reflectance are cation exchange capacity and the contents of silty, clay, organic matter and iron oxides, and correlations were higher with infrared reflectance than with visible reflectance. Results from soil survey research demonstrated that digital analysis of Landsat data can be used successfully for quality control of soil survey programs; to express quantitatively the mapping unit homogeneity by identifying, separating, and measuring inclusions occurring within mapping units; to identify and delineate by remote sensing soils differences which may not be discernible by visual observation, differences which may be related to internal drainage and/or other subsoil differences; to produce quickly and accurately general soils maps for counties by visual interpretation of observed false color images.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Indiana

RS79-1-040

5.0040, SEASAT-A COORDINATION AND APPLICATION

D.E. LICHY, U.S. Army, Coastal Engin. Res. Center, *Kingman Bldg., Fort Belvoir, Virginia* 22060 (31582)

OBJECTIVE: To coordinate the Corps needs with NASA activities with the SEASAT satellite for the development of remote sensing applications.

APPROACH: Evaluation and coordination of SEASAT-A application to the Corps needs by research, correspondence, attendance at meetings, participation in seminars and working groups and consulting with SEASAT groups of NASA, other sponsors, Corps Division and District offices, CRREL, WES, ETL, IWR and Division laboratories. This effort will match the potential capabilities of SEASAT-A with Corps problems and needs.

SUMMARY: The results of this work will be a continuing input of Corps needs and requirements for remotely sensed data on the coastal environment to NASA and development of a viable plan of attaining Corps goals using SEASAT data. It will result in application of the capabilities of SEASAT-A to the Corps needs for oceanographic data. This work will result in improved oceanographic data, ice monitoring, wave spectra and wind/wave interaction. This effort will satisfy needs for all coastal Districts as well as those of WES, CRREL, IWR, CERC and ETL for oceanographic data. Reports of progress and uses of data will be made for applications cited offices.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

RS79-1-041

5.0017, DEVELOPMENT AND APPLICATION OF PHOTOGRAPHIC TECHNIQUES OF REMOTE SENSING

G. COOPER, Univ. of Maine, Agric. Experiment Station, Botany & Plant Pathology, *36 Winslow Hall, Orono, Maine* 04473 (0071745; ME08494)

OBJECTIVE: Explore the use and efficiency of photographic remote sensing in low intensity soil surveys. Develop the use of aerial photographic ocean and estuary surveys on the Maine Coast. Accumulate, as a result of ongoing research, material for a remote sensing atlas of Maine's herbaceous vegetation. Explore various aspects of disease problems in apples and blueberries using aerial photographic techniques.

APPROACH: All objectives are being explored using existing research land and personnel. All photography is low level and intended to expand the work already underway. Except for underwater detail, as in objective 2, the work is concentrated on the use of black and white and color infrared imagery.

PROGRESS: Early winter remote sensing data on soil typing the University Forest (in cooperation with S.C.S.) acquired, now being analyzed. Preliminary color infrared survey of selected blueberry field plots finished. Results are encouraging and have stimulated ground work by research personnel working with blueberries. Final survey of poultry manure pasture plots accomplished. Evidence of migration of fertilizer outside plots evident. Forage plots on Rogers farm (release of alfalfa by herbicidal treatment) finished. Results excellent. Effects of release well shown. Bottom of estuary survey - inactive this year due to changing research workers on ground truth data acquisition. Cooperative agreement and funding (with Department of Environmental Protection) on solid waste disposal site research finalized.

SUPPORTED BY Maine State Government

RS79-1-042

5.0025, SURVEY TECHNOLOGY DEVELOPMENT
A. KEMMERER, U.S. Dept. of Commerce, Natl. Oceanic & Atmos. Admin., *Bay St. Louis, Mississippi* 39520 (SEC-207)

Overall objective is to provide technical options for achieving NMFS goals through satellite and remote sensing applications, development of sampling and data management systems, program planning (system engineering), and technology transfer and coordination. Satellite studies include SEASAT-A surface layer transport and fisheries surveillance, CZCS fishery applications, satellite tracking of porpoises and marine turtles, and development of satellite image analyses, remote sensing applications including photography and LLLTV demonstrations and support of RUFAS-II sampling systems including turtle and porpoise tags, turtle tracking, porpoise containment system design, and development of trawl door STD. Data management efforts relate to EPA studies, SEFC data, and optimized cruise tracks; program planning includes SEFC turtle PDP support, and planning support for NOAA. Technology transfer and coordination impacts the national focus of NFEL and includes NOAA technical management of CZCS program, NMFS coordination of SEASAT projects and support of ICES aerospace remote sensing group.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Marine Fisheries Service

RS79-1-043

5.0062, DEVELOPMENT OF A REMOTE SENSING APPLICATIONS PROGRAM IN VERMONT
H.H. JOHN, Univ. of Vermont St. Agr. Col., School of Natural Resources, *85 S. Prospect St., Burlington, Vermont* 05401 (NSG 7453)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-1-044

THE WORLD REMOTE SENSING BIBLIOGRAPHIC INDEX,
Tensor Industries, Inc., Falls Church, VA.
P. F. Krumpe.
December 1976. 628 p.

Descriptors: *Remote sensing, *Bibliographies, *Indexing, *United States, Publications, Geographical regions, Agriculture, Natural resources, Resources, Foreign countries, Education, Environment, Agricultural resources, World index.

This volume is a geographic index bibliography of over 4,000 references on remote sensing of natural and agricultural resources throughout the world. Citations from 1970 to August 1976 are arranged within 14 major disciplines among more than 150 geographic areas, states, and countries. This extensive compilation originates from more than 850 foreign and domestic sources among 6 major publishing categories. Instructions for procuring desired publications or reports were included, in addition to guidelines for efficient utilization of the document. This book was designed as an integrated reference guide for use in remote sensing and environmental education, training, applications research, analysis, and technology transfer. (Froehlich-ISWS)
W78-12618

RS79-1-045

SUMMARIES OF PHYSICAL RESEARCH IN THE GEOSCIENCES.
Department of Energy, Washington, DC. Div. of Basic Energy Sciences.
Report No. DOE/ER-0016, September 1978. 52 p.

Descriptors: *Geophysics, *Geothermal studies, *Remote sensing, Projects, *Department of Energy research, Aeronomy, Seismology, Geology, Hydrology, Geochemistry, Petrology, Energy, Meteorology, Sediments, Brines, Kinetics, Aqueous solutions.

Research supported by the Department of Energy is aimed at providing basic knowledge in the fields of earth, atmospheric, and solar/terrestrial sciences. This series of summaries prepared by the investigators describes work performed during 1977, the scope of work to be done in 1978, and some information on research planned for 1979. Included under the heading of on-site geosciences are programs on geoscience, remote sensing, aeronomy, geothermal energy, thermodynamics of silicates, seismology, magma energy research, and physical chemistry of geothermal solutions. Under the heading off-site geoscience, are such areas of research as seismology, meteorology, magnetic field annihilation process in the magnetosphere, isotopic studies of rare gases in terrestrial samples, and organic geochemistry of outer continental margin and deep ocean sediments. Among the programs related to water research are projects on geothermal energy, thermodynamics of high temperature brines, and kinetics and transport of aqueous solutions. (Majtenyi-IPA)
W79-00101

RS79-1-046

Statistical Mapping of Sheet Aiquile Se-20-9 (National MAP) Making Use of ERTS Images

National Aeronautics and Space Administration, Washington, D. C.
AUTHOR: Torrez, J. G.; Brockman, C. E.; Castro, A. F.
E111212 Fld: 8B, 48I STAR1608
Aug 77 33p
Rept No: NASA-TM-75039
Contract: NASW-2792
Monitor: 18
Tran-Transl. Into English from Rev. Cartografica (Brazil), No. 26, 1974 p 127-158. Subm-Transl. By Transemantics, Inc., Washington, D.C.

Abstract: New possibilities of remote sensing by means of satellites to do research on natural resources are reported. These images make it possible to carry out integrated studies of natural resources in the shortest time possible and with small investments. Various maps and a complete description of each are included. With the use of these satellites, scientists can hopefully plan development projects at the national level.

Descriptors: *Earth resources program, *Mapping, Satellite-borne photography, Statistical analysis, Cost analysis, Remote sensors

Identifiers: Translations, *Spaceborne photography, Remote sensing, NTISNASAT

N78-17450/5ST NTIS Prices: PC A03/MF A01

RS79-1-047

Procedures for Gathering Ground Truth Information for a Supervised Approach to a Computer-Implemented Land Cover Classification of LANDSAT-Acquired Multispectral Scanner Data

National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AUTHOR: Joyce, A. T.
E0923D1 Fld: 08F, 48I STAR1606
1978 48p
Rept No: NASA-RP-1015, JSC-12910
Monitor: 18

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

Descriptors: *Ground truth, *LANDSAT satellites, *Multispectral band scanners, *Terrain, Crop identification, Earth resources, Land use, Pattern recognition

Identifiers: Methodology, Data acquisition, NTISNASA

N78-15549/6ST NTIS Prices: PC A03/MF A01

RS79-1-048

Directory - Sources of Information on Exploration for Petroleum and Geothermal Resources in the State of Arizona

Arizona Oil and Gas Conservation Commission, Phoenix.
AUTHOR: Conley, J. N.
F0072H1 Fld: 8I, 5B, 48A, 97K, 88E GRAI7901
Sep 74 39p
Monitor: 18

Abstract: Contents: Index - alphabetical listing of sources of information, addresses and telephone numbers; General geological and geophysical information; Subsurface geology; Mineral resources; Surface geology; Maps; Geologic reports; Leases; Drilling; Mineral associations; Appendix.

Descriptors: *Geothermal prospecting, *Petroleum deposits, *Exploration, *Information centers, *Arizona, *Directories, Well logging, Geologic maps, Natural gas, Helium, Photogrammetry, Aerial photography, Remote sensing, Scientific societies, Bibliographies, Professional personnel, State governement, Government agencies, National government, Federal agencies

Identifiers: *Information sources, NTISSLLC

PB-286 358/7ST NTIS Prices: PC A03/MF A01

RS79-1-049

Results of Analysis of Flight and Ground Observation Materials for First Year of First Stage of ''Program of Experimental Research to Develop Methods for Remote Sounding of Soils and Vegetation on Analogous Sections of the United States and USSR for 1975-1980''

National Aeronautics and Space Administration, Washington, D. C.
E1042K4 Fld: 8M, 48E STAR1607
Jan 78 133p
Rept No: NASA-TM-75082
Contract: NASW-2791
Monitor: 18
Tran-Transl. Into English from Rezultaty Analiza Materialov Samoletnykh I Nazemnykh Nablyudeniy I-OGO Goda Pervogo Etapa 'Programmy Eksperimental Nykh Issledovaniy Po Razrabotke Metodov Distantsionnogo Zondirovaniya Pochv I Rastitelnosti NA Uchastkakhanalogakh V Ssha I Sssr NA 1975-1980 Gg (Moscow), Rept. Academy of Sciences USSR, Jul. 1977 p 1-128. Subm-Transl.

Abstract: A joint U.S.S.R. and United States program to develop methods for remote sounding of soils and vegetation is reported. The program is being conducted on similar sections of land in the USSR and the United States. Details of the data obtained and the type of sensing equipments employed are provided in the appendices.

Descriptors: *Earth resources program, *Remote sensors, *Soils, *Spectral reconnaissance, *Terrain analysis, *Vegetation, Aerial photography, Data acquisition, Entropy, Optical density, Spectrum analysis

Identifiers: Translations, USSR, NTISNASAT

N78-16409/2ST NTIS Prices: PC A07/MF A01

RS79-1-050

Proceedings of the Eleventh International Symposium on Remote Sensing of Environment. Volume II

Environmental Research Inst. of Michigan, Ann Arbor. Center for Remote Sensing Information and Analysis.*Department of Energy. (9502319)
F0032K1 Fld: 8F, 48 GRAI7901
1977 868p
Monitor: 18
11. symposium on remote sensing of environment, Ann Arbor, MI, USA, 25 Apr 1977.

Abstract: Ninety-three papers are presented discussing technology utilization and transfer. (ERA citation 03:053805)

Descriptors: *Remote sensing, *Meetings, Agriculture, Ecosystems, Geophysical surveys, Resource assessment, Technology transfer, Technology utilization

Identifiers: ERDA/580203, NTISDE

CONF-770478-P2 NTIS Prices: PC A99/MF A01

RS79-1-051

0130540 78-005268
NIGHTTIME IMAGES OF THE EARTH FROM SPACE,
CROFT THOMAS A.
SCIENTIFIC AMERICAN, JUL 78, V239, N1, P86 (12)
TECHNICAL FEATURE: PICTURES RECORDED BY U. S. AIR FORCE WEATHER SATELLITES AT NIGHT HAVE SHOWN THAT THE BRIGHTEST LIGHTS ON THE DARK SIDE OF THE PLANET ARE GAS FLARES FOUND IN ASSOCIATION WITH SOME OF THE WORLD'S MAJOR OIL FIELDS. CHARACTERISTICS OF THE LANDSAT SYSTEM USED TO OBTAIN THESE PHOTOGRAPHS ARE DESCRIBED. THE GAS FLARES ARE SEEN ALL OVER THE GLOBE, BUT THE GREATEST CONCENTRATION OF THEM IS IN THE VICINITY OF THE PERSIAN GULF. OTHER PHENOMENA LOCATED BY LIGHT FLARES ON THE LANDSAT PHOTOGRAPHS ARE FISHING FLEETS OFF THE COAST OF JAPAN, THE HEAVILY INDUSTRIALIZED COUNTRY OF JAPAN ITSELF, AND AGRICULTURAL AND NATURAL FIRES. THE PHOTOGRAPHS HAVE PROVED HELPFUL IN ILLUSTRATING THE LARGE AMOUNTS OF WASTE ENERGY GIVEN OFF ON EARTH, AND IN PINPOINTING EXACTLY WHERE THESE WASTES EXIST. (1 GRAPH, 1 MAP, 18 PHOTOS)
DESCRIPTORS: *REMOTE SENSING ; *SATELLITE APPLICAIONS ; *DAYTIME-NIGHTTIME COMPARISONS ; *LANDSAT ; *OIL FIELDS ; *NATURAL GAS FIELDS ; *FIRES ; *AGRICULTURAL LAND ; ENGLAND ; JAPAN
REVIEW CLASSIFICATION: 09

RS79-1-052

1503709 157.8 R29 ID No: 78-9149316
State of the art: moderator's comments .Integrated multiresource inventories with emphasis on planning, techniques, land classifiction systems, remote sensing, data processing and mapping.
LaBau, V J
PB U S Natl Tech Inf Serv 281036: 392-394. 1978
157.8 R29
Search: 19780000
Source: USDA Doc Type: ARTICLE
Cat Codes: 1005; 3510

RS79-1-053 4TH CANADIAN SYMPOSIUM ON REMOTE SENSING

Anonymous, Can. Symp. Remote Sensing Proc., No. 4, 613 p., May 16-18, 1977, Quebec, Canada; Incl. French Sum.
Individual papers within scope are cited under the separate authors.

RS79-1-054 REMOTE SENSING MEETING OF THE GROUP FOR THE DEVELOPMENT OF AEROSPATIAL REMOTE SENSING

Anonymous, Remote Sensing Mtg. Proc., V 1,2, 701 p., Oct. 26-28 1976, Toulouse, France, Group Dev. Teledetection Aerosp., 1977, Toulouse, France, Available in French
Individual papers within scope are cited herein under the separate authors.

RS79-1-055 UNITED NATIONS, ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Proc. of Seminar on Remote Sensing Applications, Sept. 29-Oct. 6, 1974, Bangkok, Thailand, 192 p., Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand, 1975
Individual papers within scope are cited herein under the separate authors.

RS79-1-056 ADDITIONAL INFORMATION ON APPLICATIONS OF REMOTE SENSING SURVEYS IN THAILAND

Angsuwathana, P.; Proc. of Seminar on Remote Sensing Applications, p. 106-112, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand, 1975
No abstract available.

RS79-1-057 AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY

Anson, A.; Neblette's Handbook of Photography and Reprography; Materials, Processes, and Systems, 7th Edition, p. 528-549, Van Nostrand Reinhold Co., New York, NY, 1977
No abstract available.

RS79-1-058 CSIRO AND THE AUSTRALIAN PROGRAMME FOR THE EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS)

Duggin, M.J.; Australia CSIRO, Mineral Resources Lab., Invest. Rept. No. 95, 14 p., 1972
No abstract available.

RS79-1-059 COMPARISON OF THE IMAGES AND THE MULTISPECTRAL CLASSIFICATION OBTAINED BY THE LANDSAT AND SKYLAB SATELLITES AND THE DAEDALUS AIRBORN SCANNER

Fontanel, A.; Lallemand, C.; Legendre, G.; et al.; J. de Teledetection du G.D.T.A., Tome 1,2, p. 499-539, Group Dev. Teledetection Aerosp., Toulouse France, 1977, Incl. English Sum., Available in French
No abstract available.

RS79-1-060 DEBATE ON THERMOGRAPHY

Goillot, C.; J. de Teledetection du G.D.T.A., Tome 1,2, p. 679-701, Group Dev. Teledetection Aerosp., Toulouse, France, 1977, Available in French
No abstract available.

RS79-1-061 SCIENTIFIC APPLICATIONS OF PHOTOGRAPHY

Hoadley, H.W.; Neblette's Handbook of Photography and Reprography; Materials, Processes, and Systems, 7th Edition, p. 562-606, Van Nostrand Reinhold Co., New York, NY, 1977
No abstract available.

RS79-1-062 PERSONNEL TRAINING IN REMOTE SENSING OPERATIONS AND INTERPRETATION OF DATA; 1, FUTURE DEVELOPMENT OF AND TRAINING IN REMOTE SENSING IN THE ESCAP REGION

Koopmans, B.N.; Proc. of Seminar on Remote Sensing Applications, p. 185-188, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand, 1975
No abstract available.

RS79-1-063 REMOTE SENSING; THE WAY AHEAD

Jones, A.D.; Cartogr., Aust. Inst. Cartogr., V 9, No. 2, p. 85-89, 1975
No abstract available.

RS79-1-064 THE REMOTE SENSING OPERATIONS BY THE GROUP FOR DEVELOPMENT OF AEROSPATIAL REMOTE SENSING

Laidet, L.; Marche, E.; J. de Teledetection du G.D.T.A., Tome 1,2, p. 1-9, Group Dev. Teledetection Aerosp., Toulouse, France, 1977, Incl. English Sum., Available in French
No abstract available.

RS79-1-065 MONITORING SURFACE ALBEDO CHANGE WITH LANDSAT

Otterman, J.; Geophys. Res. Letter, V 4, No. 10, p. 441-444, 1977, Sinai
No abstract available.

RS79-1-066 STATUS OF REMOTE SENSING SURVEYS CONDUCTED IN ESCAP MEMBER COUNTRIES

Perry, W.J.; Simpson, C.J.; Maffi, C.E.; et al.; Proc. of Seminar on Remote Sensing Applications, p. 13-24, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand, 1975
No abstract available.

RS79-1-067 A FRENCH SPOT TO OBSERVE THE EARTH

Repairoux, A.; Recherche, No. 77, p. 396, 1977, Available in French
No abstract available.

RS79-1-068 REFLECTIONS ON THE SIGNIFICANCE OF REMOTE SENSING DATA

Rey, P.; J. de Teledetection du G.D.T.A., Tome 1,2, p. 55-58, Group Dev. Teledetection Aerosp., Toulouse, France, 1977 Available in French
No abstract available.

RS79-1-069 FIVE FUNDAMENTAL REMOTE SENSING GUIDELINES

Robinove, C.J.; Proc. of Seminar on Remote Sensing Applications, p. 83-84, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand, 1975
No abstract available.

RS79-1-070 WORLDWIDE RESULTS OF EXPERIMENTS USING ERTS-1, SKYLAB, AND DATA FROM SIMILAR SOURCES; 1, SOME HYDROLOGIC AND GEOLOGIC RESULTS FROM EARTH RESOURCES SATELLITES

Robinove, C.J.; Proc. of Seminar on Remote Sensing Applications, p. 84-85, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand, 1975
No abstract available.

RS79-1-071 LANDSAT IMAGERY: A CANADIAN LISTING

Slaney, V.R.; Rept. No. Open File 386, 60 p., 1976, Index Map 1:10,000,000
Avail:Geol. Survey of Canada, DOE, Mines and Resources, Ottawa, Ontario, Canada
No abstract available.

RS79-1-072 AERIAL PHOTOGRPAHY IN INDONESIA

Soetanto; Photogrammetria, V 34, No. 3, p. 79-87, 1978
No abstract available.

RS79-1-073 THE USE OF AIR PHOTOGRAPHY

St. Joseph, J.K.S. (Ed.); New Edition, 196 p., John Baker, London, United Kingdom, 1977
No abstract available.

RS79-1-074 INFORMATION OBTAINED BY THE EARTH RESOURCES SATELLITE LANDSAT

Tricart, J.; Apports de la Teledetection a l'Etude des Regions Arides et Subarides, J. d'Etude Organise le 9 Avril, 1976 au CNEAT, p. 3-9, Cent. Perfectionnement, Amenagaement Milieu Nat., Strassbourg, France, 1976, West Africa, Available in French
No abstract available.

Section 2

GEOLOGY

A. Descriptive

RS79-2-001

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

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

RS79-2-002

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

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

RS79-2-003

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

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

RS79-2-004

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

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

RS79-2-005

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

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

RS79-2-006

N78-33647*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
DETERMINING CRUSTAL STRAIN RATES WITH A SPACE-BORNE GEODYNAMICS RANGING SYSTEM. 2: STATION COORDINATE ANALYSIS
Steven C. Cohen and Glenn R. Cook Aug. 1978 25 p ref Submitted for publication
(NASA-TM-79627) Avail: NTIS HC A02/MF A01 CSCL 08G

The use of a spaceborne geodynamics ranging system for determining crustal strain rates is analyzed. The use of site coordinates rather than intersite baseline distances for the strain rate determinations is emphasized. After discussing the analytical techniques which are to be employed, numerical results are presented which suggest that the use of site coordinates would result in a 20-70% improvement in the precision of the deduced values of straining. Precision of a few parts in 10 to the 9th power would be achievable with simple geometrics and a decade or two of measurements; precisions of a few parts in 10 to the 8th power would be achievable in a few years. A consideration of possible correlations among the derived target site coordinates leads to the conclusion that, with the proper choice of coordinate systems, the correlations can be made small and non-detrimental to the strain rate determinations. J.M.S.

RS79-2-007

N78-33499*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCRIMINATION OF ROCK CLASSES AND ALTERATION PRODUCTS IN SOUTHWESTERN SAUDI ARABIA WITH COMPUTER-ENHANCED LANDSAT DATA
H. W. Blodget, F. J. Gunther (Computer Sciences Corp., Silver Spring, Md.), and M. H. Podwysocki Oct. 1978 40 p refs
(NASA-TP-1327; G7802-F16) Avail: NTIS HC A03/MF A01 CSCL 08G

Digital LANDSAT MSS data for an area in the southwestern Arabian Shield were computer-enhanced to improve discrimination of rock classes, and recognition of gossans associated with massive sulphide deposits. The test area is underlain by metamorphic rocks that are locally intruded by granites; these are partly overlain by sandstones. The test area further includes the Wadi Wassat and Wadi Qatan massive sulphide deposits, which are commonly capped by gossans of ferric oxides, silica, and carbonates. Color patterns and boundaries on contrast-stretched ratio color composite imagery, and on complementary images constructed using principal component and canonical analyses transformations, correspond exceptionally well to 1:100,000 scale field maps. A qualitative visual comparison of information content showed that the ratio enhancement provided the best overall image for identification of rock type and alteration products. Author

RS79-2-008

N78-30631 Wyoming Univ., Laramie.
PREDICTING THE SURFACE WIND CHARACTERISTICS OF SOUTHERN WYOMING FROM REMOTE SENSING AND EOLIAN GEOMORPHOLOGY Ph.D. Thesis
Kenneth Edward Kolm 1977 174 p
Avail: Univ. Microfilms Order No. 7811698

LANDSAT image interpretations of sand dune fields were correlated with meteorological data to show that the presence of active dunes indicates a windy climate, the elongation of dunes and dune fields indicates dominant direction, persistence, and strength of wind flow in a given area, and the boundaries of dune fields indicate confluence, difluence, and other patterns of wind flow. Aerial photo interpretations and statistical analyses of sand dune features that were correlated with meteorological data reveal that individual dune forms record the dominant wind direction across the area, dune spacings and alignments depict local windflow patterns, and parabolic dunes created from stabilized sand are independent of the immediate structure and statigraphy and can therefore be used as both a summer wind velocity and climatic indicator. Dissert. Abstr.

RS79-2-009

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

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

RS79-2-010

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

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

RS79-2-011

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

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

RS79-2-012

N78-33845*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADAR OBSERVATIONS OF A VOLCANIC TERRAIN: ASKJA CALDERA, ICELAND
D. L. Evans 1 Oct. 1978 46 p refs
(Contract NAS7-100)
(NASA-CR-157765; JPL-Pub-78-81) Avail: NTIS HC A03/MF A01 CSCL 08F

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

RS79-2-013

N79-10499*# National Aeronautics and Space Administration, Washington, D. C.
A COMBINATION OF REMOTE AND GROUND-BASED METHODS FOR STUDYING YOUNG FOLDED DEFORMATIONS IN THE WESTERN KOPETDAG DEPRESSION
T. P. Ivanova and V. G. Trifonov Oct. 1978 18 p refs Transl. into ENGLISH of "Sochetaniye Distantsionnykh i Nazemnykh Metodov Issledovaniya Molodykh Skladchatykh Deformatsii Zapadnogo Pogruzheniya Kopetdaga" Report of the USSR Acad. of Sci., 1975 10 p Translation was announced as N77-13507 Transl. by Agnew Tech-Tran, Inc., Woodland Hills, Calif.
(Contract NASw-2789)
(NASA-TT-F-16953) Avail: NTIS HC A02/MF A01 CSCL 08F

Topographic information obtained from high-altitude photographs is combined with ground-based measurements in an analysis of young folded deformations in the Western Kopetdag depression. Sedimentation patterns obtained from pictures and maps of the area were supplemented by ground-based measurements of cuts in the mountain plain rises and river embankments to determine the history and present development of folded structures. Author

RS79-2-014

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

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

RS79-2-015

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

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

RS79-2-016

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

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

RS79-2-017

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

A new algorithm, PROBLYMAP, was developed to classify digital LANDSAT data for the purpose of mapping geology or terrain type. The algorithm assigns to each pixel a set of probabilities belonging to each terrain type. An important feature of this algorithm is that the classification of a pixel is influenced not only by its own probabilities but also by those of its eight adjacent neighbors. The main application of the algorithm was the mapping of the suite of ultramafic and mafic rocks and related sediments in the desert environment of the Oman Mountains, Sultanate of Oman. The resulting classification map shows good agreement with the best ground truth available, which includes a geology map at 1:500,000 and 1:60,000 black and white air photos. Using training sites from three known copper deposits, 180 other gossan zones were identified within the gabbro/basalt sequence. Dissert. Abstr.

RS79-2-018

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

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

RS79-2-019

N79-11450# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY GEOLOGICAL PRECAMBRIAN MAP OF PIAUI [MAPA GEOLOGICO PRELIMINAR DO PRE-CAMBRIANO DO PIAUI]
Edison Crepani, Paulo Roberto Martini, Paulo Veneziani, Augusto PaivaFilno, and Moacir Moco Oct. 1977 22 p refs In PORTUGUESE; ENGLISH summary
(INPE-1146-PE/099) Avail: NTIS HC A02/MF A01

A preliminary geological precambrian map was done using LANDSAT images and SLAR mosaics of the project RADAM/BRAZIL. The map is presented in three parts which correspond to the South, the East and the North of the State. B.B.

RS79-2-020

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

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

RS79-2-021

A79-14180 # Interactive digital image processing of Landsat data for geologic analysis. A. F. Smith (GE Space Systems Organization, Beltsville, Md.). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 197-212. 16 refs.

Several image processing and enhancement techniques employed to extract geological information are discussed. Particular consideration is given to the application of the Image 100 multispectral image processing system to the digital analysis of Landsat imagery of a study area in southwestern Arizona. The relative advantages of several supervised and unsupervised classification routines, including single-cell parallelepiped signature analysis, feature-space partitioning, and single-band density slicing are discussed. Enhancement techniques, including several combinations of linear and nonlinear contrast stretching and ratioing, are also described. Results indicate that interactive processing of Landsat data significantly aids in the mapping and analysis process for the preparation of geological maps. B.J.

RS79-2-022

A78-53389 Studies utilizing orbital imagery of India for geology and land use. R. D. Sharma (Indian Space Research Organization, Bangalore, India), B. N. Raina (Indian Photo Interpretation Institute, Dehra Dun, India), and M. S. Dhanju (Indian Space Research Organization, Space Applications Center, Ahmedabad, India). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 334-362. 11 refs.

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

RS79-2-023

A79-11763 # Landsat geologic reconnaissance of the Washington, D.C. area westward to the Appalachian Plateau. G. A. Rabchevsky, U. Boegli, and J. Valdes (American University, Washington, D.C.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 345-360. 17 refs.

The usefulness of satellite and aircraft remote sensor imagery in the mapping of major geologic structures, boundaries of geologic units and lithologies, and geomorphic provinces in the Washington, D.C. area, westward to the Appalachian Plateau is investigated. The remote sensor imagery data base consisted of Landsat and Skylab data and high-altitude infrared aerial photography. The imagery was processed primarily by photo-optical techniques and analyzed by conventional photographic interpretation methods. A series of geological and geobotanical overlays were prepared showing the interpreted results. The results showed that conventional published geologic maps of regions can be effectively supplemented by interpreted satellite and aircraft imagery overlays. (Author)

RS79-2-024

A78-53388 The geological application of Landsat imagery in Brazil. A. C. Corrêa, F. de Mendonca, and C. C. Liu (Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 318-333. 33 refs.

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

RS79-2-025

A78-53387 Analysis of geological structures based on Landsat-1 images. C. E. Brockmann, A. Fernandez, R. Ballón, and H. Claure (Servicio Geológico de Bolivia, La Paz, Bolivia). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 292-317. 16 refs.

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

RS79-2-026

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

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

RS79-2-027

A78-48588 # Photointerpretation on computer enhanced Landsat image of Serbia /Yugoslavia/. M. Hanich, B. Koscec, and M. Denih (Industroprojekt, Zagreb, Yugoslavia). *COSPAR, Plenary Meeting, 21st, Innsbruck, Austria, May 29-June 10, 1978, Paper.* 8 p. 5 refs.

The paper reviews digital image processing and presents the results of a tectonic-structural analysis of a Landsat image of Serbia. To complement digital processing and photogeological analysis of the satellite image, a quantitative analysis of the image was performed by means of the ISI VP-8 electronic analyzer. B.J.

RS79-2-028

A79-14157 # Classification of rocks on the basis of signatures and texture-measures from Landsat imagery. H. Burger (Berlin, Freie Universität, Berlin, West Germany). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 33-35.

An algorithm is described which uses both texture and signature information from multispectral images for terrain classification. The method of Haralick et al. (1973) for texture analysis is generalized to the multispectral case; other texture measures are also examined. The classification has been tested on a Landsat image of the Tibesti Mountains of Chad. Preliminary results indicate that this evaluation of the classification technique was not entirely successful. B.J.

RS79-2-029

A79-14644 • Imaging radar observations of Askja Caldera, Iceland. M. C. Malin, D. Evans, and C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Planetary Surfaces and Interiors Section, Pasadena, Calif.). *Geophysical Research Letters*, vol. 5, Nov. 1978, p. 931-934. 11 refs.

A 'blind' test involving interpretation of computer-enhanced like- and cross-polarized radar images is used to evaluate the surface roughness of Askja Caldera, a large volcanic complex in central Iceland. The 'blind' test differs from earlier analyses of radar observations in that computer-processes images and both qualitative and quantitative analyses are used. Attention is given to photogeologic examination and subsequent survey-type field observations, along with aerial photography during the field trip. The results indicate that the 'blind' test of radar interpretation of the Askja volcanic area can be considered suitable within the framework of limitations of radar data considered explicitly from the onset. The limitations of the radar techniques can be eliminated by using oblique-viewing conditions to remove geometric distortions and slope effects. S.D.

RS79-2-030

A79-11857 • Discrimination of geologic units in Death Valley using dual frequency and polarization imaging radar data. M. Daily (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, University, Santa Barbara, Calif.), C. Elachi, T. Farr (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and G. Schaber (U.S. Geological Survey, Flagstaff, Ariz.). *Geophysical Research Letters*, vol. 5, Oct. 1978, p. 889-892. 8 refs. Contract No. NAS7-100.

A simultaneous analysis of dual-frequency and dual-polarization radar imagery of an area located in the central part of Death Valley, Calif., is discussed. The radar imagery analyzed consists of like-polarized L-band, cross-polarized L-band, and like-polarized X-band imagery digitally combined and ratioed to enhance the variation in the backscatter cross section of different geologic units. It is shown that simultaneous analysis of such radar imagery leads to a synergism effect which, in the case of the area studied in Death Valley, allows nearly complete discrimination of surficial geologic units. Radar backscatter is found generally to increase with roughness from smooth Quaternary sand facies to rough and extremely rough Quaternary silty rock salt. F.G.M.

RS79-2-031

5.0070, REMOTE SENSING STUDIES APPLIED TO INTERPRET FRACTURE SYSTEMS AND STRUCTURAL STYLES IN THE PLATEAU REGIONS (ABBREV)
R.C. SHUMAKER, West Va. University, School of Arts & Sciences, Geology & Geography, *Morgantown, West Virginia* 26506 (EY-76-S-21-8040)

This remote sensing study consists of four tasks to: (1) Establish regional fracture patterns for the central and southern Appalachians and the Continental Interior by the use of satellite and aircraft images. Attempt to establish boundary zones between the three geological provinces. (2) Develop a computer program to process data required from lineament maps and field observations. Evaluate statistical and graphical procedures for validity and usefulness to the project. (3) Collect geological information available from publications and private and governmental files in order to determine the relationship of photo lineaments to geology. (4) Using hydrocarbon production data available for the project area, attempt to establish if recoveries are influenced by natural fracture and lineament patterns. Propose well locations to evaluate the effect of lineament and fractures on hydrocarbon production if arrangements can be worked out with local production companies to support drilling of the well. (FE-TIMS)

SUPPORTED BY U.S. Dept. of Energy, Div. of Coal Conversion & Utilization

RS79-2-032

LINEAMENTS ON SKYLAB PHOTOGRAPHS-DETECTION, MAPPING, AND HYDROLOGIC SIGNIFICANCE IN CENTRAL TENNESSEE,
Geological Survey, Reston, VA.
G. K. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-25625, Price codes: A05 in paper copy, A01 in microfiche. Open-File Report 76-196, March 1976. 15 fig, 10 tab, 30 ref, 1 append.

Descriptors: *Tennessee, *Aerial photography, *Remote sensing, Groundwater potential, Hydrogeology, Water yield, Mapping, Test wells, Geology, LANDSAT, SKYLAB, Lineaments.

Lineaments were detected on SKYLAB photographs by stereo viewing, projection viewing, and composite viewing. Large well yields of 25 gal/min or more can be obtained in the study area by locating future wells on SKYLAB lineaments rather than on lineaments detected on either high-altitude aerial photographs, LANDSAT images, or by random drilling. Larger savings might be achieved by locating wells on lineaments detected by both stereo viewing and projection. The test site is underlain by dense, fractured, flat-lying limestones. Soil cover averages 4 ft thick in the Central Basin and about 40 ft thick on the Eastern Highland rim. Groundwater occurs mostly in horizontal, sheet-like solution cavities, and the trends of these cavities are controlled by joints. (Lardner-ISWS)
W78-10000

RS79-2-033

GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA, REPORT,
Colorado School of Mines, Golden, Dept. of Geology.
K. Lee, G. L. Prost, D. H. Knepper, D. L. Sawatsky, and D. Huntley.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-28593, Price codes: A00 in paper copy, A01 in microfiche. Final Report, Remote Sensing Report 75-7, December 1975. 320 p, 78 fig, 12 tab, 38 ref, 9 append. NASA NAS9-13394.

Descriptors: *Remote sensing, *Geology, *Mineralogy, *Water resources, *Satellites(Artificial), *Colorado, Photography, Data processing, Mapping, Surveys, Petrology, Mining, Surface waters, Groundwater, Hydrogeology, Evaluation, Analytical techniques, Skylab.

Skylab photographs are superior to ERTS images for photogeologic interpretation primarily because of improved resolution. Similarly, S190B photos provide more geologic advantage over good color photography; S190B stereo color photos, where available, provide maximum geologic information. All major geologic structures can be recognized on Skylab photographs. Large folds, even those with very gentle flexures, can be mapped accurately and with confidence. Bedding attitudes of only a few degrees are recognized. Mineral deposits in Central Colorado may be indicated on Skylab photos by lineaments and color anomalies, but positive identification of these features is not possible. Water resource studies can use Skylab photography for interpretation of drainage, hydrogeology, and groundwater flow. S190A stereo color photography is adequate for defining drainage divides that in turn define the boundaries and distribution of groundwater recharge and discharge areas within a basin. Skylab S190B stereo photography has sufficient resolution to map hydrogeologic units and structures that may be sufficient for regional studies. Aircraft photography and field work are still necessary to produce an accurate hydrogeologic map. (Sims-ISWS)
W78-11439

RS79-2-034

The Utilization of Side Looking Airborne Radar (SLAR) in the Analysis of Karst Topography

Air Force Academy Colo (011550)

Final rept.
AUTHOR: Smith, Charles L.; Tribble, A. Paul
E106282 Fld: 17I, 8F, 8B, 63H, 48F, 48I GRAI7812
Sep 77 35p
Rept No: USAFA-TR-77-13
Monitor: 18

Abstract: Characteristics of mechanical and synthetic radar systems are reviewed. Signature elements of karst topography such as a vertical drainage pattern, knobs, and sinkholes are identified for Side Looking Airborne Radar (SLAR) imagery. SLAR imagery of the Kentucky Pennyroyal and karst areas in Florida is presented with the signature elements highlighted. Applications of SLAR imagery to the identification and mapping of karst areas in physically, climatologically, or politically inaccessible areas is addressed. (Author)

Descriptors: *Side looking radar, Geomorphology, Electromagnetic spectra, Remote systems, Mapping, Florida, Kentucky

Identifiers: *Karst topography, Sinkholes, NTISDODXA

AD-A051 330/9ST NTIS Prices: PC A03/MF A01

RS79-2-035

0132066 78-006640
GEOLOGIC MAPPING FOR COASTAL ZONE PLANNING IN CALIFORNIA-BACKGROUND AND EXAMPLES,
WILLIAMS JOHN W. ; BEDROSSIAN TRINDA L.
(SAN JOSE STATE UNIV) AND; (CALIFORNIA DIV MINES AND GEOLOGY),
ENV GEOLOGY, 1978, V2, N3, P151 (13)
SURVEY REPORT: GEOLOGISTS FROM THE CALIFORNIA DIV. OF MINES AND GEOLOGY EVALUATED THE FEASIBILITY OF LOCAL GOVERNMENTAL IMPLEMENTATION OF THE GEOLOGIC POLICIES IN THE 1975 CALIFORNIA COASTAL PLAN, WHICH WAS DESIGNED TO FACILITATE AND DIRECT COMPREHENSIVE COASTAL LAND USE PLANNING. GEOLOGIC GUIDELINES WERE APPLIED TO TWO AREAS ON THE NORTHERN COAST OF CALIFORNIA UNDER RESTRICTIONS SIMILAR TO THOSE THAT WOULD BE ENCOUNTERED BY LOCAL AGENCIES ATTEMPTING TO IMPLEMENT THE POLICIES. GEOLOGIC HAZARDS THAT SHOULD BE CONSIDERED IN COASTAL LAND USE PLANNING WERE MAPPED AND STUDIED. THE TYPES AND DETAIL OF DATA REQUIRED FOR IMPLEMENTATION OF THE CALIFORNIA COASTAL PLAN'S GEOLOGIC POLICIES COULD BE DEVELOPED BY LOCAL AGENCIES ONLY BY AUGMENTING STAFFS TO INCLUDE TRAINED GEOLOGISTS OR BY USING THE SERVICES OF CONSULTANT GEOLOGISTS. (1 DIAGRAM, 6 MAPS, 7 PHOTOS, 21 REFERENCES, 3 TABLES)
DESCRIPTORS: *COASTAL ZONE MANAGEMENT ; *CALIFORNIA ; *CARTOGRAPHY ; *LANDSLIDES ; *FLOODS ; *MINERAL RESOURCES ; *EROSION, WATER ; *LITHOLOGY ; GEOLOGY ; SEISMOLOGY ; REMOTE SENSING, INFRARED ; TIDAL WAVES
REVIEW CLASSIFICATION: 09

RS79-2-036 INTERPRETATION OF SATELLITE IMAGERY FOR SMALL-SCALE GEOMORPHOLOGIC MAPPING PURPOSES

Bashenina, N.V.; Geomorfologicheskoye Kartografirovaniye v Melkikh Masshtabakh, p. 19-26, Izd. Mosk. Univ., Moscow, USSR, 1976, Available in Russian

No abstract available.

RS79-2-037 MAPPING OF SOILS AND GEOLOGIC FEATURES WITH DATA FROM SATELLITE-BORNE MULTISPECTRAL SCANNERS

Baumagardner, M.F.; Kristof, S.J.; and Melhorn, W.N.; Genesis, Classification, and Geography of Soils, Int. Congr. Soil Sci. Trans., V 6, No. 10, Part 2, Commission 5, p. 650-659, 1974, Incl. French, German, Russian sum., Collin County, Texas

No abstract available.

RS79-2-038 THE HUMAN PERCEPTION OF GEOLOGICAL LINEAMENTS AND OTHER DISCRETE FEATURES IN REMOTE SENSING IMAGERY; SIGNAL STRENGTHS, NOISE LEVELS, AND QUALITY

Burns, K.L.; Brown, G.H.; Remote Sensing Environ., V 7, No. 2, p. 163-176, 1978

No abstract available.

RS79-2-039 AIR PHOTO-INTERPRETATION FOR SOIL MAPPING

Carroll, D.M.; Evans, R.; Bendelow, V.C.; G.B. Soil Surv., Tech. Monogr., No. 8, 85 p., 1977

No abstract available.

RS79-2-040 UTILIZATION OF "LANDSAT" IMAGES AND CONVENTIONAL AERIAL PHOTOGRAPHS IN THE DELINEATION OF SOME ASPECTS OF THE GEOLOGY OF THE CENTRAL EASTERN DESERT, EGYPT

El-Etr, H.A.; Yousif, M.S.M.; Precambrian Res., V 6, No. 1, p. A14-A15, 1978

Evolution and mineralization of the Arabian-Nubian Shield are discussed.

RS79-2-041 ANALYSIS OF THE USEFULNESS OF AUTOMATICALLY PROCESSED ERTS MULTISPECTRAL DATA FOR GEOLOGIC PURPOSES IN GEORGIA

Faust, N.L.; Georgia Inst. of Tech., Atlanta, GA, Master's, 1976

No abstract available.

RS79-2-042 REMOTE SENSING

Galmier, D.; Lacot, R.; Richard, R.; Geologues, No. 43, p. 45-61, 1977, With a contrib. by Scanvic, J.Y.
No abstract available.

RS79-2-043 SURVEY AND DESCRIPTION OF NATURAL REGIONS BY MEANS OF PHOTOGRAPHS TAKEN FROM STRATOSPHERIC BALLOONS

Girard, C.M.; Girard, M.C.; J. de Teledetection du G.D.T.A., Tome 1,2, p. 367-375, 1977, Group Dev. Teledetection Aerosp., Toulouse, France, Available in French
No abstract available.

RS79-2-044 PIT SLOPE MANUAL SUPPLEMENT 2-4; JOINT MAPPING BY TERRESTRIAL PHOTOGRAMMETRY

Herget, G.; Can. Cent. Mineral Energy Tech., CANMET Rept. No. 77-23, 34 p., 1977
No abstract available.

RS79-2-045 ASSESSMENT OF LANDSAT FILTERS FOR ROCK TYPE DISCRIMINATION, BASED ON INTRINSIC INFORMATION IN LABORATORY SPECTRA

Hunt, G.R.; Salisbury, J.W.; Geophysics, V 43, No. 4, p. 738-747, 1978
No abstract available.

RS79-2-046 A MULTI-ATTRIBUTE METHOD FOR COMPARING GEOLOGICAL LINEAMENT INTERPRETATIONS

Huntington, J.F.; Raiche, A.P.; Remote Sensing Environ., V 7, No. 2, p. 145-161, 1978
No abstract available.

RS79-2-047 LANDSLIDE MAPPING WITH THE CPI PLOTTER

Lo, C.P.; Photogramm. Rec., V 9, No. 51, p. 377-389, 1978, Incl. French, German sum.
No abstract available.

RS79-2-048 PROPOSALS FOR A NEW CLASSIFICATION OF EOLIAN SAND FEATURES FROM THE SATELLITE IMAGERY OF LANDSAT I, GEMINI, AND NOAA-3

Mainguet, M.; Z. Geomorphol., V 20, No. 3, p. 275-296, 1976, Incl. German, French sum.
No abstract available.

RS79-2-049 SMALL ROCK OUTCROPS IN VEGETATED TERRAIN IDENTIFIED BY DIGITAL PROCESSING OF LANDSAT DATA

Morse, A.; Mickeon, J.B.; Am. Assoc. Petr. Geol. Bulletin, V 62, No. 3, p. 546, 1978, AAPG-SEPM Annual Mtg.
No abstract available.

RS79-2-050 APPLYING REMOTE SENSING DATA TO STRUCTURAL GENERALIZATION IN MORPHOLOGICAL CARTOGRAPHY

Paul, S.J.; J. de Teledetection du G.D.T.A., Tome 1,2, p. 119-134, 1977, Group Dev. Teledetection Aerosp., Toulouse, France, Available in French
No abstract available.

RS79-2-051 EXAMPLE OF THE STUDY OF SALINITY OF SOILS BY MEANS OF INFRARED PHOTOGRAPHY

Peyronel, A.; J. de Teledetection du G.D.T.A., Tome 1,2, p. 67-73, 1977, Group Dev. Teledetection Aerosp., Toulouse, France, Available in French
No abstract available.

RS79-2-052 LOW-ALTITUDE MULTISPECTRAL IMAGERY AS AN AID FOR LITHOLOGIC MAPPING

Price, R.C.; Alabama Academy Sci., J., V 48, No. 3, p. 80, 1977, 54th Annual Mtg of Alabama Academy of Sci.
No abstract available.

RS79-2-053 SATELLITE OBSERVATION OF THE SUBAERIAL GROWTH OF THE ATCHAFALAYA DELTA, LOUISIANA

Rouse, L.J.Jr.; Roberts, H.H.; Cunningham, R.H.W.; Geology, Boulder, CO, V 6, No. 7, p. 405-408, 1978
No abstract available.

RS79-2-054 GEOLOGICAL IMPLICATIONS OF ERTS PHOTOGRAPHS, EAST ALABAMA

Sitz, W.; Alabama Academy Sci. J., V 45, p. 245, 1974, 51st Annual Mtg.
No abstract available.

RS79-2-055 THE USE OF ERTS-1 IMAGES IN GEOLOGY: THE INDONESIAN EXPERIENCE

Suwijanto; Hehuwat, F.; Proc. of Seminar on Remote Sensing Applications, p. 100-106, 1975, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand
No abstract available.

RS79-2-056 PRINCIPLES OF COMPUTER PROCESSING OF LANDSAT DATA FOR GEOLOGICAL APPLICATIONS

Taranik, J.V.; U.S. Geol. Survey, Open File Rept. No. 78-117, 98 p., 1978
Avail:USGS Open File Serv. Sect., Br. Distrib., Denver, CO
No abstract available.

RS79-2-057 STUDY OF ARID AND SUBARID REGIONS BY REMOTE SENSING WORKSHOP

Tricart, J. (Director); Workshop Proc., April 9, 1976, 67 p., Nat'l Center of Tropical Agronomic Studies, Cent. Perfectionnement, Amenagement Milieu Nat., Strasbourg, France, 1976, Available in French
Individual papers are cited herein under the separate authors.

RS79-2-058 LINEAR FEATURE DETECTION AND MAPPING

VanderBrug, G.J.; Doctoral, Univ. of Maryland, College Park, MD, 263 p., 1977
Avail:Univ. Microfilms
No abstract available.

RS79-2-059 COHERENT OPTICAL TECHNIQUES AS AN AID IN THE GEOLOGICAL INTERPRETATION OF AERIAL AND SATELLITE IMAGERY

Vickers, I.; Australia CSIRO, Mineral Resources Lab., Invest. Rept. No. 109, 23 p., 1975
No abstract available.

RS79-2-060 SOME EXAMPLES OF THE USES OF BALLOON PHOTOGRAPHY IN GEOLOGY

Weecksteen, G.; J. de Teledetection du G.D.T.A., Tome 1,2, p. 377-380, 1977, Group Dev. Teledetection Aerosp., Toulouse, France, Available in French

No abstract available.

Section 2

GEOLOGY

B. Exploration

RS79-2-061

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

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

RS79-2-062

N79-11449*# Environmental Research Inst. of Michigan, Ann Arbor Infrared and Optics Div.
OPTIMUM THERMAL INFRARED BANDS FOR MAPPING GENERAL ROCK TYPE AND TEMPERATURE FROM SPACE Final Task Report, Jan. 1978 - Jul. 1978
Quentin A. Holmes and Daniel R. Nuesch Sep. 1978 45 p refs
(Contract NAS9-15362)
(NASA-CR-151842; ERIM-130100-13-F) Avail: NTIS HC A03/MF A01 CSCL 20F

A study was carried out to determine quantitatively the number and locations of spectral bands required to perform general rock-type discrimination from spaceborne imaging sensors using only thermal infrared measurements. Beginning with laboratory spectra collected under idealized conditions from relatively well characterized, homogeneous samples, a radiative transfer model was employed to transform ground exitance values into the corresponding spectral radiance at the top of the atmosphere. Taking sensor noise into account analysis of these data revealed that three 1 micrometer wide spectral bands would permit independent estimators of rock-type and sample temperature from a satellite infrared multispectral scanner. This study, indicates that the location of three spectral bands at 8.1-9.1 micrometers, 9.5-10.5 micrometers and 11.0-12.0 micrometers, and the employment of appropriate preprocessing to minimize atmospheric effects makes it possible to predict general rock-type and temperature for a variety of atmospheric states and temperatures. Author

RS79-2-063

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

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

RS79-2-064

N79-10502*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MINERAL PRECIPITATION IN NORTH SLOPE AUFEIS
Dorothy K. Hall Sep. 1978 10 p refs Submitted for publication
(NASA-TM-79642) Avail: NTIS HC A02/MF A01 CSCL 08G

The Canning and Shaviovik river aufeis fields were studied on the ground and with aircraft data. Powdered calcium carbonate ($CaCO_3$) patches, a few cm in thickness, were found in discrete locations on both aufeis fields. This is indicative of chemical weathering of limestone bedrock which is known to underlie much of the eastern arctic coastal plain of Alaska. Spring or river water which remains unfrozen throughout much of the winter carries $CaCO_3$ in solution; as the river ice freezes more deeply the $CaCO_3$ in solution is forced upwards through cracks in the river ice. Upon exposure to the cold air $CaCO_3$ is excluded as the water freezes, forming successive layers during aufeis growth. In the melt season $CaCO_3$, slush/powder accumulates in patches on top of the ice as the aufeis melts downward. Author

RS79-2-065

N79-10501*# National Aeronautics and Space Administration, Washington, D. C.
REMOTE SENSING APPLIED TO PROSPECTING OF THERMOMINERAL WATER IN THE COUNTY OF CALDAS NOVAS-GOIAS
Paulo Veneziani and Celio EustaquiodosAnjos Nov. 1978 13 p refs Transl. into ENGLISH of "Sensores Remotos Aplicados a Prospeccao de Aguas Termominerais no Municipio de Caldas Novas-Goias", Rept. INPE-1327-PE/157 Inst. de Pesquisas Espaciais, Sao Paulo, Brazil, Aug. 1978 10 p Presented at the 30th Brazilian Congr. of Geol., Recife, Brazil, 1 Nov. 1978 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75583; INPE-1327-PE/157) Avail: NTIS HC A02/MF A01 CSCL 08H

LANDSAT imagery of the region were studied allowing the placement of the area of study in the regional geological context. A geological mapping of the 1.60.000 scale was done. A methodology was developed which consisted in a regional temperature mapping using trend surface analysis. Through the correlation of all these data, four different areas were localized with a high potential as thermomineral sources. Author

RS79-2-066

A78-53385 Geochemical mapping by spectral ratioing methods. R. K. Vincent (Geospectra Corp., Ann Arbor, Mich.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 251-278. 31 refs.

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

RS79-2-067

A78-53380 Remote-sensing applications for mineral resources. W. L. Smith (Michigan, Environmental Research Institute, Arlington, Va.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 73-98. 44 refs.

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

RS79-2-068

A78-53377 Foreseeable energy and mineral resource problems. W. L. Smith (Michigan, Environmental Research Institute, Arlington, Va.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 9-27. 27 refs.

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

RS79-2-069

A78-53376 Remote-sensing applications for mineral exploration. Edited by W. L. Smith (Michigan, Environmental Research Institute, Arlington, Va.). Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977. 404 p. $50. (For individual items see A78-53377 to A78-53390)

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

RS79-2-070

A78-53382 • Exploration for fossil and nuclear fuels from orbital altitudes. N. M. Short (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 157-198.

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

RS79-2-071

5.0012, STUDIES IN REMOTE SENSING APPLIED TO GEOCHEMICAL EXPLORATION

F.C. CANNEY, U.S. Dept. of The Interior, Geological Survey, Branch of Exploration Research, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9330-00815)

STATES TO WHICH PROJECT PERTAINS: Topical Project: some work done in Maine, Montana and Colorado.

The overall objective of this project is to develop remote-sensing techniques for identifying mineralized areas in regions of heavy vegetation. Vegetation can be used as a link between abnormal chemical conditions in the soil and an aircraft- or spacecraft-mounted sensor for the following reasons: (a) plants generally reflect their geological environment by their distribution patterns and minor-element content; and (b) laboratory and field studies have established that metal stressed and normal vegetation can have subtly different spectral characteristics. Therefore, a geochemical anomaly in a heavily forested area might be detected by spatial and/or spectral changes in the reflection of the vegetation canopy.

To date aerial surveys using color infrared film, multiband photography, and multispectral line scanners, coupled with the simpler interpretative techniques have not been successful in discriminating geochemical anomalies in heavily forested areas. Apparently the reflectance anomaly was totally obscured by variables unrelated to soil geochemistry. However, recent research in cooperation with W. Collins of NASA's Goddard Institute for Space Studies, and using a specially built high-resolution airborne spectrometer, suggests that high-resolution spectral data, where processed by computerized waveform analysis techniques, can be used to separate vegetation growing over a mineralized zone from background vegetation.

In the current year, additional testing of the instrument and analysis techniques will be done at several mineralized sites of different types.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

RS79-2-072

5.0007, REMOTE SENSING APPLICATIONS TO ALUNITE RESOURCES, NEVADA

R.P. ASHLEY, U.S. Dept. of The Interior, Geological Survey, Geological Division, *345 Middlefield Rd., Menlo Park, California* 94025 (9320-01941)

STATES TO WHICH PROJECT PERTAINS: Nevada.

The main effort will be to estimate the amounts of kaolinite and alunite present at many localities sampled in the Cuprite mining district, Nevada, and to examine the characteristics of aircraft scanner data and field spectrometer data for the 0.4-2.5 mm spectral region at the same localities. The objective is to develop a semiquantitative tool for mapping variations in total alunite/clay content in hydrothermally altered rocks, using aircraft scanner images for spectral bands at 1.6 and 2.2 mm. Comparison of petrographic data with field spectral reflectance data should reveal relations between mineral abundance and spectral characteristics that can be applied to use of any scanner system.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

RS79-2-073

5.0035, REMOTE SENSING OF PORPHYRY COPPER ALTERATION ZONES

R.G. SCHMIDT, U.S. Dept. of The Interior, Geological Survey, *Herndon, Virginia* 22092 (9360-01942)

STATES TO WHICH PROJECT PERTAINS: Arizona.

The project will develop and test techniques of remote sensing of large sulfide deposits, especially porphyry copper type deposits, by digital processing of LANDSAT data. Attempts will be made to relate rock alteration zones, soil minerals, and reflectance characteristics as measured from near-surface with reflectances obtained by scanners in satellites. Methods devised will be tested by using them as evaluation tools in suitable incompletely explored areas that are regarded as favorable for the occurrence of porphyry copper deposits.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

RS79-2-074

USE OF REMOTE SENSING TO QUANTIFY CONSTRUCTION MATERIAL AND TO DEFINE GEOLOGIC LINEATIONS; DICKEY-LINCOLN SCHOOL LAKES PROJECT, MAINE,

Army Terrestrial Sciences Center, Hanover, NH.
H. L. McKim, and C. J. Merry.

Special Report 242, Part II, December 1975. 8 p, 8 fig, 2 append.

Descriptors: *Remote sensing, *Construction materials, *Dam construction, *Maine, Damsites, Aerial photography, Satellites(Artificial), Aircraft, Geological surveys, Fractures(Geologic), Faults(Geologic), Drainage, Drainage patterns(Geologic), Projects, Reservoirs, *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 of surficial geology units to locate construction material within the headwaters of the St. John River Basin. This report contains Appendixes A and B of Special Report 242, Part I. Large-scale aerial photographs depicting the geologic lineations, surficial geology, drainage patterns, and boring data locations in the Dickey-Lincoln area were included. (See also W77-06888) (Sims-ISWS) W78-10263

RS79-2-075 ANALYSIS OF AIRBORNE SPECTRORADIOMETRIC DATA AND THE USE OF LANDSAT DATA FOR MAPPING HYDROTHERMAL ALTERATION

Collins, W.; Geophysics, V 43, No. 5, p. 967-987, 1978
No abstract available.

RS79-2-076 "COSA" COLOR-OBLIQUE STEREO AERIAL PHOTOGRAPHS FOR RAPID GEOLOGIC RECONNAISSANCE AND FOR PLANNING STRATIGRAPHIC MAPPING PROGRAMS

Hall, W.B.; Walsh, T.H.; Rocky Mt. Thrust Belt: Geology and Resources, Wyoming Geol. Assoc. Guidebook, No. 29, p. 751-760, 1977, Wyoming Geol. Assoc. 29th Annual Field Conf., in conjunction with Montana Geol. Soc. and Utah Geol. Soc.
No abstract available.

RS79-2-077 IMPLICATIONS OF DISEQUILIBRIUM IN EXPLORATION FOR URANIUM ORES IN THE SURFICIAL ENVIRONMENT USING RADIOMETRIC TECHNIQUES; A REVIEW

Levinson, A.A.; Coetzee, G.L.; Mineral Sci. Engng., Johannesburg, V 10, No. 1, p. 19-27, 1978
No abstract available.

RS79-2-078 EVALUATION OF THE CAPABILITIES AND LIMITATIONS OF VARIOUS REMOTE SENSING OPERATIONAL SYSTEMS; 1, SOME GEOLOGIC AND HYDROLOGIC TASKS FOR REMOTE SENSORS

Lintz, J.Jr.; Proc. of Seminar on Remote Sensing Applications, p. 121-130, 1975, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand
No abstract available.

RS79-2-079 NEW AIRBORNE EXPLORATION TECHNIQUES

Morris, D.; Australia Min., V 62, No. 11, p. 59-61, 1970
No abstract available.

Section 3

ENVIRONMENTAL QUALITY

A. Water Quality

RS79-3-001

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

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

RS79-3-002

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

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

RS79-3-003

A79-11667 * Landsat change detection can aid in water quality monitoring. H. C. MacDonald, K. F. Steele, W. P. Waite (Arkansas, University, Fayetteville, Ark.), and M. R. Shinn. In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 192-203. NASA-supported research.

Comparison between Landsat-1 and -2 imagery of Arkansas provided evidence of significant land use changes during the 1972-75 time period. Analysis of Arkansas historical water quality information has shown conclusively that whereas point source pollution generally can be detected by use of water quality data collected by state and federal agencies, sampling methodologies for nonpoint source contamination attributable to surface runoff are totally inadequate. The expensive undertaking of monitoring all nonpoint sources for numerous watersheds can be lessened by implementing Landsat change detection analyses. (Author)

RS79-3-004

A79-11765 * # Monitoring the temporal dispersion of a sewage sludge plume in the New York bight by remote sensing. R. W. Johnson (NASA, Langley Research Center, Hampton, Va.), R. M. Glasgow (Vought Corp., Hampton, Va.), I. W. Duedall (New York, State University, Stony Brook, N.Y.), and J. R. Proni (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 423-440. 8 refs.

RS79-3-005

5.0006, REMOTE SENSING OF OCEAN POLLUTANTS
D.A. WALSH, Univ. of Southern California, Ethel Percy Andrus Geront. Ctr, *3551 University Ave., Los Angeles, California* 90007 (NSG 1528)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-3-006

5.0022, MULTISPECTRAL, REMOTE SENSING AS A FRESHWATER QUALITY SURVEILLANCE TOOL
D.E. CARRITT, Univ. of Massachusetts, Graduate School, Marine Science, *Amherst, Massachusetts* 01002 (A-084-MASS)

The primary objective of this study is to demonstrate the utility of remote, multispectral sensing as a unique tool for the study and surveillance of environmental properties in freshwater resources in the Commonwealth of Massachusetts. Proposed remotely sensed, multispectral data will be used to evaluate: a) rate of eutrophication from successive estimates of standing crop of chlorophyll-containing plankton, b) location of point sources of sediment and colored water inflow together with the distribution throughout the receiving water and mixing processes between influent and receiving waters, c) changes in bottom topography, d) distribution of surface slick materials, e) mixing processes in natural waters by measuring the time and space distribution of added tracers, dyes and floats, f) the correlation between indices of land and aquatic area uses and indices of water quality or potential of a given resource as a single or multiple use resource in resource management considerations.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

RS79-3-007

5.0027, USE OF AIRCRAFT SPECTRORADIOMETRY TO DETERMINE WATER QUALITY
H.L. MCKIM, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (31583)

OBJECTIVE: To quantitatively assess water quality parameters in fresh and salt water regimes utilizing aircraft spectroradiometer data and to conduct laboratory tests to determine spectral bands of interest for quantitative and qualitative measurement of water quality data to meet Corps of Engineers requirements.

APPROACH: A prototype 500-channel aircraft spectroradiometer instrument with a 10 A spectral resolution will be used in the study to assess water quality parameters in reservoir systems. The instrument provides a digital tape readout for 500 channels ranging from the visible (0.42 micron) to the near infrared wavelengths (1.0 micron) for a nominal 60 x 60 ft. area. Aircraft spectroradiometer flights over selected test site areas will be accomplished in conjunction with ground truth data acquisition. Analysis of the high resolution multispectral data will be used to qualitatively and quantitatively assess water quality parameters, especially turbidity, based on correlation to field measurements. Laboratory testing to determine spectral bands of interest will also be conducted with the airborne spectroradiometer instrument.

In addition, theoretical models will be examined that concern the development of spectral response curves based on varying the size, optical properties and density of particulate matter under laboratory conditions. Results from the aircraft flight analyses and laboratory experiments will be compared to conventional techniques. A cost effective comparison between conventional techniques and aircraft spectroradiometry to assess water quality parameters in CE reservoir systems will be made. Development of procedures to assess water quality will be made for use by Corps of Engineers Division/District personnel.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

RS79-3-008

SKYLAB APPLICATION TO ECOLOGICAL AND OCEANOGRAPHIC INVESTIGATIONS OF DELAWARE BAY,
Delaware Univ., Newark. Coll. of Marine Studies.
V. Klemas, D. S. Bartlett, W. D. Philpot, R. H. Rogers, and L. E. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as E78-10001, Price codes: A02 in paper copy, A01 in microfiche. Final Report to NASA Langley Research Center, No. CMS-NASA-1-76, May 1976. 68 p, 5 fig, 5 tab, 41 ref. NAS1-12304.

Descriptors: *Remote sensing, *Monitoring, Environmental effects, Water pollution effects, *Delaware Bay, Outer Continental Shelf, Ocean dumping, Skylab.

SKYLAB/EREP S190A and S190B film products have been optically enhanced and visually interpreted to extract data suitable for mapping coastal land use; inventorying wetlands vegetation; monitoring tidal conditions; observing suspended sediment patterns; charting surface currents; locating coastal fronts and water mass boundaries; monitoring industrial and municipal waste dumps in the ocean; determining the size and flow direction of river, bay and man-made discharge plumes; and observing ship traffic. Film products were visually analyzed to identify and map ten land-use and vegetation categories at a scale of 1:125,000. Comparison of these thematic maps with CARETS Land Use Maps resulted in classification accuracies ranging from 50% to 98%. Digital tapes from the S192 Multispectral Scanner were used to prepare thematic maps of land use. Classification accuracies obtained by comparison of S192 derived thematic maps of land use with USGS-CARETS land-use maps in southern Delaware ranged from 44% to 100%. The resolutions of the S190A, S190B and S192 systems were 20-4-m, 10-20m, and 70-100m, respectively. (Sinha-OEIS)
W78-10441

RS79-3-009

AUTOMATIC SYSTEM CLEANER FOR REMOTE MONITOR,
J. D. Hilty.
U.S. Patent No. 4,088,575, 6 p, 5 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 970, No 2, p 636, May 9, 1978.

Descriptors: *Patents, *Monitoring, *Sampling, *Water treatment, *Water quality control, *Remote sensing, Slime, Algal poisoning, Equipment protection.

A problem commonly encountered, particularly in warm weather, is that continuing biological activity occurring in water being sampled causes the sample which is monitored remotely to be not truly representative of the water at the instant the water was removed from the lake or stream. A further problem is that the continuing biological activity produces a biological slime which grows on all surfaces contacted by the water being sampled. Such disadvantages are removed by providing an automatically timed apparatus for periodically introducing a biological poison to the water being sampled immediately as the sample is being withdrawn from its source. The periodic introduction of the biological poison functions as a complete system protector to keep all exposed surfaces throughout the monitoring system free of slime accumulations. Backwashing means are also provided to preserve the cleanliness of the mechanism which pumps the water being sampled to monitoring devices and operates to enhance the effectiveness of the monitoring and sampling devices. (Sinha-OEIS)
W79-00051

RS79-3-010

RADIATIVE TRANSFER MODEL FOR REMOTE SENSING OF SUSPENDED SEDIMENTS IN WATER,
MITRE Corp., McLean, VA. METREK Div.
A. Ghovanlou.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-32567, Price codes: A05 in paper copy, A01 in microfiche. Report MTR-7433, NASA CR-145145, February 1977. 83 p, 18 fig, 7 tab, 20 ref, 5 append. NASA F19628-77-C-0001.

Descriptors: *Remote sensing, *Turbidity, *Suspended solids, Laboratory tests, Model studies, Mathematical models, Monte Carlo method, Simulation analysis, Water quality, Sediments, Clays, Radiation, Reflectance, Computer programs, Computer models.

High concentration of suspended particles in the environmental waters alters the physical and chemical properties of the water systems and leads to a variety of hazardous ecological impacts. In addition, excessive sedimentation leads to significant economic losses because of the reduction of the nation's reservoir and flood storage capacities, and to the necessary performance of operational activities, such as dredging. Considering the importance of this problem, NASA/Langley Research Center has initiated a laboratory study on sediment characteristics as part of its remote sensing program in the area of water quality. The laboratory project was designed to determine whether the spectral characteristics of the radiance upwelling from an illuminated body of turbied water can be related to the amount and properties of the suspended particles. This report described an analytical study in the area of radiative transfer in the turbid water media. The work has been performed in support of the laboratory program in remote sensing of water quality. The modeling methodology described in this report was based on Monte Carlo simulation approach. (Sims-ISWS)
W78-10930

RS79-3-011

AERIAL SURVEILLANCE TO MONITOR WATER QUALITY IN CATFISH PONDS,
Mississippi State Univ., Mississippi State. Dept. of Wildlife and Fisheries.
H. R. Robinette, D. Finnie, F. D. Whisler, J. Young, and W. F. Miller.
In: Proceedings of the Twenty-ninth Annual Conference, Southeastern Association of Game and Fish Commissioners, October 12-15, 1975, St. Louis, Missouri, p 287-293, (1975). 2 tab, 5 fig, 7 ref.

Descriptors: *Water quality, *Aquiculture, Ponds, *Fish management, *Fish farming, *Monitoring, *Aerial photography, *Remote sensing, *Catfish, *Farm ponds, Photography, Oxygen, Commercial fish, Suspended solids, *Infrared photography, *Munsell color system.

Remotely sensed data and ground truth data were collected simultaneously from 16 experimental ponds during 6 days in June and July, 1974. Color infrared images were taken with hand-held 35 mm cameras from single engine aircraft. Numerical color values for pond color were obtained by visually matching the pond color with a Munsell color system chip which had a standardized numerical value assigned to it. Ground truth data involved the determination of 14 chemical, physical and biological parameters. Regression analysis indicated a significant correlation existed only between total and inorganic solids and the Munsell Color System. There was evidence to suggest that the color-inorganic solid relationship was masked by the organic solids present.
W78-12526

RS79-3-012

HCMM Energy Budget Data as a Model Input for Assessing Regions of High Potential Groundwater Pollution

South Dakota State Univ., Brookings. Remote Sensing Inst.*NASA Earth Resources Survey Program, Washington, D.C.

Quarterly progress rept. no. 2. Oct-Dec 77
AUTHOR: Moore, Donald G.; Heilman, J.
E0884F4 Fld: 93B d7810
Dec 77 4p
Contract: NAS5-24206
Monitor: NASA-CR-155548

Abstract: No abstract available.

Ground water, Water pollution, South Dakota, Alfalfa, Soil moisture, Vegetation, Earth Resources program, Water resources

Identifiers: NTISNASA

E78-10054 NTIS Prices: PC A02/MF A01

RS79-3-013

Investigation of Remote Sensing Techniques for Agricultural Feedlot Pollution Detection

South Dakota State Univ., Brookings. Remote Sensing Inst.*Environmental Protection Agency, Washington, DC.
AUTHOR: Schmer, Fred A.; Ryland, Dennis W.; Waltz, Fred A.
F0075A3 Fld: 13B, 2C, 2E, 17E, 68D, 98C, 98E GRAI7901
Dec 73 178p
Rept No: SDSU-RSI-72-14
Grant: EPA-16020-FPH
Monitor: EPA/670/4-73/002

Abstract: This research effort was directed toward the application of remote sensing techniques to the detection and monitoring of pollution from cattle feeding operations. Five livestock feeding operations were selected for the study along the James River from Huron to Redfield, South Dakota. Thirteen aerial missions were flown from January 1, 1971 through June 30, 1972, providing aerial photography and thermal infrared data under various weather conditions. Water samples were collected during nine of the aerial flights at fourteen river locations. Water samples were collected a minimum of every three weeks on a regular schedule to allow independent analysis of the water quality data. Data analysis consisted of visual interpretation of aerial photography and statistical analysis of film densities and water quality parameters. Film densities were read at the location of the fourteen water sampling sites and correlated with the water quality parameters. Analysis of variance and linear regression techniques were also utilized. Results indicated that remote sensing techniques utilizing low and high altitude aircraft photography can be used to locate potential feedlot pollution sources.

Descriptors: *Agricultural wastes, *Livestock, *Remote sensing , *Water pollution, Monitoring, Cattle, James River, Aerial photography, Infrared mapping, Water quality, Analysis of variance, Regression analysis, Weather, Color photography, Runoff, Aerial photographs, South Dakota, Utility aircraft

Identifiers: *Feedlot wastes, Redfield(South Dakota), NTISEPAORD

PB-286 566/5ST NTIS Prices: PC A09/MF A01

RS79-3-014

Remote Sensing for the Control of Marine Pollution. Preliminary Inventory of Available Technologies. (Teledetection Appliquee a la Lutte contre la Pollution Marine. Premier Inventaire des Techniques et Moyens)

NATO Committee on the Challenges of Modern Society, Brussels (Belgium). (406 609)
AUTHOR: Massin, Jean-Marie
F0065F2 Fld: 14B, 14E, 20F, 68D, 46C, 63F GRAI7901
Mar 78 343p
Rept No: NATO/CCMS-78
Monitor: 18
NATO furnished. Text in English and French.

Abstract: As regards damage to the marine environment, oil spills at sea are considered to be one of the main sources of pelagic pollution: at the present time, it is estimated that more than six million tons of hydrocarbons enter the marine environment as a result of shipping and certain coastal, industrial and urban activities, river-borne pollution, oil prospecting and mining at sea and, finally, natural seepage from certain sea bottoms. This pollution is mainly due to intentional discharge, i.e. the routine evacuation of hydrocarbon-carrying effluents, or to accidental discharge, as a result of damage to installations or ships. Because of the rapid development of techniques and the multiplicity of studies and research undertaken, particularly with a view to developing integrated remote detection systems to meet the overall requirements of users, it has been found desirable to take stock of present knowledge in this field (excluding satellites for the time being) so that the lines to be followed in the mentioned areas can be determined and assessed. This manual is a first inventory of available techniques, instrumentation, and research centers in the field of remote sensing of the marine environment for detection of pollution. Inclusion in this inventory of information from specific organizations or firms does not in any way imply approval or endorsement of the organizations or firms, or of particular equipment, by the CCMS, NATO, or the Alliance Nations.

Descriptors: *Oil pollution, *Monitors, *Remote sensing, *Manuals, Oil spills, Hydrocarbons, Weather, Sources, Coasts, Visible spectra, Infrared spectra, Pelagic zone, Photogrammetry, Measuring instruments, Instrumentation, Aircraft, Aerial photography, Radiometers, Optical detectors, Oceans, Irradiance, Radiance, Light scattering, Oil slicks, Optical tracking, Test equipment, Specifications, Data processing

Identifiers: *Oil pollution detection, Water pollution detection, Multiband spectral reconnaissance, NATO furnished, NTISEPAL

PB-286 223/3ST NTIS Prices: PC A15/MF A01

RS79-3-015

Thermal Pollution. Part 1. Control Techniques and General Studies (A Bibliography with Abstracts)

National Technical Information Service, Springfield, Va. (391 812)

Rept. for 1964-Feb 78
AUTHOR: Brown, Robena J.
E0893F3 Fld: 13B, 68D*, 97R*, 47, 86W GRAI7810
Mar 78 211p*
Monitor: 18
Supersedes NTIS/PS-77/0184, NTIS/PS-76/0127 and NTIS/PS-75/21-8.

Abstract: Reports concerned with control techniques for heated effluents from power and industrial plants are cited. Also included are studies on general thermal pollution problems and their abatement. Many reports on the remote sensing of thermal effluents are also cited. However, the control of thermal pollution by using the waste heat for constructive purposes is not covered in this bibliography. (This updated bibliography contains 206 abstracts, 48 of which are new entries to the previous edition.)

Descriptors: *Thermal pollution, *Bibliographies, *Water pollution control, *Cooling water, *Electric power plants, *Industrial water, Rivers, Industrial waste treatment, Steam power plants, Boilers, Thermal power plants, Nuclear power plants, Industrial wastes, Remote sensing, Water pollution abatement, Heat exchangers, Plants(Botany), Waste disposal

Identifiers: NTISNTIS

NTIS/PS-78/0171/5ST NTIS Prices: PC N01/MF N01

RS79-3-016

Suspended Sediments and Related Limnology of an Alpine Lake System. 2ND Year End Report, 1 June 1976--31 January 1977

Alaska Univ., College.*Department of Energy. (9505277)
AUTHOR: Alexander, V.; Mellor, J.; Barsdate, R. J.
E1133E2 Fld: 13B, 6F, 14B, 68D, 57H GRAI7812
1977 16p
Contract: EY-76-S-06-2229-010
Monitor: 18

Abstract: This project has the aim of first assessing the potential of remote sensing to determine changes in sediment load in arctic lakes, and then to use this technique to assess the effects of road construction on arctic freshwater aquatic habitats. The first part of the work has centered on the use of Peters and Schraeder Lakes as a natural laboratory since these lakes have a strong sediment gradient for methodology evaluation. The next stage is to expand this work to other lakes and finally to actually look at the impact of changes in sediment load due to construction activities and utilization of arctic road systems. The results of the first two years' work suggests that the method has value, and the project is now ready to approach the terminal phase in looking at the real effects of road construction in the arctic. VP-8 density slicing and densitometry of the films are the two analysis techniques in use, with Plus-X Aerographic film in an aerial mapping camera format the film of choice. Ground truth data have been collected in conjunction with the aerial mapping data, and some information on the effects of sediment load on primary production regimes has also been included. (ERA citation 03:015894)

Descriptors: *Lakes, *Roads, *Construction, *Environmental effects, *Remote sensing, Aquatic ecosystems, Arctic regions, Densitometers, Limnology, Sediments, Topological mapping, Ecosystems, Measuring instruments, Photometers, Polar regions, Surface waters, Transformations

Identifiers: ERDA/520100, NTISDE

RLO/2229/T10-2 NTIS Prices: PC A02/MF A01

RS79-3-017

Assessment of Water Quality Status and Trends in Minnesota by Remote Sensing Techniques

Minnesota Univ., Minneapolis.*Office of Water Research and Technology, Washington, D.C. (233 500)

Completion rept.
AUTHOR: Brooks, Kenneth N.; Mace, Arnett C. Jr; Meyer, Merle P.
E1032A1 Fld: 13B, 14E, 8H, 68D, 48G GRAI7811
Dec 77 66p
Project: OWRT-A-033-MINN
Monitor: OWRT-A-033-MINN(1)

Abstract: Monitoring the water quality of lakes and reservoirs by traditional field sampling techniques is a costly and time consuming process. Aerial photography, with limited field sampling, was investigated as a practical alternative to estimate the water quality of ten lakes in the Minneapolis and St. Paul metropolitan area of Minnesota. These ten lakes represented a wide diversity of trophic state and were sampled for color, turbidity, suspended sediment, chlorophyll, phytoplankton numbers, and Secchi disk depth. Regression equations for these water quality indicators were based on film transmittance. Statistically significant prediction equations were developed for Secchi disk depth, turbidity and color. Procedures are outlined which allow film transmittance to be used to estimate Carlson's Trophic State Index. Predicted tropnic state indices were not different from those calculated from water quality samples.

Descriptors: *Lakes, *Reservoirs, *Remote sensing, *Water pollution, *Urban areas, Aerial photography, Infrared mapping, Color, Turbidity, Suspended sediments, Chlorophylls, Metropolitan areas, Correlation techniques, Phytoplankton, Optical properties, Depth, Mathematical prediction, Photographic techniques, Minnesota

Identifiers: *Water pollution sampling, *Tropnic level, Carlsons Trophic State Index, Minneapolis(Minnesota), Saint Paul(Minnesota), NTISDIOWRT

PB-277 822/3ST NTIS Prices: PC A04/MF A01

RS79-3-018

0130060 *78-004826
REMOTE SENSING IMPROVES CONVENTIONAL SAMPLING PROCEDURES,
BHUTANI, J. S. ; BURTON J. S.; CHEREMISINOFF P. N.
MITRE CORP,
WATER & SEWAGE WORKS, APR 30, 78. PR-108 (5)
TECHNICAL FEATURE: THE ADVANTAGES OF USING REMOTE SENSING IN PLACE OF IN SITU WATER QUALITY MONITORING ARE THAT: IT PROVIDES AN OVERALL PICTURE OF AN AREA AND A TIME RECORD; AND IT MAY ALSO REDUCE THE COST OF MONITORING IN CERTAIN INSTANCES. HOWEVER, THE DISADVANTAGES OF REMOTE SENSING INCLUDE: HIGH INITIAL OPERATING COSTS; THE NEED FOR INCREASED SUPPORT AND COORDINATION ACTIVITIES; AND DATA HANDLING COMPLICATIONS ASSOCIATED WITH THE COLLECTION OF ALL INFORMATION FROM A SPECIFIC TARGET AREA AT OR NEAR THE SAME TIME. METEOROLOGICAL, HYDROLOCICAL, PHYSICAL, AND CHEMICAL PARAMETERS INVOLVED IN REMOTE SENSING OF WATER QUALITY ARE DISCUSSED. (6 TABLES)
DESCRIPTORS: *REMOTE SENSING ; *MONITORING, ENV-WATER ; *WATER QUALITY STANDARDS ; *CHEMICAL INDICATORS-WATER ; *PLANKTON ; *WATER TEMPERATURE ; *AGRICULTURAL WASTES ; *HUMIDITY ; *ATMOSPHERIC TEMPERATURE ; *SOLAR RADIATION ; *NUTRIENTS ; WATERFOWL ; SUSPENDED SOLIDS ; PESTICIDE RESIDUES
REVIEW CLASSIFICATION: 19

RS79-3-019

0131567 78-006255
FIELD VERIFICATION OF HAZARDOUS WASTE MIGRATION FROM LAND DISPOSAL SITES,
GIBB J. P. ; CARTWRIGH K.
(ILLINOIS STATE GEOLOGICAL SURVEY) AND,; (ILLINOIS STATE GEOLOGICAL SURVEY)
PRESENTED AT EPA/EQS/IT NATL CONF DISPOSAL OF RESIDUES ON LAND, ST LOUIS, SEP 13-15, 76, P179 (6)
TECHNICAL REPORT: IN ILLINOIS, 62 LAND DISPOSAL SITES ARE DESIGNATED BY EPA FOR HAZARDOUS CHEMICAL WASTE DISPOSAL. MORE THAN 2000 SITES HAVE RECEIVED LARGE BUT UNKNOWN QUANTITIES OF ALL TYPES OF WASTES THAT MAY HAVE INCLUDED TOXIC CHEMICALS. EFFECTIVE INVESTIGATIVE AND MONITORING TECHNIQUES FOR DETECTING AND EVALUATING QUANTITATIVELY THE EXTENT OF GROUNDWATER POLLUTION FROM SURFACE TOXIC WASTE DISPOSAL SITES ARE REPORTED. SOIL CORING IS AN EFFECTIVE MAPPING TOOL. TEMPERATURE SURVEYS, ELECTRICAL EARTH RESISTIVITY SURVEYS, AND VEGETATION MAPPING AND SAMPLING MAY PROVE USEFUL IN SHALLOW GEOLOGIC REGIMES. COLOR INFRARED PHOTOGRAPHY IS USEFUL, BUT APPLICATIONS ARE LIMITED. (4 DIAGRAMS, 1 GRAPH, 2 MAPS, 1 TABLE)
DESCRIPTORS: *HAZARDOUS WASTE DISPOSAL ; *GROUNDWATER ; *WATER ANALYSIS ; *MONITORING, ENV-WATER ; *HEAVY METALS ; *WATER TABLE ; *LEACHING ; *ILLINOIS ; *ZINC SMELTING ; *SEASONAL COMPARISONS ; MEASUREMENTS & SENSING ; REMOTE SENSING, INFRARED ; EPA CONF PAPER
REVIEW CLASSIFICATION: 19

Section 3

ENVIRONMENTAL QUALITY

B. Air Quality

RS79-3-020

N78-33670# SRI International Corp., Menlo Park, Calif.
ACOUSTIC SOUNDER ARRAY FOR APPLICATION TO AIR POLLUTION. VOLUME 1: EXECUTIVE SUMMARY AND USER GUIDE Final Report
Phillip B. Russell and Edward E. Uthe Feb. 1978 109 p
(Grant NSF AEN-73-02918-A01)
(PB-282064/5; NSF/RA-780031) Avail: NTIS HC A06/MF A01 CSCL 04A

A three year study was conducted to demonstrate the applicability of sodar (acoustic radar) techniques to San Francisco Bay area air pollution problems. A representative, smog-season data set on mixing depth and stability patterns, in a format that can easily be used by numerical air quality models was produced. Extensive comparisons between mixing depths inferred from sodar and from other techniques (balloon, airplane, tower, lidar) demonstrate that, on average in the Bay Area, sodar performs as well as any other single technique for indicating mixing depth. Filming and digitizing techniques were developed to reduce the large data set acquired in the final year to hourly mixing depth and stability indicators. Time-dependent mixing depth and stability maps derived from these data show a readily comprehensible picture of the marked spatial and temporal variations in Bay Area boundary layer behavior. Two case studies demonstrate the use of the sodar data in connection with air pollution incidents. GRA

RS79-3-021

N78-33671# SRI International Corp., Menlo Park, Calif.
ACOUSTIC SOUNDER ARRAY FOR APPLICATION TO AIR POLLUTION. VOLUME 2: CASE STUDIES AND OTHER APPENDICES Final Report
Phillip B. Russell, Edward E. Uthe, and Francis L. Ludwig Feb. 1978 125 p refs
(Grant NSF AEN-73-02918-A01)
(PB-282065/2; NSF/RA-780032) Avail: NTIS HC A06/MF A01 CSCL 04A

Data presented are: (1) acoustic and direct measurements of atmospheric mixing at three sites during an air pollution incident; (2) sodar network measurements of regional mixing depth and stability patterns for an air quality model; (3) regional patterns of mixing depth and stability; (4) sodar network measurements for input to air quality models; and (5) time-dependent maps of mixing depth and their relation to surface oxidant concentrations. GRA

RS79-3-022

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

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

RS79-3-023

A Feasibility Study for the Application of K-Band Radar in the Investigation of Cooling Tower Plumes

National Oceanic and Atmospheric Administration, Idaho Falls, Idaho. Air Resources Labs.
Technical memo.
AUTHOR: Ricks, Norman R.
E0895A1 Fld: 13B, 17I, 4B, 68A, 63H, 55B, 97R, 86O GRAI 7810
Aug 77 45p
Rept No: NOAA-TM-ERL-ARL-66
Monitor: NOAA-77110803

Abstract: The feasibility of using commercially available K-band (1 cm) radar for indirect sensing of cooling tower plumes is investigated. Using the radar equation, commercially available systems are evaluated by means of a computer model which estimates the strength of the expected return signal under sampled conditions known to exist in actual plumes. Recommendations are made for the adaptation of available radar systems and for areas of additional study. Complete data and program documentation are provided.

Descriptors: *Air pollution, *Plume detection, *Radar detection, *Cooling towers, Plumes, Feasibility, K band, Computer programs, Electric power plants, Remote sensing, Water vapor

Identifiers: Air pollution detection, NTISCOMNOA

PB-275 380/4ST NTIS Prices: PC A03/MF A01

RS79-3-024

The Capability of Satellite Borne Remote Sensors to Measure Stratospheric Trace Constituents. Volume 1: Background and Requirements

Mitre Corp., McLean, Va. Metrek Div.
AUTHOR: Keitz, E. L.
F0054I4 Fld: 4A, 68A, 55D STAR1623
May 78 216p
Rept No: NASA-CR-145309 V-1, MTR-7519-V-1
Contract: F19628-77-C-0001
Monitor: 18
Seri-3. Subm-Sponsored by NASA.

Abstract: Volume 1 of a three volume report issued as MITRE/METREX Technical Report is presented. This volume contains a synthesis of the results of two previous MITRE/METREX studies and an update of the information. These studies deal with a comprehensive review of stratospheric trace constituent measurement requirements. The scope of the study was restricted to those contituents which fall into the general category of air pollutants.

Descriptors: *Atmospheric composition, *Satellite-borne instruments, *Stratosphere, Remote sensors, Air pollution, Chemical composition, Climate, Measuring instruments, User requirements

Identifiers: *Air pollution detection, Remote sensing, Trace elements, NTISNASA

N78-32522/2ST NTIS Prices: PC A10/MF A01

RS79-3-025

Astronomical Techniques Applied to Pollution Detection: 1. Pollution Transport

California Univ., Livermore. Lawrence Livermore Lab.*Energy Research and Development Administration. (9500007)
AUTHOR: Porch, W. M.; Sherman, C. A.; Dickerson, M. H.; Green, T.; Volker, P.
E0935H2 Fld: 4A, 68A, 55E, 55B GRAI7810
Oct 77 6p
Rept No: CONF-771113-3
Contract: W-7405-ENG-48
Monitor: 18
Joint conference on sensing of environmental pollutants, New Orleans, LA, USA, 6 Nov 1977.

Abstract: An astronomical observatory located below the urban inversion in Oakland, California has been recently used as a remote sensing facility for detection of urban aerosol and molecular pollution and transport analysis. These measurements were made with a sixteen element photodiode array close to the focus of a twenty inch refracting telescope detecting visible light extinction and refraction from stellar and artificial light sources. Atmospheric transport was determined by using the time lagged covariance of the scintillation from artificial light sources at several diode separations to determine the space averaged winds which were subsequently included in a wind field model of the Bay Area including topographical effects. The results of this study demonstrate the compatibility of remotely sensed spatially averaged wind measurements as input data to mesoscale models for interpretation of pollution transport. (ERA citation 03:013060)

Descriptors: *Aerosols, *Air pollution, Earth atmosphere, Environmental transport, Measuring methods, Molecules, Remote sensing, Telescope counters, Temperature inversions, Urban areas, Wind

Identifiers: ERDA/500200, Atmospheric diffusion, Path of pollutants, California, NTISDE

UCRL-79484 NTIS Prices: PC A02/MF A01

RS79-3-026

0131820 *78-006394
EPA/NASA ENERGY RELATED REMOTE AND IN SITU SENSING INSTRUMENT DEVELOPMENT,
MUGLER, JOHN P.
NASA, VA,
PRESENTED AT EPA ENERGY/ENV II CONF, WASH DC, JUN 6-7, 77, P459 (7)
TECHNICAL FEATURE: AN EPA/NASA JOINT PROJECT FORMED TO DEVELOP ADVANCED AND IMPROVED INSTRUMENT TECHNIQUES FOR MEASURING ENVIRONMENTAL PARAMETERS ASSOCIATED WITH THE GENERATION OF ELECTRICAL ENERGY AND OTHER POLLUTION SOURCES IS DESCRIBED. THE PROJECT APPLIES A BROAD RANGE OF SPACE TECHNOLOGY TO ASSIST IN ACHIEVING THE U.S. NATIONAL GOAL OF ENERGY SELF SUFFICIENCY WITH ACCEPTABLE IMPACT ON THE ENVIRONMENT. TASKS IN THE PROJECT INCLUDE PLUME DISPERSION STUDIES, DEVELOPMENT OF THE INFRARED DIFFERENTIAL ABSORPTION LIDAR TECHNIQUE, LASAR HETERODYNE DETECTION, AND HYDROCHLORIC ACID MONITORING. (2 DIAGRAMS, 1 GRAPH, 5 PHOTOS, 10 REFERENCES, 2 TABLES)
DESCRIPTORS: *MONITORING, ENV-AIR ; *REMOTE SENSING ; *POWER PLANT EMISSIONS ; *SULFUR DIOXIDE ; *ATMOSPHERIC DIFFUSION ; *LASERS ; *REMOTE SENSING, INFRARED ; EPA, FEDERAL ; U S NATL AERO SPACE ADMIN ; HYDROCHLORIC ACID ; EPA CONF PAPER
REVIEW CLASSIFICATION: 01

RS79-3-027

0131793 78-006367
DESIGN OF NETWORK EXPERIMENTS FOR REGIONAL-SCALE ATMOSPHERIC POLLUTANT TRANSPORT AND TRANSFORMATION,
SHEIH, C. M. ; HESS G. D.; HICKS B. B.
ANL,
ATMOSPHERIC ENV, 1978, V12, N8, P1745 (9)
TECHNICAL REPORT: DESIGN CRITERIA FOR REGIONAL NETWORK EXPERIMENTS ARE OUTLINED. TRACER TESTS FOR STUDYING MECHANISMS OF POLLUTANT TRANSPORT AND TRANSFORMATION, AND AIR QUALITY MEASUREMENTS FOR EVALUATING THE EXTENT OF AIR POLLUTION ARE DESIGNED. NUMERICAL MODELS ARE EXAMINED AND SAMPLING CRITERIA ARE DEDUCED FOR THE TRACER EXPERIMENT DESIGN. FOR AN AIR QUALITY SAMPLING NETWORK, THE MAIN CRITERIA FOR SITE LOCATION ARE BASED ON SIMULATION OF THE NORTHEASTERN U.S. (5 GRAPHS, 2 MAPS, 1 TABLE)
DESCRIPTORS: *MATHEMATIC MODELS-AIR ; *AIR SAMPLING ; *ATMOSPHERIC DIFFUSION ; *ATMOSPHERIC TURBIDITY ; *UNITED STATES EAST ; *REMOTE SENSING ; *SULFUR DIOXIDE
REVIEW CLASSIFICATION: 01

Section 3

ENVIRONMENTAL QUALITY

C. Miscellaneous

RS79-3-028

5.0008, SURVEILLANCE AND PREDICTION OF THE ENVIRONMENTAL EFFECT OF HIGHWAY FACILITY BY REMOTE SENSING

S. MATHUR, Ontario Min. of Transp. & Com., *1201 Wilson Ave., M3m 1J8, Downsview, Ontario, Canada* (164805 (HRB NO.))

It is expected that aerial remote sensing is a simple, quick and relatively inexpensive means of documenting ecological changes and their progression with time. There are several phases to this study; a state-of-the-art report has been prepared and is now available. Two sites have been selected (one on Hwy 402 and on on Hwy 522 in the Canadian Shield) and spring, summer and fall imageries have been obtained. Field data gathering and interpretation analysis prior to construction is complete and the remainder of the study is dependent on the award of the contracts. Changes to the environment following construction will be monitored over a three-year period. /RTAC/

SUPPORTED BY Ontario Ministry of Transportation & Communications

RS79-3-029

Strip Mining. Volume 2. 1976-September, 1978 (Citations from the NTIS Data Base)

National Technical Information Service, Springfield, VA. (391 812)

Rept. for 1976-Sep 78
AUTHOR: Hundemann, Audrey S.
F0051D1 Fld: 8I, 13B, 48A*, 68D, 68C, 97R, 86W GRAI7901
Nov 78 195p*
Monitor: 18
Supersedes NTIS/PS-77/0951, NTIS/PS-76/0810, NTIS/PS-75/751, and NTIS/PS-75/054. For the companion Published Searches of the Engineering Index Data Base see NTIS/PS-78/1165, NTIS/PS-78/1166, and NTIS/PS-78/1167. See also Volume 1, 1964-1975, NTIS/PS-77/0950.

Abstract: Abstracts primarily pertaining to environmental impacts, land reclamation, and satellite remote sensing of mines are cited from Federally-funded research. A few abstracts deal with mining equipment, legal factors, economics, and safety aspects of strip mining. (This updated bibliography contains 189 abstracts, 58 of which are new entries to the previous edition.)

Descriptors: *Bibliographies, *Strip mining, *Coal mining, Land reclamation, Water pollution, Environmental impacts, Surface mining, Mining engineering, Spoil, Solid waste disposal, Mine wastes, Mine waters, Remote sensing, Excavating equipment, Economics, Public law, Abstracts

Identifiers: NTISNTISEN

NTIS/PS-78/1164/9ST NTIS Prices: PC N01/MF N01

RS79-3-030

Remote Monitoring of Coal Strip Mine Rehabilitation

Lockheed Electronics Co., Inc., Las Vegas, NV. Remote Sensing Lab.*Environmental Monitoring and Support Lab., Las Vegas, NV.

Final rept. 1 Jul 75-31 Dec 76
AUTHOR: Anderson, James E.; Tanner, Charles E.
F0075D2 Fld: 8I, 48A, 68 GRAI7901
Jul 78 71p
Contract: EPA-68-03-2636
Monitor: EPA/600/7-78/149

Abstract: This report discusses the accomplishments of the Phase I Operations of the EPA/NASA joint project and also compares the results of manual photo-interpretation and automated data analysis conducted during this phase. Also included in this report are the results of a feasibility study to use Landsat data for performing a regional land-cover classification of a portion of the Powder River Basin area in northeastern Wyoming, where there are numerous coal strip mines. (Color illustrations reproduced in black and white)

Descriptors: *Coal mines, *Strip mining, *Remote sensing, Monitors, Aerial photography, Photogrammetry, Photointerpretation, Land reclamation, Land use, Pollution, Environmental impacts, Data processing, Geologic maps, Digital data transmission, Vegetation, Powder River Basin, Wyoming

Identifiers: Ground truth, Landsat satellites, Multiband spectral reconnaissance, NTISEPAORD

PB-286 647/3ST NTIS Prices: PC A04/MF A01

RS79-3-031

0132035 78-006609
THE ROLE OF REMOTE SENSING IN HABITAT.
HIDALGO, HENRY ; MUSA SAMUEL
INST FOR DEFENSE ANALYSES, ARLINGTON,
PRESENTED AT ENV OF HUMAN SETTLEMENTS CONF, BRUSSELS, APR 76, V1, P59 (13)
TECHNICAL FEATURE: THE ROLE OF REMOTE SENSING IN MESOSCALE AND GLOBAL SCALE HABITAT PROTECTION AND DEVELOPMENT IS EXPLORED. A CLOSED LOOP SYSTEM WAS FORMULATED, REQUIRING CONTINUOUS FEEDBACK BETWEEN REMOTE SENSING DATA AND THE CONSEQUENCES OF ENVIRONMENTAL CONTROL DECISIONS. EXAMPLES OF MESOSCALE REMOTE SENSING USED IN LAND USE PLANNING-NEW LAND ACCRETION, OIL SPILL DETECTION, FLOOD MAPPING, DISASTER ASSISTANCE, WATER MANAGEMENT, AND WARNING OF GEOLOGIC HAZARDS-ARE INCLUDED. ON A GLOBAL SCALE, REMOTE SENSING MAY AID IN THE EFFORTS TO PRESERVE THE OZONE SHIELD. THE PROCESS OF DATA ACQUISITION, DATA PROCESSING, PHYSICAL MODELING, SOCIOECONOMIC MODELING, AND DECISION-MAKING IS DESCRIBED. (2 DIAGRAMS)
DESCRIPTORS: *REMOTE SENSING ; *ENV PROBLEMS, GENERAL ; *MATHEMATIC MODELS-LAND ; *OZONE ; *STRATOSPHERE ; *SOCIOECONOMICS ; *LAND USE CLASSIFICATION ; MONITORING, ENV-LAND ; LANDSAT ; COASTAL WATERS ; DECISION MAKING ; TOPOGRAPHY ; CONF PAPER
REVIEW CLASSIFICATION: 07

RS79-3-032

1515454 TD224.C2D7 ID No: 78-9665935 Book Cit: 79002075

Usefulness of remote sensing techniques for the environmental monitoring of the Sacramento-San Joaquin delta :; Final report / by William C. Draeger, Andrew S. Benson, Leon A. Johnson. --

Draeger, William C; Benson, Andrew S; Johnson, Leon A

California., University, Berkeley., School of Forestry and Conservation., Remote Sensing Research Program.; California., Dept. of Water Resources.

Berkeley : Remote Sensing Research Program, School of Forestry and Conservation, University of California, 51 p. : ill. ; 28 cm. 1974.

TD224.C2D7

79002075

Note: A report of research performed under contract no. 851010 for the Department of Water Resources, the Resources Agency, State of California. Bibliography: p. 32-36.

Search: 19740000

Source: OTHER US Doc Type: MONOGRAPH

Cat Codes: 6505; 6020

Descriptors: Remote Sensing Systems.; Water Quality Management; California; Sacramento River.; Water Quality Management; California; San Joaquin River.

RS79-3-033 OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE SENSING DATA TO OCS STUDIES

Belon, A.E.; Environ. Assess. of the Alaskan Continental Shelf, Principal Investigators Repts. for the Year Ending March 1976, Ice, V 14, p. 409-456, 1976, US Dept. Commerce, Environ. Res. Lab., Boulder, CO,
Avail:U.S. Dept. Int., BLM, Washington, D.C.
No abstract available.

RS79-3-034 APPLICATION OF REMOTE SENSING-INFRARED COLOR THERMAL PROFILES AND PHOTOFACSIMILES TO THE GEOLOGICAL RECONNAISSANCE OF DAM SITES; EXAMPLES OF FOUR SPECIFIC CASES

Caillon, L.; Gros, J.C.; Beliard, C.; et al.; Proc. of 4th Can. Symp. on Remote Sensing, No. 4, p. 516-531, 1977, Available in French
No abstract available.

RS79-3-035 MAPPING MINE WASTES WITH LANDSAT IMAGES

Moore, H.D.; Adams, J.H.; Gregory, A.F.; 4th Canadian Symp. on Remote Sensing Proc. No. 4, p. 294-304, 1977, Incl. French sum.
No abstract available.

RS79-3-036 PIT SLOPE MANUAL, SUPPLEMENT 10-1, RECLAMATION BY VEGETATION; VOLUME 2, MINE WASTE INVENTORY BY SATELLITE IMAGERY

Can. Center Mineral Energy Tech., CANMET Rept. No. 77-58, 216 p., 1977
No abstract available.

RS79-3-037 EVALUATION OF LANDSAT IMAGERY FOR MINED LAND STUDIES

Whitebay, L.E.; Barr, D.J.; Missouri Academy Sci. Trans., V 10-11, p. 195-199, 1977, 43rd Annual Mtg.
No abstract available.

Section 4

HYDROLOGY

Ice, Snow, Glaciers, Lakes, Rivers, Floods, Precipitation

RS79-4-001

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

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

RS79-4-002

N78-31502*# Department of Energy, Mines and Resources, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Final Report, Jul. 1974 - Mar. 1978
R. A. Halliday, Principal Investigator and I. A. Reid Apr. 1978 34 p refs Sponsored by NASA ERTS
(E78-10204; NASA-CR-157390) Avail: NTIS HC A03/MF A01 CSCL 08H

The author has identified the following significant results. The LANDSAT program has demonstrated that polar orbiting satellites can be used to relay hydrologic data from any part of Canada to a user without difficulty and at low cost. These data can be used for many operational purposes, the most important of which were: hydroelectric power plant operation; water supply for municipalities, industries, and irrigation; navigation; flood forecasting; operation of flood control structures and systems; and recreation. A recent economic evaluation of hydrometric data indicated a benefit cost ratio of 9.3 for hydrometric data collection in Canada.

RS79-4-003

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

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

RS79-4-004

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

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

RS79-4-005

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

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

RS79-4-006

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

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

RS79-4-007

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

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

RS79-4-008

A79-11672 * Multispectral remote observations of hydrologic features on the North Slope of Alaska. D. K. Hall (NASA, Goddard Space Flight Center, Greenbelt, Md.) and M. L. Bryan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 393-424. 43 refs.

Visible and near-infrared Landsat satellite imagery and active and passive aircraft microwave data are used to analyze some hydrologic features in Arctic Alaska. Lake studies using passive microwave imagery reveal that an increase in the microwave brightness temperature correlates with an increase in ice thickness. Synthetic Aperture Radar (SAR) imagery allows determination of lakes that are frozen to the bottom under certain conditions. Landsat imagery of lakes can be used to study summer ice cover dissipation, an indicator of lake depth. River channel morphometry and morphology studies are accomplished using SAR data with good (25 m) resolution. Landsat imagery is shown to be useful for analyzing interannual variations in the extent of river icings (aufeis). Snow depth variations are shown to be potentially discernable using passive microwave data. Finally, the present and potential applications of these remote sensing studies are discussed; these data are useful for locating potable water sources, planning construction in good locations, and for analyzing interannual climate fluctuations.

(Author)

RS79-4-009

A79-11757 # Multidate data extraction procedures for a statewide Landsat lake quality monitoring program. L. T. Fisher, F. L. Scarpace (Wisconsin, University, Madison, Wis.), and R. G. Thomsen (Kinetic Research, Inc., Madison, Wis.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 190-213. 7 refs.

The paper discusses the project developed to operationally monitor water quality in about 3,000 inland lakes in Wisconsin developed by the University of Wisconsin at Madison and the Wisconsin Department of Natural Resources. The requirements of the data-extraction process are identified as multidate analysis, atmospheric corrections, consistent data-set size, the use of automated techniques, and the utilization of existing hardware. The programs and files developed to meet these requirements are discussed including: a master lakes file called ACCESS, a control point file, a data file linked to ACCESS, programs to generate, test and edit the files, a control point file, a navigation program called SATNAV, and a data extraction program called EXTRACT. S.C.S.

RS79-4-010

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

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

RS79-4-011

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

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

(Author)

RS79-4-012

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

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

RS79-4-013

A79-11758 # Summary report - Application of Landsat to the surveillance of lake eutrophication in the Great Lakes basin. R. H. Rogers, J. B. McKeon (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.), V. E. Smith (Cranbrook Institute of Science, Bloomfield Hills, Mich.), and J. P. Scherz (Wisconsin, University, Madison, Wis.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 214-225.

The cost benefits of using Landsat on an operational basis in the surveillance and control of lake eutrophication was established. To accomplish this, Landsat data were used to derive maps and data graphics to support the EPA's study of lake eutrophication in Saginaw Bay, the State of Michigan, and the State of Wisconsin's lake and watershed studies. These users provided ground truth and supported evaluation of cost benefits of Landsat products. The significant results of the program included the demonstration of cost-effective systems for monitoring: trophic state of areas/scenes containing 200 or more lakes of 50 acres or larger; trophic state of the Great Lakes; and watershed land use required to predict pollutants in runoff.

(Author)

RS79-4-014

A79-12007 • An interactive lake survey program. A. Y. Smith (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Applications of digital image processing; Proceedings of the International Optical Computing Conference, San Diego, Calif., August 25, 26, 1977. (A79-12003 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 21-27. 5 refs.

Consideration is given to the development and operation of the interactive lake survey program developed by the Jet Propulsion Laboratory and the Environmental Protection Agency. The program makes it possible to locate, isolate, and store any number of water bodies on the basis of a given digital image. The stored information may be used to generate statistical analyses of each body of water including the lake surface area and the shoreline perimeter. The hardware includes a [illegible] computer, a Ramtek G100B display controller, and a tracking scanner. The system is illustrated by the LAKELOC operation as it would be applied to a Landsat scene, noting the FARINA and STATUS programs. The water detection algorithm, which increases the accuracy with which water and land data may be separated, is discussed. S.C.S.

RS79-4-015

A79-11756 # Landsat analysis of lake quality for statewide lake classification. F. L. Scarpace, L. T. Fisher (Wisconsin, University, Madison, Wis.), and K. W. Holmquist (Wisconsin Department of Natural Resources, Madison, Wis.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 173-195. 6 refs.

Landsat data have been used in the cooperative program between the Wisconsin Department of Natural Resources and the University of Wisconsin at Madison in a study of the trophic status of inland lakes. As part of the analysis procedures, a computer program was developed to decode multispectral data from Landsat tapes and to create character maps. The results show that Landsat multispectral scanner data is capable of monitoring lake trophic conditions when multitemporal satellite data is employed. Corrections for atmospheric effects and additional ground calibration data are also required. S.C.S.

RS79-4-016

A79-11661 40 years of Mississippi River floodplain change assessed by aerial photography. K. N. Olson (Idaho, Dept. of Lands, Boise, Idaho) and M. P. Meyer (Minnesota, University, St. Paul, Minn.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 40-53. 8 refs. Grant No. DACW37-74-C-0043.

RS79-4-017

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

RS79-4-018

5.0013, REMOTE SENSING TECHNIQUES TO IDENTIFY AND QUANTIFY HYDROLOGIC OPERATING PARAMETERS OF REMOTE MOUNTAIN WATERSHEDS (ABBREV)
W.D. STRIFFLER, Colorado State University, School of Natural Sciences, Earth Resources, *Fort Collins, Colorado* 80523 (B-160-COLO)

This study proposes to determine potential applications for utilizing remote sensing data in the hydrology of remote or wilderness watersheds. Specifically the study will be concerned with estimating hydrologic parameters in a water yield model using remote sensing data. Specific tasks in the study include: (1) Selecting an appropriate water yield model, (2) determining those parameters which may potentially be estimated from remote sensing data, (3) select two test sites and collect the available imagery, including LANDSAT, for the sites selected, (4) determine whether the parameters can be estimated within the accuracy requirements of the model (parameter sensitivity) using LANDSAT and various image analysis and pattern recognition techniques, (5) determine the scale requirements for the various parameters, and (6) test the estimated parameters in the model for the test site. The study will be conducted in collaboration with the Colorado Division of Water Resources, Dr. J.A. Danielson, Deputy State Engineer.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0014, DEVELOP METHODS FOR MONITORING DROUGHT IMPACT FROM LANDSAT
UNKNOWN, Colorado State University, Graduate School, *Fort Collins, Colorado* 80523 (NAS 5-25081)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-4-019

5.0026, NAVY ENVIRONMENT - AIRBORNE RADAR PROFILING OF FIRST-YEAR AND MULTI-YEAR SEA ICE THICKNESS
A. KOVACS, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (DN775324; N00014-77-MP-70016)

To develop a method of determining, by remote sensing, the thickness, top and bottom profile, effective dielectric constant, and the electromagnetic impulse velocity of first year and multi-year sea ice, using a dual antenna impulse radar system; and to develop data processing techniques to aid in analyzing and interpreting the data output from the system, and in constructing surface and subsurface reliefs of the sea profiled.

A helicopter-borne dual antenna impulse radar system will be used to profile first year and multi-year sea ice at various altitudes and speeds. Similar profiles will be obtained by ground transport of the radar system for comparative purposes. Numerous drill hole measurements will be taken over the areas profiled, such that actual ice depth can be compared with depth measurements obtained by the system. The data will be recorded on a graphic recorder and an analogue tape, which will then be computer-analyzed to obtain exact signal travel times, from which ice thickness measurements can be calculated. Utilizing this data, techniques for constructing a cross section of the ice profiled, which can be used in model studies of heat exchange between the ocean and atmosphere, studies of under-ice roughness, oil entrapment, etc., will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

RS79-4-020

5.0007. LAKE ERIE SPECTRAL RADIANCE AND IRRADIANCE STUDY
R.W. AUSTIN, Univ. of California, Scripps Inst. of Oceanography, *P.O. Box 1529, San Diego, California* 92038 (NAS 3-21473)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-4-021

THE INVENTORY AND DISTRIBUTION OF WATER AND ASSOCIATED LAND RESOURCES IN THE GARRISON/DEVILS LAKE REGION OF ND: AN APPLICATION OF RESOURCE DATA ACQUIRED BY ERTS,
North Dakota Univ., Grand Forks. Dept. of Geography.
R. D. Mower.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 091, Price codes: A03 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, Fargo, Completion Report No. WI-221-047-78, June 1978. 26 p, 1 tab, 6 fig, 22 ref. OWRT A-047-NDAK(1), 14-34-0001-7072.

Descriptors: *Remote sensing, *Land resources, Terrain analysis, Watersheds, Land management, Data collections, *Hydrologic data, Garrison, Satellites(ARtificial), *ERTS, Land use, *North Dakota, *Devils Lake Basin(N Dak).

This study was designed to inventory and spatially analyze water and land resources in the Garrison/Devils Lake Region of North Dakota utilizing resources data acquired by ERTS. Preliminary land use studies in Mercer County involved the interpretation of black and white, and color infrared (CIR) aerial photographic imagery (1:24,000), a LANDSAT color composite image (1:250,000), a Mead Dijit Graphics Generator (DGG) image (1:225,000), and a Mead Digital Laser Printer (DLP) image (1:600,000). Subsequent land use/land cover research in the Devils Lake Basin has included the interpretation and analysis of LANDSAT computer compatible tape (CCT) data using both the General Electric IMAGE 100 Multispectral Analysis System and the Bendix Multispectral Data System (M-DAS). Collaboration between Bendix Aerospace Systems Division and the North Dakota Regional Environmental Assessment Program (REAP), with assistance from the North Dakota Institute for Remote Sensing (UNDIRS), produced a land cover map at a scale of 1:500,000 for the State of North Dakota. The results of this study, in both tabular and graphic format, have been available to various planning agencies in North Dakota and to all special task force units established by the Devils Lake Committee.
W78-11373

RS79-4-022

APPLICATION OF REMOTE SENSING TO THE CHESAPEAKE BAY REGION. VOLUME 2- PROCEEDINGS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
W. T. Chen, G. W. Greas, Jr., G. D. Hickman, D. A. Pemberton, and T. D. Wilkerson.
National Aeronautics and Space Administration Conference Publication 6 (NASA CP-6), February 1978. 416 p, numerous fig, tab.

Descriptors: *Chesapeake Bay, *Water quality, *Eutrophication, *Water utilization, Water pollution, Coasts, Thermal pollution, Dredging, *Remote sensing, Models, Pollution, Outer Continental Shelf, LANDSAT.

The proceedings of a conference held April 12-15, 1977, at the Coolfont Conference Center, Berkeley Springs, West Virginia are presented. The conference was jointly sponsored by the National Aeronautics and Space Administration, the U.S. Environmental Protection Agency, and the University of Maryland. The purpose of the conference was to assemble representatives of federal and state government agencies engaged in research on the condition and evolution of the Chesapeake Bay to compose a status report, to present current activities and future plans, and to recommend a long-range future course of policies and programs. Findings of the conference were developed and presented by the attendees divided into six working groups, each of which filed a report containing conclusions and recommendations. A summary of the recommendations and conclusions of the conference are contained in Volume 1. (Sinha-OEIS)
W78-10448

RS79-4-023

EARTH RESOURCES DATA ACQUISITION SENSOR STUDY, PERIOD: DECEMBER 1, 1974- MAY 31, 1975,
Alabama Univ., Huntsville. School of Graduate Studies and Research.
E. W. Grohse.
Available from the National Technical Information Service, Springfield, VA 22161 as N75-30637, Price codes: A04 in paper copy, A01 in microfiche. Final Report, July 1975. 54 p, 1 fig, 3 tab, 46 ref, 5 append. NASA NAS8-31169.

Descriptors: *Monitoring, *Water quality, *Rivers, *Streams, Remote sensing, Satellites(Artificial), On-site data collections, Equipment, Sampling, Air pollution, Sulfur compounds, Pollutants, Water pollution, Water chemistry, Turbidity, Dissolved oxygen, Biochemical oxygen demand, Hydrogen ion concentration, Hardness(Water), Water temperature.

This preliminary study concerned itself with the investigation of the minimum data collection and data processing requirements for the development of 'smart' water monitoring systems, which disregard redundant and irrelevant data and process only those data predictive of the onset of significant pollution events. Two approaches were immediately suggested: (1) adaptation of a presently available 'smart' ambient air monitoring system developed by TVA, and (2) consideration of a 'smart' air, water, and radiological monitoring system developed by the Georgia Tech Experiment Station. In order to apply 'smart' monitoring systems, threshold values and maximum allowable rates of change of critical parameters such as dissolved oxygen and temperature are required. Hopefully, these will be determinable through STORET and other sources of water quality data, which are presently being investigated. (Sims-ISWS)
W78-11443

RS79-4-024

ACCURACY OF HYDROLOGIC MODEL PARAMETERS ESTIMATED USING REMOTELY SENSED DATA,
Agricultural Research Service, Beltsville, MD. Hydrograph Lab.
T. J. Jackson, and R. H. McCuen.
In: Proceedings, Volume 1, 'International Symposium on Risk and Reliability in Water Resources,' et al. (Eds.), University of Waterloo, Waterloo, Ontario, Canada, June 26-28, 1978, p 292-305, 1978. 5 fig, 6 ref.

Descriptors: *Parametric hydrology, *Remote sensing, *LANDSAT data, Estimating, Data collections, Equations, Mathematical models, Systems analysis, *Data acquisition.

Remote sensing offers an attractive alternative to conventional data collection employed in the estimation of certain hydrologic model parameters. In this investigation, the standard error of parameters estimated from Landsat data are examined. Relationships between the standard error and the size of the spatial modeling units are developed which allow extension of the result to larger areas. (See also W78-10094) (Bell-Cornell)
W78-10111

RS79-4-025

FLIGHT OBSERVATIONS FOR THE INVENTORY OF GLACIERS IN THE NEPAL HIMALAYAS,
Nagoya Univ. (Japan). Water Research Inst.
K. Higuchi, T. Iozawa, and H. Higuchi.
In: Collected Papers on Sciences of Atmosphere and Hydrosphere, Water Research Institute of Nagoya University (Japan), Vol 14, 1976. Reprint from Journal of the Japanese Society of Snow and Ice, 38 Special Issue, p 6-9, 1976. 3 fig, 1 tab, 2 ref.

Descriptors: *Glaciers, *Remote sensing, *Aerial photography, Aircraft, Surveys, Photography, Mountains, Ice, Foreign countries, Foreign research, Snow, Glaciology, *Himalaya Mountains, *Nepal, *Khumbu Region.

Air flights for photographing glaciers in Nepal Himalayas were carried out 8 times during the period from 1970 to 1975. The oblique aerial photographs of glaciers in the Khumbu region taken by these flights will be of aid when the glacier inventory by Muler and the maps hitherto published are compared, as a first step in the inventory study of glaciers in this region. (Sims-ISWS)
W78-10502

RS79-4-026

A CASE STUDY OF THE MEASUREMENT OF SNOWFALL BY RADAR: AN ASSESSMENT OF ACCURACY,
British Meteorological Office, Bracknell (England).
C. G. Collier, and P. R. Larke.
Quarterly Journal of the Royal Meteorological Society, Vol. 104, No. 441, p 615-621, July 1978. 3 fig, 19 ref.

Descriptors: *Remote sensing, *Snowfall, *Radar, Evaluation, Precipitation(Atmospheric), Measurement, Watersheds(Basins), Snow, Snowpacks, Surveys, Water resources, Rain gages, Runoff, Melt water, Weather, Meteorology.

Radar measurements during a period of snowfall in a region of variable terrain were described. The accuracy of estimates of areal snow depth, using a calibrated radar, was shown to be similar to that achieved for areal rainfall using the same technique. This detailed case study supported similar conclusions made by other workers, who used more cases but fewer validating measurements. It also was shown that provided the variations in terrain height are not very large, compensation for the effects of melting over low terrain can be made in deriving the snow depth field by using two independent snow depth calibration measurements-one representative of upland areas, and the other of lowland areas. (Sims-ISWS)
W78-12644

RS79-4-027

REMOTE WATER MONITORING SYSTEM,
National Aeronautics and Space Administration, Washington, DC. (Assignee).
D. C. Grana, and D. P. Haynes.
U.S. Patent No. 4,089,209, 10 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 970, No 3, p 844, May 16, 1978.

Descriptors: *Patents, *Monitoring, *Sampling, Data collections, *Remote sensing, Floating, Data transmission, Electrochemical analysis.

A remote water monitoring system is described that integrates the functions of sampling, sample preservation, sample analysis, data transmission and remote operation. The system employs a floating buoy carrying an antenna connected by lines to one or more sampling units containing several sample chambers. Receipt of a command signal actuates a solenoid to open an intake valve outward from the sampling unit and communicates the water sample to an identifiable sample chamber. Such response to each signal receipt is repeated until all sample chambers are filled in a sample unit. Each sample taken is analyzed by an electrochemical sensor for a specific property and the data obtained is transmitted to a remote sending and receiving station. Thereafter, the samples remain isolated in the sample chambers until the sampling unit is recovered and the samples removed for further laboratory analysis. (Sinha-OEIS)
W79-00047

RS79-4-028

HYDROLOGICAL APPLICATION OF LANDSAT IMAGERY USED IN THE STUDY OF THE 1973 INDUS RIVER FLOOD, PAKISTAN,
Geological Survey, Reston, VA. Geography Program; and Geological Survey, Reston, VA. Water Resources Div.
M. Deutsch, and F. H. Ruggles, Jr.
Water Resources Bulletin, Vol 14, No 2, p 261-274, April 1978. 7 fig, 1 tab, 6 ref.

Descriptors: *Flood data, *Remote sensing, *Satellite(Artificial), *Photogrammetry, Flood damage, *Indus River, *Pakistan, LANDSAT.

During August and September 1973, the Indus River Valley of Pakistan experienced one of the largest floods on record, resulting in damages to homes, businesses, public works, and crops amounting to millions of rupees. Tremendous areas of lowlands were inundated along the Indus River and major tributaries. Landsat data made it possible to easily measure the extent of flooding, totaling about 20,000 sq km within an area of about 400,000 sq km south from the Punjab to the Arabian Sea. The Indus River data were used to continue experimentation in the development of rapid, accurate, and inexpensive optical techniques of flood mapping by satellite begun in 1973 for the Mississippi River floods. The research work on the Indus River not only resulted in the development of more effective procedures for optical processing of flood data and synoptically depicting flooding, but also provided potentially valuable ancillary information concerning the hydrology of much of the Indus River basin. (Woodard-USGS)
W78-10051

RS79-4-029

LANDSAT Linear Trend Analysis: A Tool for Groundwater Exploration in Northern Arkansas

Arkansas Univ., Fayetteville. Water Resources Research Center.*Office of Water Research and Technology, Washington, D.C.

Project completion rept. May 75-30 Jun 77
AUTHOR: MacDonald, Harold C.; Steele, Kenneth F.; Gaines, Elizabeth
E0904H2 Fld: 8H, 8G, 48G GRAI7810
Jun 77 118p
Rept No: PUB-49
Contract: DI-14-34-0001-6004
Project: OWRT-A-034-ARK
Monitor: OWRT-A-034-ARK(1)

Abstract: In northern Arkansas, knowledge of deep aquifers is fairly limited. The development of these deeper aquifers to their fullest potential as reliable water sources depends upon the delineation of high yield areas, a process that may be facilitated by linear trend analysis. Satellite and photolineament maps of the 13 counties were prepared by use of LANDSAT images and Agricultural Stabilization and Conservation Service photo indexes. The lineaments and fracture traces on aerial photographs and LANDSAT images are natural linear features such as aligned stream segments, soil tonal and vegetal alignments, and topographic sags. These features are the surface manifestations of subsurface fracture zones of undermined origin, which are areas where increased solutioning of carbonate rocks has taken place. The results of statistical testing of well yields in the study area show that the fracture trace-lineament method of well location can result in improved well yields. Linear trends interpreted from LANDSAT can be useful in the search for more reliable groundwater sources.

Descriptors: *Ground water, *Water supply, *Remote sensing, *Water prospecting, Aquifers, Hydrogeology, Aerial photography, Photointerpretation, Water wells, Carbonate rocks, Porosity, Water quality, pH, Calcium, Permeability, Fracture zones, Stratigraphy, Scientific satellites, Magnesium, Iron, Inorganic nitrates, Chlorine, Arkansas

Identifiers: *Groundwater movement, *Aquifer characteristics, LANDSAT satellites, Water quality data, NTISDIOWRT

PB-277 121/0ST NTIS Prices: PC A06/MF A01

RS79-4-030

Spectral Measurement of Watershed Coefficients in the Southern Great Plains

Texas A and M Univ., College Station. Remote Sensing Center.*NASA Earth Resources Survey Program, Washington, D.C.

Final rept.
AUTHOR: Blanchard, Bruce J.; Bausch, Walter
E1005D4 Fld: 8H, 93A, 48G GRAI7811
Jan 78 60p
Rept No: RSC-3273
Contract: NAS5-22534
Monitor: NASA-CR-155718

Abstract: The author has identified the following significant results. It was apparent that the spectral calibration of runoff curve numbers cannot be achieved on watersheds where significant areas of timber were within the drainage area. The absorption of light by wet soil conditions restricts differentiation of watersheds with regard to watershed runoff curve numbers. It appeared that the predominant factor influencing the classification of watershed runoff curve numbers was the difference in soil color and its associated reflectance when dry. In regions where vegetation grown throughout the year, where wet surface conditions prevail or where watersheds are timbered, there is little hope of classifying runoff potential with visible light alone.

Descriptors: *Watersheds, *Drainage, Spectral signatures, Great Plains Corridor(North America), Soils, Earth Resources program, Trees(Plants)

Identifiers: *Runoff, *Surface water runoff, NTISNASA

E78-10073 NTIS Prices: PC A04/MF A01

RS79-4-031

1479173 S900.F6 ID No: 78-9128592
Applications of remote sensing to watershed management
Rango, A
Food and Agriculture Organization of the United Nations
F A O Conserv Guide 1: 37-52. Ref. 1977
S900.F6
Search: 19770000
Source: FAO Doc Type: ARTICLE
Cat Codes: 3505

RS79-4-032 PRACTICAL UTILIZATION OF REMOTE SENSING TECHNOLOGY FOR MANAGEMENT AND CONSERVATION OF NATURAL RESOURCES, WATER RESOURCES MANAGEMENT

Anonymous; Proc. of Seminar on Remote Sensing Applications, p. 41-80, 1975, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand

No abstract available.

RS79-4-033 STUDY OF THE CENTRAL DELTA OF THE NIGER RIVER, PROJECT "SAPHYR;" SATELLITE PROJECT HYDROLOGY RESEARCH

Bied-Charreton, N.; Cruette, J.; Dandoy, G.; et al.; 4th Canadian Symp. on Remote Sensing Proc., No. 4, p. 341-354, 1977, Incl. French sum.

No abstract available.

RS79-4-034 CONTRIBUTIONS OF REMOTE SENSING TO THE STUDY OF THE ANOMALIES OF THE NIGER RIVER

Cruette, J.; Geologues, No. 43, p. 5-16, 1977, Available in French

No abstract available.

RS79-4-035 THE APPLICATION OF REMOTELY SENSED DATA TO REGIONAL DRAINAGE BASIN ANALYSES

Frank, T.D.; McCoy, R.M.; Van Pelt, N.S.; Great Plains-Rocky Mt. Geogr. J., V 6, No. 2, p. 220-227, 1977

No abstract available.

RS79-4-036 SCIENTIFIC, TECHNICAL, AND ECONOMIC FACTORS AFFECTING THE UTILIZATION OF REMOTE SENSING METHODS FOR GEOLOGICAL, MINERAL, AND WATER RESOURCES SURVEYS EMPLOYING AIRCRAFT OR SATELLITES; I, MEETING THE REQUIREMENTS OF GEOLOGICAL AND HYDROLOGICAL SURVEYING

Koopmans, B.N.; Proc. of Seminar on Remote Sensing Applications, p. 25-40, 1975, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand

No abstract available.

RS79-4-037 USE OF EARTH SATELLITES FOR AUTOMATION OF HYDROLOGIC DATA COLLECTION

Paulson, R.W.; Collection, Storage, Retrieval, and Publ. of Water Resources Data, USGS Circ. No. 756, p. 8-14, 1978
No abstract available.

RS79-4-038 APPLICATION OF REMOTELY SENSED LAND USE INFORMATION TO IMPROVE ESTIMATES OF STREAMFLOW CHARACTERISTICS

Pluhowski, E.J.; Central Atlantic Regional Ecological Test Site (CARETS) Project, Final Report, V 8, 85 p., 1977, U.S. Geol. Survey, Reston, VA
Avail:NASA, Goddard Space Flight Center, Greenbelt, MD
No abstract available.

RS79-4-039 REMOTE SENSING IN WATER RESOURCES EXPLORATION AND DEVELOPMENT IN INDIA

Roy, S.E.; Proc. of Seminar on Remote Sensing Applications, p. 80-83, 1975, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand
No abstract available.

Section 5

VEGETATION

A. Agriculture

RS79-5-001

N78-32516*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES
Donald R. Wiesnet, Principal Investigator 15 Sep. 1978 3 p Sponsored by NASA ERTS
(E78-10211: NASA-CR-157584; Rept-4) Avail: NTIS HC A02/MF A01 CSCL 08H
There are no author-identified significant results in this report.

RS79-5-002

N78-30639*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
MONITORING CORN AND SOYBEAN CROP DEVELOPMENT BY REMOTE SENSING TECHNIQUES
Compton J. Tucker, James H. Elgin, Jr., and James E. McMurtrey, III Aug. 1978 16 p refs
(NASA-TM-79607) Avail: NTIS HC A02/MF A01 CSCL 02C
A system for spectrally monitoring the stages of crop development for corn and soybeans based upon red and photographic infrared spectral radiances is proposed. The red and photographic infrared spectral radiance, highly correlated with the green leaf area index or geen leaf biomass, enable nondestructive monitoring of the crop canopy throughout the growing season. Five distinct periods are apparent which are related to crop development for corn and soybeans. Author

RS79-5-003

N78-31518# South Dakota State Univ., Brookings. Dept. of Physics.
APPLICATION OF HEAT-FLOW TEMPERATURE MODEL FOR REMOTELY ASSESSING NEAR SURFACE SOIL MOISTURE BY THERMOGRAPHY *Final Report*
Jerald A. Tunheim Nov. 1977 50 p refs
(Contract DI-14-31-0001-6043)
(PB-279616/7; W78-05932) Avail: NTIS HC A03/MF A01 CSCL 08H
Detection and mapping of near-surface ground water by the use of remote sensed thermal emittance data (thermography) are reported. The specific focus was on detection of saline seeps in their preemergence stages. Soil temperature profiles, water table depths, and other pertinent data were collected in two potential seep areas. These data were related to thermal emittance acquired during three aircraft flights and results were used to modify a theoretical model. Author

RS79-5-004

N78-31499*# National Aeronautics and Space Administration, Goddard Inst. for Space Studies, New York.
ATLAS OF SELECTED CROP SPECTRA, IMPERIAL VALLEY, CALIFORNIA
Stephen G. Ungar, Principal Investigator, William Collins (Columbia Univ.), Jerry C. Coiner (Columbia Univ.), Dwight Egbert (General Telephone and Electronics), Richard Kiang (General Telephone and Electronics), Tina Cary (Columbia Univ.), Peter Coulter (General Telephone and Electronics), Nurit Landau (General Telephone and Electronics), Elaine Mathews (Columbia Univ.), Stephen Lytle (Columbia Univ.) et al Jun. 1977 195 p refs ERTS
(Contract NAS5-20749; Grants NsG-5080; NGR-33-008-191; NsG-5014)
(E78-10201; NASA-TM-79743) Avail: NTIS HC A09/MF A01 CSCL 02C
There are no author-identified significant results in this report.

RS79-5-005

N78-30637*# General Electric Co., Huntsville, Ala. Space Div.
GLOBAL CROP PRODUCTION FORECASTING: AN ANALYSIS OF THE DATA SYSTEM PROBLEMS AND THEIR SOLUTIONS
J. Neiers and H. Graf May 1978 83 p refs
(Contract NAS8-32491)
(NASA-CR-150749; Rept-78HV031) Avail: NTIS HC A05/MF A01 CSCL 02C
Data related problems in the acquisition and use of satellite data necessary for operational forecasting of global crop production are considered for the purpose of establishing a measurable baseline. For data acquisition the world was divided into 37 crop regions in 22 countries. These regions represent approximately 95 percent of the total world production of the selected crops of interest, i.e., wheat, corn, soybeans, and rice. Targets were assigned to each region. Limited time periods during which data could be taken (windows) were assigned to each target. Each target was assigned to a cloud region. The DSDS was used to measure the success of obtaining data for each target during the specified windows for the regional cloud conditions and the specific alternatives being analyzed. The results of this study suggest several approaches for an operational system that will perform satisfactorily with two LANDSAT type satellites. G.G.

RS79-5-006

N79-11451*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SEPARABILITY OF AGRICULTURAL COVER TYPES IN SPECTRAL CHANNELS AND WAVELENGTH REGIONS
Ravindra Kumar Oct. 1977 21 p refs
(Grant NGL-15-005-112)
(NASA-CR-157803; INPE-1147-PE/100) Avail: NTIS HC A02/MF A01 CSCL 02C
Spectral channels and wavelength regions (visible, near infrared, middle infrared and thermal infrared) were evaluated with respect to their estimated probability of correct classification (Pc) in discriminating agricultural cover types. Multispectral scanner data in twelve spectral channels in the wavelength range of 0.4 to 11.7 microns acquired in the middle of July for three flightlines, were analyzed by applying automatic pattern recognition techniques. The same analysis was performed for the data acquired in the middle of August, 1971, over the same three flightlines, to investigate the effect of time on the results. The effect of deletion of each spectral channel as well as each wavelength region on Pc is given. Values of Pc for all possible combinations of wavelength regions in the subsets of one to twelve spectral channels are also given. The overall values of Pc were found to be greater for the data of the middle of August than the data of the middle of July. S.B.S.

RS79-5-007

N78-31492*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ASSESSMENT OF THE DAMAGE CAUSED BY THE FROST OF 1975 TO COFFEE AND WHEAT CROPS IN THE NORTHWEST OF THE STATE OF PARANA USING LANDSAT IMAGES WITH AUTOMATIC CLASSIFICATION
Nelson deJesusParada, Principal Investigator, Antonio Tebaldi Tardin, Carlos Vicente Barbieri Palestino, and Claudio Roland Sonnenburg Mar. 1977 15 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10193; NASA-CR-157383; INPE-1007-NTE/078) Avail: NTIS HC A02/MF A01 CSCL 02C
There are no author-identified significant results in this report.

RS79-5-008

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

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

RS79-5-009

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

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

RS79-5-010

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

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

RS79-5-011

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

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

RS79-5-012

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

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

RS79-5-013

A79-11671 **Frequency dependence of the microwave brightness temperature of rough dielectric surfaces.** W. P. Waite (Arkansas, University, Fayetteville, Ark.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 377-392.

The problem of measuring soil moisture content in the microwave spectrum is complicated by the roughness of natural surfaces. A first order analysis using modified Fresnel coefficients initially appears attractive for both radar and radiometer applications. For radar it is found that the roughness heights that can be treated in this fashion are below 5 mm for frequencies down to 1 GHz. Beyond this the specular return is submerged in the scattered return. For radar the technique likewise suffers the disadvantage of requiring a radar measurement which destroys the fine resolution obtainable by signal processing. A radiometer measuring the specular component will appear less sensitive to roughness than a radar system measuring the scattered component. However, when the two instruments are compared when sensing the same component of the return, it is seen that the sensitivity to roughness is even greater for the radiometer due to the change in effective roughness with change in the dielectric constant of the surface. G.R.

RS79-5-014

A79-11659 **Bean area estimates from Landsat and airborne remote sensing data.** R. A. Ryerson (Department of Energy, Mines and Resources, Centre for Remote Sensing, Ottawa, Canada) and V. R. Wallen (Department of Agriculture, Crop Disease Loss Section, Ottawa, Canada). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 18-29.

The purpose of the reported experiment, which was conducted under the direction of the Canada Centre for Remote Sensing was to evaluate remote sensing data for providing accurate and timely white and red kidney bean area measurements in southern Ontario. The Ontario White and Yellow Eye Bean Producers Marketing Board requires white and red kidney bean area estimates which are 90% accurate, 95% of the time. Investigations were carried out for two test sites. Landsat coverage was obtained on August 10, while airborne data were acquired on August 17, 1976. Ground data were collected for each of 419 fields in the two test sites during the periods August 9-11 and August 17-20, 1976. It was found that the accuracy of remote sensing estimates of white and red kidney bean areas in 1976 in the test sites approach or exceed the accuracies required. G.R.

RS79-5-015

A78-47085 The analyses of multispectral data obtained from space. K. Tsuchiya, T. Iwata, H. Nakamura (National Space Development Agency of Japan, Tokyo, Japan), H. Ochiai (Toba National Merchant Marine College, Toba, Japan), and K. Takeda (Science and Technology Agency, Tokyo, Japan). In: International Symposium on Space Technology and Science, 12th, Tokyo, Japan, May 16-20, 1977, Proceedings. (A78-47001 21-12) Chofu, Tokyo, National Aerospace Laboratory, 1977, p. 617-622. 12 refs.

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

RS79-5-016

A79-13793 • A comparison of satellite sensor bands for vegetation monitoring. C. J. Tucker (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Nov. 1978, p. 1369-1380. 28 refs.

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

RS79-5-017

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

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

RS79-5-018

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

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

RS79-5-019

A79-11660 Multidate/multispectral crop identification - Digital techniques applied to high altitude photography and Landsat imagery. J. R. Jensen (Georgia, University, Athens, Ga.), L. R. Tinney, and J. E. Estes (California, University, Santa Barbara, Calif.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 30-39. 11 refs.

Multidate crop identification using microdensitometer scanned color infrared high altitude photography (original scale 1:125,000) and Landsat digital data was conduced for an 140 square kilometer study area in Kern County, California. The purpose of this analysis was not to achieve maximum crop identification accuracy per se, but to comparatively evaluate the utility of the two image formats for digital crop identification. Preliminary results indicate that the Landsat digital approach is superior to analysis of digitized high altitude photography. Vignetting in the high altitude photography dataset caused serious signature extension problems. (Author)

RS79-5-020

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

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

RS79-5-021

A79-12502 The contribution of space observations to global food information systems; Proceedings of the W. Nordberg Memorial Symposium, Tel Aviv, Israel, June 7-18, 1977. Symposium sponsored by COSPAR and International Association of Meteorology and Atmospheric Physics. Edited by E. A. Godby (Canada Centre for Remote Sensing, Ottawa, Canada) and J. Otterman (Tel Aviv University, Tel Aviv, Israel). Oxford, Pergamon Press, Ltd. (Advances in Space Exploration, Volume 2), 1978. 210 p. $25. (For individual items see A79-12501 to A79-12506)

Space technology applications to the development of global food information systems are discussed for the purpose of informing potential end users. Topic classifications include range monitoring and management, food information systems (crop observations, growing conditions, and modeling), the influence of climatic change on crop production, and marine food resources. Information obtained from satellites is described, and the organization and application of this information is considered. M.L.

RS79-5-022

A79-11748 Estimation of soil moisture and components by measuring the degree of spectral polarization with a remote sensing simulator. H. Genda and H. Okayama (Chiba University, Chiba, Japan). *Applied Optics*, vol. 17, Nov. 1, 1978, p. 3439-3443. 9 refs.

A remote sensing simulator is used to measure the degree of spectral polarization of scattered light from CuSO4, CuCl2, Fe2O3, SiC, S, NiCl2, and CoCl2 as models of soil. Comparisons are made to measurements of volcanic ash and natural soil. Results are presented for the degree of spectral polarization of SiC, the degree of spectral polarization of volcanic ash from the crater on Mt. Usu and the Kinomi housing area, the degree of spectral polarization and absorbance of Fe2O3, and the degree of spectral polarization of red soil in several degrees of moisture content. It is found that Fe appears in natural soil and that Si appears in volcanic ash. S.C.S.

RS79-5-023

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

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

RS79-5-024

A79-13852 • # Sensor needs for agricultural applications. H. Golden (NASA, Marshall Space Flight Center, Huntsville, Ala.) and J. W. Neiers (General Electric Co., Huntsville, Ala.). *American Institute of Aeronautics and Astronautics and NASA, Conference on 'Smart' Sensors, Hampton, Va., Nov. 14-16, 1978, AIAA Paper 78-1745*. 8 p.

The peculiarities of agricultural remotely sensed data requirements evoke special sensor requirements. Vegetative species do not possess significantly different spectral signature at given phases of their development cycle. Hence, the key to their discriminability is the phasing of the phenologic cycle of the subject species. Significant improvements in classification can be obtained by consistently employing multi-temporal observations taken at specific times during the year. The present approach to agricultural data processing results in extracted data equal to approximately .05% of the acquired data. This paper discusses the derivation of agricultural peculiar requirements and the benefits to the end-to-end processing system by judicial utilization and placement of key editing functions such as sample segment extraction, cloudy image removal, sample registration and the elimination of redundant data. (Author)

RS79-5-025

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

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

RS79-5-026

5.0033, AGRICULTURAL APPLICATIONS OF SATELLITE ACQUIRED EARTH OBSERVATIONS

C.L. WIEGAND, U.S. Dept. of Agriculture, Agric. Res. Service, *Weslaco, Texas* 78596 (0043879; 7202-20762-003)

OBJECTIVE: Develop and test rapid and timely methods for handling, analyzing, and applying satellite data to agricultural problems over large areas.

APPROACH: Relate satellite indicators of plant residue amount in a wheat-fallow rotation to wind and water erosion susceptibility of soils. Utilize earth surface temperatutes from NOAA (SMS AND GOES) and NASA (HCMM and LANDSAT) C) to: Estimate soil temperatures suitable for planting advisories, determine vegetative ground cover, and estimate soil water conditions and/or evapotranspiration rates. Identify crops and land uses, measure crop acreages, and classify various soil and crop condition categories in the ARS wheat yield prediction effort and joint ARS-SCS wind erosion effort. Merge the spectral indicators of biomass, growing conditions, and stresses with physiological model outputs to improve estimates of grain (sorghum, wheat) maturity date and probable yields on the Great Plains. Inventory rangeland and estimate the harvestable forage. Investigate techniques for distinguishing plants and plant residues from the variable soil background that can aid automated soil mapping and crop discrimination.

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research Service, Subtropical Texas Area

RS79-5-027

5.0031, EARLY REMOTE DETECTION OF FOMES ANNOSUS

C.E. OLSON, Univ. of Michigan, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067793; MICY00039-F)

OBJECTIVE: Evaluate capabilities of remote sensors for early detection of Fomes annosus. Identify optimum system parameters for pre-visual detection of the disease.

APPROACH: Review available imagery of NASA Test Site 190 for tonal anomalies in conifer stands and relate to vigor and disease conditions through field verification. Evaluate level-slicing with single channel and ratioed MSS data for pre-visual detection of tree-vigor decline.

PROGRESS: Laboratory work has progressed to the point where an operational field test of a multispectral scanner in the May-June time period should be the next step. Work on reflectance from pine canopies indicates that the 0.43 to 0.50 (blue) band should receive much greater attention for forest stress detection than generally supposed. This recommendation is believed applicable to damage by insect vectors as well as pathogens.

SUPPORTED BY Michigan State Government

RS79-5-028

5.0026, ESTIMATED WINTER WHEAT YIELD FROM CROP GROWTH PREDICTED BY LANDSAT

E.T. KANEMASU, Kansas State University, Agric. Experiment Station, Agronomy, *Anderson Hall, Manhattan, Kansas* 66502 (0070390; KAN-05-483)

OBJECTIVE: Evaluate an evapotranspiration model and growth equations for winter wheat in Kansas.

APPROACH: Leaf area index will be predicted from LANDSAT data. The evapotranspiration model will use LAI, solar radiation and temperature. Winter wheat growth will be estimated from growth equations derived from photosynthetic chamber data.

PROGRESS: An evapotranspiration model was developed for winter wheat. The daily meteorological inputs are solar radiation, maximum temperature, minimum temperature, and precipitation. Leaf area index is another input and allows the separation of evaporation and transpiration. The model compared favorably with lysimetric observations. Landsat imagery was used to estimate leaf area index (LAI) on a number of wheat fields throughout the growing season. The evapotranspiration model was then run using the Landsat-predicted LAI, therefore Landsat permitted the estimate of evapotranspiration from large commercial fields.

SUPPORTED BY Kansas State Government

RS79-5-029

5.0024, THE USE OF REMOTE-SENSING TECHNIQUES FOR THE DETECTION OF CROP STRESS (DISEASE AND WATER)

G.R. SAFIR, Michigan State University, Agric. Experiment Station, *East Lansing, Michigan* 48823 (0059700; MICL01077)

OBJECTIVE: Identify the major spectral and structural canopy components which contribute to the directional spectral reflectance of wheat, corn, sugarbeet, bean and soybean canopies suffering from disease and water stress. Calculate the theoretical detectability, using a mathematical directional reflectance model, of each of the above diseases for operational remote sensing systems and possibly for systems as yet undeveloped. Determine the relationship between aerial photographic ratings of diseases fields and crop yield.

APPROACH: For each canopy type, samples will be grown in the greenhouse and/or field and/or growth chamber. The biological and spectral canopy components will be measured throughout the growth cycle and analyzed. Control and stressed sample plants will be used for calculation of the spectral reflectance of a large area canopy by use of a mathematical canopy model. If the calculated canopy reflectances agree with canopy reflectances as measured in the field, then the canopy model will be used to estimate the importance of the individual canopy components to the canopy reflectances.

PROGRESS: Aerial infrared (IR) photography was used for determining the levels of Rhizoctonia root rot and black rot disease (Aphanomyces sp) of sugarbeets in the field. Significantly high correlations were found between photos ratings of disease intensity and plant vigor and preharvest ground estimates of disease severity and yield. Photo estimates of these diseases are now being used in sugarbeet breeding trials. Photo estimates of wheat spindle streak mosaic (WSMD) disease correlated significantly with ground estimates of disease intensity as well as with yield. Chlorosis levels determined using aerial photography and ground observations also were significantly correlated with yield. Initial WSMD ratings correlated significantly with increased chlorosis levels due to other stresses. Relative standing biomass was estimated, using aerial photography, for an old field ecosystem that received measured levels of wastewater irrigation. Correlations between harvested biomass and photo estimates of biomass were highly significant.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Michigan

RS79-5-030

5.0039, REMOTE SENSING FOR IMPROVED SOIL AND CROP MANAGEMENT

H.W. GAUSMAN, U.S. Dept. of Agriculture, Agric. Res. Service, Soil Water Cons Res, *509 W. 4TH St., Weslaco, Texas* 78596 (0043802; 7202-20762-002)

OBJECTIVE: Develop procedures for spectrally measuring plant stresses due to nutritional status, salinity, soil moisture, temperature, pollutants, drainage conditions, and soil edaphic factors on fruit, vegetable, and field crops and rangeland; apply remotely sensed plant and soil condition information to improve their management.

APPROACH: Thermal patterns will be sensed with scanners and radiation thermometers to develop freeze prediction equations, assess damage to sugarcane and other crops develop cold protection systems and schedule irrigations. Color infrared photography and ground truth will be related to the health and yield of sugarcane, sorghum, citrus, and other crops. Laboratory and/or field spectral reflectance measurements, made periodically on normal and stressed crops and different crop genera, species, and cultivars, will be related to chlorophyll, water content, ground cover, and other factors to determine optimum wavelengths for detecting particular conditions and species' specific responses. Models describing the interaction of light with plant canopies and soils will be developed.

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research Service, Subtropical Texas Area

RS79-5-031

5.0023, ATMOSPHERIC INFLUENCES ON ECOSYSTEMS AND SATELLITE SENSING

K.N. BROOKS, Univ. of Minnesota, School of Forestry, *St. Paul, Minnesota* 55108 (0010830; MIN-42-035)

OBJECTIVE: Develop methods for evaluation and utilization of remotely sensed data pertaining to agricultural ecosystems for ERTS and aircraft. Develop improved statistical relationships and analyses of solar radiation and certain other atmospheric variables of fundamental impact on plant growth and yield.

APPROACH: Use remote sensing techniques to provide unlimited capabilities for measurement of hydrologic variables of diverse ecosystems. This has the capability of providing synoptic and repetitive measurements of large areas unattainable from point sampling at the earth's surface. Also provides a unique opportunity to evaluate effects of alternative land management practices on hydrologic characteristics. Satellite data will permit the location and mapping of snow distribution and subsequent zones of melt; will facilitate present research related to predicting snowmelt runoff, and stream flow forecasts will be enhanced. Albedo and energy regimes information will strengthen estimates of evapotranspiration and soil moisture content of diverse vegetation and soil types. Solar radiation data collected at field locations and research sites will be provided for development and testing of statistical analyses. Data will be subjected to previously developed relationships to evaluate effects of meterological variables on forest and water ecosystems.

PROGRESS: Aerial photographs and simultaneous lake-water quality measurements were taken during the summer of 1976 on six different lakes classified from oligotrophic to eutrophic. Different levels of film exposure and processing for film 2402-58 are being studied to determine if film density-water quality correlations can be improved. Study of renovation and reclamation potentials of wastewater irrigation on iron-ore overburden material in northeastern Minnesota has been completed. Renovation of effluent with respect to phosphorus and total nitrogen was observed. The vegetation response will be followed for several years. An assessment of water quality problems associated with forest management activities in Minnesota has begun. Data and spatial mapping methodologies available from the MLMIS and other sources are being investigated. Study sites are being selected in northeastern Minnesota for field evaluations of stream sedimentation, nutrient levels, and other water quality indicators associated with natural runoff events. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Minnesota

RS79-5-032

5.0014, WINTER WHEAT YIELD MODEL FROM SURFACE AND SATELLITE METEOROLOGICAL DATA

A.M. FEYERHERM, Kansas State University, Agric. Experiment Station, *Manhattan, Kansas* 66502 (0067086; KAN-05-392)

OBJECTIVE: Adapt the Canadian multiplicative type weather-spring wheat yield model to winter wheat conditions in Kansas and other Great Plains States; test the ability of such model to predict point and area-wide (including State) yields at various stages of growth; and test its usefulness in estimating the variance of area-wide wheat production over years due to weather alone. Provide ground truth information and data reduction of ERTS imagery at two locations in Kansas.

APPROACH: The Canadian model will be used to obtain model derived wheat yields using past historical meteorological data to compare with past observed yields. The model will be modified to reflect effects of diseases, insects, fertilizers, improved varieties, and management practices. Attempts will be made to improve predictive power of model using satellite-derived data.

PROGRESS: Winter and spring wheat yield models have been developed which can be applied universally throughout the Great Plains of the United States to estimate average yields over specified regions. Applicability of the models to other wheat-growing areas of the world will be tested. The models use precipitation, minimum, and maximum temperatures, daylength, and Q(0) (solar radiation at the edge of the atmosphere) as primary daily inputs. Seasonal inputs for a given region include amount of added nitrogen, percent fallowed, varietal yielding ability, and a management and soil productivity factor. Regional inputs include long-term average daily temperature in January and average date when fifty percent of the crop is planted. Robertson's biometeorological time scale and Baier and Robertson's versatile soil moisture budget were used extensively in deriving weather-related variables. Some 1034 experimental plot yields from locations throughout the U.S. Great Plains were used to estimate parameters in the winter wheat model and 306 plot yields from the northern Great Plains were used for the spring wheat model.

SUPPORTED BY Kansas State Government

RS79-5-033

5.0005, MEASUREMENT AND FORECASTING OF SOIL MOISTURE BY REMOTE MEANS

D.D. EVANS, Univ. of Arizona, School of Earth Sciences, Hydrology & Water Resources, *Tucson, Arizona* 85721 (NSG 5279)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-5-034

Use of LANDSAT-1 Data for the Detection and Mapping of Saline Seeps in Montana

Pennsylvania State Univ., University Park. Office of Remote Sensing and Earth Resources.*NASA Earth Resources Survey Program, Washington, D.C.

Technical rept.
AUTHOR: May, G. A.; Petersen, G. W.
E1005E1 Fld: 8G, 93A, 48F GRAI7811
Mar 76 88p
Rept No: ORSER-SSEL-TR-4-76
Contract: NAS5-2304
Monitor: NASA-CR-156686
Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: The author has identified the following significant results. April, May, and August are the best times to detect saline seeps. Specific times within these months would be dependent upon weather, phenology, and growth conditions. Saline seeps can be efficiently and accurately mapped, within resolution capabilities, from merged May and August LANDSAT 1 data. Seeps were mapped by detecting salt crusts in the spring and indicator plants in the fall. These indicator plants were kochia, inkweed, and foxtail barley. The total hectares of the mapped saline seeps were calculated and tabulated. Saline seeps less than two hectares in size or that have linear configurations less than 200 meters in width were not mapped using the LANDSAT 1 data. Saline seep signatures developed in the Coffee Creek test site were extended to map saline seeps located outside this area.

Descriptors: *Montana, *Seepage, Salinity, Spectral signatures , Salts, Earth Resources program, Multispectral band scanners, Mapping

Identifiers: Salt water, Saline soils, Soil mechanics, Soil dynamics, Soils, Remote sensing, Image processing, NTISNASA

E78-10074 NTIS Prices: PC A05/MF A01

RS79-5-035

Investigation of Environmental Change Pattern in Japan

Tokyo Univ. (Japan).*National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

Final rept.
AUTHOR: Maruyasu, Takakazu
E0884G2 Fld: 8E, 93A, 48 GRAI7810
Nov 77 180p
Monitor: NASA-CR-155550
Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: The author has identified the following significant results. In the Plains of Tokachi, where the scale of agricultural field was comparatively large in Japan, LANDSAT data with its accuracy have proved to be useful enough to observe the actual condition of agricultural land use and changes more accurately than present methods. Species and ages of grasses in pasture were identified and soils were classified into several types. The actual land cover and ecological environment were remarkably changeable at the rapidly industrialized area by the urbanization in the flat plane and also by the forest works and road construction in the mountainous area. The practical use of the recognition results was proved as the base map of the field survey or the retouching work of the vegetation and land use. There was a 10% cut in cost, labor, and time. Vegetation cover in Tokyo districts was estimated by both the multiregression model and the parametric model. Multicorrelation coefficient between observed value and estimated value was 0.87 and standard deviation was + or - 15%. Vegetation cover in Tokyo was mapped into five levels with equal intervals of 20%.

Descriptors: *Japan, *Land use, Environmental monitoring, Agriculture, Forests, Coasts, Oceanography, Shorelines, Earth Resources program, Fishes, Meteorology, Multispectral band scanners

Identifiers: NTISNASA

E78-10056 NTIS Prices: PC A09/MF A01

RS79-5-036

1517979 S494.5.R4U5 ID No: 78-9704435 Book Cit: 79002366
Crop forecasting by satellite, progress and problems :; Report to the Congress / by the Comptroller General of the United States. --
U.S., General Accounting Office.
Washington : General Accounting Office, iv, 28 p. ; 27 cm. 1978.
S494.5.R4U5
79002366
Note: PSAD-78-52, B-183134.
Search: 19780000
Source: OTHER US Doc Type: MONOGRAPH
Cat Codes: 8505
Descriptors: Agricultural Estimating And Reporting.; Crop Yields; Remote Sensing.

RS79-5-037

1516874 S494.5.R4Z6 ID No: 78-9702899 Book Cit: 79002368
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. --
Zoni, S V; Vedeshin, L A; Grinberg, A M
Washington : National Aeronautics and Space Administration, v, 303 leaves : ill. -- .1976?.
S494.5.R4Z6
79002368
Note: Includes bibliographical references.
Series: U.S. National Aeronautics and Space Administration. $NASA TT F ; 17, 529 Search: 19760000
Source: OTHER US Doc Type: MONOGRAPH
Cat Codes: 8505
Descriptors: Agriculture; Remote Sensing.; Earth Sciences; Remote Sensing.

RS79-5-038

1485062 QE33.2.R4R45 ID No: 78-9134504
Uses of remote sensing by the European Economic Community .Includes agricultural usage, policy making.
Valentin, J P
In Remote Sensing of the Terrestrial Environment. R. F. Peel, L. F. Curtis & E. C. Barrett, eds. p. 225-232. 1977
QE33.2.R4R45
Search: 19770000
Doc Type: ARTICLE
Cat Codes: 1030
Descriptors: Europe

RS79-5-039

1480137 1.9 P69P ID No: 78-9129557
Aerial photography for detection and identification of Fusarium .oxysporum pisi. wilt of peas
Haglund, W A; Jarmin, M L
U.S., Dept. of Agriculture, Science and Education Administration, Federal Research
Plant Dis Rep 62 (7): 570-572. July 1978
1.9 P69P
Search: 19780700
Source: USDA Doc Type: ARTICLE
Cat Codes: 4505

RS79-5-040

1485064 QE33.2.R4R45 ID No: 78-9134506
Satellite remote sensing of agricultural resources for developing countries, present and future: an international perspective
Howard, J A
In Remote Sensing of the Terrestrial Environment. R. F. Peel, L. F. Curtis & E. C. Barrett, eds. p. 248-262. Map. Ref. 1977
QE33.2.R4R45
Search: 19770000
Doc Type: ARTICLE
Cat Codes: 1025

RS79-5-041

1518538 Z5074.R45R4 ID No: 78-9705135 Book Cit: 79001101
Remote sensing of agricultural resources :; (a bibliography with abstracts) / editor, Audrey S. Hundemann. --
Hundemann, Audrey S; ed.
Springfield, Va. : National Technical Information Service, iv, 187 p. -- 1977.
Z5074.R45R4
79001101
Note: Search period covered Oct. 1973-Sept. 1977.
Series: U.S. National Technical Information Service. $NTIS/PS ; 77/0867 Search: 19770000
Source: OTHER US Doc Type: MONOGRAPH
Cat Codes: 7505
Descriptors: Agriculture; Remote Sensing; Bibliography.

RS79-5-042

1518060 157.8 R29 No.264531 ID No: 78-9704527 Book Cit: 78013728
A selected bibliography, remote sensing applications in agriculture /; By William C. Draeger and David T. McClelland. --
Draeger, William C
.s.l.. : Technicolor Graphic Services, Inc., 32 p. -- 1977.
157.8 R29 No.264531
78013728
Note: Sponsored by the U.S. Geological Survey, contract no. 1408-0001-16439.
Series: U.S. National Technical Information Service. PB ; 264531 Search: 19770000
Source: OTHER US Doc Type: MONOGRAPH
Cat Codes: 0505; 8505

RS79-5-043

1485063 QE33.2.R4R45 ID No: 78-9134505
Perspectives offered by remote sensing in agricultural resources management .Yields forcasting, survey.
Fraysee, G
In Remote Sensing of the Terrestrial Environment. R. F. Peel, L. F. Curtis & E. C. Barrett, eds. p. 233-247. Ref. 1977
QE33.2.R4R45
Search: 19770000
Doc Type: ARTICLE
Cat Codes: 1025

RS79-5-044 REMOTE SENSING IN AGRONOMY AND PEDOLOGY; IN SEARCH OF A METHODOLOGY

Girard, M.; Girard, C.; 4th Canadian Symp. on Remote Sensing Proc., No. 4, p. 1-7, 1977, Incl. French sum.
No abstract available.

RS79-5-045 TECHNIQUES OF OBLIQUE AERIAL PHOTOGRAPHY OF AGRICULTURAL FIELD TRIALS

Harris, J.R.; Haney, T.G.; Australia CSIRO, Div. Soils Tech., Pap. No. 19, 40 p., 1973
No abstract available.

RS79-5-046 A KEY STUDY ON THE INTERPRETATION OF REGIONAL SOIL MOISTURE ON SATELLITE IMAGERY

Palabekiroglu, S.; 4th Canadian Symp. on Remote Sensing Proc. No. 4, p. 149-157, 1977, Incl. French sum.
No abstract available.

RS79-5-047 REAP LAND COVER ANALYSIS OF NORTH DAKOTA USING COMPUTER PROCESSED LANDSAT IMAGERY

Reid, J.R.; Johnson, A.W.; N. Dakota Academy of Sci. Proc., V 31, Part 2, p. 141-155, 1978, 70th Annual Mtg.
No abstract available.

RS79-5-048 QUANTITATIVE PREDICTIONS OF CHEMICAL SOIL CONDITIONS FROM MULTISPECTRAL AIRBORNE, GROUND, AND LABORATORY MEASUREMENTS

Schreier, H.; 4th Canadian Symp. on Remote Sensing Proc., No. 4, p. 106-112, 1977, Incl. French sum.
No abstract available.

Section 5

VEGETATION

B. Forestry

RS79-5-049

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

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

RS79-5-050

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

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

RS79-5-051

N79-10500*# National Aeronautics and Space Administration, Washington, D. C.
FOREST INVENTORY OF EAST THAILAND USING ERTS-1 AND GROUND TRUTH SURVEY
Darasi Sisaengthong Aug. 1976 35 p refs Transl. into ENGLISH of Rept. No. 750227 Office of the Natl. Sci. Comm. Office of the Min., Bangkok, Sep. 1975 p 1-33 Transl. by Joint Publications Research Service, Arlington
(NASA Order W-13183)
(NASA-TT-F-17065) Avail: NTIS HC A03/MF A01 CSCL 02F

The organization of the project to survey forest areas using LANDSAT 1 photographs is discussed as well as the operation of the satellite itself. Photointerpretation methods are described and discrepancies between the maps based on satellite photographs and ground surveys are examined. A.R.H.

RS79-5-052

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

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

RS79-5-053

A79-13794 Quantifying gypsy moth defoliation. R. L. Talerico, T. A. Skratt (U.S. Department of Agriculture, Northeastern Forest Experiment Station, Hamden, Conn.), and J. E. Walker (Calspan Corp., Buffalo, N.Y.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Nov. 1978, p. 1385-1392. 9 refs. Research sponsored by the U.S. Department of Agriculture.

The study investigates the potential of using color-infrared film (at a scale of 1:31,640) with the scene color standard (SCS) analysis as an objective method for measuring and mapping insect (gypsy moth, Lymantria dispar) defoliation of forest vegetation from aerial photos. In the SCS analysis, absolute reflectance measurements that can be related over time are produced from sequential aerial photos. This method is used to develop a quantitative index for defoliation based on photo-derived reflectance measurements, and to produce map overlays of the effect of defoliation from this index. A location in central Pennsylvania, USA, is selected. It is shown that aerial photographs analyzed by the SCS method serve as a permanent record of damage, and they provide a total picture of ground conditions such as the distribution of stand susceptibility and defoliation patterns. Sequential photography is suitable for providing a permanent record of changes in insect distribution and defoliation intensity for pest management. S.D.

RS79-5-054

A79-11761 # Development and evaluation of a photographic remote sensing system for the detection and quantification of urban tree stress. B. B. Eav, T. M. Lillesand, and P. D. Manion (New York, State University, Syracuse, N.Y.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 265-284. 17 refs. Research supported by the McIntire-Stennis Cooperative Forestry Program.

RS79-5-055

A79-11665 Landsat forest inventory of the Philippines. D. L. Dietrich and H. M. Lachowski (GE Image Processing and Analysis Center, Beltsville, Md.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 137-144.

RS79-5-056

A79-14152 # Spray block mapping control for spruce budworm using Landsat and high altitude remote sensing. M. D. Ashley and L. Morin (Maine, University, Orono, Me.). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-6, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 7-9. 9 refs. Research supported by McIntire-Stennis and U.S. Forest Service.

RS79-5-057

A79-14172 # Multi-temporal digital analysis of Landsat data for inventory of poplar planted groves in N. Italy. J. Mégier (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-6, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 135-140.

RS79-5-058

A79-11762 # Detection and mapping of spruce budworm defoliation in northern Wisconsin using digital analysis of Landsat data. R. P. Madding and H. E. Hogan (Wisconsin, University, Madison, Wis.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 285-300. 10 refs. Research supported by the Forest Service and Wisconsin Department of Natural Resources.

RS79-5-059

5.0011, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS

J.T. MAY, Univ. of Georgia, Agric. Experiment Station, *Athens, Georgia* 30601 (0060780; GEO-0025-MS-F)

OBJECTIVE: Organize physiographic land patterns into a system having significance and utility for resource managers. Develop a physiographic map of southern region using the new system.

APPROACH: Current information on physiography, soils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to form a unified regional system. Map development will be on a state basis, utilizing local authorities, aerial photography, and space imagery when appropriate.

PROGRESS: A basic physiographic map of Georgia was completed, using ERTS imagery and data from the Georgia Geological Survey. The finished map of Georgia will be an ERTS photograph mosaic with county lines and land forms drawn in. Maps for Alabama and Mississippi are almost complete.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Georgia

RS79-5-060

5.0013, REMOTE SENSING OF FOREST RESOURCES

R.M. HOFFER, Purdue University, Agric. Experiment Station, *Lafayette, Indiana* 47907 (0032384; IND059030)

OBJECTIVE: Analyze multispectral/multi-temporal scanner data from satellite altitudes, registered to supplimental data sets, and develop a set of computer-aided techniques that can be used in a repeatable, cost-effective manner to obtain maps and acreage estimates of forest and other natural resources features.

APPROACH: Utilize Landsat, Skylab, and other multispectral scanner data: Analyze spectral data characteristics and test several techniques for computer-aided analysis of multispectral, multi-temporal scanner data. Digitally overlay and register topographic, soils, and land ownership data onto Landsat scanner data. Define most effective techniques to obtain various types of map outputs requested by resource managers.

PROGRESS: Significant advances were made during the past year in the utilization of LANDSAT satellite data and computer-aided analysis techniques. Techniques were developed to digitally register and overlay LANDSAT data with topographic data (elevation, slope, and aspect). This allowed 1:24,000 scale quadrangle maps and acreage tabulations to be generated for various combinations of cover types and topographic parameters. As part of a NASA-sponsored LANDSAT-II project, a number of these maps were provided to Region 2 U.S. Forest Service personnel for evaluation and use in their planning and management programs. Cover type or land use maps were also generated for a portion of the Wayne-Hoosier National Forest in Indiana and provided to U.S. Forest Service personnel for evaluation and use. In a cooperative project with the Indiana Department of Natural Resources, forest cover types were also mapped using LANDSAT satellite data and computer analysis techniques for a coastal wetlands area in N.W. Indiana. These maps were produced on a Calcomp plotter; thereby allowing the user-agency to specify the scale of the output product desired. The evaluation by Indiana Department of Natural Resources indicated these maps had approximately 86% accuracy. Further testing of effective methodologies for analyzing the satellite data and for evaluating the cost-effectiveness of such techniques is underway.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Indiana

RS79-5-061

5.0033, REMOTE SENSING OF YIELD OF FOREST PLANTATIONS

C.E. OLSON, Univ. of Michigan, School of Natural Resources, Fisheries Forest Wildlife Prog, *Ann Arbor, Michigan* 48104 (0072439; MICY00098-F)

OBJECTIVE: Determine if yield of forest plantations can be determined from remote sensor data; How such remote-sensing data can be economically introduced into management and harvesting decisions.

APPROACH: A review of industrial forest plantation practices will be made in the South (North Carolina, Tennessee, and Texas), Lake States (Michigan), and Pacific Northwest (Washington-Oregon) to determine the critical factors affecting plantation yield. These factors, including initial survival, growth rates, and damage due to insects or disease, will be compared with proven and probable remote sensing capabilities. From this comparison we expect to identify those variables amenable to evaluation through remote sensing techniques. An attempt will be made to develop a regression model that will permit integration of known site data (e.g., soils, precipitation, and temperature) with remote sensor data to predict yield at rotation age, and to refine that prediction as additional data becomes available. We plan to work with the Weyerhaeuser Company and Packaging Corporation of America to identify how best to intergate such yield predictions into operational management processes. Approval of both firms has been obtained.

PROGRESS:

SUPPORTED BY Michigan State Government

RS79-5-062

5.0016, DEVELOPMENT OF TECHNIQUES FOR INVENTORYING ENVIRONMENTAL QUALITY OF FOREST LAND
C.C. MYERS, Southern Illinois University, School of Agriculture, Mcintire Stennis Program, *Carbondale, Illinois* 62901 (0065334; ILLZ-73-R-037)

OBJECTIVE: Define environmental units in the forested area of Southern Illinois. Identify factors that contribute to the environmental quality of these units. Devise methods of measurement and analysis for assessing the importance of these factors. Develop sampling and data processing procedures for inventorying environmental quality.

APPROACH: On early and most recent aerial photos of Southern Illinois units will be established. Within each unit types of environmental disturbance will be identified on the aerial photo. From the population data a probability sampling scheme will be devised for selecting environmental units. In the selected units ground data correlated to the photo data and measures of environmental quality will be obtained. Multivariate analysis procedures will be used to relate corrected photo data to measurements to environmental quality. The derived models will be field tested and computer processing methods will be devised.

PROGRESS: An equal probability sampling scheme was devised to select nine watersheds for study. Land use for the total area of 3,478 acres was determined and water samples were taken from the intermittent streams over a six-week period. Water quality was within the range of the Illinois Pollution Control Board Standards with the exception of fecal coliforms which was more than 2 times the allowable maximum. Logging slash was measured on three harvesting operations in Southern Illinois. Residue ranged from 29-93 cu. ft./mbf harvested for the species studied. An SIU forest computer mapping system has been devised to display individual resource items. Items can be located by selected classifications and displayed by coded symbols. The initial data displayed trees by diameter class and species on the agriculture lawn.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Illinois

RS79-5-063

5.0048, PHYSIOGRAPHIC CLASSIFICATION OF SOUTHERN PINE FOREST LANDS
W.F. MILLER, Mississippi St. University, Agric. Experiment Station, *102 Experiment Station Bldg., Mississippi State, Mississippi* 39762 (0060698; MIS-0606)

OBJECTIVE: Organize physiographic land patterns into a system having significance and utility for resource managers. Develop a physiographic map of southern region using the new system.

APPROACH: Current information on physiography, soils, and surface geology related to forest vegetation will be analyzed and coordinated. Localized information will be reorganized to form a unified regional system. Map development will be on a state basis, utilizing local authorities, aerial photography, and space imagery when appropriate.

PROGRESS: Additional LANDSAT imagery was ordered and provided to the Project Leader (Dr. Earl Hodgkins); the entire file of negatives was also provided to Dr. Hodgkins. Considerable time was spent in answering inquiries and providing information concerning availability of LANDSAT imagery, and procedures for acquiring the imagery. A presentation was made at the meeting, 'Ecosystems of the Appalachian Region -Classification and Mapping', held at Eastern Kentucky University, in August, 1976. The presentation dealt with the evolution of the land capability classification system being utilized with the LANDSAT imagery. On the basis of this presentation, the group evolved the following mission and objectives: Mission: To develop a multilevel classification of the ecological systems of the Appalachian Region satisfying the assessment objectives of several agencies, and to apply this system to map the ecosystems of the Appalachian Region. Developmental Objectives: 1. To recognize and map physiographic provinces and habitat regions at the 1:1,000,000 scale in a format similar to Hodgkins, Cannon, and Miller's 1976 map of Mississippi and Alabama for the 13 southern states and to extend this system to other states of the Appalachian Region. 2. To name the system and develop a guidebook on its use. 3. To sponsor a communications meeting on Ecosystems of the Appalachian Region. 4. To develop a proposal for multi-agency funding for an ecosystem classification.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Mississippi

RS79-5-064

5.0009, FOREST CLASSIFICATION AND INVENTORY SYSTEM USING LANDSAT, DIGITAL TERRAIN, AND GROUND SAMPLE DATA
A.H. STRAHLER, Univ. of California, Graduate School, *Santa Barbara, California* 93106 (NAS 9-15509)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-5-065

5.0032, AIR PHOTO ASSESSMENT OF TREE SURVIVAL FOLLOWING FLOODING
C.E. OLSON, Univ. of Michigan, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067811; MICY00087-F)

OBJECTIVE: Determine the number of living trees in five flooded populations of mixed bottomland species from air photos. Relate survival to water depths and flooding history.

APPROACH: Tree counts made from 1:8000 scale air photos taken six years after initial impoundment of Lake Oklawoka, Fla. Data compared with earlier ground data and field investigation one month after date of photography.

PROGRESS: Work is still delayed by the lack of additional photography resulting from adverse weather over the test site. Work will proceed during the Fall and Winter (1976-77) with data now on hand.

SUPPORTED BY Michigan State Government

RS79-5-066

TRANSITION ZONES OF FORESTED INLAND WETLANDS IN NORTHEASTERN CONNECTICUT,
Connecticut Univ., Storrs. Inst. of Water Resources.
P. H. Anderson, M. W. Lefor, and W. C. Kennard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 983. Price codes: A06 in paper copy, A01 in microfiche. Institute Report No. 29, Sept. 1978. 92 p, 10 fig, 17 tab, 86 ref, 3 append. OWRT A-058-CONN(3), 14-31-0001-4007.

Descriptors: *Wetlands, *Hydrologic cycles, *Remote sensing, *Plant populations, *Forested inland wetlands, *Transition zones, *Index of abundance, Vegetation distribution, Soil water content, Relief, *Connecticut.

Inland wetlands are valuable natural resources intimately associated with the hydrologic cycle. This study was designed to (1) investigate vegetation distribution and selected physical and chemical properties of wetland and bordering upland soils 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. All study sites were within the 45 sq. mile Town of Mansfield in northeastern Connecticut. Field research was conducted during the growing season of 1975. Line transects were laid out across wetland to upland transition zones. Plant species were identified and their positions on line transects were recorded. Crown cover was determined for herb layers, shrubs layers and the tree canopy. Changes in soil water content, soil pH, depth to water table and elevations were determined along the transects. In order to describe the distribution of plant species among the various zones (wetland, transition, upland), a statistical 'index of abundance' was developed. Discriminant analysis applied to the abundance data showed which plant species best separate wetlands from uplands and which are representative of natural plant associations. Of the criteria studied, vegetation distribution, soil water content and relief are the most useful for delineating deciduous wetland forests. These results are valuable for identifying and delineating inland wetlands using remote sensing imagery. (DeLara-Conn)
W78-12609

RS79-5-067

Nationwide Forestry Applications Program. Ten-Ecosystem Study (TES) Site I, Grand County, Colorado

Lockheed Electronics Co., Inc., Houston, Tex. Systems and Services Div.*National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.

Final rept.
AUTHOR: Dillman, R. D.
E0884H1 Fld: 93B d7810
Aug 77 54p
Rept No: LEC-10691
Contract: NAS9-15200
Monitor: NASA-CR-1515988
Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: No abstract available.

Colorado, Ecosystems, Grasslands, Forests, Skylab program, EREP, Mapping, Seasons

Identifiers: NTISNASA, NTISAGFS

E78-10061 NTIS Prices: PC A04/MF A01

RS79-5-068

Nationwide Forestry Applications Program. Ten-Ecosystem Study (TES) Site II, Warren County, Pennsylvania, Site Evaluation

Lockheed Electronics Co., Inc., Houston, Tex. Systems and Services Div.*National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.

Final rept.
AUTHOR: Reeves, C. A.
E0884G4 Fld: 8F, 93A GRAI7810
Nov 77 63p
Rept No: LEC-10565
Contract: NAS9-15200
Monitor: NASA-CR-151597
Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: The author has identified the following significant results. It was determined that hardwood in Warren County, Pennsylvania could best be inventoried in May. The acreage estimate was less than 3% different from Forest Service estimates.

Descriptors: *Pennsylvania, *Ecosystems, Timber inventory, Grasslands, Skylab program, EREP, Statistical analysis

Identifiers: Remote sensing, Forestry, Grassland, Inland waterways, Warren County(Pennsylvania), NTISNASA, NTISAGFS

E78-10060 NTIS Prices: PC A04/MF A01

Section 5

VEGETATION

C. Natural Vegetation

RS79-5-069

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

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

RS79-5-070

A79-12503 Remote sensing from space and the operational needs of range management. N. G. Seligman (ARO, Volcani Center, Bet Dagan, Israel) In: The contribution of space observations to global food information systems; Proceedings of the W. Nordberg Memorial Symposium, Tel Aviv, Israel, June 7-18, 1977. (A79-12502 02-43) Oxford, Pergamon Press, Ltd., 1978, p. 15-22. 16 refs.

A number of published reports on applications of remote sensing from satellites to range management are reviewed. Promising results have been obtained from applications to large scale regional vegetation surveys, effects of grazing use and fire on the range vegetation have been monitored, fairly accurate estimates of green biomass have been obtained. The possible applications of satellite derived information to operational range management is discussed. It is concluded that immediate applications are most promising where administration of range land is conducted by a central authority and in countries where the necessary organizational infra-structure exists. In the long run indirect applications through range research or through estimates of national and international livestock production may have the greater impact on the course of events in the field.
(Author)

RS79-5-071

A79-14158 # Multispectral classification on tidal lands. E. Dennert-Möller (Hannover, Technische Universität, Hanover, West Germany). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 37-40.

The application of maximum-likelihood classification to multispectral images of the tidal flats of the Jade estuary at the North Sea is discussed. Frame photographs, Landsat images, and airborne multispectral scans were obtained of such tidal flat structures as mud flats, sand flats, dry sand, seagrass, diatoms, and certain types of shells. It is found that the maximum likelihood method is successful in classifying uncovered tidal flats (such as mud and sand flats) and in discriminating them from covered flats. The same thing is true for seagrass meadows if the training fields are pretreated in the specified manner. Diatoms, however, cannot be classified in this way. B.J.

RS79-5-072

A79-11664 Mapping land covers from satellite images - A basic, low cost approach. C. D. Elifrits, D. J. Barr (Missouri-Rolla, University, Rolla, Mo.), T. W. Barney, and C. J. Johannsen (Missouri-Columbia, University, Columbia, Mo.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 106-122.

Better land management can be accomplished only through adequate collection of data which identifies present land resources and provides a basis for evaluation of land resource capabilities with respect to future needs. Remote sensor imagery and satellite imagery in particular, provides a means for supplying data which is current, synoptic, readily obtainable and relatively inexpensive. The launching of the Earth Resources Technology Satellite now called Landsat, initiated a new era in the application of remote sensing technology to land resource inventory. An outline is presented of a visual interpretation approach for interpreting and mapping general land cover types from Landsat images. Emphasis is placed upon the use of Landsat false color composites at a scale of 1:250,000. This approach is designed for users who have little or no experience with satellite imagery, want to minimize their expenditures of time and financial resources, and have limited or essentially no access to equipment normally used in image interpretation. G.R.

RS79-5-073

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

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

RS79-5-074

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

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

RS79-5-075

REMOTE SENSING OF AQUATIC PLANTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
L. E. Link, Jr., and K. S. Long.
In: Miscellaneous Paper A-77-3, August 1977. Proceedings, Research Planning Conference on the Aquatic Plant Control Program, 19-22 October 1976, Atlantic Beach, Florida. p 269-288, 8 fig, 4 tab, 4 ref.

Descriptors: *Remote sensing, *Aquatic weed control, *Mapping, *Monitoring, *Measurement, *Aerial photography, *Aquatic Plant Control Program, Aquatic plants, Species composition, Multispectral scanners, Side-looking radar, Thermal scanners, Infrared radiation, Model studies, Lakes, Reservoirs, Louisiana, Mississippi, South Carolina, Satellites, Films, Water hyacinth, Hydrilla verticillata, Egeria densa, Duckweed, Eutrophication, Water pollution effects.

Use of remote sensor systems for mapping the distribution and character of aquatic plants for control purposes is under study at the U.S. Army Engineer Waterways Experiment Station. The project covers: (1) problem definition, (2) literature review, (3) systems description, (4) model studies, and (5) field studies. Remote sensor imagery includes spectral properties (image tones), pattern properties (groupings of image tones), and association properties (knowledge of the site on the part of the interpreter). Basic types of remote sensing systems are: (1) aerial photography, including multispectral scanners; (2) thermal-infrared systems; and (3) radar or microwave systems (side-looking radar). Aerial photography, Landsat multispectral scanners, and side-looking radar systems appear to offer the greatest potential; thermal-IR sensors are probably the least useful. A computerized mathematical model of relationships between photographic remote sensors and environmental factors was developed to evaluate performance of various film/filter combinations. An example of output is given. Several field studies to verify model predictions and acquire information on extent and composition of aquatic plant species were conducted April-September 1976 at: (1) Lake Boeuf, Louisiana; (2) Lake Theriot, Louisiana; (3) Ross Barnett Reservoir, Mississippi; and (4) Santee-Cooper Reservoir (Lake Marion), South Carolina. Future studies are described. (See also W78-11591) (Lynch-Wisconsin)
W78-11621

RS79-5-076

VARIABILITY OF WETLAND REFLECTANCE AND ITS EFFECT ON AUTOMATIC CATEGORIZATION OF SATELLITE IMAGERY,
Delaware Univ., Newark. Center for Remote Sensing.
V. Klemas, and D. Bartlett.
Available from the National Technical Information Service, Springfield, VA 22161 as N77-21505, Price codes: A02 in paper copy, A01 in microfiche. Goddard Space Flight Center, Greenbelt, Maryland. January 10, 1977. 1 p.

Descriptors: *Remote sensing, *Delaware, *Tidal marshes, Wetlands, Mapping, Marshes, Marsh plants, Tides, Shore-line cover, Spatial distribution, LANDSAT, Multispectral data.

A technique for automated analysis of satellite (LANDSAT) multispectral data based on in situ measurements of target reflectance was tested and applied in delineating cover types in Delaware's tidal wetlands. The technique evaluated in situ measurements of target radiance and an atmospheric correction procedure to derive reflectance signatures for land-cover categories. Significant correlations were found between single band reflectances and tidal inundation and plant morphologic characteristics. (Steiner-Mass)
W78-12690

RS79-5-077

REMOTE SENSING FOR IDENTIFICATION AND CLASSIFICATION OF WETLAND VEGETATION,
Fisheries and Wildlife, Jamestown ND. Northern Prairie Wildlife Research Center.
L. M. Cowardin, and V. I. Myers.
Journal of Wildlife Management, Vol 38, No 2, p 308-314, April, 1974. 1 fig, 3 tab, 24 ref.

Descriptors: *Remote sensing, *Wetlands, *Vegetation, *Infrared radiation, Aquatic plants, Lakes, Swamps, *Minnesota, Wild rice, Floating plants, Aerial photography, Multispectral photography.

Multispectral photography and ground truth were obtained on an area of 12 miles (19.3 km) east of Bemidji, Minnesota, to identify and map wetlands less than 2 acres (0.8 hectare) in size, to map emergent vegetation in lakes, and to explore the feasibility of classifying vegetation from aerial photographs. Wetlands less than 2 acres in size were identified on photography taken in May 1971, and emergent vegetation was recorded on purposely overexposed infrared black and white photography from a flight in September 1971. Several vegetation types and species groups were recongizable with the aid of color, color infrared, and black and white infrared photography. Proper timing of flights, use of multispectral photography, and knowledge of the ecology of the area are considered essential for wetland mapping by remote sensing. (Stihler-Mass)
W78-12689

RS79-5-078

REMOTE SENSING TO IDENTIFY, ASSESS, AND PREDICT ECOLOGICAL IMPACT ON LAKE CHAMPLAIN WETLANDS,
State Univ. of New York Coll. at Plattsburgh.
D. J. Bogucki, and G. K. Gruendling.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 339, Price codes: A10 in paper copy, A01 in microfiche. Final Report, 1978. 191 p, 8 fig, 36 tab, 10 plates, 66 ref. OWRT C-6075 (5210)(1).

Descriptors: *Lake Champlain, *Wetlands, *Remote sensing, *Water level regulation, New York, *Aquatic vegetation, Vermont, Ecology, Ecological distribution, Environmental effects, Aerial photography, Pre-impoundment.

The objectives were to (1) utilize remote sensing techniques (color and color infrared aerial photography) to map aquatic vegetation for 12 priority Lake Champlain wetlands (9135 hectares) at a 1:2500 scale, (2) analyze the ecological effects of naturally fluctuating lake levels on the composition and distribution of major aquatic plant populations, and assess the possible effects of water level regulation from the proposed Richelieu River dam construction. Evaluation of the effects of naturally fluctuating water levels on selected aquatic vegetation over a three year period indicated that certain floating, emergent, and shrub species (particularly Typha angustifolia, Sparganium curycarpum, Scirpus fluviatalis, Cephalanthus occidentalis, Nuphar varicgatum, and Nymphaea tuberosa) benefit from high water levels. All showed decreases in distribution, density, and/or vigor during the 1975 and 1977 low water years. Low water conditions appear most favorable for the emergent Zizania aquatica and for the maintenance of the green timber areas. If Lake Champlain should be regulated, each of the Lake Champlain wetlands would react in a different manner. The varied present day wetland characteristics with respect to vegetation composition, slope, exposure, soils, and basin configuration all combine to result in a wide range of possible ecological impacts.
W78-12601

RS79-5-079

COMPUTER-AIDED ANALYSIS OF LANDSAT DATA FOR SURVEYING TEXAS COASTAL ZONE ENVIRONMENTS,
Purdue Univ., Lafayette, IN. Lab. for Applications of Remote Sensing.
S. J. Kristof, and R. A. Weismiller.
Available from the National Technical Information Service, Springfield, VA 22161 as E78-10018, Paper copy, A03 in paper copy, A01 in microfiche. Report No LARS Tech Rept 090677, to NASA/ Johnson Space Center, September 1977. 32 p, 22 fig, 2 tab, 7 ref. NAS9-14016, NAS9-14970.

Descriptors: *Remote sensing, *Coasts, *Texas, *Baseline studies, Resources, Water resources, Environmental effects, Pollution, Geomorphology, Outer Continental Shelf, Coastal zone.

A study was conducted to determine the feasibility of using machine-aided processing of LANDSAT data to inventory environmental units within the Texas coastal zone. The analysis was conducted on Landsat data collected on November 27, 1972 and February 25, 1975 over the Matogorda Bay area of the Texas coastal estuarine system. The following terrestrial and aquatic environments were discriminated: alternating beach ridges, swales, sand dunes, beach berms, deflation surfaces, land-water interface, urban, spoil areas, fresh and salt water marshes, grass and woodland, recently burned or grazed areas, submerged vegetation and waterways. Visual observation of results obtained from both the November 1972 and February 1975 data indicate that no major differences existed in the land resource maps. The results did show that analysis of Landsat data with computer-aided techniques is a viable technique for surveying coastal features. (Sinha-OEIS)
W78-12178

RS79-5-080

0129753 *78-004519
THE DENALI ASVT REMOTE SENSING PROJECT: APPLICATION IN ALASKA,
WALLER LOUIS R.
USBLM, ANCHORAGE,
PRESENTED AT NORTH AMERICAN FOREST LANDS AT LATITUDES N OF 60 SYM, FAIRBANKS, SEP 19-22, 77, P85 (23)

TECHNICAL REPORT: THE JOINT NASA-USBLM-USGS APPLICATION SYSTEM VERIFICATION AND TRANSFER PROJECT IN ALASKA USING LANDSAT REMOTE SENSING IMAGERY IS DESCRIBED. THE OBJECTIVE OF THE PROGRAM AS FAR AS IT CONCERNS USBLM IS TO TEST AND IMPLEMENT A REMOTE SENSING INVENTORY SYSTEM FOR WILD LAND VEGETATION RESOURCES. THE OUTPUT OF THE DENALI PORTION OF THE PROJECT IS DESIGNED TO PROVIDE FOR AN IN-DEPTH EVALUATION BY USBLM PERSONNEL TO PROVIDE A BASIS FOR DECISION-MAKING IN FUTURE AREAS WHEE INVENTORY DATA ARE NEEDED. IN 1977, THERE WERE ABOUT 13 DIFFERENT VEGETATION MAPPING EFFORTS UNDER WAY IN ALASKA ALONE. USE OF LANDSAT AND AERIAL PHOTOGRAPHY CAN ESSENTIALLY OVERCOME MANY OF THE PROBLEMS ASSOCIATED WITH A COMPLETE GROUND DATA COLLECTION EFFORT. (1 DIAGRAM, 2 MAPS)
DESCRIPTORS: *LANDSAT ; *REMOTE SENSING, INFRARED ; *ALASKA ; *PLANT COVER ; *U S BUR LAND MANAGEMENT ; *LAND USE PLANNING ; *DECISION MAKING ; *LAND USE CLASSIFICATION ; *AERIAL SURVEILLANCE ; *U S FOREST SERVICE ; CONF PAPER ; U S GEOLOGICAL SURVEY ; U S NATL AERO SPACE ADMIN
REVIEW CLASSIFICATION: 09

RS79-5-081 UTILIZATION OF BICHROMATIC REMOTE SENSING IN ARID AND SEMIARID REGIONS

Galibert, G.; Apports de la Teledetection a l'Etude des Regions Arides et Subarides, J. d'Etude Organise le 9 Avril 1976 au CNEAT, p. 10-20, 1976, Cent. Perfectionnement, Amenagement Milieu Nat., Strassbourg, France, Available in French

No abstract available.

RS79-5-082 THE MAPPING OF ECOLOGICAL LAND UNITS OF LABRADOR UTILIZING LANDSAT IMAGERY

Prout, N.A.; 4th Canadian Symp. on Remote Sensing Proc., No. 4, p. 282-293, 1977, Incl. French sum.

No abstract available.

Section 6

OCEANOGRAPHY

Wave Morphology, Icebergs, Seastate, Coastlines, Flora and Fauna

RS79-6-001

N78-33696*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
GEOS-3 OCEAN CURRENT INVESTIGATION USING RADAR ALTIMETER PROFILING Final Report
Clifford D. Leitao, Norden E. Huang, and Carlos G. Parra (EG and G Washington Anal. Serv. Center, Inc., Pocomoke City, Md.) Oct. 1978 32 p refs
(Contract NAS6-2730)
(NASA-TM-73280) Avail: NTIS HC A03/MF A01 CSCL 08C

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

RS79-6-002

5.0016, SEASAT SATELLITE ALTIMETRY
G. HADIGEORGE, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF581400)

AF function - use of altimetric data for the estimation and refinement of the earth's gravity field. Deficiency - lack of more precise data contributes to geodetic and gravimetric missile guidance errors. Objective - determine the accuracy with which the global geoid and earth's gravity field can be estimated from altimetric and gravimetric observations using rigorous mathematical techniques. How research contributes - improvement in the mathematical model and better representation of the global geoid and geopotential will reduce geodesy and gravity contributions to missile guidance errors.

Mathematical algorithms will be tested and/or modified for highly efficient data processing, so that detailed gravimetric features in regions with abundant GEOS-3 and SEASAT altimetric data may be extracted. Using the newly developed algorithms, conduct SEASAT studies, computer analyses, and evaluations to determine the most efficient procedure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

RS79-6-003

5.0054, FEASIBILITY OF REMOTE SENSING BENTHIC MICROALGAE
R.G. ZINGMARK, Univ. of South Carolina, School of Science & Math., Biology, *Administration Bldg., Room 115, Columbia, South Carolina* 29208 (NSG 1523)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-6-004

5.0030, SEASAT-A DATA AND OCEAN SURFACE WEATHER ANALYSIS
W.J. PIERSON, City University of New York, School of Liberal Arts & Sci., *New York, New York* 10031 (DN875051; N00014-77-C-0206)

The objective of this program is to assess the particular SEASAT-A data analysis needs of FNWC and to demonstrate how to correct the backscatter attenuation by use of scanning multifrequency microwave radiometer (SMMR), visible, and infrared data to achieve the vector wind field within the swath width at the resolution of the SEASAT-A satellite scatterometer (SASS) approach.

A SEASAT-A simulated data tape will be merged with simulated SMMR, visible, and IR data tapes. These data will then be used to demonstrate the path loss corrections required for the SASS either by simulation or by procedures immediately applicable to SEASAT data. Aliases possible in the SASS data will be determined by using available FNWC analysis and forecast products of conventional data. The FNWC surface analyses of wind and pressure will include the raw spot data as well as analyzed values and contour maps of the data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

RS79-6-005

NASA/Cousteau Ocean Bathymetry Experiment. Remote Bathymetry Using High Gain LANDSAT Data

Environmental Research Inst. of Michigan, Ann Arbor.

Final Report, Aug. 1975 - Apr. 1976.
AUTHOR: Polcyn, F. C.
E0923H4 Fld: 8J, 47G STAR1606
Jul 76 132p
Rept No: NASA-CR-156658, ERIM-118500-1-F
Contract: NAS5-22597
Monitor: 18

Abstract: Satellite remote bathymetry was varified to 22 m depths where water clarity was defined by alpha = .058 1/m and bottom reflection, r(b), was 26%. High gain band 4 and band 5 CCT data from LANDSAT 1 was used for a test site in the Bahama Islands and near Florida. Near Florida where alpha = .11 1/m and r(b) = 20%, depths to 10 m were verified. Depth accuracies within 10% rms were achieved. Position accuracies within one LANDSAT pixel were obtained by reference to the Transit navigation satellites. The Calypso and the Beayondan, two ships, were at anchor on each of the seven days during LANDSAT 1 and 2 overpasses: LORAN C position information was used when the ships were underway making depth transects. Results are expected to be useful for updating charts showing shoals hazardous to navigation or in monitoring changes in nearshore topography.

Descriptors: *Atlantic Ocean, Bathymeters, LANDSAT satellites, Remote sensors, Depth measurement, LORAN C, Multispectral band scanners, Nasa programs, Oceanography, Shoals

Identifiers: *Bathymetry, *Remote sensing, NTISNASA

N78-15662/7ST NTIS Prices: PC A07/MF A01

RS79-6-006 CARTOGRAPHIC ANALYSIS OF COASTAL CHANGE, NATURAL AND URBAN

Chardon, R.; Res. Techniques in Coastal Environ., Geosci. Man., V 18, p. 257-267, 1977
No abstract available.

RS79-6-007 USING AERIAL PHOTOGRAPHY AND ELECTRONIC COMPUTERS IN THE STUDY OF COASTAL DISPLACEMENTS, UPPER IONIAN SEA LITTORAL EVOLUTION (GULF OF TARANTO) IN THE LAST 30 YEARS

Cocco, E.; De Pippo, T.; Pennetta, M.; Soc. Geol. Ital. Boll., Boll., V 95, No. 1-2, p. 275-312, 1976, Available in French
No abstract available.

RS79-6-008 COASTAL MAPPING WITH RADAR

Lewis, A.J.; Res. Techniques in Coastal Environ., Geosci. Man, V 18, p. 239-247, 1977
No abstract available.

RS79-6-009 AERIAL PHOTOGRAPHIC INTERPRETATION OF THE BENTHIC COMMUNITIES ON BRUCE SHOALS, BISCAYNE BAY, FLORIDA

Nowlin, R.; Tennessee Academy Sci., J., V 52, No. 2, p. 67, 1977
No abstract available.

RS79-6-010 A HIERARCHICAL APPROACH TO SATELLITE INVENTORIES OF COASTAL ENVIRONMENTS

Weisblatt, E.; Res. Techniques in Coastal Environ., Geosci. Man, V 18, p. 215-227, 1977
No abstract available.

RS79-6-011 HIGH-FREQUENCY TECHNIQUES AND OVER-THE-HORIZON RADAR IN COASTAL RESEARCH

Wiseman, W.J.Jr.; Murray, S.P.; Roberts, H.H.; Res. Techniques in Coastal Environ., Geosci. Man, V 18, p. 229-238, 1977
No abstract available.

Section 7

REGIONAL PLANNING AND LAND USE

RS79-7-001

N78-32516*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report, 1 Jun. - 31 Aug. 1978
Toby N. Carlson, Principal Investigator 1 Sep. 1978 7 p refs ERTS
(Contract NAS5-24264)
(E78-10210; NASA-CR-157583; Rept-3) Avail: NTIS HC A02/MF A01 CSCL 13B
There are no author-identified significant results in this report.

RS79-7-002

N78-31486*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF ORBITAL IMAGES AS A BASIS FOR LAND UTILIZATION
Nelson deJesusParada, Principal Investigator, Mario Valerio Filho, Nilton Tocicazu Higa, and Vitor CelsodeCarvalho Jul. 1977 38 p refs In PORTUGUESE; ENGLISH summary ERTS
(E78-10187; NASA-CR-157377; INPE-1054-NTE/091) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

RS79-7-003

N78-31482*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LANDSAT (MSS): IMAGE DEMOGRAPHIC ESTIMATIONS
Nelson deJesusParada, Principal Investigator and Celina Foresti Nov. 1977 35 p refs Presented at Simposio Internacional de Percepcion Remota Applicada a Demografia y Uso Actual de Tierra, Lapaz, Bolivia, 28-30 Nov. Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E78-10183; NASA-CR-157373; INPE-1151-PE/103) Avail: NTIS HC A03/MF A01 CSCL 05K
The author has identified the following significant results. Two sets of urban test sites, one with 35 cities and one with 70 cities, were selected in the State, Sao Paulo. A high degree of colinearity (0.96) was found between urban and areal measurements taken from aerial photographs and LANDSAT MSS imagery. High coefficients were observed when census data were regressed against aerial information (0.95) and LANDSAT data (0.92). The validity of population estimations was tested by regressing three urban variables, against three classes of cities. Results supported the effectiveness of LANDSAT to estimate large city populations with diminishing effectiveness as urban areas decrease in size.

RS79-7-004

N78-33610*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERIAL THERMOGRAPHY FOR ENERGY CONSERVATION
John R. Jack Sep. 1978 22 p refs Original contains color illustrations
(NASA-TM-78959; E-9711) Avail: NTIS HC A02/MF A01 CSCL 14E
Thermal infrared scanning from an aircraft is a convenient and commercially available means for determining relative rates of energy loss from building roofs. The need to conserve energy as fuel costs makes the mass survey capability of aerial thermography an attractive adjunct to community energy awareness programs. Background information on principles of aerial thermography is presented. Thermal infrared scanning systems, flight and environmental requirements for data acquisition, preparation of thermographs for display, major users and suppliers of thermography, and suggested specifications for obtaining aerial scanning services were reviewed. B.B.

RS79-7-005

A79-11755 # The use of Landsat-derived land cover data in a flood peak correlation study. A. W. Voss (Tennessee Valley Authority, Mapping Services Branch, Chattanooga, Tenn.), J. E. Baker (Hydrocomp, Inc., Atlanta, Ga.), G. E. Hauser, and D. W. Newton (Tennessee Valley Authority, Flood Control Branch, Knoxville, Tenn.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 135-146. 7 refs.
Ground cover information derived from Landsat data has been used to estimate the flood flow frequency for ungaged watersheds. A set of prediction equations, defining flood flow at several exceedence frequencies as a function of ground cover and other geomorphic and climatic characteristics, is developed on the basis of multiple regression techniques. Nine ground-cover groups are defined for two Landsat scenes: eastern Tennessee and portions of the Tennessee Valley. Eleven geomorphic characteristics for each watershed are found from 1:24,000-scale topographic maps. The results indicate that a significant decrease in the standard error of estimate is achieved when Landsat ground-cover data is used in the regression analysis. S.C.S.

RS79-7-006

A79-11669 * A reduction in ag./residential signature conflict using principal components analysis of Landsat temporal data. D. L. Williams (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.) and F. Y. Borden (Pennsylvania State University, University Park, Pa.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 230-238. 9 refs.
One important objective of a cooperative project between the U.S. Bureau of Census and NASA is to develop the ability to accurately delineate the types of land cover in the urban-rural transition zone of metropolitan areas. The application of principal components analysis to multidate Landsat imagery is being investigated as a method of reducing the overlap between residential and agricultural spectral signatures. The statistical concepts of principal components analysis are discussed, as well as the results of this analysis when applied to multidate Landsat imagery of the Washington, D.C. metropolitan area. (Author)

RS79-7-007

A79-11754 # Interpretation of satellite and aircraft imagery for planning/design and management of marine parks and reserves. J. A. Dobbin (James Dobbin Associates, Toronto, Canada). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 93-117. 38 refs. Research supported by the Ford Foundation.
The establishment of marine parks and reserves represents an important new approach for the protection of critical marine ecosystems. Interpretation of remotely sensed imagery could be an effective method for the collection, classification, and analysis of resource information for planning and managing marine parks and reserves. This potential was examined in two case studies using Landsat, high and low altitude aircraft imagery, and the technique of density slicing to supplement existing information obtained from ground observations. In both case studies, interpretations revealed important new information and established the value of these techniques for site specific analyses. Landsat imagery could also be a vital tool for a survey team in the efficient acquisition of up-to-date data, especially in remote areas, for the planning of regional systems of marine parks and reserves. (Author)

RS79-7-008

A79-12089 Detection of heat loss through the use of aerial infrared imagery. N. A. Mavrotheris (USAF, Offutt AFB, Neb.) and J. L. Passauer (Defense Mapping Agency, Topographic Center, Washington, D.C.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 183-189.

The Strategic Air Command (SAC) used overhead infrared reconnaissance imagery to detect heat losses from the roofs of buildings. The effort was highly successful and revealed not only individual heat losses but also systemic losses in entire classes of buildings. On-the-spot inspections of buildings experiencing heat losses confirmed the accuracy and reliability of overhead infrared as a heat loss detector. (Author)

RS79-7-009

A78-49683 # Thermal infrared imagery use in urban energy surveys. J. E. Colcord (Washington, University, Seattle, Wash.). *(American Society of Civil Engineers, Annual Convention, Exposition and Continuing Education Program, San Francisco, Calif., Oct. 17-21, 1977.) ASCE, Transportation Engineering Journal*, vol. 104, Sept. 1978, p. 637-651. 9 refs.

The application of thermal infrared imagery in urban energy surveys is discussed. The imaging apparatus is described noting the controls, detection equipment, recording devices, and power supplies. Data obtained at university areas and urban-residential sites are given. Recommendations are made for the aerial surveillance of heat loss. S.C.S.

RS79-7-010

A79-11668 * Techniques for land use change detection using Landsat imagery. G. L. Angelici, N. A. Bryant, and S. Z. Friedman (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 217-228. Contract No. NAS7-100.

A variety of procedures were developed for the delineation of areas of land use change using Landsat Multispectral Scanner data and the generation of statistics revealing the nature of the changes involved (i.e., number of acres changed from rural to urban). Techniques of the Image Based Information System were utilized in all stages of the procedure, from logging the Landsat data and registering two frames of imagery, to extracting the changed areas and printing tabulations of land use change in acres. Two alternative methods of delineating land use change are presented while enumerating the steps of the entire process. The Houston, Texas urban area, and the Orlando, Florida urban area, are used as illustrative examples of various procedures. G.R.

RS79-7-011

A79-13795 Texture-tone analysis for automated land-use mapping. S.-Y. Hsu (New York, State University, Binghampton, N.Y.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Nov. 1978, p. 1393-1404. 20 refs.

The paper outlines the development of an image-processing technique with black-and-white photos on the basis of a texture analysis approach which should be applicable to other imaging systems. Two models of texture analysis are discussed. Model I with 17 spatial-tone measures derived from 3 by 3 data matrix is determined as very effective in classifying general land use types. With six additional waveform parameters, Model II is developed specifically to discriminate objects and scenes of subtle differences. The solution algorithms for Model I and Model II are programmed in FORTRAN language. In addition to the feature extractor and the classifier, the hit-rate and false alarm rate also depend on the factors regarding sample size, location, and number of training sets. A correct classification rate of 95% for the training set and 85-90% for the data property set is obtained with panchromatic images. S.D.

RS79-7-012

A79-14168 * # Computer-aided analysis of Landsat data for surveying Texas coastal zone environments. S. J. Kristof and R. A. Weismiller (Purdue University, West Lafayette, Ind.). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universitat Graz, 1978, p. 107-115. 7 refs. Contracts No. NAS9-14016; No. NAS9-14970.

The feasibility of using machine-aided processing of Landsat data to inventory environmental units was studied by analyzing geometrically corrected and spatially registered Landsat data collected over the Matagorda Bay area of the Texas coastal estuarine system. A clustering algorithm (nonsupervised processor) was used to divide the data into groups of sample points of similar spectral characteristics, and correlation of spectral classes with reference data on a point-to-point basis showed the coastal features exhibit unique spectral variations. Use of a maximum likelihood algorithm permitted discrimination of 13 terrestrial and aquatic environments. M.L.

RS79-7-013

A79-14167 # Realistic land use mapping. O. Kolbl (Eidgenössische Anstalt für das Forstliche Versuchswesen, Birmensdorf, Switzerland). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 103-106. 7 refs.

Several land-use mapping methods are compared with reference to two projects in Switzerland: a national forest inventory and a land-use statistic for regional planning. The methods taken into consideration are: (1) the use of multispectral images combined with automatic classification modes, (2) texture analysis of conventional black and white photographs, and (3) visual photointerpretation supported by electronic data processing. The paper tries to highlight the state of the art in remote sensing as applied to very specific tasks. B.J.

RS79-7-014

5.0068, REGIONAL PLANNING & RESOURCE MANAGEMENT - APPLICATIONS OF MONITORING AGRICULTURAL LAND USE UTILIZING REMOTE SENSING PHOTOGRAPHY

B.J. NIEMANN, Univ. of Wisconsin, Agric. Experiment Station, Landscape Architecture, *116 Agriculture Hall, Madison, Wisconsin* 53706 (0062731; WIS01906)

OBJECTIVE: Evaluate the use of remote sensing (near infrared photography .7 to .9 microns), thermal 8. to .2 microns and sensing platforms including conventional, high-altitude and satellite systems as a data source for agriculture and rural land use planning. Emphasis will be placed on the detection of resources for inclusion in the projected state-wide spatial resource data bank.

APPROACH: With the assistance of a remote sensing technical/liason committee, data needs potentially applicable for detection by remote sensing will be identified. Interpreted data will be compared with ground truth supplied by the technical/liason committee or by comparing with either of three existing spatial computer data banks.

PROGRESS: For rural regional resource planning and management the research results indicated that (1) a comprehensive understanding of large and complex landscapes is obtainable with high-altitude infrared photography and LANDSAT imagery; (2) the transfer and use of assessment variables from other resource regions for assessing landscape variation is inappropriate; (3) data analysis techniques such as cluster analysis (i.e., agglomerative and polythetic) are quite useful in gaining a new and more complete understanding of a large and complex landscape region especially when discriminating variables are unknown; (4)tandem stratified geographic sampling is an efficient and discriptive procedure by which to manage and utilize large volumes of data; (5) high-altitude color infrared photography (1:120,000) taken in the fall in conjunction with the application of sampling and cluster analysis techniques provides a useful data base for assessing rural landscape quality; (6) LANDSAT imagery paper products (1:250,000 and 1:500,000) is more efficient but not as descriptive in assessing regional landscape variance; and LANDSAT imagery proved to be especially useful in assessing landscape change if procedures are available for between date comparisons.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Wisconsin

RS79-7-015

5.0046, LAND-USE MAPPING IN DIGITAL FORMAT FROM AIR PHOTOS

C.E. OLSON, Univ. of Michigan, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067794; MICY00040-F)

OBJECTIVE: Develop an interactive, digital, storage and retrieval system for land-cover data extracted from air photos. Complete land-cover mapping of Washtenaw Co., Mich., in this digital format.

APPROACH: A one hectare grid based on the UTM coordinate system is used as the matrix for land-cover data. Also included is a four-level expansion of the classification system in USGS Circular 671, and demographic, transportation, and soil permeability data. The classification scheme includes 150 forest classes. All data inputs are based on human interpretation of existing air photos.

PROGRESS: Testing of the interactive retrieval software revealed the need for substantial modifications to the CLOVER program developed for Project SNAFOR to accommodate the flexibility required. Adaptation of the LIGMALS software developed for processing LANDSAT data appears more promising than revising CLOVER.

SUPPORTED BY Michigan State Government

RS79-7-016

5.0034, USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION

R.D. VLASIN, Michigan State University, Agric. Experiment Station, Resource Development, *New Administration Bldg., East Lansing, Michigan* 48823 (0064769; MICL01168)

OBJECTIVE: To demonstrate the operational ability and uses of remote sensing for land use planning and policy formulation. Specifically to: develop, apply, and evaluate a system which will incorporate remote sensing for classifying land use and resource characteristics; apply remote sensing to program needs of selected Michigan agencies; apply the findings of the research to the land use policy formulation process in Michigan.

APPROACH: Actual sites selected with governmental units to test usefulness of various RS applications. 'Short-term' direct agency applications to permit development, completion, evaluation, and approaches. Applications also to longer-run policy efforts. Departments of Crop & Soil Sciences, Forestry, Resource Development, Urban Planning & Landscape Architecture, and Geography involved.

RS79-7-017

5.0001, THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO SOIL MAPPING AND LAND USE PROBLEMS OF ALABAMA AND SOUTHEASTERN UNITED STATES

O.L. MONTGOMERY, Alabama Agric. & Mech. Univ., School of Agriculture, Natural Resource & Env Studies, *Normal, Alabama* 35762 (NSG 8062)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-7-018

5.0052, RAPID MAPPING OF LAND USE BASED ON REMOTE SENSED DATA

F.Y. BORDEN, Penn. State University, School of For. Resources, *102 Ferguson Bldg., University Park, Pennsylvania* 16802 (0059566; PEN01931)

OBJECTIVE: Develop a system of rapid classification and mapping of land use based on aerial photographic and multispectral remote sensed information.

APPROACH: Using computers and other specialized automatic image analysis equipment, aerial photographs, multispectral imagery and digitized imagery data will be analyzed by multivariate statistical methods and by machine-researcher interactive means to produce map displays of land use patterns such as forest types, agricultural and non-agricultural open land as two of many examples.

PROGRESS: Using the system for processing multispectral scanner (MSS) data from LANDSAT, analysis and mapping were done of land cover in Columbia county, Pa., of forest cover in parts of the Allegheny National Forest, and of geology of the San Matral region in Saudi Arabia. Results were most satisfactory using canonical analysis. Image enhancement was obtained by transforming the data by the first three axes of the canonical transformation matrix followed by a color film or cathode ray tube display. Twenty-two Skylab S192 MSS channels were evaluated by principal components and canonical analyses. Three spectral bands were found to be most important in discriminating among targets typical of Pennsylvania. Suitability analyses of various land uses for the Delaware River Water Gap Natural Recreation Area were performed on resource data organized in a grid cell format. For each land use, suitability ratings were assigned to attributes of appropriate data variables. The ratings of these data attributes for a given cell are added to arrive at an overall cell suitability score. Grey scale maps depicting various land use suitabilities were overlaid on the preliminary development plan in order to identify critical areas. Land classification maps based on data attributes or activity suitabilities were also developed to assist in planning.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Pennsylvania

RS79-7-019

5.0036, REMOTE SENSING APPLICATIONS TO LAND RESOURCE INVENTORY

B.E. FRAZIER, Washington State University, School of Agriculture, *Pullman, Washington* 99163 (0070070; WNP00323)

OBJECTIVE: Determine suitability of LANDSAT-based information for land resource inventories. Develop subclasses to the Anderson land use classification that have utility as a data base for local planners. Evaluate other remote sensing systems and techniques for potential application to land resource studies as they become available.

APPROACH: An investigation of LANDSAT-based information products for rural land use applications will be conducted using Whatcom County data. Functional subclasses of the Anderson system will be devised. Photo interpretation and satellite imagery interpretation techniques will be developed to isolate required categories. Evaluate new systems as they become available for public use, i.e., remote sensing instruments, e.g., thermal energy detectors developed for military use.

PROGRESS: Computer programs have been developed to manipulate LANDSAT CCT data. Capabilities are to produce gray scale maps in 10 levels of single or multiple lands, density slices, band ratios or other mathematical combinations, and to tabulate individual pixed brightness values. Programs have been written to operate at minimum cost by providing for reduced study area sizes (4 mi x 3 mi). Consultation was provided to the Pacific Northwest Regional Commission's Land Resource Inventory Task Force (LRITF) via appointment to its University Advisory Committee (UAC). Accomplishments of the UAC include evaluations of several LRITF remotes sensing projects and submission of mobile analysis lab proposal to NASA and PNRC. Land use change investigation in Whatcom county has continued in order to define specifically the shift from prime to non-prime agricultural areas.

SUPPORTED BY Washington State Government

RS79-7-020

5.0065, PLANNING, IMPLEMENTATION, EVALUATION OF REMOTE SENSING (PIERS)

D.E. LICHY, U.S. Army, Coastal Engin. Res. Center, *Kingman Bldg., Fort Belvoir, Virginia* 22060 (31581)

OBJECTIVE: To plan, implement and evaluate the state of art of remote sensing technology related to coastal engineering.

APPROACH: Review research related to coastal engineering and implement where applicable remote sensing techniques. Evaluate the cost-effectiveness and relate to operation Corps needs. Develop algorithms for the use of remote sensing in coastal engineering. This will involve multi-sensors evaluation such as LANDSAT, SEASAT, multi-spectral, laser and conventional aerial photography.

SUMMARY: This work unit will enable a more efficient use of remote sensing techniques in Corps projects in the coastal area. Development of methodologies and a reference manual of remote sensing techniques will be provided for use in coastal engineering projects and studies.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

RS79-7-021

5.0050, IDENTIFICATION OF ALTERNATIVES FOR LOCAL LAND USE DECISIONS

M.P. CARLSON, Univ. of Nebraska, School of Arts & Sciences, Geology, *Lincoln, Nebraska* 68508 (0066985; NEB-02-001)

OBJECTIVE: Develop remote sensing products to provide data for land use decisions. Establish criteria for defining critical environmental areas. Design procedures for delimiting specific use areas. Identify alternative definitions of land use categories. Assess impacts of these definitions.

APPROACH: Prepare and test land use maps based on ERTS imagery & RB-57 color infrared photography. Prepare, test and utilize definitions for critical environmental areas based on existing definitions & local needs. Identify present land use definitions & assess their impact on efficiacy of local land use planning & zoning.

PROGRESS: Research was continued in the area of land use planning. Manuscripts of research results are in process.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Nebraska

RS79-7-022

A Regional Land Use Survey Based on Remote Sensing and Other Data: A Report of a LANDSAT and Computer Mapping Project, Volume 2

Federation of Rocky Mountain States, Inc., Denver, Colo.*National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

Final rept.
AUTHOR: Nez, George; Mutter, Douglas L.
E0884J2 Fld: 8B, 93A, 48 GRAI7810
Apr 77 117p
Contract: NAS5-22338
Monitor: NASA-CR-155611
Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: The author has identified the following significant results. The project mapped land use/cover classifications from LANDSAT computer compatible tape data and combined those results with other multisource data via computer mapping/compositing techniques to analyze various land use planning/natural resource management problems. Data were analyzed on 1:24,000 scale maps at 1.1 acre resolution. LANDSAT analysis software and linkages with other computer mapping software were developed. Significant results were also achieved in training, communication, and identification of needs for developing the LANDSAT/computer mapping technologies into operational tools for use by decision makers. (Portions of this document are not fully legible)

Descriptors: *Land use, Regional planning, Thematic mapping, Resources management, Rocky Mountains(North America), Arizona, Colorado, Utah, Wyoming, New Mexico, Montana, Earth Resources program, Computer techniques

Identifiers: Remote sensing, NTISNASA

E78-10071 NTIS Prices: PC A06/MF A01

RS79-7-023

A Regional Land Use Survey Based on Remote Sensing and Other Data: A Report on a LANDSAT and Computer Mapping Project

Federation of Rocky Mountain States, Inc., Denver, Colo.*NASA Earth Resources Survey Program, Washington, D.C.

Final rept.
AUTHOR: Nez, George; Mutter, Doug
E0884J1 Fld: 8B, 93A GRAI7810
Apr 77 25p
Contract: NAS5-22338
Monitor: NASA-CR-155610

Abstract: The author has identified the following significant results. New LANDSAT analysis software and linkages with other computer mapping software were developed. Significant results were also achieved in training, communication, and identification of needs for developing the LANDSAT/computer mapping technologies into operational tools for use by decision makers.

Descriptors: *Land use, Arizona, Colorado, Montana, New Mexico, Utah, Wyoming, Rocky Mountains(North America), Earth Resources program, Thematic mapping, Digital data

Identifiers: *Rocky Mountain Region(United States), NTISNASA

E78-10070 NTIS Prices: PC A02/MF A01

RS79-7-024

A Regional Land Use Survey Based on Remote Sensing and Other Data: A Report of a LANDSAT and Computer Mapping Project, Volume 3

Federation of Rocky Mountain States, Inc., Denver, Colo.*National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

Final rept.
AUTHOR: Nez, George; Mutter, Douglas L.
E0884J3 Fld: 88, 93A, 48 GRAI7810
Aug 77 761p
Contract: NAS5-22338
Monitor: NASA-CR-156676
Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: The author has identified the following significant results. The project mapped land use/cover classifications from LANDSAT computer compatible tape data and combined those results with other multisource data via computer mapping/compositing techniques to analyze various land use planning/natural resource management problems. Data were analyzed on 1:24,000 scale maps at 1.1 acre resolution. LANDSAT analysis software and linkages with other computer mapping software were developed. Significant results were also achieved in training, communication, and identification of needs for developing the LANDSAT/computer mapping technologies into operational tools for use by decision makers. (Portions of this document are not fully legible)

Descriptors: *Land use, Regional planning, Thematic mapping, Resources management, Rocky Mountains(North America), Arizona, Colorado, Utah, Wyoming, New Mexico, Montana, Earth Resources program, Computer techniques, Digital data, Data processing

Identifiers: Remote sensing, NTISNASA

E78-10072 NTIS Prices: PC A99/MF A01

RS79-7-025

Mapping Land Cover from Satellite Images: A Basic, Low Cost Approach

Missouri Univ., Columbia.
AUTHOR: Elifrits, C. D.; Barney, T. W.; Barr, D. J.; Johannsen, C. J.
E1112H4 Fld: 88, 48I STAR1608
Jan 78 24p
Rept No: NASA-CR-2952, M-247
Contract: NAS8-31767
Monitor: 18

Abstract: Simple, inexpensive methodologies developed for mapping general land cover and land use categories from LANDSAT images are reported. One methodology, a stepwise, interpretive, direct tracing technique was developed through working with university students from different disciplines with no previous experience in satellite image interpretation. The technique results in maps that are very accurate in relation to actual land cover and relative to the small investment in skill, time, and money needed to produce the products.

Descriptors: *Land use, *Mapping, LANDSAT satellites, Remote sensors, Aerial photography, Low cost, Photointerpretation

Identifiers: Remote sensing, NTISNASA

N78-17446/3ST NTIS Prices: PC A02/MF A01

RS79-7-026

The Inventory and Distribution of Water and Associated Land Resources in the Garrison/Devils Lake Region of ND: An Application of Resource Data Acquired by ERTS

North Dakota Water Resources Research Inst., Fargo.*Office of Water Research and Technology, Washington, DC.

Completion rept. May 75-May 78
AUTHOR: Mower, Roland D.
F0063H4 Fld: 13B, 8H, 48G GRAI7901
May 78 28p
Rept No: WI-221-047-78
Contract: DI-14-34-0001-7072
Project: OWRT-A-047-NDAK
Monitor: OWRT-A-047-NDAK(1)

Abstract: This study was designed to inventory and spatially analyze water and land resources in the Garrison/Devils Lake Region of North Dakota using resource data acquired by ERTS. Preliminary land use studies in Mercer County involved the interpretation of black and white, and color infrared (CIR) aerial photographic imagery (1:24,000), a LANDSAT color composite image (1:250,000), a Mead Dijit Graphics Generator (DGG) image (1:225,000), and a Mead Digital Laser Printer (DLP) image (1:600,000). Subsequent land use/land cover research in the Devils Lake Basin has included the interpretation and analysis of LANDSAT computer compatible tape (CCT) data. The results of this study, in both tabular and graphic format, have been made available to various planning agencies in North Dakota and to all special task force units established by the Devils Lake Committee.

Descriptors: *Devils Lake Basin, *Land use, *Water resources, Infrared mapping, Color photography, Scientific satellites, Assessments, Management, Watersheds, Hydrology, Image processing, North Dakota, Remote sensing

Identifiers: Mercer County(North Dakota), LANDSAT satellites, NTISDIOWRT

PB-286 091/4ST NTIS Prices: PC A03/MF A01

RS79-7-027

Application of Remote Sensing Data to Surveys of the Alaskan Environment

Alaska Univ., College. Geophysical Inst.*NASA Earth Resources Survey Program, Washington, D.C.

Annual rept. 1 Jul 74-30 Jun 75
AUTHOR: Miller, J. M.; Belon, A. E.
E1005E4 Fld: 93B d7811
30 Jun 77 224p
Grant: NASA-NGL-02-001-092
Monitor: NASA-CR-155731
Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: No abstract available. (Portions of this document are not fully legible)

Alaska, Environmental monitoring, Soils, Land management, Forests, Vegetation, Earth Resources program, Land use, Data acquisition, Inventories, Data processing, Photointerpretation

Identifiers: NTISNASA

E78-10077 NTIS Prices: PC A10/MF A01

RS79-7-028

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A regional land use survey based on remote sensing and other data :; Quarterly report for period April 10-July 10, 1975 / George Nez. --
Nez, George
Goddard Space Flight Center.; Federation of Rocky Mountain States.
Denver, Colo. : Federation of Rocky Mountain States, ii, 12, .10. leaves : ill. -- 1975.
HT392.N4
78013834
Note: Project no. NAS 5-22338; prepared for Goddard Space Flight Center.
Series: U.S. National Aeronautics and Space Administration. $NASA CR ; 3233 Search: 19750000
Source: OTHER US Doc Type: MONOGRAPH Location: DCB
Cat Codes: 1005
Descriptors: Regional Planning; United States.; Remote Sensing Systems.

RS79-7-029 A METHOD FOR DRAWING SLOPE MAPS FROM AERIAL PHOTOGRAPHS

Anselmo, V.; Godone, F.; Soc. Geol. Ital. Boll., V 95, No. 1-2, p. 75-79, 1976
No abstract available.

RS79-7-030 THE USE OF THE LANDSAT IMAGE-ENHANCEMENT METHOD FOR LAND-USE MAPPING OF WINNIPEG, MANITOBA

Hathout, S.; Great Plains-Rocky Mt. Geogr. J., V 6, No. 2, p. 239-245, 1977
No abstract available.

RS79-7-031 LAND USE MAPS; THE RESULT OF A SEMI-AUTOMATIC ANALYSIS OF FALSE COLOR AERIAL PHOTOGRAPHS

Maurer, H.; Dorigo, G.; Geogr. Helv., V 33, No. 1, p. 25-28, 1978, Available in French
No abstract available.

RS79-7-032 GEOGRAPHIC INFORMATION SYSTEM DEVELOPMENT IN THE CARETS PROJECT

Mitchell, W.B.; Fegeas, R.G.; Fitzpatrick, K.A.; et al.; Central Atlantic Regional Ecological Test Site (CARETS) Project, Final Report, V 4, 71 p., 1977, USGS, Reston, VA, Cosponsored by NASA
No abstract available.

RS79-7-033 USE OF TOPOGRAPHIC DATA FOR LAND-USE LAND-COVER IDENTIFICATION BY LANDSAT IMAGERY

Solomon, S.I.; Aggarwal, A.S.; Nazar, T.; 4th Canadian Symp. on Remote Sensing Proc., No. 4, p. 158-162, 1977, Incl. French sum.
No abstract available.

Section 8

DATA MANIPULATION

Image Processing, Models, Algorithms, Simulations

RS79-8-001

N78-31498*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

ANALYTICAL TECHNIQUES FOR THE STUDY OF SOME PARAMETERS OF MULTISPECTRAL SCANNER SYSTEMS FOR REMOTE SENSING

E. R. Wiswell and George R. Cooper, Principal Investigators Jun. 1978 195 p refs EREP

(Contract NAS9-15466)

(E78-10200; NASA-CR-151827; LARS-TR-061778; EE-TR-78-28) Avail: NTIS HC A09/MF A01 CSCL 05B

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

RS79-8-002

N79-10504# Los Alamos Scientific Lab., N. Mex.

SOME TECHNIQUES FOR DIGITAL PROCESSING, DISPLAY AND INTERPRETATION OF RATIO IMAGES IN MULTISPECTRAL REMOTE SENSING

G. W. Wecksung and J. R. Breedlove 1977 9 p refs Presented at the Intern. Optical Computing Conf., San Diego, Calif., 25 Aug. 1977

(Contract W-7405-eng-36)

(LA-UR-77-1877; Conf-770844-1) Avail: NTIS HC A02/MF A01

A simple mathematical interpretation of the properties of ratio images derived from LANDSAT and other sources of multispectral imagery is presented. A spectral signature is defined which is well represented by ratios of pairs of spectral bands and can be related to the problem of clustering and unsupervised learning. Some practical problems arising in the generation of LANDSAT ratio images were considered, and an effective, simple method for reduction of the dynamic range of such images is presented along with digital image processing examples. DOE

RS79-8-003

N79-11365*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ANALYTICAL MODELS AND SYSTEM TOPOLOGIES FOR REMOTE MULTISPECTRAL DATA ACQUISITION AND CLASSIFICATION

Friedrich O. Huck, Stephen K. Park, Ernest E. Burcher, and W. Lane Kelly, IV Aug. 1978 39 p refs

(NASA-TM-78795) Avail: NTIS HC A03/MF A01 CSCL 14B

Simple analytical models are presented of the radiometric and statistical processes that are involved in multispectral data acquisition and classification. Also presented are basic system topologies which combine remote sensing with data classification. These models and topologies offer a preliminary but systematic step towards the use of computer simulations to analyze remote multispectral data acquisition and classification systems. Author

RS79-8-004

N78-31480*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

STUDY OF GEOMETRIC DISTORTIONS OF LANDSAT IMAGES

Nelson DeJesusParada, Principal Investigator, Wilson Custodio C. Dasilva, Jose Carlos Maia, and Luis Danilo Damasceno Ferreira Jun. 1978 61 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS

(E78-10181; NASA-CR-157371; INPE-1286-PE/140) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author identified significant results in this report.

RS79-8-005

N78-30645# GEC-Marconi Electronics Ltd., Chelmsford (England).

DEFINITION OF A GROUND SAR PROCESSOR FOR SEASAT-A Final Report

A. B. E. Ellis, S. R. Brooks, and W. T. Welford (Imp. Coll. of Sci. and Technol.) Paris ESA 1978 194 p refs

(Contract ESTEC-3154/77-NL-HP(SC))

(ESA-CR(P)-1060) Avail: NTIS HC A09/MF A01

Results are presented of the definition study for a ground Synthetic Aperture Radar (SAR) processor for Seasat-A. The ground processor is required to accept both SAR and auxiliary data and any external control signals. It must compress the SAR data in both range and azimuth in order to produce image data at the output, preferably on computer-compatible tape. Three options have been considered for the processor, and a general purpose array processor. The preferred solution is the array processor in view of its flexibility. However, it is the most costly solution and also will require software changes. ESA

RS79-8-006

N78-30640# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.

SOME NEW MAP DATA ENCODING SCHEMES Interim Report

Herbert Freeman 1978 11 p refs

(Grant AF-AFOSR-2937-76)

(AD-AC54853; AFOSR-78-0946TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

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

RS79-8-007

N78-30646# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).

THE PHOTOGRAMMETRIC BUNDLE ADJUSTMENT AND THE RESOLUTION OF LARGE NORMAL EQUATIONS SYSTEMS Ph.D. Thesis - Tech. Hochschule Darmstadt, West Ger. [DIE PHOTOGRAMMETRISCHE BUENDELAUSGLEICHUNG UND DIE AUFLOESUNG GROSSER NORMALGLEICHUNGSSYSTEME]

Kurt Haag Bayerische Akad. der Wiss. 1977 114 p refs In GERMAN

(Ser-C/Diss-232; ISBN-3-7696-9288-8) Avail: NTIS HC A06/MF A01

The application of bundle adjustment to photogrammetry is discussed. Approaches dealt with include a functional and stochastic model, the representation equation and the rotation matrix, stochastic properties of the image coordinates, and the taking into account of failures in the terrestrial pass points. The equation and the matrix structures of bundle adjustment and their application in a bundle adjustment program are discussed. Algorithms for solving linear equation systems, and the applications known so far in photogrammetry, are surveyed. Various procedures for the direct solving of large linear equation systems with sparsely occupied coefficient matrices are discussed. ESA

RS79-8-008

N78-31516# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

THE COVERAGE FIELD OF EARTH OBSERVATION SATELLITES AT THE EARTH SURFACE. DESCRIPTION OF THE COMPUTER PROGRAM COFI [DAS UEBERDECKUNGSFELD ERDBEOBACHTENDER SATELLITEN AUF DER ERDOBERFLAECHE. BESCHREIBUNG DES RECHNERPROGRAMS COFI]

E. Fritz Jochim and W. Pawlik 1977 66 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-487)

(DLR-IB-552-77/40) Avail: NTIS HC A04/MF A01

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

RS79-8-009

N78-32528# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

SHADED PERSPECTIVE IMAGE OF TERRAIN

Thomas M. Strat Mar. 1978 39 p refs

(Contract N00014-75-C-0643)

(AD-A055070; AI-M-463) Avail: NTIS HC A03/MF A01 CSCL 08/2

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

RS79-8-010

N78-30634*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SOME OBSERVATIONS ABOUT LANDSAT DIGITAL ANALYSIS

Robert R. Jayroe, Jr. Aug. 1978 40 p

(NASA-TM-78184) Avail: NTIS HC A03/MF A01 CSCL 05B

Several hypotheses concerning LANDSAT data are analyzed. These hypotheses are: (1) LANDSAT does not discriminate vegetation types, but mostly sees chlorophyl and canopy cover (2) A majority of the features in the ground scene possess linearly proportional amounts of color from each spectral band. (3) The data are continuous and as a result there is no true separability of ground scene features in the data, but some features possess an excess of color in a particular band pair. (4) There are relatively few features present in the spectral data, and these do not correspond to the conventional definitions that are used. (5) Aside from seasonal effects, in a distributional sense all LANDSAT data are essentially the same. The only difference is the way the data are spatially arranged in the image. S.B.S

RS79-8-011

A79-12279 Markov image modeling. J. W. Woods (Rensselaer Polytechnic Institute, Troy, N.Y.). *IEEE Transactions on Automatic Control*, vol. AC-23, Oct. 1978, p. 846-850. 15 refs. Grant No. AF-AFOSR-77-3361.

The theory of two-dimensional spectral factorization is reviewed in the context of recursive modeling. The role of the Markov random field in recursive image modeling is then presented. Since spectral factorization in two or higher dimensions generally results in infinite-order factors, it is necessary to perform Markov modeling after spectral factorization. The above concepts are then applied to the problem of Kalman filtering of images. (Author)

RS79-8-012

A79-12111* A system for extracting three-dimensional measurements from a stereo pair of TV cameras. Y. Yakimovsky (Miami, University, Miami, Fla.) and R. Cunningham (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Computer Graphics and Image Processing*, vol. 7, 1978, p. 195-210. 21 refs. Contract No. NAS7-100.

Obtaining accurate three-dimensional (3-D) measurement from a stereo pair of TV cameras is a task requiring camera modeling, calibration, and the matching of the two images of a real 3-D point on the two TV pictures. A system that models and calibrates the cameras and pairs the two images of a real-world point in the two pictures, either manually or automatically, was implemented at JPL. This system is operating and provides three-dimensional measurement resolution of plus or minus 5 mm at distances of about 2 m. (Author)

RS79-8-013

A79-11752* User-oriented data processing considerations in linear array applications. R. A. Tracy and R. I. Noll (Westinghouse Electric Corp., Baltimore, Md.). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 55-61.

Past generations of remote sensors on spacecraft have used mechanically scanned point detectors. To meet the requirements of flexibility, compactness, low power, and high reliability, future systems will make use of the solid-state line array technology. Line array applications provide the user with many advantages such as increased dynamic range and geometric stability but also present them with a unique set of processing requirements. Dark current, responsivity variations, and thermal drifts must be corrected for thousands of individual elements. (Author)

RS79-8-014

A79-14175 # DIBIAS - The digital image processing system at DFVLR, system design and applications. P. Nowak (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Oberpfaffenhofen, West Germany). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 167-169.

Attention is given to the design, hardware, software, and applications of the DIBIAS image processing system. The system, which does not require extensive operator training, offers immediate data display on a color television screen. The hardware consists of an alphanumeric terminal and keyboard, a graphic terminal, a flying-spot scanner to digitize transparencies from 30- and 70-mm film, and an electronic film recorder. The software is divided into five subsystems: elementary image enhancement, multispectral classification, digital filtering, texture analysis, and processing programs. S.C.S.

RS79-8-015

A78-47083 Standard Mesh compatible Landsat mapping. S. Tanaka, H. Kano (Remote Sensing Technology Center of Japan, Tokyo, Japan), and Y. Suga (Hosei University, Koganei, Tokyo, Japan). In: International Symposium on Space Technology and Science, 12th, Tokyo, Japan, May 16-20, 1977, Proceedings. (A78-47001 21-12) Chofu, Tokyo, National Aerospace Laboratory, 1977, p. 605-610.

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

RS79-8-016

A79-12278 Estimation-detection of object boundaries in noisy images. N. E. Nahi and S. López-Mora (Universidad de los Andes, Bogota, Colombia). *IEEE Transactions on Automatic Control*, vol. AC-23, Oct. 1978, p. 834-846. 23 refs. NSF Grant No. ENG-75-03423; Contract No. F33615-76-C-1203.

Estimation of boundaries of objects in noisy images is considered when the objects and the background are statistically characterized. The noise is assumed white, additive, and Gaussian. Optimal recursive estimators in a joint estimation-detection context are derived. Applications to binary pictures are illustrated. (Author)

RS79-8-017

A79-14182 # Innovations in digital image processing. A. N. Williamson (U.S. Army, Engineer Waterways Experiment Station, Vicksburg, Miss.). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 223-231.

The image data processing equipment used by the U.S. Army Engineer Waterways Experiment Station is described including the PDP-15 computer system and the electromechanical drum-type film-scanning and film-writing system. A technique is presented for producing suspended material distribution maps on the basis of spectrum matching. Methods for detecting time-dependent changes are described. Attention is given to the use of color composites for the visual interpretation of changes and to the digital comparison of Landsat scenes. S.C.S.

RS79-8-018

A79-14174 # Digital detection of linear features in satellite imagery. L. Montoto (IBM España, Madrid Scientific Center, Madrid, Spain). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-05) Graz, Technische Universitat Graz, 1978, p. 149-153.

A set of algorithms is presented designed to locate lines and curves in multispectral images and to connect those linear features with identical characteristics (i.e. radiance levels). The user runs interactively the set of algorithms in sequential order starting with a line and a curve detection and ending with a line following algorithm. The line and curve detection algorithm uses local operators to first enhance linear features in the input image and, second, associate a vector to every pixel belonging to those features with a magnitude and direction related to the m x m neighbors of that pixel through a template-matching process. The algorithm has been applied to locate the drainage network of rivers in Central Spain using Landsat multispectral images. (Author)

RS79-8-019

A78-52692 Television techniques in image processing. T. H. Williams, R. M. Lee, and M. E. Barnett (Imperial College of Science and Technology, London, England). *Optica Acta*, vol. 25, Aug. 1978, p. 839-847. 5 refs.

The evolution of a single-channel video-processing system is described, together with the design and operation of a related four-channel instrument. The incorporation of this system into a video-rate interactive multispectral classifier for remote sensing imagery is discussed. (Author)

RS79-8-020

A79-12073 Balloon Altitude Mosaic Measurements /BAMM/ Program. W. G. Weppner (USAF, Space and Missiles Systems Organization, Los Angeles, Calif.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 41-44; Discussion, p. 44.

The Balloon Altitude Mosaic Measurements Program (BAMM) is designed to make temporal, spatial, and spectral measurements of earth backgrounds in the infrared. The measurements obtained from BAMM will support another SAMSO development, the Mosaic Sensor Program. The measurements will be made from a stabilized balloon-borne platform at 100,000 ft. altitude. Scenes to be viewed are background sources such as cirrus clouds, high altitude lakes and snowfields, ocean effects (glitter, land/sea interface), and temporal buildup of cumulus clouds. Emphasis will be on obtaining these measurements at low sun-scattering angles. The instruments consist of a 2.7-micron radiometer, a 2.5-5.5-micron interferometer, and a TV camera for real-time viewing and pointing. Four-by-four element mosaic arrays will be the focal planes for the radiometer and interferometer. Per-element resolution is 1 kilometer at nadir. Seven flights are planned, each approximately ten hours duration, beginning in January 1978. (Author)

RS79-8-021

A79-14171 # Quantification of the changes of large areas by comparing the frequency distributions of digital images. R. Lepuschitz (Wien, Technische Universität, Vienna, Austria). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 131-133.

A procedure for classifying changes in an area using two digital Landsat MSS images is presented. One image is taken before the change (e.g. snow-fall), the other after. Changes are detected using the frequency distributions of the grey values of corresponding pixels. The procedure is applied to one pair of Landsat images of Tyrol to map the snow-cover. (Author)

RS79-8-022

A78-52688 Optical decoding of satellite-borne synthetic aperture radar. M. E. Barnett, R. W. Smith, and W. T. Welford (Imperial College of Science and Technology, London, England). *Optica Acta*, vol. 25, Aug. 1978, p. 707-714.

The optical decoding of synthetic aperture radar carried on an earth-orbiting satellite is discussed. Restrictions on the peak power available for the radar pulses are considered. It is noted that since satellites travel in an inertial orbit relative to fixed stars, the earth's diurnal rotation creates transverse terrain movements relative to the satellite path. S.C.S.

RS79-8-023

A79-14151 Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Technische Universität Graz, Graz, Austria, October 3-5, 1977. Symposium supported by the Austrian Solar and Space Agency, Federal Ministry for Science and Research, U.S. Army, et al. Edited by F. W. Leberl (Graz, Technische Universität, Graz, Austria). Graz, Technische Universität Graz (Geodätisches Institut, Mitteilungen, No. 29), 1978. 242 p. $10.00. (For individual items see A79-14152 to A79-14182)

Papers are presented on such topics as the multitemporal analysis of Landsat data and change detection, multispectral classification of tidal lands, the cadastral localizing of crop inventories obtained by remote sensing, information extraction from digital images of the earth and planets, and land-use mapping techniques. Consideration is also given to multitemporal analysis of Landsat data for the inventory of poplar groves in Northern Italy, digital detection of linear features in satellite imagery, and interactive digital image processing of Landsat data for geological analysis. S.J.

RS79-8-024

A79-14170 # Photographic spectral signature - A new tool in the image processing of the false colour or colour transparencies. G. M. Lechi (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 127-130.

The article discusses a concept of spectral signature applicable to the image processing of false color or color transparencies. The image to be analyzed is scanned by an Optronics Photomation machine which reads an image with three different spot dimensions. Three matrices are thus obtained and statistical distributions are determined of the photographic densities of blue, green, and red. Computing algorithms are applied to selected data in order to correlate the data of the three bands. The results may be reproduced by means of a standard computer printout or, using the Photomation machine, in the exact scale of the original scanned data. S.C.S.

RS79-8-025

A79-12015 Two-dimensional image coding by micro-adaptive picture sequencing /MAPS/. A. E. LaBonte (Control Data Corp., Digital Image Systems Div., Minneapolis, Minn.). In: Applications of digital image processing; Proceedings of the International Optical Computing Conference, San Diego, Calif., August 25, 26, 1977. (A79-12003 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 99-106. Contract No. F30602-76-C-0350.

Micro-Adaptive Picture Sequencing (MAPS), a computationally-efficient contrast-adaptive variable-resolution digital image coding technique, is described. Both compression and decompression involve only integer operations with no multiplies or explicit divides. The compression step requires less than 20 operations per pixel and the decompression step even fewer. MAPS is based on the combination of a simple vision heuristic and a highly nonlinear spatial encoding. The heuristic asserts that the fine detail in an image is noticed primarily when it is sharply defined in contrast while larger more diffuse features are perceived at much lower contrasts. The coding scheme then exploits the spatial redundancy implied by this heuristic to maintain high resolution where sharp definition exists and to reduce resolution elsewhere. Application of MAPS to several imagery types with compressions extending to below 0.2 bits per pixel is illustrated. (Author)

RS79-8-026

A79-12021 New developments in digital image processing displays. J. N. Latta (Science Applications, Inc., Arlington, Va.). In: Applications of digital image processing; Proceedings of the International Optical Computing Conference, San Diego, Calif., August 25, 26, 1977. (A79-12003 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 164-171.

Display devices which accept large arrays of digital data for spatial visual presentation are considered. Trends in display systems are examined. New developments are related to the containment of as many functions as possible within the display itself, an ability to handle much larger data arrays, wide dynamic range data, and the construction of arbitrary boundary image mosaics from two or more images. Details regarding the new display technology are also considered, giving attention to color and monochrome display units, memories which utilize MOSRAM and CCD's technologies, the types of spatial data processing, the display microcomputer, questions of data handling, graphics and overlays, display interaction, and aspects of dynamic image presentation. G.R.

RS79-8-027

A79-14176 # A branched classification system applied to special problems in multispectral data analysis. F. Quiel (Karlsruhe, Universität, Karlsruhe, West Germany). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 171-174. Research sponsored by the Bundesministerium für Forschung und Technologie.

A branched classification algorithm is applied to data collected with a 11-channel multispectral scanner during flight over east-west strips in the Rhine Valley. At each branching point in this algorithm a picture element is classified into one of two possible classes. Separation criteria can be selected independently of the criteria used at branching points. The procedure and results are discussed with attention to scan-angle effects, multidate classification, and texture. It is suggested that the high flexibility of the described system permits application to classification tasks for which the maximum likelihood algorithm or unsupervised techniques are unsuitable. (Author)

RS79-8-028

A79-11764 # Effects on multispectral radiometry of reflection from adjacent terrain and subsequent atmospheric scattering over the object pixel - and their elimination. J. Otterman (Tel Aviv University, Tel Aviv, Israel). In: American Society of Photogrammetry, Annual Meeting, 44th, Washington, D.C., February 26-March 4, 1978, Proceedings. (A79-11751 02-43) Falls Church, Va., American Society of Photogrammetry, 1978, p. 363-372. Research supported by the U.S.-Israel Binational Science Foundation.

An analytical formulation is presented for the nadir radiance, as measured from a satellite. The solution is based on the single scattering approach to the radiative transfer through a turbid atmosphere, bounded by a Lambert surface. In the solution, two terms can be identified as due to a reflection from the vicinity of the object pixel and, respectively, (1) upward scattering to the satellite above the object pixel and (2) downward scattering to the object pixel. The first term can be regarded as due to a cross-radiance effect and the second to a cross-irradiance effect. It is shown that the cross-radiance term is the more important one. The contribution to this term of an annular reflecting area as a function of distance from the object pixel is given in terms of appropriate functions and plotted. The feasibility of eliminating these spurious effects by appropriate data processing is discussed. (Author)

RS79-8-029

A79-14181 # Interdisciplinary application of the 'DIBIAS' digital image processing system to geological and maritime problems. K. A. Ulbricht (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Oberpfaffenhofen, West Germany), P. Hoppe (Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, West Germany), and D. Schmidt (Deutsches hydrographisches Institut, Hamburg, West Germany). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 215-218. 7 refs.

The digital image processing system DIBIAS has been developed for the evaluation of multispectral images, including those from Landsat. This paper discusses the application of the DIBIAS system to several examples of geological and maritime imagery of such areas as: (1) deserts in the Sudan and mountainous regions in Morocco, (2) Lake Constance and the Rhine estuary, and (3) the Baltic Sea. B.J.

RS79-8-030

A79-14178 # Evaluation of multispectral scanner data by hybrid methods. W. Schneider, R. Polak, and P. Schattschneider (SPACETEC Datengewinnungs GmbH und Co., Vienna, Austria). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 185-188. 5 refs.

The paper describes hybrid automatic classification scheme for processing data from an analog multispectral scanner. The procedure involves visual inspection of film recordings of selected channels; electronic analog processing of the scanner data for the visually selected areas; sophisticated and flexible processing of the small quantity of data obtained after the analog averaging operations. The procedural steps following visual selection - extraction of spectral and textural descriptors; correction of the effects of varying scan angle, sun angle, and atmospheric conditions; and digital classification of each sample area by subdividing the descriptor space by hyperplanes - are described. (Author)

RS79-8-031

A79-12277 Partial differential equations and finite difference methods in image processing. II - Image restoration. A. K. Jain (California, University, Davis, Calif.) and J. R. Jain (New York, State University, Amherst, N.Y.). *IEEE Transactions on Automatic Control*, vol. AC-23, Oct. 1978, p. 817-834. 39 refs. Grant No. DAAG29-77-G-0044; Contract No. N00953-77-C-0003-MJE.

Application of Partial Differential Equation (PDE) models for restoration of noisy images is considered. The hyperbolic, parabolic, and elliptic classes of PDE's yield recursive, semirecursive, and nonrecursive filtering algorithms. The two-dimensional recursive filter is equivalent to solving two sets of filtering equations, one along the horizontal direction and other along the vertical direction. The semirecursive filter can be implemented by first transforming the image data along one of its dimensions, say column, and then recursive filtering along each row independently. The nonrecursive filter leads to Fourier domain Wiener filtering type transform domain algorithm. Comparisons of the different PDE model filters are made by implementing them on actual image data. Performances of these filters are also compared with Fourier Wiener filtering and spatial averaging methods. Performance bounds based on PDE model theory are calculated and implementation tradeoffs of different algorithms are discussed. (Author)

RS79-8-032

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

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

RS79-8-033

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

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

RS79-8-034

A79-11666 Positional information from single and multiple coverage multispectral scanner data. M. M. Ethridge and E. M. Mikhail (Purdue University, West Lafayette, Ind.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 173-190. 5 refs. Contract No. NOAA-0501-6217-T-19980.

The restitution of single and multiple coverage multispectral scanner (MSS) digital data is considered. The term restitution is defined as the process by which the space coordinates of a given point are operated on to produce corresponding object space coordinates of the same point. Therefore, a good restitution technique accounts for errors due to tilt displacement, relief displacement, panoramic distortion, etc., so that the resulting object space coordinates plot as an orthographic projection. Attention is given to two dimensional restitution techniques, a statistical analysis of the two dimensional restitution results, three dimensional restitution techniques, an algorithm for the simulation of MSS data, and numerical results. It is concluded that the Gauss-Markov technique shows substantial promise for the restitution of single coverage aircraft MSS digital data. G.R.

RS79-8-035

A79-14197 A distortion-free map projection for analysis of satellite imagery. J. L. Junkins and J. D. Turner (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *Journal of the Astronautical Sciences*, vol. 26, July-Sept. 1978, p. 211-234. Research supported by the U.S. Geological Survey; Grant No. DAAG53-76-C-0067.

A formulated dynamic map projection is described and tested numerically. The satellite's subpoint trace (groundtrack) on the reference ellipsoid is the invariant line; in contrast, the invariant line in static map projections must be an equator, a meridian, or a parallel. A local sensing time is associated with each plot point in the satellite sensors' field of view. The formulation is valid for any continuous satellite orbit or orbit segment. Algorithms for projection of dense sets of remotely sensed data are efficient since the solution is analytical (except for some integrals). It is suggested that the continuous normal view provided by the space oblique Mercator projection has immediate applicability. M.L.

RS79-8-036

A79-12280 Frame-to-frame restoration of diffusion images. E. Angel (Rochester, University, Rochester, N.Y.) and A. K. Jain (California, University, Davis, Calif.). *IEEE Transactions on Automatic Control*, vol. AC-23, Oct. 1978, p. 850-855. 26 refs. Grant No. DAAG29-77-G-0044.

Frame-to-frame image data are acquired in many applications such as Radar, Biomedical, and Television imaging. In many situations, the imaging phenomenon can be modeled by a diffusion process. Here, we consider the problem of recursive filtering of such images on a frame-to-frame basis. Also, a two-dimensional problem of restoration of blurred images can be solved by imbedding it in this three-dimensional recursive filtering problem without blur. The model structure leads to a computationally feasible filtering algorithm achieving large reduction of dimensionality and is useful in real-time hardware simulation or generation of such blurred image data as might occur in a forward looking radar (FLR). (Author)

RS79-8-037

A79-13843 # Image feature analysis using deft sensors. S. T. Kowel, P. G. Kornreich, A. Mahapatra, M. Mehter, and T. Szebenyi (Syracuse University, Syracuse, N.Y.). *American Institute of Aeronautics and Astronautics and NASA, Conference on 'Smart' Sensors, Hampton, Va., Nov. 14-16, 1978, AIAA Paper 78-1727.* 6 p. 11 refs. Army-supported research.

A description is presented of the results of tests conducted with monolithic direct electronic Fourier transform (DEFT) imaging sensors. The output of the DEFT device is a sinusoidal electrical current. The amplitude of the current is proportional to the amplitude of the Fourier transform components of the two-dimensional image, and the phase of the current is proportional to the phase of the Fourier transform components of the image. The image sensor consists of a double layered CdS film deposited on a z-cut LiNbO3 substrate. Two interdigital transducers, each parallel to one of two orthogonal edges of the square sensor, are used for the generation of surface acoustic waves. Previous devices had an externally mounted shadow mask. Since the mask was spaced about 50 micrometers from the device, imaging with a lens was difficult. The present monolithic device eliminates this difficulty. G.R.

RS79-8-038

A79-14156 # Multitemporal analysis of Landsat data and change detection. G. Blanc, A. Fontanel, C. Lallemand, and A. Wadsworth (Institut Français du Pétrole, Rueil-Malmaison, Hauts-de-Seine, France). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 27-31.

Using Landsat images it is shown that reference objects can be utilized to obtain relative radiometric corrections of multitemporal multispectral images. Invariant objects for which constant radiance is assumed are chosen as references. Temporal changes can be detected using multispectral classification with simultaneous consideration of radiometrically corrected images. Numerical techniques based on correlation matrix calculations can be used without any calibration since the original data are standardized. The best results are obtained by using several reference objects with different multispectral signatures located in the low and high values of the histograms. B.J.

RS79-8-039

A79-11670 Update on digital stereophotogrammetry and digital image processing at ETL. M. A. Crombie and L. A. Gambino (U.S. Army, Computer Sciences Laboratory, Fort Belvoir, Va.). In: American Society of Photogrammetry, Fall Technical Meeting, Little Rock, Ark., October 18-21, 1977, Proceedings. (A79-11657 02-43) Falls Church, Va., American Society of Photogrammetry, 1977, p. 317-350. 14 refs.

A description is given of investigations directed toward digital stereo photogrammetry and toward the development of an interactive digital processing system, the Digital Image Analysis Laboratory (DIAL). It is expected that the interactive capability of DIAL will enable analysts to begin coordinating stereo correlation calculations and classification procedures in the near future. Some geometric problems associated with digital methods are considered, taking into account spatial distortion, terrain slopes, and exterior geometry. Attention is given to epipolar geometry, convergent photography, image shaping, a match point error estimate, the correlation function, the match error, aspects of match evaluation, scanner considerations, and the quantization error due to the density reading error. G.R.

RS79-8-040

A79-14163 # A low throughput digital image enhancement system. G. Harris, Jr. (U.S. Geological Survey, EROS Data Center, Sioux Falls, S. Dak.). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 79-87. 6 refs.

The EROS Data Center (EDC) has been experimenting with various image enhancement techniques for the purpose of producing improved Landsat film products for the user community. Initial processing results were based on algorithms developed by the U.S. Geological Survey in Flagstaff, Arizona. The algorithms were installed on computer systems at EDC for testing, modification, and implementation into a production system. These algorithms perform correction for radiometric and geometric anomalies inherent in Landsat digital data. The enhancement algorithms are designed to perform contrast and edge enhancement and reduce effects of atmospheric scattering due to haze. B.J.

RS79-8-041

A78-47082 Image processing in remote sensing. A. K. S. Gopalan, D. S. Kamat, K. L. Majumder, C. V. S. Prakash, and V. L. Swaminathan (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). In: International Symposium on Space Technology and Science, 12th, Tokyo, Japan, May 16-20, 1977, Proceedings. (A78-47001 21-12) Chofu, Tokyo, National Aerospace Laboratory, 1977, p. 599-604. 11 refs.

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

RS79-8-042

A78-51333 # Influence of light scattering in the atmosphere on the selection of spectral channels (Vliianie rasseianiia sveta v atmosfere na vybor spektral'nykh zon). Iu. V. Krylov. *Geodeziia i Kartografiia*, June 1978, p. 22-25. 6 refs. In Russian.

Light-scattering effects in the atmosphere must be taken into account when choosing spectral channels for satellite-borne multispectral remote sensors of the earth surface. This paper presents a comparative analysis regarding the selection of channels for the 450-700 nm visible region; scattering is considered, while absorption is neglected. It is found that, for this range, light scattering may cause a shift to the long-wave part of the spectrum. B.J.

RS79-8-043

A78-53384 Digital enhancement of Landsat MSS data for mineral exploration. R. M. Hord (Institute for Advanced Computation, Falls Church, Va.). In: Remote-sensing applications for mineral exploration. (A78-53376 24-43) Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1977, p. 235-250.

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

RS79-8-044

A79-14164 # Digital processing of Landsat data for geological applications. R. Haydn (Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 89-92.

Various digital image processing techniques are described and their feasibility for geological applications is discussed. Based on Landsat images mainly representing arid areas, the treatment of single-band and multiband data is demonstrated using algorithms for contrast manipulations, for statistical enhancement and analysis, and for logical operations. The use of analog techniques such as the combination of processed images by color composition techniques is also discussed. From a methodological point of view, principal-component transformation and band ratioing are found to be extremely useful, especially in combination with postprocessing techniques. B.J.

RS79-8-045

A79-13319 • Adaptive coding of MSS imagery. A. Habibi, A. S. Samulon, G. L. Fultz (TRW Defense and Space Systems Group, Redondo Beach, Calif.), and D. Lumb (NASA, Ames Research Center, Moffett Field, Calif.). In: NTC '77; National Telecommunications Conference, Los Angeles, Calif., December 5-7, 1977, Conference Record. Volume 1. (A79-13301 03-32) New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 10:2-1 to 10:2-8. 7 refs. Contract No. NAS2-8394.

A number of adaptive data compression techniques are considered for reducing the bandwidth of multispectral data. They include adaptive transform coding, adaptive DPCM, adaptive cluster coding, and a hybrid method. The techniques are simulated and their performance in compressing the bandwidth of Landsat multispectral images is evaluated and compared using signal-to-noise ratio and classification consistency as fidelity criteria. (Author)

RS79-8-046

A79-12109 The Image Detail Enhancement System /IDES/. B. A. Horwitz (Itek Corp., Lexington, Mass.). In: Clever optics: Innovative applications of optics; Proceedings of the Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12107 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 83-90.

The paper discusses the Image Detail Enhancement System (IDES) which is a real-time analog image modification system. The instrument is applicable to contouring, level slicing, and contrast enhancement. In contrast to digital image enhancement systems, the IDES is a high-speed large space-bandwidth system. It can process the equivalent of a 2048 x 2048 image on a one-inch square clear aperture in real time. S.C.S.

RS79-8-047

A79-14169 # Digital preprocessing applied to MSS landuse surveying. J. V. Kuilenburg (Utrecht, Rijksuniversiteit, Utrecht, Netherlands). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 117-119.

The paper discusses digital preprocessing techniques for multispectral images with reference to MSS landuse mapping applications. Three types of preprocessing are described: (1) preprocessing for image improvement such as the correction for atmospheric and technical distortions, (2) preprocessing for the enhancement of specific features; and (3) preprocessing for data reduction prior to visual interpretation or machine processing. The techniques are described in relation to a rural area in Holland. S.C.S.

RS79-8-048

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

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

RS79-8-049

A79-12012 Classification consistency of bandwidth compressed multispectral scanned /MSS/ images using Bayes supervised classifier. A. Habibi and A. Y. Hung (TRW Defense and Space Systems Group, Redondo Beach, Calif.). In: Applications of digital image processing: Proceedings of the International Optical Computing Conference, San Diego, Calif., August 25, 26, 1977. (A79-12003 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 79-84. 6 refs.

Several approaches to the classification of multispectral scanner images are discussed including parametric and nonparametric classification, supervised and unsupervised classification, and the Bayes classifier. Consideration is also given to the use of hybrid encoders which use a concatenation of Hadamard transform and differential pulse code modulation encoders. Experimental results are presented for a Bayes parametric supervised classifier used to classify a 512 x 512 portion of a Landsat A image of Goldfield, Nevada. S.C.S.

RS79-8-050

A78-48008 Aided-track cursor for improved digitizing accuracy. G. W. Hunka (RCA, Camden, N.J.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Aug. 1978, p. 1061-1066.

An aided-track cursor for use on any backlighted table is described. Cursor position is sensed by an x-y servo slaved to cursor motion by magnetic position sensing. Coordinate data are generated by incremental optical encoders coupled to the carriage guide system. Key feature is the incorporation of a linear photosensitive array consisting of 64 photodiodes spaced at a 2-mil pitch distance. As the operator views the function to be digitized, it is simultaneously imaged onto the array by means of a beamsplitter and lens. To achieve accuracy in the presence of line curvature, a computer used in conjunction with the cursor calculates a rotational signal from prior coordinate values to maintain the array perpendicular to the curve. Processing the detected array signal combines both analog and digital circuitry. P.T.H.

RS79-8-051

A78-52690 Spatial filtering applied to remote sensing imagery. P. R. Harnett, G. D. Mountain, and M. E. Barnet (Imperial College of Science and Technology, London, England). *Optica Acta*, vol. 25, Aug. 1978, p. 801-809. 7 refs.

A high-quality optical system has been developed for the optical processing of remote sensing imagery. Picture formats in excess of 10 to the 7th pixels can be accommodated. Examples are given which involve satellite photography, sonar and airborne radar images. (Author)

RS79-8-052

A78-48002 Macrophotography of satellite images. J. R. Eyton and R. P. Kuether (Illinois, University, Urbana, Ill.). *Photogrammetric Engineering and Remote Sensing*, vol. 44, Aug. 1978, p. 1019-1021.

A method for obtaining high-quality macrophotography of Landsat and Skylab images with the aid of an enlarger and high-definition, high-contrast film is briefly described. A list of enlarger bulbs and color balancing filters recommended for the process and a list of films, both conventional and unconventional, with which excellent results have been obtained, are provided. Enlargement factors for high-resolution color images from the Skylab mission are given. P.T.H.

RS79-8-053

A78-48546 # An algorithm for the automatic recognition of textures on aerial photographs (Ob odnom algoritme avtomaticheskogo raspoznavaniia tekstur na aerofotosnimkakh). B. N. Epifantsev and V. A. Molodykh (Tomskii Politekhnicheskii Institut, Tomsk, USSR). *Geodeziia i Aerofotos'emka*, no. 2, 1978, p. 84-90. 5 refs. In Russian.

In the present paper, an attempt is made to obtain a compact description of the elements of black-and-white 1:5000 aerial photographs of forest, meadow, plowland, and water areas. An automatic recognition algorithm employing a group of characters in the form of the frequency characteristics of textures obtained by the method of identifying hidden periodicities is proposed. The textures under consideration are recognized by a Bayesian procedure within the framework of a minimized system of characters. The applicability of the obtained system of characters to the solution of texture recognition problems is demonstrated. V.P.

RS79-8-054

5.0063, SOFTWARE SYSTEMS FOR PROCESSING ADVANCED SATELLITE DATA

L.P. MURPHY, U.S. Army, Engineer Topographic Labs., *Fort Belvoir, Virginia* 22060 (31580)

OBJECTIVES: Analyze, model, develop techniques/software; and perform feasibility testing of algorithms for extracting useful terrain data from advanced (LANDSAT-D) satellite systems for selected CoE applications; obtain hardware/software trade-offs and costs for computer processing of the advanced high resolution (30 m/pixel) Thematic, Mapper, LANDSAT-D, digital data.

APPROACH: Through in-house efforts, conduct a search and review of NASA studies which assess the impact of processing LANDSAT-D, Thematic Mapper (TM) data (approximately 8 times LANDSAT A and B) using current ADP systems and techniques, locate and/or acquire digital simulations of the TM data and/or acquire RBV (40 m) digital imagery from LANDSAT (launch date February 1978). Generate or modify software and process simulation. TM data into image forms using ETL DIAL and EBR; evaluate utility of images and pixel data for selected CoE applications (e.g., permits, open water detection). Under contract in the latter part of FY78 perform limited experimentation, comparative analysis of land-use extraction outputs from NASA partially processed data and from corrected MSS data (resample) and provide recommendations for improved software/algorithms and techniques. As work is phased through FY 78-80, digital image processing costs, software/algorithms, associated hardware and/or commercial sources to the CoE Districts and Divisions will be identified for feature extraction processing from advanced (LANDSAT-D) satellite data. The results of other ETL feature extraction research from military and ASPO funding will be incorporated into the results of this work unit.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

RS79-8-055

5.0006, AIRBORNE OCEAN SURVEILLANCE AND RECONNAISSANCE TECHNOLOGY DEVELOPMENT

B. JACKSON, General Dynamics Corporation, *P.O. Box 80847, San Diego, California* 92138 (DN881225; N62269-77-ET-71546)

To continue the development and simulation of ANC (abrupt nonlinear compression) algorithms and extend the technique to include two-dimensional algorithms. To further investigate digital recording techniques with the laser line scanner. This contract supports work unit ZT701, Agency Accession No. DN781263.

Review the previous work done on one-dimensional ANC algorithms and determine the possibilities of improving the initialization procedures, reversal of relative temperature, and streaking effects. Develop two-dimensional algorithms using the same techniques used in the one-dimensional algorithm. Simulate the results using the laser line scanner and the infrared ship imagery data bank. Examine the feasibility of using the laser line scanner to recover digital data recorded on film.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

RS79-8-056

Orthogonal Transformations of Digital Data

Sandia Labs., Albuquerque, N.Mex.*Department of Energy. (5659000)
AUTHOR: Cooper, J. A.
E1133K4 Fld: 98, 62 GRAI7812
1977 14p
Rept No: CONF-771206-17
Contract: EY-76-C-04-0789
Monitor: 18
Digital signal processing symposium, Albuquerque, NM, USA, 6 Dec 1977.

Abstract: The application of orthogonal transformations to digital data is somewhat analogous to the use of Fourier and Laplace transforms with analog data. Some motivations for making transformations are to emphasize or suppress features and to code or mask the data. Two families of transformations and their possible application are discussed. One of these is derived from the relatively well-known Walsh functions; the other is an apparently new transformation technique based on matrix algebra. Certain Walsh functions have patterns similar to those caused by sinusoidal noise sources. A method is described for identifying the appropriate Walsh functions, and then for resolving phase-shifted patterns into sums of pairs of Walsh functions. This procedure is analogous to the resolution of a phase-shifted sinusoidal signal into the sum of a sine and a cosine signal. This technique is useful when periodic perturbations must be filtered out from the data or enhanced. An application for these modified Walsh transforms is described for identifying features in radar return from the ground; and an application for the new matrix algebra technique used for masking data is presented. 1 figure, 1 table. (ERA citation 03:016318)

Descriptors: *Data processing, Digital systems, Missiles, Orthogonal transformations, Pattern recognition, Radar, Measuring instruments, Range finders

Identifiers: ERDA/990200, Walsh functions, *Signal processing, NTISDE

SAND-77-1605C NTIS Prices: PC A02/MF A01

Section 9

INSTRUMENTATION AND TECHNOLOGY

Systems, Applications, Innovations

RS79-9-001

N79-11456# European Space Agency, Paris (France).
ANALYSIS OF A REMOTE SENSING PAYLOAD FOR THE SPACELAB D3 MISSION (PRELIMINARY PHASE A) Final Report
F. Schlude Jun. 1978 129 p refs Transl. into ENGLISH of 'Untersuch. zu einer Fernerkundungsnutzlast fuer die Spacelab-Mission D3', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-551-77/8, Dec. 1977
(ESA-TT-482; DLR-IB-551-77/8) Avail: NTIS HC A07/MF A01

A remote sensing payload for atmospheric physics and earth sensing for the Spacelab D3 mission is proposed. Topics include scientific and technological objectives, experiment selection, experimental hardware, and mission-dependent equipment. The following equipment is discussed: metric camera focal length 30 or 60 cm; mechanical scanner, 7 channels, 17 deg aperture angle, push-broom scanner, 4 channels, 4.3 deg aperture angle; microwave experiment of the first Spacelab payload, 9.6 GHz; and SAR facility, 2 frequencies, 2 polarizations, fixed angle of depression. It is concluded that the mechanical accomodation can be achieved without any problems, the electrical primary powers can be supplied, the thermal balance sheet problems can be regarded as soluble, and the data handling, both aboard Spacelab and in the transition section, can be solved only by a reduction of the operating periods. ESA

RS79-9-002

N79-11379# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPATIAL FILTERING DESIGN CONSIDERATIONS FOR A LASER LINE SCANNING SENSOR M.S. Thesis
William D. Strautman Dec. 1977 60 p refs
(AD-A055503; AFIT/GEO/EE/77-6) Avail: NTIS HC A04/MF A01 CSCL 20/5

The performance of an airborne laser terrain mapper, which collects slant range and reflectance data simultaneously, is determined in part by the spatial filtering effects of the finite laser beam spot size. An analysis of the spatial filtering effects and the resulting distortion of the terrain profile slant range to the aircraft is made to interpret the interaction between the terrain characteristics and the resulting laser line scan information. Emphasis is placed on the range interactions. In particular, the terrain height profile is modeled as a single sinusoid in one spatial dimension with constant reflectivity. The laser transmitter is sinusoidally intensity modulated, so that the received signal is subcarrier phase modulated by the terrain height profile. This phase modulated signal is low pass filtered to represent the effects of the spatial filter. Numerical analysis is utilized to evaluate this nonlinear filtering problem and to examine the range error in terms of the maximum range height variations. The resulting mean-squared range distortion error is added to the range squared distortion error originating from the receiver noise in the Phase Locked Loop phase tracking circuit. The distortion due to spatial filtering is shown to increase with the laser modulation frequency while the errors due to detection noise decrease with frequency. GRA

RS79-9-003

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

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

RS79-9-004

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

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

RS79-9-005

N79-10393*# Itek Corp., Lexington, Mass. Optical Systems Div.
FEASIBILITY STUDY FOR THE APPLICATION OF THE LARGE FORMAT CAMERA AS A PAYLOAD FOR THE ORBITER PROGRAM Final Report
Sep. 1978 195 p
(Contract NAS9-15490)
(NASA-CR-151848; Itek-78-9549A-2-Rev-A) Avail: NTIS HC A09/MF A01 CSCL 14E

The large format camera (LFC) designed as a 30 cm focal length cartographic camera system that employs forward motion compensation in order to achieve the full image resolution provided by its 80 degree field angle lens is described. The feasibility of application of the current LFC design to deployment in the orbiter program as the Orbiter Camera Payload System was assessed and the changes that are necessary to meet such a requirement are discussed. Current design and any proposed design changes were evaluated relative to possible future deployment of the LFC on a free flyer vehicle or in a WB-57F. Preliminary mission interface requirements for the LFC are given. J.M.S.

RS79-9-006

N79-10391* National Aeronautics and Space Administration. Pasadena Office, Calif.
SURFACE ROUGHNESS MEASURING SYSTEM Patent
Atul Jain, inventor (to NASA) (JPL) Issued 18 Jul. 1978 15 p Filed 24 Nov. 1976 Supersedes N77-17325 (15 - 08, p 1020) Sponsored by NASA
(NASA-Case-NPO-13862-1; US-Patent-4,101,891; US-Patent-Appl-SN-744577; US-Patent-Class-343-17.2PC; US-Patent-Class-343-5CM; US-Patent-Class-343-5W; US-Patent-Class-324-77K) Avail: US Patent Office CSCL 14B

Significant height information of ocean waves, or peaks of rough terrain is obtained by compressing the radar signal over different widths of the available chirp or Doppler bandwidths, and cross-correlating one of these images with each of the others. Upon plotting a fixed (e.g., zero) component of the cross-correlation values as the spacing is increased over some empirically determined range, the system is calibrated. To measure height with the system, a spacing value is selected and a cross-correlation value is determined between two intensity images at a selected frequency spacing. The measured height is the slope of the cross-correlation value used. Both electronic and optical radar signal data compressors and cross-correlations are disclosed for implementation of the system.
Official Gazette of the U.S. Patent Office

RS79-9-007

N79-11457# European Space Agency, Paris (France).
THE COVERAGE FIELD OF EARTH OBSERVATION SATELLITES AT THE EARTH'S SURFACE. DESCRIPTION OF THE COMPUTER PROGRAM COFI
E. Fritz Jochim and W. Pawlik Aug. 1978 77 p refs Transl. into ENGLISH of 'Das Ueberdeckungsfeld erdbeobachtender Satelliten auf der Erdoberflaeche. Beschreibung des Rechnerprogramms COFI', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-552-77/40, 1977 Original report in GERMAN previously announced as N78-31516
(ESA-TT-487; DLR-IB-552-77/40) Avail: NTIS HC A05/MF A01

The computer program described produces a printer plot of the coverage field and coverage frequency within a given period in geographical coordinates or in geographical latitude against the mean solar time. Nadir angle and half width of the perpendicular to the orbit scanning sensor may be chosen freely. Multiply-covered regions are made evident by a variable density or special characters. Restrictions are possible on mean local solar time intervals. The subsatellite curve can be represented with the Local Mean Time marked on the curve. The program aids in the mission analysis of earth observation satellites.
Author (ESA)

RS79-9-008

N79-11455# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
MILLIMETER WAVE IMAGING OF GROUND BASED OBJECTS
H. Gniss and K. Magura Jan. 1978 58 p refs In GERMAN; ENGLISH summary
(Contract BMVg-GF-76/77)
(Rept-1-78) Avail: NTIS HC A04/MF A01

Problems concerning the recognizability of millimeter wave images obtained from various targets (models of ground based objects) at 36 GHz in laboratory experiments are dealt with. The dependence of image fidelity on lateral resolution of the mapping aperture and the form, orientation, and depolarization properties of the target are discussed. Because of the spatial distribution of only a limited number of scattering centers on the object, which depend on aspect angle and polarization generally, the image fidelity is affected strongly. Smoothing of the resulting image intensity fluctuations was obtained by incoherent superposition of independent partial images. The image disturbances resulting from ground and environment clutter were investigated.
Author (ESA)

RS79-9-009

N79-10389* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF OBTAINING INTENSIFIED IMAGE FROM DEVELOPED PHOTOGRAPHIC FILMS AND PLATES Patent
Barbara S. Askins, inventor (to NASA) Issued 18 Jul. 1978 8 p Filed 9 Jun. 1976 Supersedes N76-26449 (14 - 17, p 2189)
(NASA-Case-MFS-23461-1; US-Patent-4,101,780; US-Patent-Appl-SN-694406; US-Patent-Class-250-475; US-Patent-Class-96-27R; US-Patent-Class-96-60R; US-Patent-Class-252-301.1R; US-Patent-Class-252-301.16) Avail: US Patent Office CSCL 14E

A method is explained of obtaining intensified images from silver images on developed photographic films and plates. The steps involve converting silver of the developed film or plate to a radioactive compound by treatment with an aqueous alkaline solution of an organo-S35 compound; placing the treated film or plate in direct contact with a receiver film which is then exposed by radiation from the activated film; and developing and fixing the resulting intensified image on the receiver film.
Official Gazette of the U.S. Patent Office

RS79-9-010

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

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

RS79-9-011

A79-14179 # A self-contained Landsat data reception and precision cartographic image production system. D. S. Sloan and R. Orth (MacDonald, Dettwiler and Associates, Ltd., Richmond, British Columbia, Canada). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 189-196. 16 refs.

The paper outlines the design and capabilities of the Line Scan Receiving and Processing System (LSRPS) devised as a self-contained direct readout ground station system for the reception and processing of data from earth-observation satellites. Attention is given to the digital Image Analysis System (IAS) which can be incorporated into the LSRPS when located at the same site, or operates as a stand-alone system in an installation remote from ground reception facilities. The IAS permits precision cartographic and thematic products to be developed from digital line-scan data. The entire IAS system is developed around the four main activities encountered in digital image analysis, viz. radiometric correction, geometric correction, image classification, and image manipulation. The IAS provides the user with a standard image analysis framework involving a set of basic modules which can be easily extended or modified to allow for new developments and needs.
S.D.

RS79-9-012

A79-12023 Scanners using a distributive system of microprocessors. G. E. Murine. In: Applications of digital image processing; Proceedings of the International Optical Computing Conference, San Diego, Calif., August 25, 26, 1977. (A79-12003 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 187-196.

A distributive system is a network of coordinated data processing stations. The results of functional procedures are integrated into a system stream by some designated processing sequence. The integration process may reside in a specific microprocessor or may be embedded in a collective protocol. Data available to all processors are placed in a memory called the Common Data Memory (CDM) while any code available to all processors are placed in a common memory (normally ROM or PROM) called the Common Program Memory (CPM). Two different classes of distributive systems are considered. In the 'dedicated system', each microprocessor through its code and logic is assigned a nonvarying task. The 'nondedicated system' removes this restriction. Any available microprocessor may execute a specific task of arbitrary length, thereby making the tracking of the operational sequence of the system the major point of interest in a nondedicated environment. It is reasonable to assume that a marriage of the two systems might result in a third system which is hybrid, and best suited to certain specific applications. Several hybrid systems are developed.
G.R.

RS79-9-013

A79-13847 • # **The application of smart sensor techniques to a solid-state array multispectral sensor.** L. W. McFadin (NASA, Johnson Space Center, Houston, Tex.). *American Institute of Aeronautics and Astronautics and NASA, Conference on 'Smart' Sensors, Hampton, Va., Nov. 14-16, 1978, AIAA Paper 78-1732.* 8 p.

The solid-state array spectroradiometer (SAS) developed at JSC for remote sensing applications is a multispectral sensor which has no moving parts, is virtually maintenance-free, and has the ability to provide data which requires a minimum of processing. The instrument is based on the 42 x 342 element charge injection device (CID) detector. This system allows the combination of spectral scanning and across-track spatial scanning along with its associated digitization electronics into a single detector. B.J.

RS79-9-014

A79-13381 • **Feature discrimination and detection probability in synthetic aperture radar imaging system.** R. G. Lipes and S. A. Butman (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: NTC '77; National Telecommunications Conference, Los Angeles, Calif., December 5-7, 1977, Conference Record. Volume 3. (A79-13301 03-32) New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 49:6-1 to 49:6-6. Contract No. NAS7-100.

Images obtained using synthetic aperture radar (SAR) systems can only represent the intensities of resolution cells in the scene of interest probabilistically since radar receiver noise and Rayleigh scattering of the transmitted radiation are always present. Consequently, when features to be identified differ only by their contribution to the mean power of the radar return, discrimination can be treated by detection theory. In this paper, we develop a 'sufficient statistic' for discriminating between competing features and compare it with some suboptimal methods frequently used. Discrimination is measured by probability of detection error and depends on number of samples or 'looks', signal-to-noise ratio (SNR), and ratio of mean power returns from the competing features. Our results show discrimination and image quality rapidly saturate with SNR (very small improvement for SNR not less than 10 dB) but continue to improve with increasing number of looks. (Author)

RS79-9-015

A79-12075 **State of the art of infrared detectors.** H. Levinstein (Syracuse University, Syracuse, N.Y.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 52-56. 15 refs.

A historical survey of the development of infrared detectors is presented with reference to parameters including minimum detectable power, noise equivalent power, spectral response, and response speed. Detectors produced in the 1940-1950 period were characterized by polycrystalline films prepared by various techniques. The next stage of development consisted of detectors produced from single crystals in which response to longer wavelengths was produced by adding impurities to germanium and creating transitions between the impurities and one of the bands. During the past decade, detectors with an adjustable energy gap were designed on the basis of HgCdTe and PbSnTe. In addition, charged coupled devices have been developed in conjunction with impurity-activated silicon. Procedures for the optimization of detector parameters are proposed including the detectivity, modifications in the time constant, and variations in spectral response. S.C.S.

RS79-9-016

A79-12081 **SPIRE - Spectral Infrared Experiment.** R. M. Nadile, N. B. Wheeler, A. T. Stair, Jr. (USAF, Geophysics Laboratory, Bedford, Mass.), D. G. Frodsham, and C. L. Wyatt (Utah State University of Agriculture and Applied Science, Logan, Utah). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 118-123; Discussion, p. 124. 15 refs.

A Spectral Infrared Experiment (SPIRE) rocket payload designed to make selective measurements of the sunlit earth limb is described. Two cryogenically cooled CVF spectrometers and a dual channel photometer will be used to spatially and spectrally map the horizon from 5000A to 15.5 microns. All three sensors have been telescoped with low scatter optics which are capable of resolving an 8-km tangent height at the limb while rejecting competitive terrestrial and solar radiation. A coaligned TV camera and two celestial pointing monitors complete the instrument complement. Experiment objectives, instrument and telescope design, subsystem tests, and subsequent modifications are described. (Author)

RS79-9-017

A79-12095 **A quantitative determination of surface temperatures using an infrared camera.** C. K. Hsieh (Florida, University, Gainesville, Fla.) and W. A. Ellingson (Argonne National Laboratory, Argonne, Ill.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 228-235. 12 refs. ERDA-supported research.

A method is presented to determine the surface-temperature distribution at each point in an infrared picture. To handle the surface reflection problem, three cases are considered that include the use of black coatings, radiation shields, and band-pass filters. For uniform irradiation on the test surface, the irradiation can be measured using a cooled, convex mirror. Equations are derived to show that this surrounding irradiation effect can be subtracted out from the scanned radiation, thereby relating the net radiation only to emission from the surface. To provide for temperature measurements over a large field, the image-processing technique is used to digitize the infrared data. The paper spells out procedures that involve the use of a computer for making point-by-point temperature calculations. Finally, a sample case is given to illustrate applications of the method. (Author)

RS79-9-018

A79-12078 **System limitations of infrared detectors.** G. R. Pruett (Texas Instruments, Inc., Dallas, Tex.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 77-79.

Thermal imaging systems for industrial and military applications have capabilities not envisioned twenty years ago. Much of this rapid growth in capabilities is a direct result of synergistic coupling between system and detector design engineers funded by the United States Department of Defense. In many designs both the detector and the system optical designs have been pushed to levels very near their fundamental limits. It is therefore, advantageous to spell out some of the fundamental limitations on detectors to avoid the needless design iterations which result when only the equations (without boundary values) are manipulated in the quest to meet the system packaging and sensitivity requirements. (Author)

RS79-9-019

A79-12080 Infrared solid state imaging arrays. R. D. Nelson (Rockwell International Corp., Advanced Sensor Laboratory, Anaheim, Calif.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 91-101. 9 refs.

Possible system applications of Infrared Charge Transfer Devices are reviewed. It is found that this device technology can have a very significant systems impact. Analyses are performed to calculate the quantum efficiency, quantum yield, frequency response, photoconductive gain, operating temperature, noise and the distinction between parallel and transverse bias configurations of silicon detectors. Tables of silicon detector properties are included. Approaches to the interface circuitry which couples the detectors and the CTD multiplexer are examined. Examples of existing low background and high background IRCTD detector arrays are given. (Author)

RS79-9-020

A79-14166 # GOBI - A large format color printer for rectification and image mosaics. H. Hruska (SPACETEC Datengewinnung GmbH und Co., Vienna, Austria) and J. Jansa (Wien, Technische Universität, Vienna, Austria). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 97-101. Research sponsored by the Forschungsförderungsfonds der gewerblichen Wirtschaft.

GOBI is a large-format image analyzing and rectification system developed for the purpose of producing color image displays derived from both digital and analog data. The system is designed to print variable image formats up to 80 cm x 120 cm. The image pixels are generated in digital form on a color CRT screen; an analog image deformation can be introduced to get any desired scale on the film. The equipment is specifically designed for color displays of both aerial and spaceborne (i.e. Landsat) multispectral and thermal IR scanner data. The data handling concept is to control image processing by a microprocessor in two basic modes of operation. B.J.

RS79-9-021

A79-12091 An unheated four-bar infrared test target. F. O. Bartell, A. G. DeBell, B. B. Fannin, J. S. Nissley, W. L. Wolfe (Arizona, University, Tucson, Ariz.), and C. M. Giorgi (U.S. Army, Electronic Proving Ground, Fort Huachuca, Ariz.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 198-204.

A four-bar infrared test target has been built to test the feasibility of using perforated ambient temperature plates for the four bars instead of the customary plates operated at temperatures different from ambient. Six different sizes of four-bar arrays provide six different spatial frequencies. Front and back arrays of perforated plates are moved relative to one another by a motor drive to expose more or less of a sky reflector backplate, thereby producing a varying apparent temperature differential between the bars and their interstices. The target system also features a radiometric monitor which mechanically servos the bar patterns to compensate for changes such as dust or clouds. Qualitative tests with infrared imaging systems show satisfactory bar patterns which disappear when the perforations are closed. Quantitative tests show that differential temperature accuracies of about one tenth of a kelvin can be attained. (Author)

RS79-9-022

A78-53000 # Infrared remote temperature measurements: Its physics with reference to complexities, approximations and limitations involved. I - Conceptual considerations and surface temperature estimation. R. K. Gupta (Indian Institute of Tropical Meteorology, Poona, India). *Indian Institute of Science, Journal, Section B - Physical and Chemical Sciences*, vol. 60, June 1978, p. 135-169. 76 refs.

A critical review of spaceborne IR remote temperature measurements is presented, with particular reference to the spectroscopic aspect of the radiative transfer problem in order to reveal the intricacies and uncertainties in the formulation of the radiative transfer equation. Attention is given to the concept of local thermodynamic equilibrium and to the determination of surface temperature, especially over oceans where it is difficult to get data by conventional methods. Estimation of sea-surface temperature using 3.7- and 11-micron channels as well as the use of a statistical technique in obtaining clear column radiance from cloudy areas are discussed. S.D.

RS79-9-023

A79-14154 # A general purpose version of the computer-controlled image scanner OSIRIS. N. Aslund, K. Carlsson, L. Majlof, and L. Olsson (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 15-18. 8 refs. Research supported by the Styrelsen for Teknisk Utveckling.

The original OSIRIS (Our Second Image Reading Instrument System) machine uses a linear self-scanning diode array for the digitization of images. The present paper describes a general purpose version of OSIRIS. The geometrical resolution is 1024 x 512 pixels and the photometric resolution exceeds 200. Software has been developed for the reading and processing of arbitrarily selected subregions up to 128 x 128 pixels of the original picture. These pictures are displayed on a TV screen for interactive manipulations. One current application of OSIRIS is the analysis of satellite photographs. B.J.

RS79-9-024

A79-14153 # Digitization of images by means of fast raster scanning using the vibrating prism facility of the measuring machine IRIS. N. Aslund, K. Carlsson, N. von Gersdorff, and L. Petersson (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: Image processing - Interactions with photogrammetry and remote sensing; Proceedings of the International Symposium, Graz, Austria, October 3-5, 1977. (A79-14151 03-35) Graz, Technische Universität Graz, 1978, p. 11-14. 5 refs. Research supported by the Swedish Board for Space Activities.

The paper describes a method for fast raster scanning of arbitrarily chosen regions of photographic recordings measuring up to 30 cm x 30 cm. No back-and-forth movement of the carriage of the machine is required. The pixel size is 25 microns x 25 microns; the scanning and digitization of a region of 64 x 40 pixels is performed in less than 10 seconds. All this accomplished by using the IRIS (Image Reading Instrument System) measuring machine which employs a movable table and incorporates a vibrating prism for scanning purposes. In this way raster scanning can be performed with a speed that is completely sufficient for interactive work. The application of this interactive technique to multispectral aerial photographs of forests is examined. B.J.

RS79-9-025

A79-12079 A review of HgCdTe infrared detector technology. M. B. Reine and R. M. Broudy (Honeywell Radiation Center, Lexington, Mass.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 80-89; Discussion, p. 90.

RS79-9-026

A79-12074 An optical mask system of target to background discrimination. D. McCaughey (Aerospace Corp., El Segundo, Calif.). In: Modern utilization of infrared technology III: Civilian and military; Proceedings of the Third Seminar, San Diego, Calif., August 25, 26, 1977. (A79-12067 02-35) Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 45-50. Research sponsored by the Aerospace Corp.

An optical method of suppressing an imaging system's response to a slowly varying background interference is described. The method involves masking the photodetectors with a photochromic plate and a model for this system is developed. The photochromic mask is shown to be equivalent to an optical Automatic Gain Control (AGC) device. The time response of such a system is developed and simulation results are presented that demonstrate the feasibility of this approach. (Author)

RS79-9-027

5.0034, ENERGY-RELATED REMOTE AND IN SITU SENSING INSTRUMENT DEVELOPMENT

E.V. BROWELL, U.S. Natl. Aero. & Space Adm., Environ. & Space Sciences Div., *Hampton, Virginia* 23665 (D6-E771-BEU; V625D-68)

OBJECTIVES: To develop advanced and improved instrument techniques for measuring environmental parameters associated with the generation of electrical energy and other pollution sources.

APPROACH: To meet these objectives, the following tasks will be conducted: Task 1 - Raman Lidar - Evaluate Raman Lidar for remote measurement of SO2 concentration at power-plant stack exit. Task 2 -Plume Dispersion Studies: Apply aerosol scattering lidar techniques to the study of plume dispersion under various atmospheric conditions. Task 3 - IR DIAL - To develop and apply the tunable infrared (IR) Differential Absorption Lidar (DIAL) technique to the remote measurement of molecular plume effluents. Task 4 - Laser Heterodyne Detector - To evaluate the use of the laser heterodyne detector technique as a means to increase the sensitivity of long path continuous wave absorption measurements using diffuse reflectors. Task 5 - HCl Monitor - to develop and deliver to EPA an improved in situ HCl chemiluminescent monitor. Task 6 - UV DIAL - To evaluate the UV Differential Absorption Lidar (DIAL) technique for remote measurements of the concentration of SO2, O3, and aerosols at a power-plant stack exit and within the stack plume.

CURRENT PLANS AND/OR PROGRESS: Necessary modifications to the Raman lidar have been completed. A contract has been let for the Tunable IR Laser (delivery January, 1978) which will be integrated with the IR Telescope, detector, and data processor to construct a mobile lidar system. The laser heterodyne detector in the long path laser monitoring system is under evaluation, with a technical report on the effects of speckle scheduled for completion in January, 1978. All laboratory and field evaluation of the HCl detector have been completed. The UV DIAL system will be calibrated and field tested jointly with EPA during January 1978. Operational field tests are scheduled for April, 1978.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Energy Minerals & Industry

RS79-9-028

5.0025, MICROWAVE SATELLITE SENSOR TRADE-OFF ANALYSIS

J.C. HOLTZMAN, Univ. of Kansas, School of Engineering, Electrical Engin., *Learned Hall, Lawrence, Kansas* 66044 (NAS 9-15602)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

RS79-9-029

SUB-SERVICE SURVEYING.

Water and Waste Treatment, Vol. 21, No. 6, p 29, June, 1978.

Descriptors: *Tracking techniques, *Sewers, *Drains, *Electromagnetic waves, *Remote sensing, Electronic equipment, Instrumentation, Marking techniques, Mapping, Analytical techniques, Pipes, Sewerage, Municipal wastes.

The electro-magnetic subsurface GPR 104 Drain Locator, manufactured by Electro-location Ltd., of Bristol, England, eliminates the need to excavate trial holes in locating the course of uncharted drains or sewers. A probe is rodded, jetted, or floated through the pipe; signals are transmitted by the probe to a hand-held surface receive equipped with earphones. The GRP 104 Drain Locator has reportedly saved the Cheltenham Borough in England the large expense of excavating the trial holes generally required to locate and map subsurface drains. (Lisk-FIRL)
W78-10723

RS79-9-030

Techniques for Using Diazo Materials in Remote Sensor Data Analysis

Missouri Univ., Rolla. Dept. of Mineral, Petroleum, and Geological Engineering.
AUTHOR: Whitebay, L. E.; Mount, S.
E1112I1 Fld: 8G, 14E, 17E, 48F, 82B, 62F STAR1608
Jan 78 21p
Rept No: NASA-CR-2953, M-246
Contract: NAS8-31767
Monitor: 18

Abstract: The use of data derived from LANDSAT is facilitated when special products or computer enhanced images can be analyzed. However, the facilities required to produce and analyze such products prevent many users from taking full advantages of the LANDSAT data. A simple, low-cost method is presented by which users can make their own specially enhanced composite images from the four band black and white LANDSAT images by using the diazo process. The diazo process is described and a detailed procedure for making various color composites, such as color infrared, false natural color, and false color, is provided. The advantages and limitations of the diazo process are discussed. A brief discussion interpretation of diazo composites for land use mapping with some typical examples is included.

Descriptors: *Photographic processing, Data reduction, Landsat satellites, Remote sensors, Infrared photography, Photographic emulsions, Photographic processing equipment

Identifiers: *Photographic images, Infrared images, Photogrammetry, Remote sensing, Infrared mapping, *Diazo processes, Image processing, NTISNASA

N78-17447/1ST NTIS Prices: PC A02/MF A01

RS79-9-031

Design and Fabrication of Nosecone for WB-57F Aircraft Fitted with APQ-102A Side Looking Radar

Hacking Labs., Santa Clara, Calif.

Final Report.
E0915J3 Fld: 01C, 17I, 51C, 63H STAR1606
Dec 77 104p
Rept No: NASA-CR-151592
Contract: NAS9-15189, HL PROJ. 22
Monitor: 18

Abstract: The design, fabrication, and testing of a nose cone which included a radome for a NASA WB-57F high altitude natural resources mapping aircraft was reviewed. The plane was fitted with a APQ-102A side looking radar operating at 9.6 GHz. The radar is directed normally to the direction of the flight and downward by a changeable angle, and it is assumed that the axis of the plane will not deviate from this direction by more than + or - 6 deg. The radome is required to subtend an angle of 160 deg centered 30 deg below the left horizon.

Descriptors: *Earth resources survey aircraft, *Nose cones, *Radomes, *Side-looking radar, Structural engineering, Aerial photography, Aerial reconnaissance, High altitude, Mapping, Radome materials

Identifiers: B-57 aircraft, WB-57F aircraft, AN/APQ-102A, NTISNASA

N78-15028/1ST NTIS Prices: PC A06/MF A01

RS79-9-032

A Maximal Chromatic Expansion Method of Mapping Multichannel Imagery Into Color Space

Lockheed Electronics Co., Inc., Houston, Tex. Systems and Services Div.*NASA Earth Resources Survey Program, Washington, D.C.

Technical rept.
AUTHOR: Juday, Richard D.; Abotteen, R. A.
E1005E2 Fld: 14E, 93A, 82B GRAI7811
Jan 78 14p
Rept No: LEC-10830
Contract: NAS9-15200
Monitor: NASA-CR-151617
Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: The author has identified the following significant results. A color film generation method that maximally expands the chromaticity and aligns Kauth brightness with the gray axis was presented. In comparison with the current LACIE film product, the new color film product has more contrast and more colors and appears to be brighter. The field boundaries in the new product were more pronounced than in the current LACIE product. The speckle effect was one problem in the new product. The yellowness speckle can be treated using an equation. This equation can be used to eliminate any speckle introduced by the greeness. This product leads logically toward another that will employ quantitative colorimetry which will account for some of the eye's perception of color stimuli.

Descriptors: *Image enhancement, Digital data, Colorimetry, North Dakota, Large area crop inventory experiment, Skylab program, EREP, Satellite-Borne photography, Brightness, Color

Identifiers: Image processing, NTISNASA

E78-10075 NTIS Prices: PC A02/MF A01

RS79-9-033

Ice and Fog: Detection and Warning Systems (A Bibliography with Abstracts)

National Technical Information Service, Springfield, Va. (391 812)

Rept. for 1964-Feb 78
AUTHOR: Habercom, Guy E. Jr
E0893I1 Fld: 4B, 8L, 13L, 8J, 85D*, 55D, 47C, 48H*, 86W GRAI7810
Mar 78 155p*
Monitor: 18
Supersedes NTIS/PS-77/0188, NTIS/PS-76/0096 and NTIS/PS-75/23-1.

Abstract: Sea ice, aircraft ice, bridge ice, and fog formation detecting methods are reviewed in these Government-sponsored research reports. Remote aerial sensing and ground based detection systems are among the methods investigated. (This updated bibliography contains 150 abstracts, 32 of which are new entries to the previous edition.)

Descriptors: *Bibliographies, *Ice, *Fog, *Detection, Optical detection, Remote sensing, Infrared detection, Aerial reconnaissance, Warning systems, Abstracts

Identifiers: NTISNTIS

NTIS/PS-78/0181/4ST NTIS Prices: PC N01/MF N01

RS79-9-034

Selection of a Seventh Spectral Band for the LANDSAT-D Thematic Mapper

Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.*NASA Earth Resources Survey Program, Washington, D.C.

Final rept. 15 Aug 77-15 Jan 78
AUTHOR: Holmes, Quentin A.; Nuesch, Daniel R.
E1005F1 Fld: 8B, 93A, 48I GRAI7811
Jan 78 89p
Rept No: ERIM-130100-4-F
Contract: NAS9-15362
Monitor: NASA-CR-151624
Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D.

Abstract: The author has identified the following significant results. Each of the candidate bands were examined in terms of the feasibility of gathering high quality imagery from space while taking into account solar illumination, atmospheric attenuation, and the signal/noise ratio achievable withing the TM sensor constraints. For the 2.2 micron region and the thermal IR region inband signal values were calculated from representative spectral reflectance/emittance curves and a linear discriminant analysis was employed to predict classification accuracies. Based upon the substantial improvement (from 78 to 92%) in discriminating zones of hydrothermally altered rocks from unaltered zones, over a broad range of observation conditions, a 2.08-2.35 micron spectral band having a ground resolution of 30 meters was recommended for inclusion on the TM.

Descriptors: *Thematic mapping, Spectral signatures, Agriculture, Geology, Vegetation, Wheat, Skylab program, EREP, Reflectance, Radiative transfer

Identifiers: NTISNASA

E78-10078 NTIS Prices: PC A05/MF A01

RS79-9-035 THEMATIC MAP PLOTTING WITH THE HELP OF MULTIDIMENSIONAL SATELLITE DATA

Haefner, H.; Geogr. Helv., V 33, No. 1, p. 21-24, 1978, Available in German
No abstract available.

RS79-9-036 SIDE-LOOKING RADAR AND INFRARED LINE SCANNER AS OPERATIONAL SURVEYING SYSTEMS FOR GEOLOGY AND HYDROLOGY

Koopmans, B.N.; Proc. of the Seminar on Remote Sensing Applications, p. 131-156, 1975, Econ. and Soc. Comm. Asia and Pacific, Mineral Resources Sect., Bangkok, Thailand
No abstract available.

RS79-9-037 INTERPRETATION TECHNIQUES FOR X-BAND SLAR

Parry, J.T.; 4th Canadian Symp. on Remote Sensing Proc., No. 4, p. 376-394, 1977
No abstract available.

RS79-9-038 USE OF A REMOTE COMPUTER TERMINAL DURING FIELD CHECKING OF LANDSAT DIGITAL MAPS

Robinove, C.J.; Hutchinson, C.F.; J Res. U.S. Geol. Survey, V 6, No. 4, p. 511-514, 1978
No abstract available.

RS79-9-039 CHARACTERISTICS OF THE LANDSAT MULTISPECTRAL DATA SYSTEM

Taranik, J.V.; U.S. Geol. Survey Open-File Rept. No. 78-187, 114 p., 1978,
Avail:U.S. Geol. Survey Open-File Serv. Sect., Denver, CO
No abstract available.

AUTHOR INDEX

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CONFERENCES, SYMPOSIA AND SHORT COURSES

April 23-27, 1979	13th Int'l Symposium on Remote Sensing of Environment	Jerald Cook Environmental Research Inst. of Michigan Univ. of Michigan Ann Arbor, MI 313/994-1200
May 13-17, 1979	32nd Annual Conference, Society of Photographic Scientists and Engineers Boston, MA	Dietrich Schultze SPSE Boston, MA 202/347-1140
May 15-17, 1979	7th Biennial Workshop on Color Aerial Photography in the Plant Sciences	Shirley Bell Univ. of California Conferences & Campus Services 4475 Chemistry Annex Davis, CA 95616
May 21-24, 1979	Symposium on Measurement, Mapping and Management in the Coastal Zone	LCDR John E. Chubb, USN DMA Hydrographic-Topographic Center Attn: PPII Washington, DC 20315 202/227-2064
June 11-15, 1979	5th Annual Pecora Memorial Symposium Sioux Falls, SD	Morris Deutsch EROS Data Center Sioux Falls, SD 57198 703/860-7872
June 27-29, 1979	5th Purdue Symposium on Machine Processing of Remotely Sensed Data	Laboratory for Applications of Remote Sensing (LARS) Purdue University 1220 Potter Drive W. Lafayette, IN 47906 317/749-2052
August 19-24, 1979	Air and Space Technology in the Forest Environment Arcata, CA	Donna Hankins Office of Continuing Education Technology Transfer I Humbold State Univ. Arcata, CA 95521 707/826-3112

August 20-24, 1979	Conference on Remote Sensing of the Earth's Surface Plymouth, NH	Dr. Louis S. Walter Earth Survey Applications Division Code 920 Goddard Space Flight Ctr Greenbelt, MD 20771 301/344-8671
September 10-14, 1979	Symposium on "Remote Sensing for Natural Resources - an International View of Problems, Promises and Accomplishments" Moscow, ID	Robert C. Heller College of Forestry Wildlife & Range Sci Univ. of Idaho Moscow, ID 83843
September 17-21, 1979	Fall Technical Meeting ASP and ACSM Sioux Falls, SD	Frederika Simon P.O. Box 1837 Sioux Falls, SD 57101