ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following range

IAA (A-10000 Series) A81-30425 – A81-40832
STAR (N-10000 Series) N81-21998 – N81-28046

This bibliography was prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by PRC Government Information Systems.
EARTH RESOURCES

A Continuing Bibliography
With Indexes
Issue 31

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between July 1 and September 30, 1981 in

- Scientific and Technical Aerospace Reports (STAR)
- International Aerospace Abstracts (IAA).
This supplement is available as NTISUB/038/093 from the National Technical Information Service (NTIS), Springfield, Virginia 22161 at the price of $10.50 domestic; $21.50 foreign for standing orders. Please note: Standing orders are subscriptions which do not terminate at the end of a year, as do regular subscriptions, but continue indefinitely unless specifically terminated by the subscriber.
INTRODUCTION

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

This literature survey lists 505 reports, articles, and other documents announced between July 1 and September 30, 1981 in Scientific and Technical Aerospace Reports (STAR), and International Aerospace Abstracts (IAA).

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in STAR and IAA.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in STAR, or IAA, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the variation in citation appearance.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

* IAA entries identified by accession number series A81-10,000 in ascending accession number order;
* STAR entries identified by accession number series N81-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

* subject, personal author, corporate source, contract number and report/accession number.
AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A81-10000 Series)

All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies of accessions are available at $7.00 per document up to a maximum of 40 pages. The charge for each additional page is $0.25. Microfiche (1) of documents announced in IAA are available at the rate of $3.00 per microfiche on demand, and at the rate of $1.25 per microfiche for standing orders for all IAA microfiche. The price for the IAA microfiche by category is available at the rate of $1.50 per microfiche plus a $1.00 service charge per category per issue. Microfiche of all the current AIAA Meeting Papers are available on a standing order basis at the rate of $1.50 per microfiche.

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CANADIAN CROP CALENDARS IN SUPPORT OF THE EARLY WARNING PROJECT

M. H. Trenchard and T. Hodges, Principal Investigators
Aug. 1980 151 p refs
Sponsored by NASA. USDA. Dept. of Commerce. Dept of Interior, and Agency for International Development ERTS

(Canadian Crop Calendars for LACIE are presented. Long term monthly averages of daily maximum and daily minimum temperatures for subregions of provinces were used to simulate normal daily maximum and minimum temperatures. The Robertson (1968) spring wheat and Williams (1974) spring barley phenology models were run using the simulated daily temperatures and daylengths for appropriate latitudes. Simulated daily temperatures and phenology model outputs for spring wheat and spring barley are given.

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Experiments in infrared multispectral mapping of earth resources.


Two evolutionary infrared remote sensing experiments provide the basis for the development of an operational mapping capability for geology exploration. A 10-band radiometer scheduled for an early Shuttle flight has completed an aircraft flight program which demonstrated the utility of a number of narrow spectral channels. A multispectral mapper utilizing an infrared area array detector to acquire simultaneous images in multiple wavelengths is being assembled. A design concept for an operational sensor which employs area arrays for registered multispectral image data acquisition is under study. The sensor would utilize onboard spectral band selection, radiometric correction, and data compression to satisfy the demanding requirements of the user community.

(Author)
AContinuingBibliography(Issue31)

OCTOBER1981

AGRICULTUREANDFORESTRY

Includecropforecasts,cropsignatureanalysis,soildentification,
diseasedetection,harvestestimates,rangeresources,
timberinventory,forestfiredetection,andalifemigration
patterns.

A81-30567 # Determination of snow depth on winter crop
fields from aerial gamma-ray mapping data. Opredelenie
vysoty snega na polialakh s posalami ozimykh kul'tur po rezultatam samoletných
gamma-samok snezhnogo pokrova. G. V. Shilin (Vsesoiuznyi
Nauchno-Issledovateî'ski Institut Sel'kokhoziaistvennogo Mashino-
stroeniia, Moscow, USSR). In: Aerial gamma-ray mapping of soil
moisture and snow cover. Moscow, Gidrome-

A81-33462 * Crop identification and leaf area index calcu-
lations with Landsat multitemporal data. J. E. Chance (Pan American
University, Edinburg, Tex.). International Journal of Remote
NaG-8033.

Formulas are given to convert land-based vegetative canopy
spectral reflectance measurements into Landsat digital counts in the
four channels for a clear standard atmosphere. These formulas are
shown to predict the curves found by plotting multitemporal
Landsat trajectories. With correct interpretation, plots of channel 3
versus channel 4. Landsat data for crops are shown to yield
information on both crop identification and crop leaf area index.

(Author)

A81-33463 * Stratification of natural vegetation for forest
and rangeland inventory using Landsat digital imagery and collateral
data. A. H. Strahler (California University, Santa Barbara, Calif.).
15-41. 25 refs. Research supported by the U.S. Forest Service and
University of California; Contracts No. NAS9-15505, No. NAS7-100.

A81-33464 Multidate spectral refection as predictors of yield
in water stressed wheat and barley. P. J. Pinter, Jr., R. D.
Jackson, S. B. Idso, and R. J. Reginato (U.S. Water Conservation
Laboratory, Phoenix, Ariz.). International Journal of Remote

Spectral reflectances of several crops at Phoenix, Arizona were
measured during two growing seasons using a hand-held radiometer,
the Exotech Model 100A, that had a spectral bandpass configuration
similar to scanning radiometers aboard Landsat 2 and 3. During the
period of grain filling, yields of two wheat and one barley variety
were well correlated with the integrated daily values of a modified
vegetation index derived from reflectances in MSS Bands 5 and 7
(0.6-0.7 and 0.8-1.1 micron respectively). The derived model
accounted for 88 per cent of the variability in yields from 103 to
656 g/ sq m which were due to differential experimental soil moisture
conditions (20 to 70 cm applied water).

(Author)

A81-33465 * A comparison of two methods for classifying
forestland. R. F. Nelson (NASA, Goddard Space Flight Center, Earth
Resources Branch, Greenbelt, Md.). International Journal of Remote
NAS9-1550B.

Two methods of developing land-cover classifications using
Landsat multispectral data were compared. The first method, called
P-1, uses a semi-automated approach to develop training statistics
which characterize the land-cover types. The second, called multi-
cluster blocks, depends more on analyst interaction to produce the
training statistics used by the classifier. The results showed that P-1
performed as well as the multicluster-blocks approach on a moun-
tainous study area in southwestern Colorado. These results may
interest any resource discipline which has available to it ground-
checked or photointerpreted information. P-1 can use this informa-
tion directly to output a land-cover classification with little
analyst interaction.

(Author)

A81-34502 # On some aspects and results of rectification
for command area development. H. K. Sinha (Survey of India, Pilot
Map Production Plant, Hyderabad, India). In: International archives
of photogrammetry; International Society for Photogrammetry,
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 313-322. 6 refs.

It is pointed out that while topographical surveying is of great
importance to agricultural development, the resources for this work
are limited. For this reason, aerial photography (high-gain imagery)
is seen as a useful tool that can provide, at a cost that is relatively low,
 improved relative horizontal and vertical information about agricul-
tural land and land that can be developed for agriculture. The
principal elements of the perspective rectification system are
outlined, and the cost effectiveness and performance characteristics
(accuracy, image quality) of different scales of rectified prints are
assessed.

(Author)

A81-34515 # A method for temporal image analysis of
conventional archives-photographs in relation to the study of soil

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It is noted that the measurements with spectroradiometers were made in the spectral ranges from 0.5 to 1.1 microns and from 1.5 to 2.4 microns were conducted on sugar beets and barley. B - In situ measurements with spectroradiometers. H.-J. Boehnel, W. Fischer, and G. Knoll (Fraunhofer-Institut für physikalische Messtechnik, Freiburg im Breisgau, West Germany), and A. Kadro (Freiburg, Universität, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.


The spectral reflectance factors are calculated and compared with the corresponding values determined from the MSS data of the same imagery material are almost the same for both instruments. M. Cagirici (Gartenamt, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
the use of satellite data for updating Nova Scotia forest inventory.

G.R.


A description is presented of procedures followed in establishing, monitoring, and updating a farm land inventory. The three methods considered as alternatives for data acquisition include satellite imagery analysis, airborne imagery analysis, and ground survey. Airborne data acquisition was used for the forest inventory in New Brunswick. Data collection by ground survey was found to have a distinct advantage over the other methods, and it was finally selected for the inventory project. The inventory data was recorded graphically on maptabs and then converted into digital form. Monitoring and updating of the data were performed by digital image analysis techniques using precision processed Landsat MSS images, which are registered on the Universal Transverse Mercator projection grid.

G.R.


The principles governing a specialized conversational man-machine complex of aerospacial data interpretation used in assessing forest resources are presented. Also given is a distribution of functions between man and computer for solving the principal tasks. A flow chart is given of the automatized interpreter working place. Results are presented of experimental searches in aerospacial forest data processing. The results are seen as confirming the possibility of designing such a man-machine complex.

C.R.


Results of two forest stratification projects are presented to show that Landsat data, when combined with guided clustering techniques, can provide detailed stratification of forest environment. It is shown that conifer species groupings, vegetative cover classes, and three size classes can be discriminated with accuracies ranging from 83 to 91%.

V.L.


The quantity of data produced by multispectral scanner systems from satellite (or even aircraft) altitudes is seen as clearly indicating a need for effective computer-aided analysis techniques. It is noted that since the launch of Landsat-1 in 1972, significant progress has been made in developing and refining a variety of techniques for processing and analyzing such data. Three basic aspects of computer processing of MSS (multispectral scanner) data are discussed: preprocessing, enhancement, and classification. Recent developments in classification techniques are then assessed. Consideration is given to the use of ancillary data as part of the process of classification. The ECHO (Extraction and Classification of Homogeneous Objects) algorithm and the layered classification technique, which appear to be particularly important for an effective analysis of earth resource features, are discussed. Future prospects for remote sensing data collection systems and analysis techniques are considered.

C.R.


The reflection characteristics of barley and wheat covers at various stages of development are investigated as a function of viewing angle in order to determine the sensitivity of oblique radiometric measurements to changes in vegetation structure. Reflection indicatrices representing the relative variation of reflectance with viewing angle were obtained in bands corresponding to those of Landsat by a four-channel radiometer rotating in vertical planes parallel and perpendicular to the solar azimuth. The curves measured are found to depend on radiometer orientation with respect to the sun, wavelength, and cloudiness as well as the geometric structure of the vegetation cover, which is determined by its growth phase, and to deviate significantly from the Lambert law. Results demonstrate that stereoradiometry may be an important tool in crop surveillance and inventories, providing information on crop identities and growth stages that has yet only been obtained in sequential studies.

A.L.W.
The evaluation of satellite imagery provided information regarding potential farming areas. A map showing the distribution of farm areas for a part of West Africa could be plotted on the basis of the available imagery. A comparison of soil characteristics and population density made it possible to identify areas, which are sparsely populated, in spite of a presence of good soil. These areas have agricultural potential, which is still not utilized. The water levels in reservoirs and lakes in Upper Volta and Niger are subject to large seasonal fluctuations. Satellite imagery has made it possible to identify reservoirs with water resources which are currently not fully utilized. It is found that time-consuming visual evaluation procedures can be partly replaced by computer-supported evaluation of satellite imagery.


In fields planted with grain (winter wheat, winter rye, summer wheat, and miscellaneous barley), 27 reference plots, each an area of 10 x 10 m, were selected. Aerial photographs on color infrared film were obtained a few weeks before the harvest. At the harvest, the yield from the reference plots were determined on a weight basis. Density values on the film were obtained for blue, green, and red. Finally, the correlation between spectral signature and yield were calculated. A common correlation factor of 0.71 was obtained for all four types of grain. Attention is given to the procedure used in obtaining the aerial photographs, the computer-aided evaluation of the aerial photographs, and a test with sugar beets and corn.


This work analyzes the result of applying a principal component transformation to a subimage of Landsat frame number 224-10135. This subimage corresponds to a geographic area in the geologic basin of Madrid, which is formed by a variety of tertiary and quaternary sedimentary deposits. The analysis aims at the identification and discrimination of soil features, and is carried out with the help of pattern recognition techniques provided by the interactive system ERMAN-II. (Author)


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A81-34570  #  Photo interpretation of the vegetation through
densitometry. D. Marchetti (Cerrado Agricultural Research Center,
Brasilia, Brazil) and G. J. García (Botucatu, Faculdade de Agro-
nomia, São Paulo, Brazil). In: International archives of photogram-
metry; International Society for Photogrammetry, Congress, 14th,

Measuring optical density significantly increases the possibility of photo interpretation of vegetation. Two types of densitometers measure optical density: a transmission densitometer measures the quantity of light crossing the film; a reflection densitometer measures the quantity of light reflected from the surface of a photographic print. Densitometric measurements offer more consistent results than those obtained by conventional photo interpretation. The utilization of colored infrared film suggests an increase in the importance of densitometric readings. Munson’s notation and the characterization of color are not as elucidative as optical density values, which are not subjective, have high repetitive parameters, and use perfectly calibrated densitometers. The importance of densitome-
try for photo interpretation increases as the photographic scale decreases.

J.F.

A81-34571  #  Yield estimates for corn crop through the

Yield estimates obtained through remote sensing allow information to be obtained quickly and reduce the data volume necessary for the traditional system of yield forecasting. A test study showed that color infrared film can be used to forecast yield estimates for corn crops. The technique used to photograph with infrared film involved equipping the camera with rectifying device to vary the focal distance 0.25%; a yellow filter was used to prevent the blue light from reaching the emulsion. Six trials were made with different quantities of fertilizers. Quantitative interpretation of the photographs was made on numerical data obtained through densitometers, and the interaction between production and optical density was analyzed through correlation and linear regression. The correlation coefficient for the colored infrared film was 0.86 with the significance level of 1% probability. The quantitative interpretation of the results suggests the application of this method to other cultures.

J.F.

A81-34577  #  Modelling tree damage-type patterns for photo

A81-34579  #  Application of remote sensing methods at

A review is given on the application of remote sensing and image analyzing methods in plant pathology, particularly at macroscopic and microscopic levels. The review illustrates various methods and techniques for detection, identification and assessment of symptoms of vegetation damage caused by diseases, pests and physiological stress, and for studies of the parasites as well as for use in demonstrations in plant pathology and related subjects and for training in conventional plant disease assessment. (Author)

A81-34580  #  Evaluation of radar images by means of visual

Radar images obtained by means of Side Looking Airborne Radar (SLAR) have been considered in the evaluation. The E-SLAR employed operates at a frequency of 9.55 GHz and makes use of vertical polarization. The data were recorded in ten tones of gray. For evaluation purposes the data have to be presented on a television screen and be photographed. This process introduces certain loss of information. The recordings were made between 1977 and 1979 in flights over Switzerland and Germany. The flight altitude was 1000 m above ground. It was found that visual interpretation of X-band radar images provides valuable information regarding geology and soil of the investigated area if differences concerning soil and rock characteristics are expressed by morphological distinctions.

G.R.

A81-34582  #  Mapping polar vegetation at Spitsbergen by
use of Landsat. H. A. Oedege, R. Ottenze (IBM, Oslo, Norway)
and N. Oritsland (Norsk Polarinstitutt, Oslo, Norway). In: Interna-
tional archives of photogrammetry; International Society for Photo-
grammetry, Congress, 14th, Hamburg, West Germany, July 13-25,
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 723-733. 8 refs.

Changes that occurred between 1946 and 1975 in the vegetation cover of an area of approximately 3920 sq km in northwestern Falcon State, Venezuela, were identified and analyzed using medium scale panchromatic photographs. A descriptive key was developed to interpret the categories in the 1946 photographs and to permit comparisons of aerial photographs taken 29 years apart. It contained 25 categories based on horizontal distribution of vegetation and percentage plant cover. Aerial photo missions of 1946 at a scale of 1:40,000 and of 1975 at a scale of 1:50,000 were used. Photointer-
pretation of the 1946 mission resulted in 87 units which show relative homogeneity in terms of texture, tone, and pattern. The complete listing of units and their cover type in 1946 and 1975 are presented in table form; each unit is also described and changes that occurred are identified. The 12 most frequent events are listed and 10 hypotheses are formulated to explain the causes of desertifica-
tion, and include: conversion of agricultural or pastoral lands into wastelands due to ecosystem mismanagement; soil slides from denuded slopes, which in turn are due to mismanagement; and ecosystems degradation next to the boundary between contracted and evenly distributed vegetation caused by man’s activity.

K.S.

A81-34587  #  Two-phase sample design for large-area forest
inventories, using aerial photographs 1:50,000, and supplementary
ground measurements (Ein zweiphasiges Stichprobenystem für forstliche Grossraum-Inventuren, gestützt auf IRC-Luftbilder 1:50,000 und ergänzende terrestrische Messungen). J. Schade (Frei-
burg, Universität, Freiburg im Breisgau, West Germany). In: Interna-
tional archives of photogrammetry; International Society for Photo-
grammetry, Congress, 14th, Hamburg, West Germany, July 13-25,

A multiphase sample-design system was found to provide a suitable cost-effective approach for solving problems encountered in connection with large-area forest inventories in Central Europe. A complete set of informative forestry data could be assigned to each point of a grid structure covering the aerial photographs. The
product of crown cover (in percent) and age provided the best aerial-photograph parameter for estimating available supplies of various types of wood. The corresponding correlation values for the principal types of wood were about 0.9. Attention is given to the interpretation of the aerial photographs, details concerning the ground samples, aspects of data processing, and relations between the variables.

G.R.


A test area of the severely damaged pine forests in the lower Swiss Rhone Valley was sampled systematically. Nine site, stand, and damage characteristics were rated and encoded for each sample plot using medium scale color infrared (CIR) aerial photographs. The objective of this study is to quantify the interdependencies between these variables. Using a multiple linear regression in connection with a principal component analysis, the damage variable 'pine mortality' is expressed in terms of site and stand characteristics.

(Author)


An operational system based on remotely sensed data is outlined for the study and protection of forest resources through thematic mapping and forest inventory. Solutions to nature-conserving and scientific problems, such as water regime observation of rivers and lakes within the forest fund, dust and sand storms, and pollution control are proposed. The system uses (1) meteorological and resource satellite, orbital stations, and automatic spaceships which provide multispectral TV and photographic data, space-visual interpretation data, and radiometric photography; (2) aircraft which provide multispectral or spectral photography, IR-thermal imagery, radar sensing, and aerovisual observation; and (3) data obtained from ground level.

K.S.


A soil-salinization study of 10,000 sq km of the Konya basin in Central Turkey, using Landsat data, is reported. A soil salinity interpretation map, based on image element analysis and on ground-truth data, was obtained, and it was used during the whole field-work period. A detailed description of the Landsat data, processed on the digital interactive image analysis system DIBIAS, is presented. The classification scheme, applied to both the 1975 and the 1979 scenes, differentiates between eight categories, i.e., four classes of soil salinization degrees, two classes of arable land, one class of mountain area, and one class of water. It is concluded that the correct choice of Landsat data and the accurate coordination between Landsat image interpretation and field work are extremely important for the results of digital classification, that change detection is strongly influenced by the quality of the classification made, and that semidetailed surveys (to a scale of 1:50,000) in arid zones supported by digital procedures (i.e., classification and change detection) may become increasingly significant.

K.S.


Oblique viewing sensors are to be launched in the late 1980's on the Multispectral Resource Sampler, being developed by the U.S. Since the resulting oblique measurements will need to be better understood, the reflectance response with a view angle of wheal, excluding atmospheric effects but simulating the response of a multispectral scanner, is analyzed. Spectra were taken continuously in the wavelength range of 0.45 to 2.4 microns at more than 1200 view/illumination directions with a 20 C spectral radiometer, and data were acquired six meters above four wheat canopies, each at a different stage of growth. The study shows that the canopy reflective response is a function of the illumination angle, the scanner view angle, and the wavelength; and the variation is greater at low solar variations.

K.S.


An investigation of damaged trees affected by industrial air pollution, using a computerized classification of multispectral scanner images, is described. The results obtained are supported by recent ground truth data, available criteria for data analysis, and are given for the interpretation of reverse color images by Murtha (1972). The Qader-classification used in the study is analyzed for its applicability, and the advantages of the method are discussed in relation to the evaluation of environmental impact on vegetation. Results show that the probability calculations used to separate sample classes can be advantageously applied in the recognition of homogeneous classes, but were found to interfere when differing concrete symptoms were to be investigated.

E.B.


A81-34628 // Numerical evaluation of infrared color film for the study of beech bark disease /Fagus silvatica L./ (Exploitation numérique du film infrarouge couleur pour l'étude de la maladie de l'écorce du hêtre /Fagus silvatica L./). P. Boissard, B. Andrieu, P. G. AGRICULTURE AND FORESTRY


A81-34631 # Differences in the spectral characteristics between healthy and diseased crops determined for sugar beet and winter barley - Definition of the ground truth data on the common sugar beet test sites /Bologna, Italy/ and description of the results acquired in the thermal infrared range. C. de Carolis, P. Amodeo (Milano, Universita, Milan, Italy) and C. Cerato, G. Ciardadini (Istituto Sperimentale per le Colture Industriali, Bologna, Italy). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8.


Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 520-527. 7 refs.

This paper deals with a general method of deriving information from forest sample plots from fixed air base photography without extensive control for each plot. The method requires a test area with given control to alloy in-flight calibration. Both inner orientation of the inner and their outer orientation relative to a model coordinate system can be derived from photographing the test area. The theoretical accuracy of the method is discussed, and some practical applications with wing-tip mounted cameras are reported. (Author)


An investigation is conducted regarding the availability of Landsat data for forest type classification, timber volume estimation, yearly growth estimation and deforested area monitoring. Attention is given to the characteristics of the test area, a forest type classification, procedures for finding deforested areas, and the examination of the considered areas by the subtraction method. A multiple regression analysis was conducted concerning the relationships between Landsat Band 5 and 7 data and timber volume or yearly growth. Deforested areas of a forested region were detected by a method which involved the observation of differences in Landsat Band 5 data, taken at different times. G.R.


Forest defoliation changes permeability of forest cover and modifies reflectance which under these conditions includes the spectral responses of undergrowth and bare soil. This is especially true for southern French Landes cluster pine forests because of tree characteristics and space between plantings. Ground, aerial and Landsat multispectral data therefore show variations due to degree of defoliation and the reflectances of environmental components so that the cluster pine spectral signature is almost always modified by environmental factors. Defoliation can only be detected by a series of surveys showing marked reflectance variations and interpretation must take into account the 3 year period necessary for the cluster pine to reestablish foliage. D.B.


Pine root degradation is southwestern France due to parasite attack impedes water circulation functions and leads to tree deterioration. A fall in water content of needles or tree liber occurs after a period of several weeks or months and only then is detection of diseased state possible by infrared thermal techniques. An experiment was carried out to determine whether diseased trees could be detected before symptoms became visible to naked eye inspection but results were not definitive. However, a temperature differential between healthy and diseased trees was observed and diseased trees are 1 or 2 C hotter. Ground examination continues to determine whether higher temperatures indicate tree disease. An infrared camera at 8-14 microns was used. D.B.


Basic principles and the results of research work concerning the use of remote sensing techniques for detecting stress or damage in agriculture and forestry are given. In most cases, aerial IRC photography was used, because, in general, both changes in reflective reflectance as well as in texture have to be taken into account in data evaluation. In forestry, practical application of research results has been established in a large variety of cases, whereas in agriculture only a few research findings could be transferred to practical use yet. The reasons for these facts are discussed, and proposals are made to close the existing gaps between science and application. (Author)


The spectral reflectance characteristics of vegetation have been studied with the objective to learn how to extract useful information about the state of surface vegetation from space-borne observing systems, with emphasis on agricultural applications. Results of simulation studies based on high-resolution airborne spectrometer data indicate that changes in biomass, plant pigment, and leaf water content can be independently tracked by monitoring the reflective properties of vegetation with an appropriate selection of bands. V.L.


The radar clutter behavior of vegetation is characterized by a probability density function of the Eulerian angles of rotation. The radiative transfer equations are solved by an iterative approach to first order in albedo. In the half space limit the results are identical to those obtained via the approach of Foldy's and distorted Born approximation. Numerical results of the theory are illustrated using parameters encountered in active remote sensing of vegetation layers. A distinctive characteristic is the strong depolarization shown by vertically aligned leaves. V.L.


The feasibility of using remote sensing data for soil mapping in the Baikal region is demonstrated. A correlation is established between soil types and photogenic landscape components that can be distinguished by density, color, or image pattern. The vertical zonation of soil cover corresponding to the zonation of large landscape divisions is shown.


The feasibility of crop characterization from remotely sensed multispectral reflectance data is discussed with reference to a deterministic reflectance model developed by Suits (1972). It is shown that the reflectance data in visible, near infrared, and the near-infrared wavelength regions provide information which makes it possible to assess the development of soil cover and the leaf area index at the vegetative stage and crop yellowing due to leaf senescence.

V.L.


The spectral reflectance characteristics of vegetation have been studied with the objective to learn how to extract useful information about the state of surface vegetation from space-borne observing systems, with emphasis on agricultural applications. Results of simulation studies based on high-resolution airborne spectrometer data indicate that changes in biomass, plant pigment, and leaf water content can be independently tracked by monitoring the reflective properties of vegetation with an appropriate selection of bands. V.L.
Polarized visible light is an indicator of scene roughness; smooth surfaces polarize visible light to a greater extent than rough surfaces. On the assumption that canopy roughness is a function of vegetation amount, the relationship between polarized visible light and vegetation amount was investigated. Twelve aerial survey flights taking polarized visible light photography were made during an 18-month study. At the same time, either percent vegetation cover or dry green biomass (by harvest) were recorded for each of four vegetation types: mature and young bog-recovered meadows, scrub, and pasture. There was a linear relationship between polarized visible light and vegetation amount, with an average correlation of 0.63 (significant at the 5% level). In the winter, the sites had a high canopy and percent polarization. In the summer, when canopies were complete and undisturbed, the ability to estimate vegetation amount was maximized, but the difference between sites minimized.

(Author)

01 AGRICULTURE AND FORESTRY


Under an experimental program of ground-based scatterometry, the radar response to soil surface has been investigated using a scatterometer operating at 1.5, 3, 4.5, and 9 GHz. The effects of the angle of incidence, frequency, polarization, surface roughness, and soil moisture are examined. Techniques used for the characterization of soil moisture and surface roughness are briefly reviewed. V.L.


Spectral brightness coefficients have been measured for various types of soils and vegetation in the visible spectral range (400-800 nm) with an aperture of 13 deg. Relationships between the parameters of soil and vegetation (type, properties, composition, and structure) and their spectral reflectance characteristics are discussed. V.L.


Laboratory and in situ reflectance measurements in the visible and near infrared have been carried out on various crops including wheat, rice, millet, corn, soil, and groundnut in order to investigate their spectral responses in different spectral bands. Measurements have been also conducted over several wheat plots to study the effect of water stress on the signatures. It is found that the best period for monitoring water stress in wheat by remote sensing is 45-80 days after sowing. V.L.


A time-dependent energy budget model designed to make possible the prediction of the temperature of terrain scene elements that contain a simple layer of vegetation and to diagnose the effect of vegetation on remotely sensed temperatures is discussed. It is noted that the model was developed for use as a module in conjunction with existing nonvegetated-terrain temperature models. Vegetation is assumed to be a horizontally homogeneous but porous layer partially covering a specified ground surface. Energy budgets for the foliage and the ground are evaluated separately but are interdependent. The sensitivity of the vegetation module to its input variables when used in tandem with a bare-ground model is examined and found to be most strongly dependent on the degree of foliage cover. The model results are verified against measurements made on two moderate days for a 12% high-vegetation cover or dry hay and are compared with results from a complex vegetation model. Results are highly satisfactory and similar for both models. C.R.


An algorithm for estimating moisture content of a bare soil from the observed brightness temperature at 1.4 GHz is discussed and applied to a limited data base. The method is based on a radiative transfer model calculation, which has been successfully used in the past to account for many observational results, with some modifications to take into account the effect of surface roughness. Besides the measured brightness temperatures, the three additional inputs required by the method are the effective soil thermodynamic temperature, the precise relation between moisture content and the smooth field brightness temperatures and a pair of parameters related to surface roughness. The procedures of estimating surface roughness parameters and of obtaining moisture content from observed brightness temperature are discussed. The algorithm is applied to observations from truck mounted and airborne radiometers. The estimated moisture contents compare favorably with the observations in the top 2 cm layer. (Author)


Red and photographic-infrared spectral data collected on 21 dates over the growing season, with a hand-held radiometer were quantitatively correlated with total dry-matter accumulation in winter wheat. The spectral data were found to be highly related to vigor and condition of the plant canopy. Two periods of drought stress and subsequent recovery from it were readily apparent in the spectral data. Simple ratios of the spectral radiance data compensate for variations in solar intensities and, when integrated over the growing season, explained 79% of the variation in total above-ground accumulation of dry matter. A satellite system is proposed to provide large-area assessment of total dry accumulation or net primary production from terrestrial vegetation. (Author)


A farming technique based on a simplistic physical model
providing a classification algorithm for mixture landscapes. Results of applications to LANDSAT inventory of 0.5 million acres of forest land in Northern Maine are presented. Significant potential for potential commercial use was observed in New Hampshire. Work identified 15 million acres of potential land-use change, and 25 million acres of potential forest land in the state. The work is presented in a report available upon request.


Six forest cover categories were mapped, along with 10 general land cover classes. To map the state's 100 million acres, 1.6 acre mapping units were utilized. Map products were created. Standing forest acreage for the state was computed to be 26.8 million acres.

T.M.

T.A. 23544* Science and Education Administration, Weslaco, Tex.


Avail: NTIS HC AO3/MF AO1 CSCL 02C

Emisive and reflective data for 10 days, and IR data for 6 nights in south Texas scenes were analyzed after procedures were developed for removing cloud-affected data. HCMM radiometric temperatures were within 2°C of dewpoint temperatures on nights when air temperature approached dewpoint temperatures, significantly correlated with variables important in evapotranspiration; and, related to freeze severity and planting depth soil temperatures. Vegetation greenness indexes calculated from visible and reflective IR bands of NOAA-6 to -9 meteorological satellites will be useful in the AgRISTARS program for seasonal crop development, crop condition, and drought applications. T.M.


Avail: NTIS HC AO2/MF AO1 CSCL 02C

Infrared data of the Wahita River watershed were screened to include areas having greater than 60% pasture. This improved the July 24/July 13 and October 5/November 30 temperature/antecedent precipitation index (API) relationships, but the coefficient of determination was not improved in the July 29/July 13 relationship. Surface temperatures were recalculated using the atmospheric correction factor calculated by the modified RADTRA model. In all cases the correction factor was reduced. The model estimate and lake surface temperatures may be used for Rockets and Satellites'. HCMM

Avail: NTIS HC AO3/MF AO1 CSCL 02F

A winter black and white band 5, a winter color, a fall color, and a diazo color composite of the fall scene were used to assess the use and potential of LANDSAT images for mapping and estimating acreage of small scattered forest tracts in Barry County, Michigan. Forests as small as 2.5 acres were mapped from each LANDSAT data source. The maps for each image were compared with an available forest-type map. Mapping errors detected were categorized as boundary and identification errors. The most frequently misclassified areas were agricultural lands, land-uses, brushlands and lowlands, and mixed hardwood stands. Stocking level affected interpretation more than stand size. The overall level of the interpretation performance was expressed through the estimation of classification, interpretation, and mapping accuracies. These accuracies ranged from 74% to 98%. Considering errors, accuracy, and cost, winter color imagery is the best LANDSAT alternative for mapping small forest tracts. However, since the availability of cloud-free winter images of the study area is significantly lower than images for other seasons, a diazo enhanced image of a fall scene is recommended as the best next best alternative. T.M.

T.A. 23544* Kansas Univ., Lawrence. Space Technology Center.

CROP PHENOLOGY AND LANDSAT-BASED IRRIGATED LANDS INVENTORY IN THE HIGH PLAINS Interim Report. 1 Sep. - 30 Nov. 1980

E. A. Martinko, Principal Investigator. J. Poracsky, E. R. Kipp, and H. Krieger. 30 Nov. 1980 34 p ERTS (Grant NAG2-57)

Avail: NTIS HC AO3/MF AO1 CSCL 02C

The activity concentrated on identifying crop and irrigation data sources for the eight states within the High Plains Aquifer and making contacts concerning the nature of these data. A mail questionnaire was developed to gather specific data not routinely reported through standard data collection channels. Input/output routines were designed for High Plains crop and irrigation data and initial statistical data on crops were input to computer files. T.M.

T.A. 23544* Kansas Univ., Lawrence. Space Technology Center.


Avail: NTIS HC AO3/MF AO1 CSCL 02C

Optimal LANDSAT image dates for 1980 were identified based on the weekly crop-weather reports for Colorado, New Mexico, South Dakota, Texas, Oklahoma, Arkansas, Nebraska, and Wyoming. The 1979 agricultural statistics data were entered into computer files and a revised questionnaire was developed and mailed to ASCS county agents. A set of computer programs was developed to allow the preparation of computer-assisted graphic displays of much of the collected data. T.M.


Avail: NTIS HC AO3/MF AO1 CSCL 02C

EXPERIMENTAL APPLICATION OF LANDSAT TO GEOBOTANICAL PROSPECTING OF SERPENTINE OUTCROPS IN THE CENTRAL APPALACHIAN PIEDMONT OF NORTH AMERICA

Howard W. Mielke, Principal Investigator (Macalester Coll.) Jul.
A PARAMETERIZATION OF EFFECTIVE SOIL TEMPERATURE FOR MICROWAVE EMISSION


A parameterization of effective soil temperature is discussed, which when multiplied by the emissivity gives the brightness temperature in terms of surface (T sub s) and deep (T sub d) soil temperatures as T = T sub s + T sub d. The thermal data was used to test the brightness temperature of a set of soil profiles observed at USDA facilities in Arizona and Georgia. The calculations were found to be a function of wavelength and is in the range 0.05 to 0.20 wavelengths at the wavelength of dry soil condition and 0.1 - 0.25 wavelengths at wet soil conditions. Calculated values of emissivity show strong diurnal variations when the soils are wet, while there is little diurnal change when the soil is dry. The soil moisture was calculated using the dilution of temperature and emissivity. The gradient treatments among effective wavelengths are compared using the effective temperature, surface temperature, and emissivity. A.R.H.

A STOCHASTIC APPROACH TO THE DETERMINATION OF THE SPECTRAL NATURE OF THE MICROWAVE EMISSION FROM SOILS


Techniques developed from aircraft flights over the Washita watershed in central Oklahoma were applied to HCM data analysis. Results show that (1) canopy temperatures were accurately measured remotely; (2) surface temperature differences detected relative soil moisture differences; (3) surface temperature differences were related to stress in nearby wheat fields; and (4) no relationship was found between final yield differences, thermal infrared data, and soil moisture stress at growth stages. The HCM thermal data proved to be quite adequate in detecting relative moisture differences; however, with a 16 day day/night overpass frequency, more frequent overpasses are required to analyze more cases within a 7 day period after the storm. Better normalization techniques are also required. A.R.H.

A applied to the multispectral satellite for quickly and accurately locating mineral sensitive vegetation communities over vast tracts of land.


Techniques developed from aircraft flights over the Washita watershed in central Oklahoma were applied to HCM data analysis. Results show that (1) canopy temperatures were accurately measured remotely; (2) surface temperature differences detected relative soil moisture differences; (3) surface temperature differences were related to stress in nearby wheat fields; and (4) no relationship was developed between final yield differences, thermal infrared data, and soil moisture stress at growth stages. The HCM thermal data proved to be quite adequate in detecting relative moisture differences; however, with a 16 day day/night overpass frequency, more frequent overpasses are required to analyze more cases within a 7 day period after the storm. Better normalization techniques are also required. A.R.H.


Public and private agencies were introduced to the use of remotely sensed data obtained by both satellite and aircraft, and benefited from facilities for data processing enhancement and interpretation as well as from the institution’s data library. Cooperative ventures involving the performance of operational activities included assistance to the Bureau of Land Management in the suppression of wildfires, the selection of sites for power projects and sediment transport near Prudhoe Bay; the establishment of a colar infrared file of the outer continental shelf environment and reindeer herds. A.R.H.


Procedures to evaluate the accuracy of LANDSAT derived wildland cover classifications are described. The procedures include: (1) implementing a stratified random sample for obtaining unbiased verification data; (2) performing area by area comparisons between validation and LANDSAT data for both heterogeneous and homogenic fields; (3) providing overall and individual classification accuracies with confidence limits; (4) displaying results within contingency tables for analysis of confusion between classes; and (5) quantifying the amount of information (bits/square kilometer) conveyed in the LANDSAT classification. E.A.K.

N81-24605*# University of South Florida, Tampa. STOCHASTIC ANALYSIS OF MULTIPLE-PASSBAND SPECTRAL CLASSIFICATIONS SYSTEMS AFFECTED BY OBSERVATION ERRORS Chris P. Tsokos Dec. 1980 31 p. ref. (Grant NAGI-9) (NASCAR-CR-164366) Avail: NTIS HC A03/MF A01 CSCL 08B

The classification of targets viewed by a pushbroom type
multiple band spectral scanner by algorithms suitable for implementation in high speed online digital circuits is considered. A class of algorithms suitable for use with a pipelined classifier is investigated through simulations based on observed data from agricultural targets. It is shown that time distribution of target types is an important determining factor in classification efficiency. E.A.K.

APPENDIX B: INVENTORY OF CONIFEROUS FORESTS


(Grant NAG-2341)

(E81-10120; NASA-CR-164114) Avail: NTIS C03/MF A01 CSCL 05B

The teaching module on image classification procedures using the VICAR computer software package was developed to optimize the training benefits for users of the VICAR programs. The field test of the module is discussed. An intensive forest land inventory strategy was developed for Humboldt County. The results indicate that LANDSAT data can be computer classified to yield site specific forest resource information with high accuracy (82%). The 'Douglas-fir > 80%' category was found to cover approximately 21% of the county and 'Mixed Conifer > 80%' covering about 13%. The 'Redwood > 80% resource category, which represented dense old growth trees as well as large second growth, comprised 4.0% of the total vegetation mosaic. Furthermore, the 'Brush' and 'Brush-Regeneration' categories were found to be a significant part of the vegetative community, with area estimates of 9.4 and 10.0%. E.D.K.

APPENDIX C: A COMPARATIVE STUDY OF SMALL SCALE REMOTELY SENSED DATA FOR MONITORING CLEARCUTTING IN HARDWOOD FORESTS


Avail: NTIS HC A16/MF A01 CSCL 02F

Manual photointerpretation techniques were used to analyze images acquired by high altitude aircraft, the Skylab multispectral and ERTS-1 (Earth Resources Technology Satellite), the LANDSAT multispectral scanner, and the LANDSAT-3 thermal beam vidicon camera. A color-additive viewer, and digital image analysis were also used on the LANDSAT MSS imagery. The value of each type of remotely sensed data was judged by the ease and accuracy of clearcut identification, and by the amount of detail discernible, especially regarding revegetation. Results of a site study in the Allegheny National Forest, Pennsylvania indicate that high altitude aerial photography, especially color infrared photography acquired during the growing season, is well suited for identifying clearcuts and assessing revegetation. Although photographs acquired with Skylab's ETC also yielded good results, only incomplete inventories of clearcuts could be made using LANDSAT imagery. Results for the Adirondack region of New York State were similar for the aircraft and satellite photography, but even less satisfactory for the LANDSAT imagery. A.R.H.

A zoom stereoscope was used to interpret aerial color photographs of the Finger Lakes region near Bath, New York, and areas of conifers were delineated on acetate sheets. Scale was determined for each photograph and units were converted to acres. Photographically enlarged positive transparencies of imagery from LANDSAT bands 5, 6, and 7 for the southern portion of the study area were placed in a cold additive viewer and reinterpreted with each other to provide a composite image. A green filter was used on band 5, blue on band 6, and red on band 7. Conifers appeared at dark, reddish purple. Acreage was determined using a grid. Results show that the total conifer stands within 50 miles of Bath is approximately 176,000 acres of which 60,000 acres are in Pennsylvania. The study was conducted to determine the feasibility of locating a particleboard manufacturing firm in the Southern Tier. A.R.H.
levels were heterogeneity of both canopy and understory of the rain forest, inaccuracies in generalized vegetation maps used to evaluate deforestation, analysis of errors in LANDSAT images due to both geometric errors and misleading pixel portrayal. The change in the decline patterns was too small to be measured by either enhancement of LANDSAT images or interpretation of vegetation maps compiled from aerial photographs.

Dissert. Abstr.

N81-25626# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT SUPPORTS DATA NEEDS FOR EPA 208 PLANNING
(E81-10148: NASA-TM-82382) Avail: NTIS HC A03/MF A01 CCSC 05B

Excerpts from federal legislation and regulations mandating areawide water treatment management as a means of restoring and maintaining the integrity of the nation's water are presented along with requirements for grants to the states for water quality planning, management, and implementation. Experiences using LANDSAT to identify nonpoint sources of water pollution as well as land/ use/land cover features in South Dakota, Kentucky, Georgia, New Jersey, and Texas are described. Present activities suggest that this type of remote sensing is an efficient, effective tool for areawide water quality planning. Interaction with cognizant federal, state, and local government personnel involved in EPA section 208 planning activities can guide the development of new capabilities and enhance their utility and prospect for use.

A.R.H.

N81-25627# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

The experiment design, data acquisition and preprocessing, data base management, analysis results and development of instrumentation for the AgrISTARS Supporting Research Project, Field Research task are described. Results of several investigations on the spectral reflectance of corn and soybean canopies as influenced by cultural practices, development stage and nitrogen nutrition are reported as well as results of analyses of the spectral properties of crop canopies as a function of canopy geometry, row orientation, sensor view angle and solar illumination angle are presented. The objectives, experiment designs and data acquired in 1980 for field research experiments are described. The development and performance characteristics of a prototype multiband radiometer, data logger, and aerial tower for field research are discussed.

A.R.H.

N81-25628# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

The development of spectrometry crop development stage models is discussed with emphasis on models for corn and soybeans. One photothermal and four thermal meteorological models are evaluated. Spectral data were investigated as a source of information for crop yield models. Intercepted solar radiation and soil productivity are identified as factors related to yield which can be estimated from spectral data. Several techniques for machine classification of remotely sensed data for crop inventory were evaluated. Early season estimation, training procedures, the relationship of scene characteristics to classification performance, and full frame classification methods were studied. The optimal level for combining area and yield estimates of corn and soybeans is assessed utilizing current technology: digital analysis of LANDSAT MSS data on sample segments to provide area estimates and regression models to provide yield estimates.

A.R.H.

N81-25634# Army Military Personnel Center, Alexandria, Va.
Dorothy Fay Klasse May 1981 107 p refs (AD-A099286) Avail: NTIS HC A06/MF A01 CCSC 02/4

Satellite imagery can be of very real value to the poorly mapped areas of the world. Because agriculture is dynamic with constantly changing conditions, remote sensing offers the feasibility of monitoring agricultural lands over an extended period of time. The specific objectives of this research are: (1) to estimate the total acreage/hectares of oasis agricultural lands of the Turpan Depression on selected dates from 1972 to 1978: (2) to prepare thematic maps of the oasis agriculture for the years 1972, 1973, 1977, and 1978; and (3) to assess the agricultural land reclamation efforts within this study area. This thesis dealt with the mapping of oasis agriculture from LANDSAT imagery and the associated problems relating to image resolution, and the lack of ground data and supporting information.

Author (GRA)

N81-27573# Food and Agriculture Organization of the United Nations, Rome (Italy).
FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS OFFICE FOR SPECIAL RELIEF OPERATIONS (OSRO)

Avail: NTIS HC A09/MF A01

The nature of assistance provided through OSRO in response to request for emergency aid in the agricultural, livestock and fishery sectors, from many parts of the world, is described. Activities include: agro-economic assessment and monitoring of emergency requirements and supply; carrying out relief and rehabilitation operations, e.g., provision of feed supplies, agricultural equipment, transport and storage facilities, breeding animals for livestock rehabilitation; and planning for disaster preparedness and prevention. Starting in the Sahelian countries in 1973, OSRO organized or participated in over 80 missions, involving 21 different countries by September 1980.

Author (ESA)

N81-27585# Bristol Univ. (England). Dept. of Geography.
SATELLITE MONITORING OF CONDITIONS CONducive TO THE UPSURGE OF INSECT PESTS

Avail: NTIS HC A09/MF A01

Reference is made to a variety of insect pests which are, or probably could be, monitored better through satellite assisted environmental assessments. Special attention is paid to the screw worm (a temperature sensitive cattle pest) in Mexico and the southern USA, the desert locust (a traditional rainfall dependent agricultural pest) in northwest Africa, and the armysworm (a pest possibly influenced by mesoscale convective outbreaks) in eastern Africa. It is seen that the most efficient and cost effective uses of satellite data for the monitoring and control of insect pests lies in centralization of satellite facilities and the simultaneous use of their data for a wide variety of purposes.

Author (ESA)
ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.


Microwave methods for the remote sensing of earth resources are discussed, with emphasis on theoretical and experimental studies of the microwave emission properties of natural objects. The use of such methods in oceanography, geology, hydrology, and agriculture is considered. Recent literature in this domain is reviewed. P.T.N.


The urban planning data system CARINE is described along with its contents of topography (surface and substrate), property ownership, characteristics of local government, and demography. Land developers who use the system have access to information listing occupancy, vacancy, or presence of works in progress. Surveys of Marseille are cited as an example with the scale of graphic display set at 1/3000 for city center to 1/8000 for outlying areas. Initial cartography is based on existing cadastral maps and aerial photography derived photogrammetry. The data base is upgraded daily by requests, building permits, address change entries, and optically scanned maps. D.H.K.


The application of photogrammetry to the mapping of U.S. highways is surveyed. It is noted that in 1956 the Ohio Department of Highways initiated a program to digitize cross section data from the double-projection stereoplottor to punched card format. In 1959 an acceptable cross section digitizer was developed that became known as the Autotrol scaler. The mix of major mapping equipment directly owned at the state level as of November 1979 is shown in tables. The two basic systems that have been developed for gathering the data needed to automate the mapping process in the highway departments - the classic cartographic system and the digital approach system - are described. C.R.


The considered investigation is mainly concerned with settlement areas of a type which originated since 1920. However, the conclusions are also applicable to older housing areas and the old nuclei of cities and villages. It is pointed out that the requirements for the desired topographic system can best be satisfied by making use of photogrammetric approaches. Attention is given to the advantages of aerial photogrammetric methods, details regarding photogrammetric procedures, and the relation between modern terrestrial surveying methods and photogrammetric procedures for land-register applications. G.R.


Identifying and mapping cultural changes by use of Landsat MSS (RBV) imagery is less costly and time consuming than methods used by extensive block aerial photographic coverage. Landsat images were tested for detecting and mapping land changes in the area designated by sheets 74A, 74B, 74C, and 74D in the Canadian National Topographic System. A minimum of five images was required to obtain reliable revision information. The images to be studied were registered with a map background, and an overlay showing the location of all detectable changes was produced. No errors in change detection of man-made and natural features were found when MSS imagery was used at 1:250,000, although the exact nature of all aerial changes and linear features could not always be identified. Use of Landsat in map revision implies greater precision in identifying culture changes in map sheets and a significant reduction in the actual flight time needed for aerial block coverage. J.F.


Extensive public construction projects, particularly those related to transportation, involve the use of big areas of land. Careful planning of such projects can ensure that harmful effects connected with the implementation of the construction plans will be kept to a minimum. The possibilities for an employment of photogrammetry as an aid in the planning operations is discussed, taking into account the importance of the information provided by an interpretation of aerial photographs, especially in cases in which the available maps are obsolete. G.R.

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Photogrammetric methods used in land surveys are considered, taking into account the employment of photographs and maps of different types, the use of stereoplotters for producing land maps, the use of analytical photogrammetric methods to obtain numerical information for land survey controls, and the employment of electronic digitizers with computer to create numerical land data systems on the basis of existing maps. Errors in the results provided by photogrammetric methods are related to imperfections in material and equipment, effects of the processing environment, and the limitations of human sensing abilities.

G.R.


The considered system includes a minicomputer with a main storage of 144 K, a Planippcomp C 100, comparators, terminals, and a printer. The system is used for aerotriangulation operations for land-register applications, altitude evaluation studies, and large-scale topographic evaluations undertaken for the plotting of special maps for planning operations. Attention is given to a use of a large computer for large-scale operations, the advancement by use of a supervised regime. The study results from a collaboration with NASA on Landsat use in resources investigations of the delta and lower basin of the Danube. Meteorological sensing in the thermal band is subjected to densitometric comparisons at a 1:1,000,000 scale. Measurements are automatically traced for four spectral bands and equalized to form histograms to establish the degree of variability of the samples. An ongoing program exists to enhance data compression for extensive zone coverage. The operator adjusts the grey levels for quick reference to the distribution functions. This interactive ability, coupled with automatic analysis for Gaussian distribution, lognormal, and uniform Rayleigh, is designed for creation of a standard data bank. Imagery can be overlaid in time, superimposed one area on another, and picked for comparison with reference areas. Classifications performed for 25 x 50 km of the ecosystem of the lower Danube, covering wild and cultivated lands and river life, are presented.

D.H.K.


The considered method makes it possible to store arbitrary area data and classification data uniformly and efficiently. The data are stored in a fixed coordinate system in the form of a hierarchy of elements. The selected approach makes it possible to conduct search and combinatorial operations rapidly. The salient characteristics of the structure employed for the data storage include modest storage requirements, the simplicity of combinatorial operations, and the capability for rapidly combining the desired elements.

G.R.


Remote sensing data from the Landsat RBV camera and high altitude photographs are studied for their applicability in establishing and compiling semi-orthophotomaps for the purpose of the environmental change detection in urban areas. Results show that a semi-orthophotomap obtained by Landsat imagery has a possibility of detecting environmental changes, such as a new town formation at the scale of 1:50,000, with a horizontal displacement factor of less than 0.2 mm. A topographical map at 1:200,000 scale with contours at 100 m were obtained from Skylab S19A A photographs for small areas. Semi-orthophotomaps are given and analyzed in detail.

E.B.


Procedures followed in thematic mapping, working under equipment constraints, and augmentation by use of a supervised regime are presented. The study results from a collaboration with NASA on Landsat use in resources investigations of the delta and lower basin of the Danube. Meteorological sensing in the thermal band is subjected to densitometric comparisons at a 1:1,000,000 scale. Measurements are automatically traced for four spectral bands and equalized to form histograms to establish the degree of variability of the samples. An ongoing program exists to enhance data compression for extensive zone coverage. The operator adjusts the grey levels for quick reference to the distribution functions. This interactive ability, coupled with automatic analysis for Gaussian distribution, lognormal, and uniform Rayleigh, is designed for creation of a standard data bank. Imagery can be overlaid in time, superimposed one area on another, and picked for comparison with reference areas. Classifications performed for 25 x 50 km of the ecosystem of the lower Danube, covering wild and cultivated lands and river life, are presented.

D.H.K.


An attempt is made to analyze the planimetric and thematic mapping potential of visually interpreted Landsat MSS bulk images for application to integrated surveys of Brazilian natural resources. From the results of many operational applications, it is observed that the maps made from the images meet the planimetric and thematic requirements of third order maps in accordance with the norms of the Brazilian Geographic Service. It is noted that maps requiring detail with minimum dimensions greater than 100 m can readily be obtained from the interpretation of Landsat MSS imagery. Since the thematic accuracy of such maps also fulfills the basic requirements for regional surveys, the maps provide an excellent basis for monitoring operations and the assessment of natural resources.

C.R.

The problems encountered in attempting a study of the relationship between land use and soil erosion in St. Catherine, Jamaica, are treated. It is shown that existing classifications, based on cover, crop type, or usage on the date of photography, are unsuited for the purposes of this project. Using the differences between small-scale peasant holdings and large-scale commercial holdings as an example, it is shown how a classification is derived. In addition, the kinds of problems encountered in carrying out photo-interpretation in the humid tropics are illustrated.

C.R.


Aerial photography at a scale of 1:10,000 has been used to map the habitat resources of a new town site in order to reduce the environmental impact on the original plant and animal life. Three stages of the first phase of the study are outlined, including data collection and discrete mapping, evaluation, and production of isolopleth points.

V.L.


The advantages of air survey methods are reviewed. It is shown that the field survey located only 87% of the sites, cost between 4.5 and 9.5 times as much, and took nearly 12 times as long as the equivalent air photo based survey. The remote sensing unit employed in the air survey operations has been developed as an operational system for identifying, mapping, and measuring derelict land for various county planning authorities in the U.K. Attention is given to the construction of national surveys of derelict land, the West Midlands Derelict Land Survey, the importance of 'neglected waste land', questions of 'surrounding land use', vegetation type and cover, and the data sources used.

G.R.


Experimental evidence indicates that the optimum system for measurement of urban land use involves the use of orthogonal dot grid overlays to aerial photographs. The system was developed and tested with reference to a 7.0 square kilometer surrounding the town of Preston, England, using panchromatic aerial photography taken in the years 1946 and 1973. A classification scheme with four levels of detail and the methodology required for the project produced both aerial data and a graphical representation of the data. Land use data was recorded in a cellular format directly from the photography and used as computer input, easing the production of selected multiple or single theme maps. Dot grids (optimum notational unit cell - 1.00 ha) produced better results than grid squares, since no estimations of proportions or domination are required. The method proved significant in that land use could be recorded at identical points for each year, maps produced could be combined without gaps or overlap, and the information was compatible with other data referenced to the National Grid or administrative units. Relationships were also recognized between the land use data obtained in the project and population data.

J.F.


A map showing aspects of land use for an area in West Germany has been drawn on the basis of Landsat imagery obtained in 1975. Computer-aided analysis and classification were used in the evaluation process. The computer-aided evaluation of digital image data is to be offered as an additional aid to persons engaged in planning operations. Attention is given to aspects of image processing, regional analysis, geometrical adaptation, the selection of sampling units, problems of classification, and questions of quality control.

G.R.


Methods of application of thermal mapping to thermal pollution from centralized electric power plants and building heat loss are presented. Helicopters equipped for oblique and thermographic photography have been used in 20 surveys of isotherms of sites before and after plant construction, and during normal plant operation. Densitometry was used for interpretation when the thermography was homogeneous. This study of primary energy producers has been extended to coastally sited refineries, resulting in 2000 km of French coastline being mapped at a 1:100,000 scale. Ground truth comparisons were required for building studies to compensate for lack of uniform emissivity and it is noted that buildings with good insulation display characteristics of unheated buildings. Samples of a housing development and a central nuclear plant are provided.

D.H.K.


SLAR imagery from K- and X-band systems, along with an ascending pass, digitally processed L-band Seasat SAR imagery of different environments and scales have been used to investigate the effect of radar azimuth angle on small settlement detection. It is
found that, on a broader scale, the detectability of small settlements (less than 1000 population) is affected by radar azimuth. If the entire settlement morphology and geometry are such that the street and building pattern is oriented within 10 deg parallel or perpendicular to the flightline, most of its surface area will be susceptible to specular return, thus increasing the probability of identification. V.L.


The usefulness of different image scales and density sliced imagery for the interpretation data from remote sensing radar imagery of urban areas are investigated. Digitally processed L-band Seasat SAR imagery of the Denver, Colorado area was used to generate black-and-white prints of the scene at scales of 1:500,000, 1:131,000 and 1:41,000, and the imagery at each scale was density sliced using an interactive iterative classification approach to define urban land cover categories. An averaging algorithm is found to be necessary to reduce noise and improve useful imagery from the macro and meso-scale products, while the raw data products were sufficient for the micro-scale imagery. In particular, the macro-scale products are found to be useful for distinguishing Level I land cover classes (agriculture, forestry, rangeland and urban areas), meso-scale imagery is capable of Level II land cover category detail (large-scale residential, commercial/industrial and open space areas), and micro-scale products provide the most precise measurement of urban growth patterns. The density-sliced images are found to be of little value compared to the raw data prints, as much image texture and tone information is lost by the assignment of colors and spectral class ranges to the data.

A.L.W.


The preparation of the transportation master plan for Tripoli, a project which included comprehensive traffic surveys, and development forecasting, is discussed as an example of the use of aerial photography in practical urban planning. The planning was based on the results of a land and space use survey based on the interpretation of stereoscopic aerial photographs to determine the total land area of the city and its zones, land use distribution by economic activity, ground floor space and total floor space, as well as to estimate city population and the economic and zonal distribution of jobs within the city. Final forecasting of urban populations and employment in the year 2005 was accomplished from estimates of natural population growth, and allowable maximum urban densities for each city zone on the one hand, and of the capacity of each zone to accommodate new activities on the other. Traffic models were then calibrated by comparing estimates of present traffic obtained from the land use patterns with actual traffic volume and distribution. The importance of the aerial land and space use survey for urban planning is pointed out.

A.L.W.


This paper describes case studies aimed at detecting and quantifying urban tree stress of two fundamentally different types in two locations: (1) maple decline - in Syracuse, New York, and (2) Dutch Elm Disease - in St. Paul, Minnesota. In the maple decline study, factor analysis was used to develop numerical 'stress indexes' based on ground data. Then, spectral density measurements from 1.6000 color infrared photography were related (through multiple regression) to these stress indexes. The resulting statistical model enabled prediction of stress conditions throughout the study area, based solely on spectral density measurements. In the Dutch Elm Disease detection study, first a conventional interpretation of 1:6000 and 1:12,000 color infrared photography of multiple dates was performed. Second, scanning microdensitometer data were analyzed in various ways to explore digital approaches to detection of the disease. Described briefly are ongoing studies of the use of digitally enhanced images and discriminant function analyses to aid the disease detection process.

A.L.W.


The National Swedish Institute for Building Research recently investigated the potential of aerial thermography for surveying heat loss, temperature distributions, cooling phenomena and shelter effects. New remote sensing equipment, such as an infrared linear scanner, registers heat radiation on a tape recorder, which is later digitized and fed into a computer or converted into photographographic intensity depends on wavelength, object temperature and object emissivity. The method used for aerial thermography in urban planning involves thermal registration and picture production, interpretation and compilation of thermal information, and the selection of objects using other available information (real-estate registers). Thermographic studies attempt to draw a correlation between energy, building structure, and local climate, as well as offer proposals for decreasing energy consumption. Further work still needs to be done before the aerial thermography method is fully operational.

J.F.


Radar imagery projects related to Nicaragua, South East Peru, and Nigeria are considered. Nicaragua was the first case in which an entire country was given complete commercial mapping radar cover. The objective was data acquisition for regional planning and development purposes. Seasat overland imagery is also examined. The main factors influencing interpretation include the waveband (L), the comparatively steep depression angle, and the availability of digital format. In connection with a discussion of regional interpretation, attention is given to objectives, limiting factors, and interpretative parameters. Aspects of resolution, bias and subjectivity, problems with interpretative teams, ground truth, and the importance of computerization are also considered.

G.R.


A person charged with environmental planning tasks requires for his decisions a broad spectrum of area-related environmental data. The data needed are in many cases not available. Some of the environmental data required cannot be obtained with conventional methods. The difficulties presented by this situation can possibly be overcome by making use of the methods of remote sensing. A study was, therefore, conducted to obtain information concerning the
extent to which remote sensing procedures could contribute to a solution of the environmental mapping problems, taking into account the methods which would be suited to provide missing data and bring existing data up-to-date. Attention is given to the mention, the 'ecological mapping of the European Community', the requirements which remote sensing will have to meet, and the contribution made by remote sensing in providing the required data. G.R.


The relationship between remote sensing-based predictors (Landsat multispectral data) and ground-based criteria (population density according to a census) is analyzed. The data are Landsats 1 and 2 multispectral scanner (MSS) digital tapes and the grid square basis population density obtained from the Japanese census. Correlation analysis shows that MSS band 5 has a positive correlation with population density while band 7 has a negative one. On the assumption that the relationship is linear, multiple correlation analysis is applied and a correlation of approximately 0.75 is obtained. In addition, on the assumption that the relationship is a complex and nonlinear system, a heuristic self-organization approach - Group Method of Data Handling - is applied, and a more precise analysis is carried out for subdivided population density classes. According to the population-density values of each subdivided class, the accuracy of population density identification from Landsat data is approximately 80-75%. C.R.


Environmental protection procedures require inventories of ecological systems, often in remote areas where costs of conventional multispectral photography and ground studies are prohibitive, particularly in the early stages. This paper recounts experiences with 35 mm oblique photography taken from low altitudes using infra-red and color film. The results apply to arid zones, about which little appears to be known. For vegetation inventories factors considered are season of the year, flight altitude and orientation with respect to the sun. Ground and film spectroradiometric measurements confirm the efficacy of infra-red film for arid zone vegetation. (Author)


On August 29/30, 1977, the urban area of Hagen in West Germany was examined by means of an IR-scanner. The data were processed and 'thermal maps' were prepared. The obtained data, together with aerial photographs, area-utilization analyses, topographical maps, and field measurements provided the basis for the design of a synthetic, climatic, functional map. This map furnishes city planners with information regarding local climatic relations. The interpretation of the IR data is discussed, taking into account the consideration of flight time and weather relations, the assignment of area temperatures, the importance of the relations between surface temperatures and the air layer near the ground for the evaluation of the IR data, and the temperature field at daytime and at night. G.R.


Techniques and methods establishing a natural resource inventory for possible transmigration projects in the province of East Kalimantan, Borneo, are discussed, and data obtained by side looking airborne radar (SLAR) surveys are analyzed. The evaluation of recent data obtained by satellite imagery and high-altitude photography proved inadequate, due to the restrictions imposed by the geographical location of the region, the smoothing results, noting the related effects of the Inner Tropical Convergence Zone, dense vegetation, and the intense cloud formation covering the majority of available images. The radar system used, operating in the X-band at a frequency of 9.6 GHz and 3.12 wave length, was found to transmit through clouds and mist air without any significant losses. E.B.


Correction of data related to patterns of land use obtained by remote sensing during low flights is proposed with a qualitative smoothing method using a probability-based majority rule. It is expected that representative surface characteristics will be extracted with fair accuracy and unnecessary information and noise eliminated, by bringing out a clear specification of zone boundary from the available data. Four parametric studies are described: (1) how the number of classes affects the smoothing results, (2) how the repetition of smoothing influences the results, (3) what threshold value should be taken for the posterior probability in each pixel, and (4) whether the mask size taken influences the final results. Results show that the qualitative smoothing method can be effective when a small number of classes are used for a test area, however, when too many classes exist, a significant smoothing effect cannot be expected. To remove the scanning and random noise, one iteration is basically sufficient, though the final output quality determines the required iteration number. E.B.


The environments under which aerial survey cameras are used often differ drastically from the controlled environment under which they are calibrated. As a result, the image quality and the geometry may differ from the values reported in the calibration certificate. The environmental conditions of the aerial surveys have been investigated by means of an international questionnaire. The answers provided the range of temperature and atmospheric pressure to which the cameras are exposed. Certain conditions of pressure and temperature have been simulated in the laboratory to determine geometric changes in one American mapping camera. These are reported. Suggestions for better control are advanced. A review of the literature is made and summary results from Working Group member studies are reported. (Author)


The limitations of a purely graphical information system are easily recognized in connection with projects involving the integration of topographical information in a computational procedure. A cadastral survey is accomplished only for 65 percent of the country and its revision is rather incomplete. It is proposed to base the new survey on point sampling in aerial photographs, using a 100 m grid. The position of the sample points on the aerial photographs is determined analytically. The procedure takes into account the relief as well as the position and inclination of the individual photographs. The points are plotted by means of an automatic procedure on a film that is used as overlay of the aerial photographs for the purely visual photointerpretation. G.R.
much higher level of flexibility can be obtained if cartographic information is suitably integrated in an electronic computer installation. Such an integration requires the digitizing of cartographic information and, the establishment of an appropriate data processing system. Model concepts concerning an information system are considered and the practical applications of photogrammetry are discussed, taking into account topographic mapping, cadastral renovation, and land use studies.

G.R.


A comprehensive model is presented for simulating the signature radiance of a discrete cloud of aerosols and vapors suspended in the atmosphere, in a configuration that incorporates clouds, observer, and sun. The problem of calculations has been validated by computer tests for the range 0.25-28.5 microns, using the atmospheric transmittance/radiance model LOWTRAN. Improved simulation of the processes involved may be anticipated through incorporation of the following: (1) the effect of relative humidity of the atmosphere on aerosol extinction; (2) specification of parameters defining ensembles of nonspherical particles; (3) inclusion of multiple-scattering effects for optically thick clouds; and (4) specification of the effects of nonspherical clouds, such as those typical of pollution sources.

O.C.


Instrumentation and calibration of certain systems used on aircraft and ships for atmospheric research at NPS are described. Computer programs for acquisition and analysis of aerosol and micrometeorological data are included.

GRA


The wetlands and water-related land use in the Uinta Basin were classified and mapped using photointerpretation of U-2 infrared photography and digital LANDSAT data. The digital maps were used to augment photointerpretations. A highly effective diagnostic tool emerged when the LANDSAT digital print was photoreduced to a film positive at the same scale as the U-2 film and overlain on the U-2 color film. As a result of this merging technique, cover types can be identified more accurately and probabilistic statements can be made about the relative amounts of water being consumed in one pasture vs. another. The hazards to urban development on sensitive and unstable land in the foothills of Davis County were studied using NASA U-2 photography. Shoreline fluctuations were mapped in the Farmington Bay using LANDSAT digital data.

T.M.


Areas within which the National Ambient Air Quality Standard (NAAQS) for ozone is likely to have been exceeded are shown to be related to the observed annual second-maximum ozone concentrations. Meteorological situations and seasons during which high ozone concentrations are most likely in various parts of the country are described, so that special monitoring studies can be designed to supplement existing data. An aircraft monitoring protocol is given that will provide observations that are representative of ground-level conditions. Conditions that cause ozone data to be unrepresentative are described as are uncertainties associated with instrumental and calibration factors.

GRA


The Epsilon/AFGL balloon-borne aerosol sizing spectrometer was flown on a stratospheric balloon flight on 27 May 1980 over Holloman AFB, N.M., in an attempt to correlate with the SAGE four-channel solar limb extinction experiment. Useful aerosol altitude concentration profiles were obtained within several hundred Km and several hours of the SAGE overpass subthreshold point. The data indicate that particles greater than 0.4 microns in diameter are above the tropopause (14 Km in the instance). Speculations regarding a possible explanation for this effect are offered. Predictions of SAGE tangential extinction vs. altitude from aerosols alone have been derived from the data, and are included to facilitate correlation and comparison with those derived from aerosol models currently in vogue.

Author (GRA)


Avail: NTIS HC A16/MF A01 CSCL 08B

Potential industrial sites were assessed using high and medium altitude aircraft photographs and supporting information on the 4,730 sq. km. (1.825 sq. mile) county. Factors evaluated include land availability, slope, site accessibility, soil drainage, other subsurface characteristics, and the expected physical as well as visual impacts on existing land use. Areas unavailable or unsuitable for development were eliminated first, and the remaining areas evaluated and the best sites identified.

Author


Avail: NTIS HC A16/MF A01 CSCL 08B

The nature of landfill-related information that can be derived from existing and, or historic, aerial photographs, is reviewed. This information can be used for conducting temporal assessments of landfill existence, land use and land cover, and the physical environment. As such, analysis of low cost, readily available aerial photographs can provide important, objective input to landfill inventories, assessing contamination or health hazards, planning corrective measures, planning waste collection and facilities, and developing on inactive landfills.

Author

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES


Aval: NTIS HC A01/MF A01 CSCL 13B

A refinement to the matrix approach to environmental impact assessment is to use landscape units in place of separate environmental elements in the analysis. Landscape units can be delineated by integrating remotely sensed data and available single-factor data. A remote sensing approach to landscape stratification is described and the conditions under which it is superior to other approaches that require single-factor maps are indicated. Flowcharts show the steps necessary to develop classification criteria, delineate units and a map legend, and use the landscape units in impact assessment. Application of the approach to assessing impacts of a transmission line in Montana is presented to illustrate the method. A.R.H.

N81-27567*# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT'S ROLE IN HUD 701 PROGRAMS
Aval: NTIS HA A02/MF A01 CSCL 058

A survey of states concerning the use of LANDSAT in support of the comprehensive planning assistance program (Title IV, section 701) of the Housing and Community Development Act (1974) which is aimed mostly at small communities and rural counties. shows: (1) state governments are aware of the application of LANDSAT for inventorying land use and land cover at the state and local level; (2) use of satellite data was associated with the development of automated geographic information systems and the computer capability of handling and analyzing mapped information and other data tied to geographic coordinates and boundaries; and (3) LANDSAT capabilities in states tend to be institutionalized within state government information services where they can be readily assessed by state agencies. A summary of the state program for New Jersey and South Dakota is presented along with the state development guide plans, the rationale for using the satellite, and potential applications. A.R.H.

N81-27568*# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT'S ROLE IN STATE COASTAL MANAGEMENT PROGRAMS
Aval: NTIS HC A02/MF A01 CSCL 08C

The framework for state programs found in the Coastal Zone Management Act and examples of state opportunities to use LANDSAT are presented. Present activities suggest that LANDSAT remote sensing can be an efficient, effective tool for land use planning and coastal zone management. A.R.H.

N81-27571f# European Space Agency, Paris (France).
SATELLITE REMOTE SENSING. APPLICATIONS TO RURAL DISASTERS

Emphasis is placed on international disaster relief and remote sensing applied to rural disasters in developing countries. Basic principles of remote sensing are presented along with equipment description and performance data. Environmental data relay via satellite (e.g., Argos) and environmental monitoring are discussed. Synthetic observation of tropical storms, rainfall, and snow cover are considered. Flood mapping and earthquake damage assessment are also addressed. A.R.H.

N81-27572f# United Nations Disaster Relief Office, Geneva (Switzerland).
INTERNATIONAL DISASTER RELIEF AND THE ROLE OF THE UNITED NATIONS DISASTER RELIEF

The United Nations Disaster Relief Office, the Office of the United Nations Disaster Relief Co-ordinator (UNDRO). Among the most severe disasters which strike rural areas are floods, famine, storms, earthquakes, volcanic eruptions and epidemic disease. The multiple facets of these disasters complicate the process of anticipating and providing relief. In this process, UNDRO plays three roles: (1) it performs the role of coordination among donor countries, especially by providing channels of communication; (2) it seeks ways to develop and implement plans to enable countries to withstand disasters; and (3) UNDRO works to develop and implement plans through which the disastrous effects of natural phenomena can be avoided or mitigated. Many of these objectives can be facilitated through improved information and communication provided by satellite technology. Author (ESA)

N81-27574f# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.
SATELLITE REMOTE SENSING APPLIED TO RURAL DISASTERS IN DEVELOPING COUNTRIES

Aval: NTIS HC A09/MF A01

The need for the application of advanced technologies to help overcome rural problems in the developing countries is discussed. It is particularly for warning of uncertainties and assessing rural disasters that satellite remote sensing is seen to have an increasingly important role to play in the near future. Three types of satellites (polar orbiting earth resources: polar orbiting environmental; geostationary environmental) are considered. The application of satellite sensing to rural disasters is conveniently classified according to the time needed for the impact of the disaster to be felt. Short-term disasters are viewed as the easiest to monitor by satellite remote sensing. Some FAO examples are given. These include: the FAO Experimental Desert Locust Survey Program; floods in the Sudan; floods in Pakistan; and monitoring drought in South Africa. Author (ESA)

N81-27578f# European Space Operations Center, Darmstadt (West Germany). Meteosat Data Management Dept.
ENVIRONMENTAL DATA RELAY VIA SATELLITE

Aval: NTIS HC A09/MF A01

Data collection systems, using Earth exploration satellites, are discussed. The systems are explained with particular emphasis on the METEOSAT geostationary system. Current applications supporting a range of disciplines, are reviewed in order to demonstrate the general applicability of the system to a wide range of data collection problems. Author (ESA)

N81-27580f# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
AUTOMATIC COLLECTION SYSTEMS FOR SATELLITE ENVIRONMENTAL DATA IN ARGENTINA

Aval: NTIS HC A09/MF A01

A project which demonstrates the application and utility of relaying data from various sensors via the Geostationary Operational Environmental Satellite (GOES) system to users in Argentina is presented. The GOES data collection system (DCC) is described, and data collection platform operation is specified. In reference to user requirements dictated by the Argentine government, GOES DCS data distribution performance is reported. Fields of application cover agriculture, livestock breeding, hydroelectric resources, snow and ice reporting as well as water management, solar research, and seismology. Author (ESA)

N81-27582f# National Environmental Satellite Service, Washington, D. C.
METHODS FOR TROPICAL CYCLONE INTENSITY ANALYSIS AND FORECASTING USING SATELLITE DATA

Aval: NTIS HC A09/MF A01

The application of satellites to rural disasters is introduced. The scope of the problem of disaster relief, is defined from the viewpoint of the Office of the United Nations Disaster Relief Co-ordinator (UNDRO). Among the most severe disasters which strike rural areas are floods, famine, storms, earthquakes, volcanic eruptions and epidemic disease. The multiple facets of these disasters complicate the process of anticipating and providing relief. In this process, UNDRO plays three roles: (1) it performs the role of coordination among donor countries, especially by providing channels of communication; (2) it seeks ways to develop and implement plans to enable countries to withstand disasters; and (3) UNDRO works to develop and implement plans through which the disastrous effects of natural phenomena can be avoided or mitigated. Many of these objectives can be facilitated through improved information and communication provided by satellite technology. Author (ESA)
The use of satellite imagery for monitoring tropical storms is reviewed. A technique which provides reliable intensity estimates each day from a series of pictures instead of relying on the features observed in just one picture is presented. The analysis procedure includes: (1) locating the cloud system center and classifying the storm based on cloud patterns; (2) measuring the changes in spiral banding and cloud-top temperature; and (3) using a tropical cyclone development model which was empirically developed based on 15 years of data. This is an analysis procedure for both visible and infrared data. It gives a storm classification T-number which relates empirically to the central sea level pressure of the storm and to the maximum wind. Satellite pictures are used to detect the initial stages of tropical cyclone development before a storm reaches tropical storm intensity. A 24 hour storm intensity forecast is also possible by extrapolating forward along the modeled growth (or weakening) curve of the storm.

Author (ESA)

AERIAL CAMERAS OF THE TES TYPE HAVE BEEN DEVELOPED FOR THE PHOTOGRAPHY OF VARIOUS GEOGRAPHICAL REGIONS. THE CAMERAS ARE EQUIPPED WITH ROTOR SHUTTERS AND DEVICES FOR AUTOMATIC EXPOSURE CONTROL; THE LENSES ARE SPHERICAL (EXCEPT FOR THE AFA-TES-5 CAMERA) AND DISTORTION DOES NOT EXCEED 10 MICRONS, RESOLUTION IS WITHIN 35-25 LINES/MM, AND THE ACCURACY OF STEREONEEDING IS + 0.3 MICRONS. IN PARTICULAR, THE AFA-TES-5 CAMERA HAS AN ASPHERICAL LENS, AND A DISTORTION OF NOT LESS THAN 16 LINES/MM; THE CAMERA IS USED FOR THE AERIAL PHOTOGRAPHY OF LARGE AREAS AT SMALL SCALES.

B.J.


IT IS NOTED THAT THE DEVELOPMENT OF AERIAL PHOTOGRAPHY METHODS AND METHODS OF PHOTOGRAMMETRIC PLOTTING HAS GIVEN RISE TO PROBLEMS THAT GO BEYOND THE THEORY ASSOCIATED WITH THE ISOMORPHOUS REPRESENTATION OF ORTHOGRAPHIC BUNDLES OF RAYS AND PLANES ONTO A PROJECTION PLANE. A NEW APPROACH TO THE PROJECTION PLANE IS PROPOSED HERE. THE PLANE IS REGARDED AS THE RESULT OF THE REFLECTION OF A BILINEAR BUNDLE CONSISTING OF TWO CROSSING LINES AND THE TOTALITY OF RAYS AND SECOND-ORDER SURFACES PASSING THROUGH THOSE LINES.

C.R.


THE PAPER REPORTS ON THE DEVELOPMENT OF A CONCEPT FOR RECTIFICATION ON A MUTUAL REFERENCE IMAGE IN ORDER TO PERMIT CORRELATION OF REMOTE SENSING PHOTOGRAPHS OF MUD FLATS. IT IS REPORTED THAT DIFFERENT OBJECTIVE FUNCTIONS SHOW SOME DEVIATIONS IN THE RESULTS DUE TO THE UNSTRUCTURED TOPOGRAPHY OF THE MUD FLATS. ATTENTION IS GIVEN TO QUALITY AND ACCURACY OF TWO CHOSEN OBJECTIVE FUNCTIONS WHICH ARE PRESENTED BY EXAMPLES FOR AUTOCORRELATION AS WELL AS UNITEMPORAL AND MULTITEMPORAL CORRELATION. FINALLY, A PREHANDLING OF THE DATA BY GEOMETRIC OR DENSITOMETRIC TREATMENT IS SHOWN TO BE NECESSARY FOR INCREASING THE AVAILABLE INFORMATION FROM THE IMAGE SIGNALS.

M.E.P.


IMAGE PROCESSING OF HCMM-SATELLITE THERMAL IMAGES FOR SUPER-POSITION WITH OTHER SATELLITE IMAGERY AND TOPOGRAPHIC AND THEMATIC MAPS IS SHOWN TO BE NECESSARY FOR INCREASING THE AVAILABLE INFORMATION FROM THE IMAGE SIGNALS.
second degree is found to be justified for the coordinate transforma-

tion in aerial triangulation. It is pointed out that the application of
polynomials higher than second degree would not be useful because
it would enhance the number of transformation coefficients and
consequently the necessary number of ground control points. C.R.

A81-34449  # The use of SPOT images for the topographic

mapping of industrial and developing nations (Utilisation des images
SPOT pour la cartographie topographique des pays industriels et des
pays neufs). A. Baudoin (Institut Géographique National, Saint-
Mandé, Val-de-Marne, France). In: International archives of photo-
grammetry; International Society for Photogrammetry, Congress,
Volume 23, Part B 4, Commission 4. Hamburg, Committee of the
International Congress for Photogrammetry, 1980, p. 56-65. 6 refs. In French.

Problems posed by the application of images obtained by the
SPOT remote-sensing satellite to the topographic mapping of
industrial nations using an automatic system associated with a
geographical data bank management system and of developing
countries at a scale of 1:100,000 are examined. A possible procedure is
presented for the utilization of Landsat or SPOT data in the revision
of topographic maps of well-mapped nations which involves the
construction and utilization of interconnected files of space images
for the compilation of planimetric and complementary files. Based
on previous experience with Landsat, it is expected that by the use
of such a system, topographic maps may be revised every 2 to 3 years
for a scale of 1:50,000 and every year for a scale of 1:100,000 with
the use of high-resolution SPOT images. For the case of developing
countries lacking precise cartography, the stereoscopic and high-
resolution capabilities of SPOT allow mapping on a scale of
1:100,000 with an altitude resolution of 10 to 20 m to be performed
by the proper programming of the two SPOT High-Resolution
Visible instruments for complete vertical and stereoscopic coverage,
followed by image triangulation, and the calculation of a geometric
model of each stereo image. The resulting digital data may then be
used in subsequent map revisions. A.L.W.

A81-34478  # The plotting of topographic maps on the basis

of interferometric recordings with active sensors (Erstellung topogra-
phischer Karten aus interferometrischen Aufnahmen aktiver Sens-
oren). D. Kolouch (Hanover, Universität, Hanover, West Germany). In:
International archives of photogrammetry; International Society for
Photogrammetry, Congress, 14th, Hamburg, West Germany, July
Hamburg, Committee of the International Congress for Photogrammetry,

The use of Side-Scan-Sonar systems for topographic studies of
the sea floor is discussed. Side-Scan-Sonar is a dynamic imaging
system. It consists basically of three units, including a platform for
the sensors, a cable, and a control and recording unit. For the
construction of the measurements, the platform is pulled through
the water by means of the cable. High-frequency acoustic pulses are
emitted by the sensors to both sides. The sound wave impinges on
the sea floor and is partly reflected to the sensor. The reflected
pulses are transformed into electric signals, which are amplified. The
signals can be recorded on magnetic tape. The recorded data provide
a basis for the employment of digital data processing techniques. The
interference effects observed in connection with the superposition
of two signals are utilized for the topographic analysis of the sea floor.
G.R.

A81-34494  # The positional accuracy of Landsat MSS imag-

ery of Turkey (Die Lagengenauigkeit der Landsat MSS-Aufnahmen der
Türkei). C. Ormeci and M. Ayvac (Istanbul, Technical University,
Istanbul, Turkey). In: International archives of photogrammetry;
International Society for Photogrammetry, Congress, 14th, Ham-
burg, West Germany, July 13-25, 1980, Presented Papers. Volume
23, Part B 4, Commission 4. Hamburg, Committee of the Interna-
tional Congress for Photogrammetry, 1980, p. 579-586. 6 refs. In German.

An investigation is conducted regarding the possibilities for a
utilization of Landsat Multispectral Scanner (MSS) imagery. Four
pictures which can represent the whole of Turkey have been selected.
In the Landsat MSS pictures with a scale of 1:1,000,000 and
topographic maps with a scale of 1:25,000 check points and their
coordinates were considered. On the basis of a Helmert and an affine
transformation of the check point coordinates, a mean error of 5 or
300 m was obtained. G.R.

A81-34496  # Transfer of targets between aerial photo-

graphs. I. Persson, K. Viklander, and A.-C. Wirlee (Kungl. Tekniska
Hogskolan, Stockholm, Sweden). In: International archives of
photogrammetry; International Society for Photogrammetry, Con-
gress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented
International Congress for Photogrammetry, 1980, p. 597-599.

An attempt is made to find a more accurate method of
obtaining the control points in the aerial photographs used in
mapping. Geodetically measured points with targets are photo-
graphed from a low altitude with a measuring camera (scale,
1:10,000). The targets in these photographs are then transferred to
photographs taken at a higher altitude (4600 m), the transferring
measurement being performed in a stereocomparator. The size of the
investigation area is 15 x 15 km, and 11 geodetically measured points
with targets (0.6 x 0.6 m) are used. Two methods (optical and
mathematical) are used in transferring the targets from one photo-
graph to the other. The errors from the two methods are compared
in a table. C.R.

A81-34498  # The production of large- and medium-scale
topographic maps by the interactive digitization of stereoscopic
models (Production des cartes topographiques à grande et à moyenne
echelle par numérisation interactive des modèles stéréoscopiques).
C. de Saint Plairier, D. Bruger, and J. Côte. In: International archives of
photogrammetry; International Society for Photogrammetry, Con-
gress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented

A81-34500  # Cartographic basis of the structurization of
digital topographic models (Kartentheoretische Grundlagen bei der
Strukturierung digitaler Kartenmodelle). W. Schwenk. In: Interna-
tional archives of photogrammetry; International Society for Photo-
grammetry, Congress, 14th, Hamburg, West Germany, July 13-25,
Hamburg, Committee of the International Congress for Photogrammetry,
1980, p. 629-638. 5 refs. In German.

A81-34503  # Revision of topographic maps - Results of the
Fribourg Test by Commission D of the OEEPE. E. Spiess (Zürich,
Eidgenössische Technische Hochschule, Zurich, Switzerland). In:
International archives of photogrammetry; International Society for
Photogrammetry, Congress, 14th, Hamburg, West Germany, July
Hamburg, Committee of the International Congress for Photogram-

The efforts of seven European national mapping organizations in
a map revision test designed by Commission D of the OEEPE in the
1976 are described. In the test, various photogrammetric and cartographic
techniques (stereoplotting versus orthophoto method, drawing versus
scribing) were used to update a 1:25,000 topographic map of a
suburban area in Fribourg, Switzerland. The results of the verifica-
tion of the test samples in terms of accuracy, completeness, and time
required in the various sub-processes are presented in a summarized
version of the final report on this experimental work. C.R.

A81-34508  # Anamorphic integration of numerical photo-
grammetric surveys into a geodetic network (Intégration anamor-
photique de levés photogrammétriques numériques dans un réseau
géodésique). U. L. W. van Twembeke (Ecole Royale Militaire de
Saint-Cyr, Mériel, Louvain, Belgium). In: International archives of
photogrammetry; International Society for Photogrammetry, Congress,
Volume 23, Part B 4, Commission 4. Hamburg, Committee of the

The paper presents a technique for converting photogrammetri-
To meet the need of integrating morphological and textural land information with remotely sensed multispectral data, an interactive software program was devised, using as its input Landsat digital data obtained from a demonstration project conducted in Southern Italy. The topographic signal was classified into heterogeneous blocks based on spatial relationships by a modified version of ECHO (Extraction and Classification of Homogeneous Objects). The contour lines of each altitude range were interactively or automatically obtained and the corners were input to the program for the extraction of each sub-area. Geometrically registered contour lines and satellite images are shown on an interactive color monitor, superimposed on a grid in which each mesh can be subdivided. The program finds z, xz and zy for all mesh points and then applies a cubic polynomial function to find the pixel altitude in each grid and subgrid. Subdivisions allow mesh dimensions in different parts of the image to be changed, saving time and core memory and obtaining a better precision than with a constant mesh dimension. J.F.

A81-35738 # Photogrammetric and cartographic features of space photographs of the earth, with orbital photography using the MKF-6 camera taken as an example (Fotoogrammetricheskije i kartograficheskie osobennosti kadrovskh komishskh kamer fen MKF-6). B. A. Novokovskii (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). Issledovanie Zemli iz Kosmosa, Mar.-Apr. 1981, p. 92-96. 6 refs. In Russian.

An analysis of photogrammetric and cartographic features of space images of the earth's surface was performed for photographs taken by the MKF-6 multispectral camera on Soyuz-22. The effects of the sphericity of the earth's surface and of the camera inclination angle were taken into account. Attention is given to the analog system for processing these images, which includes stereoplotters equipped for differential transforming. B.J.


Gravity anomalies on the continents are determined by gravimetry while geoid undulations on the ocean are obtained from satellite altimetry. Satellite altimetry can be used to determine directly and point-by-point the geoid undulations on the oceans with an accuracy of about plus or minus one to plus or minus two m. Values of the perturbation potential on the ocean, along with Stokes mixed boundary value problem, are used to find an analytic expression for this potential on the earth's surface and in the external space of the earth. J.F.


Papers are presented in the field of space geodesy and its applications to the dynamics of the solid earth, ocean studies, planetary geodesy, earth tide and rotation studies and non-geodetic effects on satellite orbital motion. Topics considered include the use of microaccelerometers in space geodetic experiments, orbit computations using the method of fictitious observations, geoid prediction using collocation and digital terrain models, gravity slippage and the edifice equilibrium shape of the earth, the variability of dynamic ocean topography, and the use of satellite perturbations in the study of ocean tides. Attention is also given to a method for defining topographic datums for planets other than the earth, tidal effects in the evolution of natural satellite orbits, satellite...
Doppler positioning in geodynamics studies, the effects of neutral and charged particle collisions on Lagoa satellite motion, and a satellite laser ranging station.

A81-38229


Approaches to the least squares combination of satellite and ground-based measurements of terrestrial gravitational field components for physical geodesy are considered. The direct least squares combination is based on the direct weighting of primary solutions for a gravity field component when the variance-covariance relations between the solutions are known; several preliminary solutions may then be combined in a stepwise manner, or for each degree of their spherical harmonic expansions. Global least squares combinations may also be performed based on known degree variances and covariances and mean square variations of the primary gravity field solutions. Examples of global combinations are presented for geoid determinations based on two sets of uncorrelated spherical harmonics, and on a set of satellite spherical harmonics and gravity anomalies at the mean earth sphere. Although the global least squares estimator is shown to be more efficient than direct least squares combination, it is pointed out that the global estimator depends on information rarely available in practice.

A81-38230


A geodetic survey has been conducted in northern Greenland from 78 deg N on the west coast to 76 deg N on the east coast for purposes of mapping as well as photogrammetric densification and geoid determination. The Doppler satellite technique was used as the primary method for station coordinate determinations, supplemented by classical geodetic methods including gravity measurements and trigonometric and barometric height determinations. Gravimetric geoids were predicted using the collocation method involving the treatment of gravity field quantities (geoid undulation, deflection of the vertical and gravity anomaly) as linearized functionals applied to the anomalous gravitational potential. Due to the sparse gravity data available and the mountainous terrain, coarse digital terrain models were utilized in order to account for the effects of topography on gravitation. Preliminary data reductions have so far been performed only for the area north of 80 deg latitude, resulting in rms errors in gravimetric geoid prediction with respect to Doppler-derived undulations of less than 1 m when topographical data is taken into account and isostatic or residual terrain model data reduction is employed.

A81-38231


A prototype geodetic receiver is being developed for application with the NAVSTAR Global Positioning System. Data obtained with an experimental version of the receiver applied to simulations of performance of the prototype version indicate that the relative positions of stations 10 to 100 km apart can be obtained with 1- to 2-cm accuracy after 6 hr of observations provided that water vapor radiometers are used to obtain tropospheric refraction coefficients for the data. Initial studies show that the use of surface weather data, but without water vapor radiometers, would give 2- to 5-cm accuracies, but a more realistic modeling of the errors under these conditions is required.

A81-38233


The OSGB (Ordinance Survey of Great Britain) Scientific Network was defined and rigorously adjusted in 1970. Since then, satellite-Doppler derived positions became available at a number of stations. A series of comparisons between these Doppler positions and the corresponding terrestrial coordinates confirmed a previously suspected significant and systematic scale error in the latter. An attempt made in 1978, to eliminate these systematic errors by a combined adjustment of the terrestrial and the Doppler derived data, failed on account of poor geometrical modeling. Subsequently, new adjustment models were devised and successfully tested on a variety of simulated and real networks, culminating in the redefinition of the OSGB 80 scientific network.

A81-38234


The successful inclusion of Doppler satellite measurements into a least squares adjustment with terrestrial observations over an area of 1,582,300 km is described. The corrections to each type of observation conform to the statistical model based on the a priori variances and the precision of the adjusted coordinates is well within first order geodetic specifications. These results show that spatial measurements made for special projects can be incorporated into national data bases which will thus give maximum cost benefit.

A81-38249


It is pointed out that the Earth Physics Branch has been operating two TRANET satellite Doppler tracking stations near Ottawa and Calgary in cooperation with the U.S. Defense Mapping Agency (DMA). Reduction software specifically designed for geodynamic applications such as the investigation of crustal movements was only recently completed. The geodynamic earth rotation Doppler reduction program (GERDOP) has been developed from geodetic Doppler reduction packages which includes such features as adjustment in phases and error modelling for station and satellite biases. A description is given of preliminary data reduction efforts which were concentrated mainly on finalizing strategies and weighting for routine processing of data from the Canadian satellite Doppler monitoring stations. The data reductions indicate that simultaneous modelling of orbital, position and earth rotation biases with appropriate a priori constraints results in more representative formal error estimates.

A81-40332


Topography is the dominant factor in the SLAR image of a hilly area. To analyze soil moisture condition by interpretation of this imagery, a first step is to estimate the influence of topography on microwave backscatter. With a digital terrain illumination model, a SLAR image can be simulated. This was done by modeling 50 m x 50 m grid elements of a 3.2 sq km catchment. Comparison of the corresponding model and SLAR image grid elements revealed a quite good correlation. The remaining variation is to a large degree explained by soil moisture changes in the catchment area. When two extremely different moisture conditions were compared, the sen-
sitivity of microwave backscatter to decreasing incidence angle was obvious. Presentation of the spatial distribution of soil moisture was prevented by insufficient spatial resolution for the very heterogeneous catchment. [Author]

N81-22344f National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

30 Sep. 1980 4 p ERTS
(Contract NAS5-26047)
(E81-10110: NASA-CR-164104) Avail: NTIS
HC A02/MF A01 CSCL 08G

A graphic software package was developed to plot the dipole positions for a particular model on a world map. An arrow is drawn at each dipole in the direction of the horizontal magnetization vector, with length proportional to the horizontal magnitude. A contouring package represents the radical component of the dipole models and its peripheral components is utilized to derive two mutually phase locked optical wavelength signals and one phase locked microwave CW signal which respectively traverse the same distance measurement path. The optical signals are comprised of pulse type signals. Phase comparison of the two optical wavelength pulse signals is used to provide the dry air density while phase comparison of one of the optical wavelength pulse signals and the microwave CW signal is used to provide wet or water vapor density of the air. The distance to be measured corrected for the atmospheric dry and water vapor densities in the measurement path is computed from these measurements. A time interval unit is included for measuring transit time of individual optical pulses for resolving the phase ambiguity needed with the phase measurements to give the true target distance.

A.R.H.

N81-22445f National Aeronautics and Space Administration. Washington, D. C.
PUBLICATION OF THE MAPS OF TENKE AND MANONO (Zaire) FROM LANDSAT DATA Translated by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by South Dakota State Univ., Brookings. (Contract NASw-3198)
(NASA-TM-76479: SDSU-RSI-VISP-81-02) Avail: NTIS
HC A03/MF A01 CSCL 08B

The collection of cartographic data on Zaire up to the present time was based on aerial reconnaissance. This approach is very expensive if repetitive coverage is required in such a large country. The integration with the LANDSAT program among the data collection systems improves the mapping efforts substantially. T.M.


(Contract NAS5-26157)
(E81-10108: NASA-CR-164102) Avail: NTIS
HC A02/MF A01 CSCL 08F

Data from a 2 day period recorded by Magsat were used to produce world magnetic maps of the scalar total field and three vector component total fields. Subtracting the reference field of Magsat 6’/80, a scalar anomalous field and three vector component anomalous fields were also mapped. After removing 718 bad points from the original data, every fifth point was picked for contouring. While the main geomagnetic field of the Earth is surprisingly well mapped considering the short data period, the anomaly maps suffer from data sparseness. The entire Magsat file collected at altitudes of 600-100 m in nonmountainous terrain and at 900-1000 m in mountainous terrain was averaged to reduce the total data to 6,500 measurements, yielding a 0.1 deg sampling interval along the flight path. A U.S. aeromagnetic anomaly surface map was produced and the new field was upward continued to a 300 km altitude. Differences in anomaly structure between the POGO and the data map produced were attributed to insufficient removal of the reference field. Reprocessing of the data using the GSFC reference field (9/80-2) should remove the low harmonic field and improve the anomalous field structure.

A.R.H.

N81-22443f Business and Technological Systems, Inc., Seabrook, Md.

HC A02/MF A01 CSCL 08B

A future sensor is considered for mapping the Earth’s gravity field to meet future scientific and practical requirements for earth and oceanic dynamics. These are approximately + or - 0.1 to 10 mgal over a block size of about 50 km and over land and an oceanic geoid to 1 to 2 cm over a distance of about 50 km. To achieve these values requires a gravity gradiometer with a sensitivity of approximately 10 to the -4 power EU in a circular polar orbiting spacecraft with an orbital altitude ranging 160 km to 180 km.

Author


HC A02/MF A01 CSCL 08G

A computer program was prepared for modeling segments of the Earth’s crust allowing for heterogeneity in magnetization in calculating the Earth’s field at Magsat heights. This permits investigation of a large number of possible models in assessing the magnetic signatures of subprovinces of the Canadian shield. The fit between the model field and observed fields is optimized in a semi-automatic procedure.

A.R.H.


(Contract NAS5-26157)
(E81-10112: NASA-CR-164106) Avail: NTIS
HC A02/MF A01 CSCL 08G

An approach to estimating the Curie point isotherm using the classical Gauss method inverting a system of nonlinear equations. The method, slightly modified by a differential correction technique, directly inverts filtered Magsat data to calculate the crustal structure above the Curie depth, which is modeled as a magnetized layer of varying thickness and susceptibility. Since the depth below the layer is assumed to be nonmagnetic, the bottom of the layer is interpreted as the Curie depth. The method, once fully developed, tested, and compared with previous work by others, is to be applied to a portion of the eastern U.S. when sufficient Magsat data are accumulated for the region.

A.R.H.

N81-22449f National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

03 GEODESY AND CARTOGRAPHY

analyzed relative to crustal and core content. The power spectra for one of the dipole models and a spherical harmonic model based on Magsat data through degree and order 23 is presented. A.R.H.
03 GEODESY AND CARTOGRAPHY

N81-28517*# Tokyo Univ. (Japan). Geophysics Research Lab.

Sponsored by NASA ERTS (E81-10096; NASA-CR-160494: PR-2) Avail: NTIS


John F. Hermance, Principal Investigator 31 Mar. 1981 5 p


N81-28521*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.


Sponsored by NASA ERTS (Contract NASS-25882) (E81-10117; NASA-CR-164111: QR-4) Avail: NTIS

N81-28535# Lincoln Lab., Mass Inst. of Tech., Lexington. LINEAR FILTERING MODELS FOR TERRAIN IMAGE SEGMENTATION


Author

152
A method for modeling images of natural terrain is developed and applied to the segmentation of aerial photographic data. An underlying stochastic structure based on linear filtering concepts provides a means of modeling the terrain in local areas of the image. Superimposed on this is a Markov random field that describes transitions from regions of one terrain type to another. Maximum likelihood and maximum a posteriori estimation is applied to estimate regions of similar terrain. Results of application to digitized aerial photographs of a rural area are presented and discussed.

Author (GRA)
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Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.


The remote sensing of laser-induced uranyl ion fluorescence is discussed as a potential indicator of uranium occurring in geologic materials at the earth's surface. The paper studies the optical characteristics of uranyl geologic targets, and reports measurements made of the time-dependent relative fluorescence brightness, the excitation and emission spectra, the fluorescence lifetime and the fluorescence quantum yield of over 100 uranyl-bearing and nonuraniferous mineral, rock and soil samples using pulsed laser excitation at 4250 A and detection within a 50 A bandwidth at 5250 A. High fluorescence yields are found for uranyl minerals such as meta-autunite, liebigite and andersonite, ranging from 0.42 to 0.8. In addition, a laser system for the experimental assessment of the remote sensing of uranyl geologic targets has been developed. A relationship is derived for the signal-to-noise power ratio (S/N) of a fluorescence measurement, and limitations to the sensitivity which are imposed by system parameters and noise sources are examined. The dependence of S/N on the surface area concentration of the uranyl mineralization, the laser excitation parameters, the background illumination, the range and the observation time is demonstrated.

D.K.


Results of an aeromagnetic survey of Kansas, conducted by the Kansas Geological Survey for the last five years are presented. The main purpose of the survey was to learn about the buried Precambrian basement, which underlies a Phanerozoic cover of variable thickness ranging from 150 to 3,000 m. A rather distinct boundary was seen between the northern 1,625-m.y.-old mesozonal granitic terrane and the southern 1,400-m.y.-old epizonal granite and rhyolitic terrane, whose magnetic signature is a linear series of almost contiguous lows trending west across the state. Of the 14 circular magnetic highs in northeastern Kansas, two were drilled, and results suggested that the older 1,625-m.y.-old crust is dotted with younger, 1,350-m.y.-old granitic plutons similar in composition to southern, 1,400-m.y.-old epizonal granite and rhyolitic terrane. A second vertical derivative map revealed that the southern part of the Proterozoic Central North American Rift System extends through Kansas to the Oklahoma border.

K.S.


The purpose of the reported study is to analyze Seasat SAR imagery of a heavily vegetated mountainous land surface and to determine the potential of this microwave imaging system for geologic mapping. It is found that geologic mapping using orbital Seasat SAR imagery is feasible in the Appalachian Valley and Ridge province, where the radar system is highly sensitive to change of surface slope. Image tones and textures correlate with distinctive topography, from which generalized lithologic and structural interpretations are derived. Major and minor linear topographic features are easily mapped from the SAR images. The SAR sensor suppresses subdued geomorphic lineaments that strike parallel with or near to the radar look direction. This deficiency is partly compensated by the dual directions of radar illumination obtainable from the Seasat imaging system.

G.R.


SLAR imagery provided the data required for the production of map-controlled radar mosaics at scales of 1:250,000 and 1:200,000. The mosaics served as the basis for the generation of new geologic and vegetation maps of Togo and part of Nigeria. Numerous geologic revisions resulted, not only with the addition of previously unknown structural features, a revision of age relationships, and the refinement of unit boundaries, but also with the repositioning of rock units and the reorientation of major faults.

G.R.


One of the paths of Seasat recorded over Precambrian Shield and Quaternary deposits in Southern Ontario is analyzed and evaluated. The inherent structural characteristics of metamorphosed and igneous rocks are investigated and comparisons are made between the structural patterns interpreted on Seasat-SAR data and the patterns recognized on Landsat images and aerial photographs. Analysis carried out to establish the characteristics of L band radar and look angle with the positions of the bedrock structures is described. The size and positions of surficial deposits such as drumlins are studied and recorded.

(Author)


The use of remote sensing data for oil and gas exploration in the central part of the western Siberian plain is considered. Techniques
to increase the efficiency of interpretation of deep structures are examined, and the necessity of augmenting the development of automated interpretation systems is emphasized.

B.J.


The objectives of Project 143 of The International Geological Correlation Program (IGCP), are discussed. The capability to explore, identify, and develop new energy and mineral resources, and the improvement of the rate of technology transfer in the field of remote-sensing throughout the world, are the primary objectives of Project 143. Secondary objectives are: (1) to establish uniformity in terminology and symbology relating to the interpretation of satellite data, (2) to compile a world-wide bibliography of scientific reports dealing with the research and practical geological applications of satellite data, and (3) to conduct workshops in areas where such applications may be most beneficial. Details on the Indian and Bolivian workshops of 1979 are given, as are plans for data analyses in 1981 and 1982.


The tectonic interpretation of Landsat data in the study of a mountainous and a basin area of western Hungary is described and the correlation with the respective field data is discussed. General results show that data obtained in the basin area could be correlated with topographic and geologic maps at a scale of 1:100,000, while the lineaments represented only 70-80 percent of the fractures at this scale. However, the number is considered to be sufficient for statistical analysis. An evaluation of the data for the basin area shows that the azimuth, length, frequency and shape of the lineaments are the same for the tectonic as well as for the field observation data, but on a smaller scale. For the mountainous area it is concluded that the tectonic application of satellite images in a well-known stratigraphic and paleogeographic area is not considered to be complete, suggesting that the method may even be used in the exploration of mineral resources.

E.B.


Images of the Alps taken with the Jet Propulsion Laboratory's L-band Side Looking Airborne Radar (SLAR) have yielded the first important finding relative to tectonics: a fracture zone revealed by night data that is completely absent from daytime pictures. Comparison of different polarizations of different flights' images permits the mapping of Triassic diapirs with associated Zn and Pb mineralizations.

O.C.


The space geological maps which are currently made in the USSR depict only those elements which are identified on satellite imagery. The geological interpretation of the elements is based on known geological, geophysical, chemical, and geomorphological data. Space geological maps can be utilized in many different ways. They provide a basis for the revision of existing geological, tectonic, geomorphological, hydrogeological, and other maps conveying geological information. The features on these maps reveal the distribution of mineral deposits. Satellite imagery analysis has made it possible to recognize structures containing mineral deposits. An unexpected result of the study of satellite imagery was the detection of a great number of ring structures in the earth's crust. The existence of these structures implies that it may be necessary to revise traditional concepts regarding the tectonic evolution of the earth's crust.

G.R.


The use of earth observation satellites for mineral and energy exploration is discussed in terms of the different systems now in existence, which provide improved data on the surface reflectance (Landsat), thermal emission (HCMM), and the magnetic variations (MagSat) of the earth's surface and crust. The operational application of the data in the construction of global, specified geological, and metallogenic maps, indicating mineral and energy resources, is pointed out. Further application for petroleum and geobotanical exploration and the monitoring capabilities of the data with regards to dynamic environmental and geological processes, such as volcanic activities, floods, and meteorological aspects, is discussed. It is concluded that the Sesat and GEOS satellites have proven that the L-Band (25 cm) synthetic aperture radar, and radar altimetry function from space can provide accurate surface information even during cloud formation.

E.B.


Geological methods of interpretation are used to derive specific information about the structure and behavior of the uppermost parts of the lithosphere from satellite images. The recognition of such deep-seated features is equivalent to the remote sensing of remote
sensing data interpretations. Study results nevertheless indicate that there is a high degree of useful information to be found in images taken during the BIOSPHERE experiment aboard Salyut 6 in 1978, with a hand-held camera.

O.C.


Analysis of space images of the volcanic region in the Western Pacific Ring has helped delineate tectonic features that determine the distribution of ore deposits. The belt comprises a number of ring structures of different orders which are observed at the intersections of major faults. The structures identified include: (1) the intersection of arcuate faults belonging to different rings; (2) marginal parts of ring structures; (3) minor ring structures occuring at the margins of large rings; and (4) minor rings occuring at the intersection of deep-seated faults. In all these cases, the local structural control of mineralization is suggested.

O.C.


The activities of the National Remote Sensing Centre at Farnborough, England, equipped with computing facilities, are discussed with regards to Project No. 143 - Remote Sensing and Mineral Exploration. The possibilities of cooperating with other facilities and/or activities such as digital processing of Seasat data and the use of Landsat imagery for the purpose of mineral exploration, mapping, establishing consultancy programs, lithological discrimination in a variety of climatic, topographic, and geological environments, and studies of botanical anomalies around ore deposits, are investigated. The survey shows that numerous activities across the globe are presently conducted including spectral discrimination of lithologies in arid and semi-arid areas, mineralization in the Chilean Andes, and classification of the iron-rich gossans associated with porphyry copper mineralization. Toxicity investigations of soils based on geochemical and geobotanical Landsat data are undertaken in Brazil, Argentina, and Spain, and refinement of statistical treatment of fracture data in the tectonic analysis of large areas (the entire African continent) is reported.

E.B.


14 refs.


The interpretation of Landsat imagery data in the study of regional tectonic and sulphide ore localization in Rajasthan, India is discussed. In comparing the Landsat imagery to existing field observations and ground truth data a close correlation was found. Results of the study show that sulphide ore deposits are stratigraphically controlled, rather than structurally, and the occurrences in the Khetri copper belt, Pur-Banera Pb-Zn-Cu belt, and Zawas Pb-Zn belt seem to be controlled by longitudinal lineaments showing little affinity towards transverse features. The observations were found to be in conformity with the prevalent ideas of syngeneic-remobilized origin of these deposits.

E.B.


6 refs.

Discussion of linear features on Landsat imagery, indicating subsurface phenomena in the Northern Calcareous Alps are analyzed with regards to possible origin and tectonic significance. Different data sets pertaining to tectonic profiles, statistically distributed joint measurements of terrestrial photogrammetry, and aerial photographs and density maps of areas corresponding to those of the satellite images, were studied. Results show that all investigat-ed lineaments exhibit the typical structure of the Internal Zones, characteristic of shear fractures. Most important in the structure of the lineaments are Associated Fractures, situated at different distances outside the External Zones. The displacement of the Associated Fractures was found to be greater than that of the lineaments, possibly caused by a slow increase of tectonic forces, which fissured the rocks in a broad zone, while for the former, the forces may have increased very fast, causing displacement and small fissuring. Imbedded in the Internal Zone, smaller shear fractures with moving planes and mylonite were found to be the most striking discovery. It is concluded that linear features on satellite images have a very complex structure and the interpretation for a single structure can be obscured by many factors.

E.B.


Microwave holography has already proved its value as a 'microwave X-ray'. In this application microwave holography is used to map the profile of an object hidden behind a medium which is opaque to radiation of both optical and X-ray wavelengths but is transparent to radiation of microwave wavelengths. As a practical application, this technique may be used effectively in profiling the depth of ice caps or mineral beds of a particular type and in mapping the surface geometry. The first radar which incorporated the 'hologram matrix' was used for measuring the thickness of ice and was named Holographic Ice Surveying System Radar (HISS) radar. The principle of HISS is based on the manipulation of information contained in the hologram matrix. Attention is given to the step frequency radar and the multifrequency hologram matrix radar.

G.R.


The potential use of data from existing and planned earth resources satellites for identifying surface materials is examined. Two different methods for applying existing data to surface materials identification are discussed. The first seeks to apply basic models of the physical processes that come into play in the reflection and emission of radiation. The second method employs 'training sets' to empirically determine the signature of particular materials under given illumination conditions. It is noted that several difficulties complicate the application of the first method, and it is concluded that the present and planned Landsat spacecraft probably do not justify the use of the basic physical models. The method using training sets is considered useful with presently available data.

Several examples using special multispectral combinations of Landsat data illustrate the present potential of the existing earth resource satellite systems and suggest the increased potential promised by the higher spatial and spectral resolution of the next generation of earth resources satellite systems.
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It is noted that a knowledge of the thermal inertia of the earth's surface can be used in geologic mapping as a complement to surface reflectance data as provided by Landsat. Thermal inertia, which is a body property, cannot be determined directly but can be inferred from radiation temperature measurements made at various times in the diurnal heating cycle, combined with a model of the surface heating processes. A model of this type is developed and applied along with temperature measurements made in the field and by satellite to determine thermal properties of surface materials. An example from a test site in western Nevada is used to demonstrate the utility of this technique.

C.R.


The characteristics of side-looking airborne radars and methods used to obtain and process radar imagery are examined with emphasis on geologic and geographic feature extraction. Specific applications discussed include identification of types of terrain, soils, and vegetation, identification of rock species, tectonic studies, and ice sheet mapping.

V.L.

N81-23650* National Aeronautics and Space Administration. Earth Resources Lab., Bay St. Louis, Miss.


Assistance by NASA to EPA in the establishment and maintenance of a fully operational energy-related monitoring system included: (1) regional analysis applications based on LANDSAT and auxiliary data: (2) development of techniques for using aircraft MSS data to rapidly monitor site specific surface coal mine activities; and (3) registration of aircraft MSS data to a map base. The coal strip mines used in the site specific task were in Campbell County, Wyoming; Big Horn County, Montana; and the Navajo mine in San Juan County, New Mexico. The procedures and software used to accomplish these tasks are described.

A R.H.


The relationship between lowering of the water table and sinkhole development in Pierson and in Hillsborough County, Florida was investigated. The locations of recently developed (1973) collapses were examined with respect to lineaments or fracture traces that are expressed in the terrain and visible in aerial photography and satellite imagery. It was anticipated that these relationships would provide the basis for establishment of criteria for mapping those land areas that have the greatest potential for sinkhole development. The analysis was performed in the expectation that the data would be used for reconnaissance regional- and state-scale mapping of sinkholes and other related phenomena. The data from the test site were subjected to a variety of analysis techniques including regression analysis, principal component analysis, and outlier detection. A delimitation method based on a cluster analysis was examined. Principal components analysis was used to determine the best set of variables to use in the analysis. The analysis resulted in a Delphi map of the study area which includes the water table, Wilson's Sinkhole, and several other sinkholes.

R.C.T.


Efforts concentrated on developing a technique for relating laboratory spectral reflectance curves of known rocks and vegetation on LANDSAT multispectral images. The techniques involve determination of the laboratory spectral signature of a material of interest and searching a stack of spatially registered multispectral images for materials with the desired spectral signature. Changes in spectral reflectance caused by vegetation cover were also investigated in surface samples from Hawaii.

T.M.


The variations exhibited by these data were reduced and classified into a number of linear combinations by using the PCA program. The PCA program then generates histograms and outlier maps of the individual variates. Black and white plots can be made on a Calcomp plotter by the application of follow-up programs. All programs referred to in this guide were written for a DEC-10. From this analysis a geologist may begin to interpret the data structure, insight into geological processes underlying the data may be obtained.

DOE


The utility of data acquired in space for both basic and applied studies of the geology of the Earth was evaluated. Focus was placed upon the gaps in the current ability to make effective use of remote sensing technology within the Earth sciences. A long range plan is presented for future research that involves an appropriate balance between the development and application of space techniques.

T.M.


The feasibility of using thermal inertia, inferred from remotely sensed temperature data, to complement LANDSAT reflectivity data for reconnaissance geologic mapping and mineral exploration is under investigation. The bulk of HCMMD data tapes was received and processed, and a thermal inertia image of one data set was made. Additional areas of interest were identified on the HCMMD photographic products and data tapes were ordered for these areas. During analysis of selected subareas, various sedimentary rock units were distinguished in the Death Valley, California test site and areas of altered rock were identified in the Cuprite/Goldfield, Nevada test site.

A.R.H.

N81-26516f Texas Univ. at El Paso, Dept. of Geological Sciences.
While data is available on the lithospheric and crustal structure of the Andes region of South America, there is limited knowledge of these aspects of the eastern portion of the continent. For this reason, a surface wave dispersion study of the area was initiated. Long period seismograms were obtained for a tripartite analysis of dispersion. A flow chart of the analysis to be conducted is presented along with a preliminary geologic/tectonic map that was prepared. Efforts to characterize the provinces identified in terms of their geological and geophysical parameters continue.

A.R.H.

One of the main goals of the LAGEOS satellite mission is the detection of regional geotectonic movements. A parametric study with the intention to obtain the optimal baseline precision from dynamic solutions of laser ranging to LAGEOS is presented. The varied parameters are: length of reduced arc, number of tracking stations, data noise and rate, biases, refraction errors, system efficiency, gravity model errors in the value of GM. The baseline precisions are 1-10 cm depending upon the set of parameters adopted. General principles obtained are also presented.

Author

Aspects of the remote sensing of coastal and shallow waters are considered, with reference to Meteor-satellite multispectral data. It is found that spectral distinctions between various bodies of water are determined mainly by the turbidity of surface water, and not by optical characteristics of the bodies of water. It is suggested that multispectral data can be used to study the spatial-temporal dynamics of turbid surface waters.


A method is proposed for determining wind velocity and wave height (with infinite or known fetch length) from satellite measurements of thermal radiation emission of the system rough sea surface-atmosphere. As an illustration, wind velocity is calculated from airborne microwave measurements obtained during the joint Soviet-American experiment SAMEX-76 in the Pacific Ocean.


The effect of defocusing of synthetic aperture radar (SAR) imagery of ocean waves, caused by wave motion is studied. Consideration is given to the spread modulation of image brightness. The analysis employs a two-scale model of VHF radiation scattering.


Radar backscatter values are calculated from 1.3- and 9.4-GHz synthetic aperture radar (SAR) data collected off the coast of Florida. It is noted that the data on these values (averaged over many wave trains) can best be modeled by the Bragg-Rice-Phillips model, which is based on roughness variation and the complex dielectric constant of oceans. This result suggests that capillaries on the surface of oceanic waves are the principal cause for the surface return observed by an SAR. It is found that salinity and temperature of the sea at small and medium incidence angles produce little effect upon sea-surface reflection coefficients at X-band, for either of the linear polarizations. The observations presented here are considered to support a theory that the ocean surface appears relatively stationary in the absence of currents. The reflecting surface is most likely moving slowly in relation to the phase velocity of the large gravity waves.

C.R.


This study represents an attempt to quantitatively assess the capability of a spaceborne radar altimeter to infer ocean surface wind speeds from a measurement of the backscattered power at vertical incidence. The study uses data acquired during 184 near overflights of NOAA data buoys with the GEOS-3 satellite radar altimeter and encompasses a wind-speed range from less than 1 to 18 m/s. An algorithm is derived from the data comparison for converting measurements of the normalized scattering cross section of the ocean surface at 13.9 GHz into estimates of the surface wind speed at the standard anemometer height of 10 m. The algorithm is straightforward and potentially useful for on-board processing of raw altimeter data for the purpose of providing real-time estimates of surface wind speed. For winds in the range of 1 to 18 m/s, the mean difference between the altimeter-inferred winds and the buoy measurements is negligible while the standard deviation of the difference is 1.74 m/s.

(Author)

A81-34533 Sea ice morphology in the context of wave-ice interaction studies. A. M. Cowan (Cambridge University, Cambridge, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 214-224. 16 refs. A seven year wave-ice interaction study was carried out in the Arctic Ocean, the Labrador Sea, the Bering Sea, and the coastal zones of Greenland, using side-looking airborne radar, infrared linescan imagery, laser and photographic sensors mounted on fixed-wing aircraft and helicopters, and sonar on nuclear submarines. Experiments were performed to establish such parameters as pressure-ridge spacing and the ratio of ridge sail height to keel draft. Of the morphological parameters, the one which emerges as being of greatest importance in the context of wave-ice interaction studies is fluvial distribution. As the waves propagate through an ice-field, they are scattered and attenuated by the distribution of floe sizes they partially create. The analysis, primarily of aerial photographs, was carried out with a modular scanning image analyzer. K.S.


Two different correction procedures are discussed. One procedure uses a polynomial, and transforms the radiation-equivalent temperatures into the temperatures which are measured on the ground. The second procedure makes use of atmospheric corrections, which take into account transmission and characteristic radiation. The accuracy of the obtained result is checked with the help of independent ground-based control measurements. Both procedures and the method for correcting the video data can be programmed for implementation on a minicomputer. The accuracy of the data provided by the two correction procedures is sufficient for the final user, who might be an engineer in the coastal service. G.R.

A81-34600 Landsat imagery of phytoplankton development in the Baltic Sea. K. A. Ulbricht (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Oberpfaffenhofen, West Germany) and U. Horsmann (Kiel, Neue Universität, Kiel, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 932-941. 7 refs. Remote sensing data application in the investigation of the variability and characteristics pertaining to phytoplankton growth patterns for possible BTL evaluation is studied, analyzing the complicated hydography and mixing processes. Blue-green algae growth, predominantly of the Nodularia spumigena, is analyzed, and results are compared to previous data. General results confirm that the phytoplankton productivity, the variability of growth patterns, and the movement of plankton communities are determined by the intensity of light radiation, presence of mineral nutrients, and the particular wind and sea current system. Additionally, particular
results show that the length of the presence of the plankton community in the near surface of the euphotic layer influences the production of phytoplankton. Nitrogen fixation by algae was found to influence the nitrogen budget of the Baltic Sea area; however, since variations in the estimated N-fixation calculations range from 2000 to 100,000 tons annually, further research with satellite (Landsat) measurements compared to ground truth data is suggested.

(Author)


A summary is presented of weather conditions, including ocean surface waves, observed during Seasat pass number 1339. Seasat passed almost parallel to the East Coast on September 28, 1978 at 1520 GMT. Attention is given to local weather and northeast winds, wave spectra observations, winds and waves from the southeast, and directional wave forecasts. Sample wave forecasts from the southeast, for grid points 222 and 223, prepared by Fleet Numerical Oceanographic Center, Monterey, California, are illustrated in a figure. Another figure shows the location of thunderstorm activity associated with the surfage trough of low pressure.

G.R.


An attempt has been made to derive bottom features in a coastal area from airborne, multispectral imagery. For this purpose Ocean Color Scanner (OCS) data taken at high tide above the Jade Estuary is compared with a hydrographic map as well as a Landsat scene taken at low tide.

(Author)


It is pointed out that Arctic resources represent about 40% of the oil and gas potential of all the world. Minerals are other primary products of great economic value. The importance of navigation in ice-covered sea areas becomes evident in this connection. Ice studies and remote sensing as an aid to navigation are consequently very important. Attention is given to the Committee for High Arctic Research Liaison and Information Exchange, a planned Swedish Arctic Interdisciplinary Expedition, exploration and transportation of natural resources in ice-covered sea areas, a comprehensive remote sensing experiment on sea ice, atmospheric and oceanic research, glacial extent and climatic variations, pollution problems as studied in bottom sediments, submarine volcanism and the history of the continental margins, and marine biology.

G.R.


The study revealed the unique features of winter sea ice dynamics in the Canadian Arctic during 1974-1978 winter seasons. The features included the presence of open water and thin ice in parts of Smith Sound, northern Baffin Bay, western Jones Sound, Foxe Basin, Lancaster Sound, and southeast Baffin Bay. In addition, persistence of leads and polynyas at Smith Sound, Melville Bay, northern Lancaster Sound, Jones Sound, Home Bay, eastern Baffin Bay, and Amundsen Gulf was remarkable phenomenon. Further, active leads were found in Baffin Bay and Beaufort Sea throughout the winter season. Two ice dams at Smith Sound and Barrow Strait regulated the influx of ice into northern Baffin Bay. The influx of ice into northern Baffin Bay through Smith Sound, Jones Sound, and Lancaster Sound estimated to be 554 cu km per year, whereas the influx of ice from the Arctic Ocean and the Central Archipelago through Robeson Channel, Fram Sound, and Barrow Strait was about 201 cu km per year.

(Author)


An intrusion of loop current water up DeSoto Canyon and onto the West Florida continental shelf to within 8 km of the shore occurred in February 1977. Boat, aircraft, and satellite data collected in the area for another purpose were used to estimate the space and time scales of the intrusion and the ultimate fate of the intruded waters. The duration of the event was 18 days. Oceanic waters advanced across the shelf at speeds of 20 cm/s. At maximum intrusion, 6550 sq km of shelf were affected. Approximately half the intruded water reeded off the shelf, and half appears to have been modified in situ.

(Author)


A81-35873 Evaluation of ocean bottom features from Ocean Color Scanner imagery. P. Lohmann (Hannover, Universität, Hanover, West Germany) and H. van der Pienpen (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Optoelektronik, Obergfellsehen, West Germany). Photogrammetria, vol. 36, Apr. 1981, p. 81-89. 9 refs.

The use of images obtained by the Ocean Color Scanner (OCS) operated at high altitudes to derive information concerning ocean bottom features in coastal regions is investigated. The OCS was installed on a Mystère-20 aircraft which was flown at an altitude of 11 km over the German Bight, a region characterized by frequency changes in bottom topography at high tide. Data was recorded on high-density digital tape and processed to correct for atmospheric absorption and geometric effects and to enhance image contrast. The structures of up to 7.5-m depth revealed by the OCS imagery are found to be in accordance with features shown by hydrographic maps, and with those seen on Landsat imagery taken at low tide, when all tidal areas were free of water. It is pointed out that, due to the amount of suspended particles in the water, OCS channel 7 (0.666-0.679 microns) appears best suited for bottom imagery in an area such as the North Sea.

S.C.S.


Space systems used in the First GARP Global Experiment (FGGE) of the Global Atmospheric Research Program (GARP) are discussed along with special observing systems, observations in the tropics, wind determination, and data assessment. Other topics considered are related to air-sea interaction, the structure of the troposphere, the stratosphere, radiation processes, and cloud structure. Attention is given to the role of space techniques in FGGE, geostationary operational environmental satellite system performance, the Meteosat system during the FGGE, the performance of the FGGE drifting buoy system, actual performance and capabilities...
of the Argos system, the determination of wind vectors from Meteosat water vapor channel data, FGGE operations and data management, U.S. FGGE special data sets and special effort, vertical mass and moisture structure from TIROS-N, measurements of the earth radiation budget from satellites during the FGGE, and the sensitivity of the earth's radiation budget to changes in cloudiness.

G.R.


It is pointed out that the U.S. contribution to the First GARP Global Experiment (FGGE) of the Global Atmospheric Research Program (GARP) included support from geostationary satellites located at three operating locations. The U.S. GOES-East and GOES-West satellites at 75 deg W and 135 deg W longitude respectively are the satellite operated by the National Environmental Satellite Service (NESS) of the National Oceanic and Atmospheric Administration (NOAA) on a continuous basis to meet many U.S. requirements and to provide a variety of services to the international meteorological community. The GMS (Geostationary Meteorological Satellite) and Meteosat were provided by Japan and the European Space Agency (ESA) respectively.

G.R.


A new type of satellite for the National Oceanic and Atmospheric Administration (NOAA) polar-orbiting series was inaugurated with the launch of TIROS-N on 13 October 1978. In order to gain more nearly full global coverage and at the same time observations at additional times of the day, two satellites comprise the system, one in a morning orbit and the other in an afternoon orbit. Attention is given to the TIROS-N operational vertical sounder characteristics, TIROS-N AVHRR channel characteristics, the communications link, TIROS-N products for the First GARP Global Experiment (FGGE) of the Global Atmospheric Research Program (GARP), and the future TIROS-N system. TIROS-N products for FGGE include sounding products, vertical temperature profiles and clear radiance sea surface temperatures, and data collected from buoys and balloons.

G.R.


Argos operates under the supervision of a bilateral organization comprising CNES on one side, and NOAA and NASA on the other. The Argos system comprises user's platforms equipped with sensors and platform transmitter terminals, a space segment consisting of two satellites in orbit, and a data processing and distribution center. Attention is given to user platforms, aspects of data collection, monitoring system performance, principles of platform location accuracy, the Argos data processing system, the interval between data collection and availability, and applications of the Argos system. It is pointed out that the Argos system is particularly suitable for gathering environmental data in three broad areas, related to the sciences of the atmosphere, the sciences of the seas, and the earth sciences.

G.R.


A method is suggested for the determination of cloud motion vectors on the basis of meteorosat images. In the first step of the determination procedure the meteorosat image data are converted into video-signals by a TV camera. The video-signals are digitized by means of an analog-to-digital converter. The practical implementation of the procedure is demonstrated with the aid of a numerical experiment including a meteorological test. The results of the study prove that the Soebel operator applied in the cloud pattern recognition is suitable for the determination of cloud displacements.

G.R.


It is pointed out that the First GARP Global Experiment (FGGE) of the Global Atmospheric Research Programme (GARP) is the largest international meteorological/oceanographic experiment ever conducted. In this connection several U.S. Federal agencies were concerned with maximizing the utilization and overall quality of the FGGE data sets. For several purposes, including the need to stimulate the development of interactive oceanic-atmospheric models, the U.S. FGGE Project Office is supporting the production of a Level III-b oceanographic and meteorological analysis in the FGGE format. This project has been undertaken by the Fleet Numerical Oceanography Center (FNOC) for the period covering the FGGE Operational Year (1 December 1978-30 November 1979). Attention is also given to the restructure of the FGGE Level II-B data set and a special effort related to an improvement of the usefulness of satellite data in numerical weather forecasting through the use of a sophisticated man-machine interactive process.

G.R.


General circulation patterns in the area south of South Africa are determined by three ocean circulation systems which meet in this region. These systems include a wind-induced coastal upwelling in the Benguela system, the Agulhas Current, and the zonal flow of the Antarctic Circumpolar Current system. Variability in these systems is substantial, making oceanologic studies by conventional hydrographic means difficult. The combined use of satellite thermal infrared imagery, hydrographic measurements, and drifting buoys has, therefore, been considered for the study of the complex circulation patterns. Attention is given to the sources of the Agulhas Current, the influence of the Agulhas Current on Cape upwelling, and the Agulhas Current interaction with the subtropical convergence.

G.R.

A81-36269 Application of multispectral data to the detection of sea surface phenomena. H. Ochiai (Toba National Merchant Marine College, Toba, Japan) and K. Tsuchiya (National Space


Initial results from the Seasat scanning multichannel microwave radiometer indicate that the sea surface temperature can be measured with a root-mean-square sensitivity of 1.2 C or better. The first microwave map of sea surface temperature for the entire Pacific has been produced. (Author)


Landsat's multiple spectral scanner (MSS) digital data are analyzed using a radiance isolation method to demonstrate a relationship between MSS radiance and sediment concentration in the process of estimating the turbidity of coastal water. The atmospheric degradation of the signal is investigated along with steps to eliminate possible atmospheric effects on the radiance data, which are then correlated to data related to sediment concentration. An error analysis is presented by which remotely sensed radiance can be calculated, and a comparison is made with existing ground truth data. Maps of sediment distribution are produced from the MSS radiance data, and it is demonstrated that the spatial variations displayed are caused by the optical properties which are indicative of a concentration of aquatic suspended solids in the upper levels of the sea, suggesting turbulence. E.B.


The surface area above submarine springs of fresh water exhibit temperatures and salinities lower than the surrounding sea waters. A multifrequency radiometer system which earlier demonstrated an accuracy of 1 degree C and 1 part per thousand in remotely detecting the surface temperature and salinities, respectively, was used to detect submarine freshwater springs. The first mission on February 4, 1978, consisted of overflight measurements over three fourths of the coastal areas around the island of Puerto Rico. During the second mission on February 6, 1978, special attention was directed to the northwest portion of Puerto Rico where several submarine springs had been reported. The previously reported spring locations correlated well with the locations detected by the radiometer. After separating the surface runoffs such as rivers, lagoons, marshes, and bays, 44 submarine freshwater springs were identified which indicates that the submarine freshwater outflow locations are more numerous around the island than had earlier been estimated. The majority of the submarine springs are located at the northwest and southeast portion of the Puerto Rican coastline. The success of detecting the same submarine springs during both missions at the northwest portion of the island was 35%. (Author)


Data are presented that support the hypothesis that remote sensing records reveal, in their anomalous gray shades and thermal evidence for upwelling, specific differences in aerosol chemistry that reflect both surface and subsurface sources. Specific illustrations of the striking changes in aerosol composition are provided for continental, marine, and coastal regions, emphasizing the unique enrichment of nitrate particulates in areas of coastal upwelling. Spectra that are characteristic of these differing atmospheric particulates, as collected in numerous field studies, are included for the mid-infrared range. These spectra furnish essential "ground truth" for satellite and high altitude aircraft image interpretation. C.R.


The industrial waste dumped 180 n. miles south of Galveston was monitored in July 1977 by water sampling, hydrographic measurements, acoustic tracking on board two vessels, and by aerial photography. The plume of the waste diffused vertically and horizontally. Photodensitometry of aerial photos of the plume showed lateral dispersion of the plume in agreement with two other methods: acoustic tracking of the waste suspended and transmissometer sampling. In addition, the method showed small scale features like the lateral and longitudinal variations in the photodensity, indicating the waste concentration. This waste concentration showed periodic changes in its axial distance, with the spectral peak at about 160 m wave length. It shows a sharp increase at the windward edge of the plume as do the acoustic records. This phenomenon is explained in terms of the shearing current near the surface together with vertical diffusion. The periodic change along the axis is explained in terms of the Langmuir circulation and in terms of internal ship waves. (Author)

A81-40767 # Possible differences between mean sea-levels from satellite altimetry. M. Bursa and Z. Sima (Ceskoslovenska Akademie Ved, Astronomicky Ustav, Prague, Czechoslovakia). Studia Geophyaetia et Geodietica, vol. 25, no. 1, 1981, p. 1-4. Differences between the mean sea levels of the Pacific, Atlantic, and Indian Oceans and the Mediterranean Sea are determined based on an analysis of satellite altimetry data. Values of the geopotential geoid were computed for 5 x 5 deg blocks using mean geoidal heights reported by Rapp (1979) from GEOS altimeter data and various geopotential models. When the geopotential models with the greatest internal consistency (GEM 7, 10 and 10b) are used, differences of less than 0.5 m are obtained between the mean sea levels in the Pacific, Atlantic, and Indian Oceans and the Mediterranean Sea, and less than 0.2 m between the Pacific, Atlantic and Indian Oceans. The accuracy of the determinations is noted to be limited by the accuracy of the geopotential models. A.L.W.

N81-228754 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik. SEA STATE MEASUREMENT WITH A TWO FREQUENCY SCATTEROMETER: THEORY. Michael Kelintz May 1980 161 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-710) (DFVLR-FB-80-32) Avail: NTIS HC A08/MF A01

In the context of the SPACECELAb program, sea state measurements with a two frequency scatterometer are considered. A system analysis of two frequency scatterometry, especially signal analysis for stationary and airborne (aircraft: satellite) measurements, is presented, and an unambiguous method for wind direction determination is given. A statistical model of sea state, based on the frequency spectrum of the water wave height distribution, is used. The radar echo from the sea surface is
characterized for a monochromatic output signal. An autocorrelation function is developed, and application in consideration of the Doppler spectrum of the sea surface reflectance function is shown.

Author (ESA)

N81-23565# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.


Data sets obtained from sea ice test sites in the Beaufort Sea as part of Canada's SURSAT program and from SAR-77 flights over the Labrador Sea were analyzed. A synthetic aperture radar system operating simultaneously at 3 cm and 23 cm wavelengths with two orthogonal polarization receivers provided the imagery. Ground truth was also available. The SAR data were converted into digital image format and four basic measurements made on the data from each test site: (1) mean value, (2) standard deviation, (3) histogram, and (4) relative power scans at constant range lines. The results are presented in several formats: (1) cluster plots, (2) variance versus ice type, (3) coefficient of variation, and (4) two measures of the polarization ratio. Relative values of backscatter coefficients for several ice types are compared, but absolute values cannot be obtained.

GRA

N81-23947# Naval Oceanographic Office, Bay St. Louis, Miss.

THE OCEANOGRAPHIC ENVIRONMENTAL REFERENCE SERVICE RETRIEVAL PROGRAM USERS GUIDE Final Report


Detailed instructions are presented for the retrieval of information from the Oceanographic Environmental Reference Service Data Base, which is accessed by the use of an interactive program. The data base is designed to serve as an inventory of oceanographic data collection efforts and an index to the data collected. Information available on cruises includes cruise number, platform name, sponsoring organization, dates, areas covered and scientist in charge. Data descriptions include position, depth of sample, sampling rate, quantity, measuring device, and points of contact for data retrieval. The detailed data can be accessed by cruise, data type, WMO area identifier, and world water body. Prompting statements guide the user in the selection of query responses for information retrieval.

Author (GRA)

N81-24504# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.


(NASA-TM-82117) Avail: NTIS HC A03/MF A01 CSCL 08C

Global maps of precipitable water over derived from scanning multichannel microwave radiometer (SMMR) data reveal salient features associated with ocean currents and the large scale general circulation in the atmosphere. Nimbus-7 SMMR brightness temperature measurements in the 21 and 18 GHz channels are used to sense the precipitable water in the atmospheric over oceans. The difference in the brightness temperature (T sub 21 - T sub 18), both in the horizontal and vertical polarization, is found to be essentially a function of the precipitable water in the atmosphere. An equation, based on the physical consideration of the radiative transfer in the microwave region, is developed to relate the precipitable water to (T sub 21 - T sub 18). It is shown that the signal (T sub 21 - T sub 18) does not suffer severely from the noise introduced by variations in the sea surface temperature, surface winds, and liquid water content in non rain clouds. The rms deviation between the estimated precipitable water from SMMR data and that given by the closely coincident ship radiosondes is about 0.25 g/cm sq cm.

E.A.K.
ING VIA SATELLITE-TRACKED DRIFTERS
PRELIMINARY RESULTS OF GULF STREAM RING TRACK-

The third drifter left its ring in 15 days after completing a large detached ring, and was tracked for 110 days before drifting out into the Sargasso Sea. A second ring was tracked for 39 days before it was lost from the Doppler shifted signal. Two buoys were launched in the fall of 1978 and utilized for five air deployable buoys. The initial investigation began simultaneously at reasonable cost is to tag each ring with a sophisticated computer model in order to measure the Labrador Current and the North Atlantic Current off the coast of Newfoundland was studied. Results would be used for warning mariners of the hazards presented by drifting ice and icebergs. The local user terminal is described and the handling of satellite tracked buoy data is depicted. Results show that a more sophisticated computer model which predicts iceberg drift can be implemented using satellite information.

OPERATIONAL USE OF TIROS/ARGOS SYSTEM IN INTERNATIONAL ICE PATROL
J. J. Murray and C. R. Weir

Avail: NTIS HC A06/MF A01

As part of the U.S. drifting buoy development program extensive testing was performed to verify system performance prior to the start of the experiment. End to end systems tests were performed to establish system interface compatibility and to determine correction to production buoys that were needed prior to buoy deployment during the experiment. Data quality analyses were performed on systems prior to and during buoy deployment periods. Sixty-four buoys were deployed by ship and aircraft in the southern oceans as part of an array of over 300 meteorological drifting buoys participating in the experiment. Preliminary results indicate that approximately 50% of the buoys are still operational after one year of operation. An extensive test and evaluation program preceded the deployment of operational buoys. Predeployment and deployment testing was performed to evaluate the quality of the data from each of the buoys being deployed. A description of each test and the evaluation results are given. Buoy performance during the first and second Special Observing Periods is summarized.

U.S. DRIFTING BUOY PERFORMANCE DURING FGGE
E. G. Kerut and R. P. Kozak

Avail: NTIS HC A06/MF A01

As part of the U.S. drifting buoy development program extensive testing was performed to verify system performance prior to the start of the experiment. End to end systems tests were performed to establish system interface compatibility and to determine correction to production buoys that were needed prior to buoy deployment during the experiment. Data quality analyses were performed on systems prior to and during buoy deployment periods. Sixty-four buoys were deployed by ship and aircraft in the southern oceans as part of an array of over 300 meteorological drifting buoys participating in the experiment. Preliminary results indicate that approximately 50% of the buoys are still operational after one year of operation. An extensive test and evaluation program preceded the deployment of operational buoys. Predeployment and deployment testing was performed to evaluate the quality of the data from each of the buoys being deployed. A description of each test and the evaluation results are given. Buoy performance during the first and second Special Observing Periods is summarized.

Naval Oceanographic Office, Bay St. Louis, Miss.

PRELIMINARY RESULTS OF GULF STREAM RING TRACKING VIA SATELLITE-TRACKED DRIFTERS
Barry P. Blumenthal

Avail: NTIS HC A06/MF A01

The most promising technique to monitor several rings simultaneously at reasonable cost is to tag each ring with a satellite tracked, freedrifting buoy. The initial investigation began in the fall of 1978 and utilized five air deployable buoys. The buoys transmitted to the NIMBUS-6 satellite for geostrophic current measurements. The position of the buoy was calculated from the Doppler shifted signal. Two buoys were launched in September and one in November 1978. One drifter remained trapped in its ring for 110 days before drifting out into the Sargasso Sea. A second ring was tracked for 39 days before it coalesced with the Gulf Stream which swept the buoy eastward. The third drifter left its ring in 15 days after completing a large 150 km loop around the ring perimeter. The remaining two buoys were deployed in March 1979. One buoy was tracked for only one month at which time the frequency of the transmitted signals drifted outside the allowable limits. The last buoy, which is still transmitting, provided real time tracking of the ring through June when Navy laboratories conducted Gulf Stream ring acoustics experiments.

Author (ESA)

EXAMPLES OF METEOROLOGICAL SATELLITE DATA UTILIZATION
J. C. Favard

Avail: NTIS HC A09/MF A01

Different uses for satellite remote sensing are presented. Examples mainly concern METEOSAT. SMS, and GOES experience. Data applications include stereography, cloud cover analysis, thermal mapping, and ocean surface temperature sounding as an aid to the tuna fishing industry. Data collection techniques are explained, and results are highlighted in context.

Author (ESA)

ACKNOWLEDGMENTS
N81-27774# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany)

PRELIMINARY DEVELOPMENT OF A MEASURING NETWORK FOR THE NORTH SEA AND BALTIIC (VENMO 1 AND 2). EXPERIMENTAL INVESTIGATIONS, DEVELOPMENT AND TEST OF EQUIPMENT FOR AUTOMATIC MEASURING STATIONS AT SEA WITH DATA TRANSMISSION
Hartmut Schulze (Kernenergieverwertung in Schiffbau und Schiffsfahrt m.b.H.) and Siegfried Govaerts (Bundesministerium fuer Forschung und Technologie)

Avail: NTIS HC A05/MF A01

The stepwise installation of a measuring network in the North Sea and Baltic Sea is described. The network consists of automatically operated stations with UHF data transmission due to the possible use of satellites. The network provides long-term synoptic sampling of oceanographic and meteorological data over wide sea areas. Following the requirements of potential users, development priorities are described for automatically operated complete measuring and telemetering systems, characterized by high reliability and long-term accuracy. Special components and subsystems of highest importance, regarding these user requirements, are described. Air temperature and pressure, wind velocity and direction, air humidity, water temperature and pressure, conductivity, etc., are among the main physical parameters emphasized.

Author (ESA)
HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.


A81-30562 // Experience of aerial snow cover mapping in the European part of the USSR (Opty razvitiia samoletnykh gamma-ray mapping of snow cover in the European part of the USSR). A. N. Stroganov (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skikhoziaistvennogo Mashinostroeniia, Moscow, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 95-110. 8 refs. In Russian.

A81-30563 // Industrial use of aerial gamma-ray mapping of snow cover in the Asian part of the USSR (Opty razvitiia samoletnykh gamma-ray mapping of snow cover in the Asian part of the USSR). A. A. Markhevskaia (ZSRNIGMI, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 46-54. 8 refs. In Russian.


The usefulness of aerial gamma-ray mapping of snow cover in hydrological forecasting has been investigated by comparing aerial and ground-based data. It is shown that aerial gamma-ray mapping makes it possible to estimate the total water resources in the form of snow, water, and ice with allowance for soil moisture variation in the upper soil layer of 0-30 cm. In contrast, data obtained by ground-based survey are limited to water resources contained in snow and surface ice cover.

A81-30565 // Results of experimental gamma-ray mapping of snow cover in mountains (Nekotorye rezul'taty eksperimental'nykh gamma-ray mapping of snow cover in mountains). M. I. Getker, A. V. Suslov (Saratovskii Nauchno-Issledovatel'skii Institut Gidrometeoroizdat, Saratov, USSR). In the European part of the USSR during the period 1971-1978 is presented. 128 p. In Russian.

Aerial gamma-ray mapping experiments were conducted in the mountains of Tien Shan at altitudes 1200-3500 m above sea level over an area covered by a network of 160 routes, each 1.5 km long. Gamma radiation intensity was measured in the energy range 0.3-3.0 MeV. Snow distribution curves are presented.


Commercial instrumental has been developed for aerial gamma-ray mapping which can be applied for determining the water content of snow cover in the water equivalent range 10-300 mm with an accuracy of 0.3 mm or a weight moisture content of up to 50% in the surface soil layer with an accuracy of 1%. Essentially, the instrumentation consists of a specialized aerial radiometer which measures gamma-quanta fluxes in the energy range 0.02-2.4 MeV and 2.4-3.0 MeV, flight altitude, and flight duration.

A81-31925 // The use of aerial and space photographs for hydrogeological studies in deserts (Ispol'zovanie avtionsiono-gamma-ray mapping of desert regions and also for the investigation of hydrogeological changes in such regions caused by anthropogenic factors. Particular attention is given to the use of large- and medium-scale photographs for the mapping of ground water and to the use of small- and medium-scale photographs for the hydrogeological mapping and exploration of exogenic processes associated with subsurface water. The use of remote sensors methods to compile maps intended for the protection of subsurface water from pollution is discussed along with the search for regions that are suitable for the subsurface storage of surface water.

B.J.

New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 49.1.4-49.1.7. 12 refs. NSF Grant No. ENG-79-09374; Grant No. NSF-5335.

Measurements were performed with active and passive microwave sensors for both dry and wet snow conditions. A layer of Rayleigh scatterers with irregular surface boundaries is found to be a reasonable model for interpreting passive and active measurements in X- and Ku-bands. It was found that roughness had a significant effect on both backscatter and emission from wet snow; however, only a small effect was noted for dry snow.


A statistical study is made of Lake McConaughy, Nebraska by associating Landsat multispectral data from six satellite passes with plant chlorophyll data in order to examine the process of eutrophication. The reflectances and chlorophyll data were processed by the Statistical Package for the Social Sciences and by computer, and both bivariate and multiple regression analysis revealed many relationships connecting chlorophyll with band 4, 5, 6, and 7 reflectances. A bivariate regression equation utilizing band 7 reflectance was selected as the best available descriptor and predictor of chlorophyll. Regression equations relating reflectance to chlorophyll yielded actual images. Ground truth figures from a boat using thermistors at a 6 in. depth agreed to within 0.5 C. The aerial photographs were analyzed for total suspended particles, chlorophyll, and yellowing organisms. The Volume Spectral Response agreed well with laboratory modeling. A negative correlation was found with actual samples, standard errors of 5.5 pph for chlorophyll and 3.0 ppm for suspended solids were considered well within effective bounds. Use of the techniques for rooftop heat loss studies, fishing, and long and short term tidal cycles is suggested.


Data from an airborne IR scanner and aerial photography of power plant cooling water discharges along the lower Hudson River were subjected to densitometric analysis. Varying flow levels and parallel paths flying allowed determination of attenuation, air and sky radiance, three factors which, when included in the Planck equation with the density of each point of the scanner images, were subjected to densitometric analysis. Ground truth figures from a boat using thermistors at a 6 in. depth agreed to within 0.5 C. The aerial photographs were analyzed for total suspended particles, chlorophyll, and yellowing organisms. The Volume Spectral Response agreed well with laboratory modeling. A negative correlation was found with actual samples, standard errors of 5.5 pph for chlorophyll and 3.0 ppm for suspended solids were considered well within effective bounds. Use of the techniques for rooftop heat loss studies, fishing, and long and short term tidal cycles is suggested.


Image patterns of mud flats produced by remote sensing using the matched filtering method, are analyzed. Single structural elements of a given image pattern as well as entire image pattern formations are studied as the basis for the investigation. The parameters presented propose the possibility of a simulation of morphometric ground measurements, the elimination of unwanted light effects, and the characterization of types of mud flats. Images of test areas, representing the morphologic aspects are given, and computer diagrams representing the parametric evaluation of the study are presented and detailed.


It is pointed out that for some natural processes, changes in process characteristics occur within the time required by the sensor system to acquire the data. Flooded water, for instance, covers tidal flats with a current velocity of 1 to 3 m/sec. In one Landsat-scene, the stage of tidal coverage is locally different, i.e. the satellite picture does not show the low water situation within the entire scene. Time-scale problems concerning mapping on the basis of remote sensing Landsat MSS imagery are considered, taking into account the need of mapping the intertidal area. Another problem regarding the time scale is related to the fact that the tidal phases of high and low water set in at different times along the German North Sea coast.


An assessment is conducted of three types of aerial photographs for monitoring the vegetation of balancing lakes. Aerial photographs of two lakes were supplied for the two years 1977 and 1978. These included black and white prints, and true color and color infrared transparencies, at a scale of 1:2,500, with a 9 x 9 inch format. The results of the study suggest that the best overall film type for monitoring the emergent and submerged vegetation of balancing lakes is color infrared film. This is due mainly to the high and low levels of reflectance from vegetation and water respectively on this film type. The bright red tones of the vegetation thus stand out against the dark, blue-black of the water surface.

G.R.

A81-36465  


The problem to obtain information regarding the surface temperature of a body of water is considered. For the determination of the part of the energy of a body of water which is removed from the water, as a consequence of evaporation and convective heat transfer, it will be necessary to measure and process values for the input parameters of the employed mathematical formalism. A part of the input values needed can be obtained as a result of remote sensing operations, such as the determination of water surface temperatures with the aid of infrared scanning devices. The acquisition of the data and their interpretation is discussed, taking into account also problems of geometrical rectification.

G.R.

A81-35972  
Control of water resources using remote sensing data (Upravlenie vodnymi resursami na osnove distantsionnoi informatsii), V. A. Leonidov. Geodezija i Kartografiia, Apr. 1981, p. 57-60. 5 refs. In Russian.

A81-36267  

Paper describes a PTM Nd:YAG laser operating reliably at pulse repetition frequencies (PRF) of up to 400 Hz. Technical problems encountered include thermal effects in the laser rod, design of suitable Q-switch circuitry, and the problem of doubler lifetime. A stable resonator designed to correct thermal lensing and birefringence is described, along with a differential Q-switch driver for high PRF operation. A power output of 2.4 W at 1.6 microns was obtained in PTM operation at 400 Hz. Thermally induced birefringence in the index-matched Q-switch imposed a limit on the average power of the PTM laser.

B.J.

Snow which is characterized by the absence of melting metamorphism and exhibits a decreasing brightness temperature with increasing frequency above 10 GHz; (2) the spring snow for which the phases of melting and refreezing of the surface layer are discriminat-
ed by a complete reversal of the microwave brightness temperature spectrum around 2 cm wavelength; and (3) the summer snow which is characterized by extremely high brightness temperature due to melting, particularly above 10 GHz.

V.L.

A81-36270  

A81-39322  

An overview is presented of the U.S. Geological Survey's satellite data telemetry program, which in over eight years of experimentation, contractor services and studies, new instrumentation developments, and intergovernmental agency cooperative programs has proven to be a reliable and cost effective tool for the remote acquisition of hydrologic data. Real-time hydrologic data are potentially useful in improved flood warning, irrigation water allocation, water supply forecasting, reservoir management, water quality monitoring, hydropower generation, the management of navigational waters, and allocation of urban water supplies. Economic studies of satellite telemetry-supplied flood warning and irrigation water allocation data show that the benefits derived outweigh system costs.

O.C.

A81-39325  

The frequency-doubled Nd:YAG laser, operated in pulse transmission mode (PTM), can provide the required performance characteristics for the application of airborne coastal hydrography. This paper describes a PTM Nd:YAG laser operating reliably at pulse repetition frequencies (PRF) of up to 400 Hz. Technical problems encountered include thermal effects in the laser rod, design of suitable Q-switch circuitry, and the problem of doubler lifetime. A stable resonator designed to correct thermal lensing and birefringence is described, along with a differential Q-switch driver for high PRF operation. A power output of 2.4 W at 1.6 microns was obtained in PTM operation at 400 Hz. Thermally induced birefringence in the index-matched Q-switch imposed a limit on the average power of the PTM laser.

B.J.

N81-22451*  
Wisconsin Univ. - Madison. Environmental Remote Sensing Center. WETLAND MAPPING FROM DIGITIZED AERIAL PHOTOGRAPHY.


Computer assisted interpretation of small scale aerial imagery was found to be a cost effective and accurate method of mapping complex vegetation patterns if high resolution information is desired. This type of technique is suited for problems such as monitoring changes in species composition due to environmental factors and is a feasible method of monitoring and mapping large areas of wetlands. The technique has the added advantage of being in a computer compatible form which can be transformed into any georeference system of interest.

E.D.K.
Estimates of low flow and flood frequency in several southwestern Wisconsin basins were improved by determining land cover from LANDSAT imagery. The utility of land cover in multiple-regression techniques, the standard error of estimate (SE) for the least annual 7-day low flow for 2- and 10-year recurrence intervals of ungauged sites were lowered by 9% each. The SE of flood frequency in the 'Driftless Area' of Wisconsin for 10-, 50- and 100-year recurrence intervals were lowered by 14%. Four of nine basin characteristics determined from satellite imagery were significant variables in the multiple-regression techniques, whereas only 1 of the 12 characteristics determined from topographic maps was significant. The percentages of land cover categories in each basin were determined by merging basin images, digitized from quadrangles, with a classified LANDSAT scene. Both the basin boundary X-Y polygon coordinates and the satellite coordinates were converted to latitude-longitude for merging compatibility.

T.M.


HEAT CAPACITY MAPPING MISSION (HCMM) THERMAL SURFACE WATER MAPPING AND ITS CORRELATION TO LANDSAT

(E81-10137: NASA-CR-164145) Avail: NTIS HC A02/MF A01 CSCL 05B

Graphics are presented which show HCMM mapped water-surface temperature in Lake Anna, a 13,000 dendrological-shaped lake which provides cooling for a nuclear power plant in Virginia. The HCMM digital data, produced by NASA were processed by NOAA/NESS into image and line-printer form. A LANDSAT image of the lake illustrates the relationship maps were significant. T.M.

N81-23563/# California Univ., Berkeley.

REMOTE SENSING OF WATER QUALITY IN RESERVOIRS AND LAKES IN SEMI-ARID CLIMATES Final Report
Harold M. Anderson and Alexander J. Horne Dec. 1976 143 p refs

(Grant No.G-2003) (NASA-CR-166178; SELR-75-1) Avail: NTIS HC A07/MF A01 CSCL 08H

Overflame measurements using aerial cameras (remote sensing) combined with water truth collected from boats most economically provided wide-band photographs rather than precise spectra. With use of false color infrared film (400-850 nm), the reflected spectral signatures seen from hundreds to thousands of meters above the lake merged to produce various color tones. Such colors were easily and inexpensively obtained and could be recognized by lake management personnel without any prior training. The characteristic spectral signatures of various algal types were also recognizable in part by the color tone produced by remote sensing. T.M.

N81-23688/# Department of Energy, Washington, D. C. Assistant Secretary for Environment.

COMPARING ENERGY TECHNOLOGY ALTERNATIVES FROM AN ENVIRONMENTAL PERSPECTIVE

A number of individuals and organizations advocate the use of comparative, formal analysis to determine which are the safest methods for producing and using energy. An opposing viewpoint is presented, arguing that for technical reasons, analysis can provide no definitive or rationally credible answers to the question of overall safety. Analysis has not and cannot determine the sum total of energy to human welfare and economical communities from energy technologies. Analysis has produced estimates of particular types of damage: however, it is impossible to make such estimates comparable and commensurate across different classes of technologies, and the result of the deficiencies, comparative analysis cannot form the basis of a credible, viable energy policy. Yet, without formal comparative analysis, how can health, safety, and the natural environment be protected. A method is multi-dimensional for improving the Nation's approach to this problem: health and the environment should be considered as constraints on the deployment of energy technologies, constraints that are embodied in Government regulations.

A.D.E.
of purposes in several regions of the world, mainly within the tropics is discussed.

Author (ESA)

N81-27586f] Norwegian Water Resources and Electricity Board, Oslo.

SNOW MELT WATER RUN-OFF PREDICTION


Avail: NTIS HC A09/MF A01

Remote sensing in hydrology to observe and measure dynamic conditions of water quantity and quality is introduced. The 1972 investigation of damage caused by the disastrous flood of Rapid Creek at Rapid City, South Dakota, is cited as an example. A number of other floods of varying types in varying terrains that were examined in detail on aircraft or satellite imagery are mentioned. Modes of data collection, processing and interpretation are described. A basis for design of a national program for quick-response flood mapping for damage assessment is established.

Author (ESA)

N81-27606f] WAPORA, Inc., Chevy Chase, Md.

POTENTIAL EFFECTS OF ENVIRONMENTAL REGULATORY PROCEDURES ON GEOThermal DEVELOPMENT

Gene V. Beeland and David B. Boies Jan. 1981 100 p refs

Contract DE-AC01-BOET-27208 (DOE/ET-27208/T2) Avail: NTIS HC A05/MF A01

The potential effects of several types of applicable environmental regulatory procedures on geothermal development were assessed, and problem areas were identified. The possible impact of procedures adopted pursuant to the following Federal statutes were analyzed: Clean Air Act; Clean Water Act; Safe Drinking Water Act; and Resource Conservation and Recovery Act. State regulations applicable, or potentially applicable, to geothermal facilities were also reviewed to determine: permit information requirements; prepermit air or water quality monitoring requirements; effect of mandated time frames for permit approval; and potential for exemption of small facilities. The regulations of the following states were reviewed in the review: Alaska, Arizona, California; Colorado; Hawaii; Idaho; Montana; Nevada; New Mexico; Oregon; Utah; Washington; and Wyoming.

DOE

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DATA PROCESSING AND DISTRIBUTION SYSTEMS

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


Topics discussed include the digital correction of geometric distortions of multispectral images, the filtering of cloud cover on multispectral images, and a comparative analysis of image compression algorithms for use in the interpretation of multispectral data. Attention is also given to the evaluation of soil moisture and related processes from remote sensing data, the use of brightness coefficients of natural objects for the interpretation of satellite images, and the evaluation of the dynamics of turbid waters from multispectral images.


An algorithm for correcting geometric distortions of remote sensing imagery from the Meteor satellites is presented; these distortions are determined by the earth's curvature, the characteristics of satellite motion relative to the earth, and the characteristics of the scanner. The correction is performed on a digital computer equipped with image data input-output devices.


The paper establishes the feasibility of using brightness coefficients of objects on the earth's surface, measured on the ground, for the interpretation of satellite remote sensing data. The proposed method was applied to the interpretation of Meteor-satellite multispectral data.


An historical overview is given of the machine analysis of vertical views of the earth's surface, present image analysis algorithms are discussed, and the characteristics of future systems are projected. Methods discussed include multispectral pixel classification, quantitative texture estimation, some partition into statistically homogeneous objects, and direct use of spatial context. Multitemporal schemes using concatenated multispectral vectors and temporal partitioning or cascading are also described. In conclusion, trends in data base management and novel sensor systems are discussed.

A81-32356 Digital preprocessing of SEASAT imagery. V. S. Frost, J. A. Stiles, J. C. Holtzman (University of Kansas Center for Research, Inc., Lawrence, Kan.), and D. N. Held (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: ICC '80 (International Conference on Communications, Seattle, Wash., June 8-12, 1980, Conference Record. Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 49.7-1-49.7.5. 10 refs. Research supported by the California Institute of Technology; Contract No. NAS7-100; Grant No. DAAG29-77-G-0075.

A model for radar image data is derived for use in developing enhancement techniques. This model describes the image data as the result of a multiplicative-convolved noise process. This information is then used to design a minimum mean square error (MMSE) filter. The resulting filter is implemented adaptively to change with local statistics. A radar image processing technique which provides the MMSE estimate inside homogeneous areas and tends to preserve edge structure is thus developed. This technique has been implemented and tested using digitally correlated SEASAT-A synthetic aperture radar (SAR) imagery.


IR imagery from various terrain backgrounds has been collected by the Environmental Research Institute of Michigan using the ERIM MX scanner, and analyzed to determine the statistics of both radiometric and spatial features. Some of the terrain-background characteristics in the form of histograms, equivalent ellipse statistics, and power spectra for several IR bands are described. In addition, the industrial target data collected as part of the development of a DARPA image data base for autonomous terminal homing technology evaluation is described.


An assessment of the ability of orbital synthetic aperture radar (SAR) imaging systems to provide useful information about aeolian features, and to determine how such a system might be constrained by the need to image these features, is presented. SEASAT and aircraft radar imagery of five areas of sand dunes are studied, and compared to Landsat imagery and air photos, for two wavelengths (3.0 and 23.5 cm) and incident angles ranging from 0 to 70 deg. It is shown that the illumination direction of the radar beam is important, since directional dune features must be oriented within 60 deg of perpendicular to the radar illumination direction in order to be imaged. It is concluded that the availability of radar imagery for two directions greatly facilitates interpretation of dune morphology and derivation of conclusions about causative wind regimes.


The requirements for future data systems for earth resource observation data are examined. Estimates are made for both expected data volumes and data delivery requirements. Research and development activities presently underway are described, including (1) high-speed processors such as the massively parallel processor; (2) data storage systems, including optical disk configurations and (3) distributed data systems such as high-speed local networks and the applications data service system.

DATA PROCESSING AND DISTRIBUTION SYSTEMS


Subjects related to the mathematical analysis of data are discussed, taking into consideration block adjustment with additional parameters, metric aspects of remote sensing data, analog versus digital image processing of photogrammetric imagery, error detection and reliability studies in analytically formed strips, some high efficiency digital techniques for remote sensing data processing, two methods of plotting from Landsat imagery using analogue instruments, digital terrain model in levelling plotting on large scale topographic maps, analytical aerial triangulation with idealized models, and planimetric transformation of synthetic aperture radar imagery. Attention is also given to real time orientation as integral part of online analytical aerial triangulation, photogrammetric applications of Landsat MSS imagery, bundle block adjustment with small format photographs, efficient design of a system for simultaneous adjustment of photogrammetric and geodetic observations and additional parameters, and the current status of metric reduction of active scanner images.

G.R.


The application of additional parameters in using self-calibrating block adjustments in the correction of systematic photogrammetric image errors is studied. The theoretical status of the method is reviewed and the problems of selection reliability, determinability, and statistical assessment of additional parameters are stressed. A critical evaluation of balancing functional and stochastic mathematical models is presented. Results show that the accuracy of block adjustments with additional parameters has improved considerably, and external accuracy of adjusted coordinates is drastically enhanced, while the internal discrepancies and hence the estimates are reduced. The estimates of random errors of wide-angle aerial photographs are brought down to about three microns in the negative scale, and in some cases values close to two microns have been reached. Geographic accuracy potential of photogrammetry is confirmed, although further research is necessary.

E.B.


Efficient and convenient representation of remote sensing data is highly important for an effective utilization. The task of merging different data types is currently dealt with by treating each case as an individual problem. A description is provided of work which is carried out to standardize the multidata merging process. The basic concept of the new approach is that of the self-defining data set (SDDS). The creation of a standard is proposed. This standard would be such that data which may be of interest in a large number of earth resources remote sensing applications would be in a format which allows convenient and automatic merging. Attention is given to details regarding the multidata merging problem, a geometric description of multi-type data sets, image reconstruction from track-type data, a data set generation system, and an example multi-type data set.

G.R.


It is noted that digital image processing in the field of conventional photogrammetry can make use of operational methods that have been developed for remote sensing. However, the restoration of photographic imagery's resolution affords large data sets, which cannot be handled economically on today's computer generation. The flexibility of digital image processing is demonstrated for applications of terrestrial photogrammetry.

C.R.


The radiometric and geometric quality of images acquired by the SPOT remote sensing satellite system is examined as given by mission specifications and recent evaluations of system performance at the current level of development. The characteristics of the ground and space segments of the system, which is intended for launch in 1984 to obtain high-resolution images in the visible and near infrared of the earth's surface by the use of an array of detector bars, are reviewed, and the three levels of image processing to be provided are indicated. Factors influencing the precision of the reconstruction of the spectral luminance observed in the image product are then examined in relation to image noise due to photon and electron statistics and errors in relative detector calibration, errors of nonlinearity in the ratios of the numerical values and observed luminances of two points, the relative precisions of spectral bands and times, and the instrument transfer function. Geometrical specifications on the SPOT images in the areas of point localization precision, the preservation of relative distances, anisomorphism, local coherence, multispectral coincidence and relief restoration are also considered.

A.L.W.


A method is described for gross error detection during the process of strip formation from independent models based on the data snooping technique developed at Delft University, the Netherlands. In addition, the planimetric coordinates of the points are checked for errors arising from point misidentification between strips. A study of the reliability of the observations is also carried out. The method presented is found to be very effective for checking observational data prior to the execution of aerial triangulation using strips as units. Errors of a magnitude of 8 to 9 units of variance factor can be readily located. It is also pointed out that the x coordinate of the projection centres is difficult to control.

C.R.

A mathematical approach for analytical aerial triangulation is discussed. Instead of reconstructing the actual models, equivalent models are set up in an idealized way. One of the photographs in a stereoscopic pair, conventionally the left hand one, is treated as a perfectly vertical picture. The right hand photograph is then projectively transformed so that the principle of radial line intersection and derivation of heights by basic parallax formula become applicable. It is pointed out that the considered analytical approach avoids explicit determination of orientation elements and complexities involved therein. The transformations can be utilized for orthophotography and preparation of idealized stereoramas.

A81-34401


The considered investigation has the objective to develop a method for the planimetric transformation of airborne synthetic aperture radar (SAR) imagery. According to the selected approach, the acquired radar imagery is examined and its geometric characteristics are experimentally determined. The results are used as a basis for the design of a suitable mathematical model for the transformation. The imagery investigated was obtained with a dual-frequency, dual-polarization SAR, which had been installed in an aircraft. The two frequencies of operators were the X and the L-band. The sensor was operating in a shallow angle mode. It is pointed out that the planimetric information extracted with digital mapping techniques from the acquired SAR imagery will satisfy Class A mapping standards at scales of 1:100,000 to 1:50,000.

A81-34403


The main factors limiting the cartographic applications of available space imagery are resolution and geometric accuracy. For Landsat Multispectral Scanner (MSS) imagery, the major weakness is its resolution. A description is given of investigations which were conducted to develop new mathematical techniques for rectifying MSS imagery. The investigations are also concerned with the possibility to obtain height information from Landsat MSS images, and with an employment of the images for topographic mapping, map revision, and thematic mapping. Attention is given to data and observation, geometrical analysis, parametric correction, the merits of polynomial and affine dimensional methods, stereophotogrammetric methods, and aspects of MSS image rectification. It was found that heights can be determined to a high degree of accuracy.

A81-34406


It is pointed out that filter techniques for noise reduction and amplification of desired information are of great importance in digital image analysis. Two-dimensional filter theory is briefly discussed, and the effects of certain designed filters are described.

Using two sets of test block data, the possibilities offered by the Hanover Bundle Block Adjustment Programs for identification and consideration of systematic image errors were investigated. It was found that, despite favorable initial conditions, no significant accuracy increases could be obtained through an a priori refinement of the photo coordinates by means of réseau cross measurements; and that the number of parameters used in computation must be found using statistical tests. An iterative adjustment that considers systematic image error by spline interpolation was found to produce better results than the bundle block adjustment on the basis of 13 additional parameters, though these were not as good as the adjustment made on the basis of 16- and 20-parameter sets. It is concluded that an additional accuracy increase for one of the two test areas could be obtained by an a priori/a posteriori correction of the radial symmetric distortion from the data of a previous adjustment.


It is noted that the bundle adjustment program BOBUE makes it possible to compute the whole standardized inverse of the normal equations or of standard errors only. Using this software, blocks of synthetic data with randomly distributed generated errors are investigated. Standard errors and correlation coefficients deriving from bundle solutions are presented numerically and graphically. An attempt is made to deal with the effect of point density per photo and the variation of parametrization. Typical findings from real block adjustment are also given.


The design of a general photogrammetric system to be implemented on a minicomputer is presented. A general data structure is proposed which uses terms and definitions from graph theory, and which simplifies the manipulation and sorting of different observations and supplementary information in such a way as to optimize the data flow through the computer. It allows different sets of geodetic observations to be included, optimizing the entire system and treating the geodetic observations as part of the system, and not as a separate addition. Other types of observations can also be included in a natural way: e.g., stastoscope observations, a priori constraints, and photogrammetric model observations.


A general procedure is presented for the geometrical processing of images obtained by an arbitrary sensor of an arbitrary object which is based on the systematic use of digital models. The procedure involves the determination of image formation parameters including three sensor-centered spatial coordinates and three orientation parameters in object space, followed by the construction of an imaging model allowing image coordinates to be derived from object-space coordinates by interpolation in a regular mesh. The digital model thus obtained can be used in digital rectification, orthophotography and analytical plotting, as well as automatic correlation and the reconstruction of an object from multiple images in the case of objects with variable opacity.

A81-34437 # The Terrestrial/Photogrammetric /TP/ technique for the detection and compensation of systematic height errors in block aerial triangulation. M. M. Abdel Rahim (Glasgow, University, Glasgow, Scotland). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers.
coordinates being obtained from small-scale maps) the coordinates of the ground control must be treated as observed values and must be adjusted when solving the photogrammetric system. This requirement led to the development of two bundle adjustment algorithms. In the first, the coordinates of the ground control as well as the photo measurements are used as observations in the collinearity condition equations. In the second algorithm, the camera parameters, the ground coordinates of the control points, and the photo measurements are employed as observations in the collinearity condition equations.

C.R.


Several systems are discussed for the digitization of existing graphics, among them manual digitizing, automatic tracking (photosensing devices or laser beams) and automatic raster scanning systems (film or flat scanners). It is noted that with the use of aerial photography data can be collected digitally during photogrammetric stereocompilation or automatically scanned for the production of profile data or dense digital elevation models. The effects of data acquisition systems on the process of encoding and structuring cartographic information systems are assessed. Attention is also given to special software for the structuring of data and to possible future systems.

C.R.


The Commission E of the OEEPE is concerned with the recognition of objects in aerial photographs, aerial photography reproductions, and the transformations of aerial photographs. The commission has two working groups, one group examines possibilities for the design of a mathematical model for the optical-photographic transfer: object-aerial photograph negative. Another group is charged with a study of the effects of the reproduction techniques on interpretation possibilities in the case of orthophotos. The second group completes a comparative experimental study regarding the photophographic reproduction methods commonly employed in Central Europe, taking into account the scales 1:5,000, 1:10,000, and 1:25,000.

G.R.


The proposed method makes use of a special aerial photograph. All planimetric elements in the area are identified and the changes which have to be made in the map are determined. An analytic and an analog approach can be employed for the revision procedure. The analog approach is selected if the number of changes is greater than 40%, while the analytic method is used in all other cases. The automatic system Aristo used for the revision process consists of three main parts, including a minicomputer, a drawing device, and digitizing equipment. The minicomputer with the computer program forms the center of the system.

G.R.


The applications of high-flown, super-wide angle aerial photography, within the scale range 1:11,000-1:1,100,000 to both small and medium scale mapping and subsequent revision procedures in South Africa are discussed. Attention is also given to aerial triangulation, the production of 1:50,000 orthophoto maps, and the later use of these maps in various related cartographic processes. It is noted that the work thus far undertaken has yielded very promising results, especially with regard to economy, accuracy, and the depiction of extensive areas of bush, sand dunes, and desert.


It is noted that Canada's vegetationless North is being mapped with the aid of the Geostar Photomapper. The automatically created digital terrain model (DTM) based on the 1:40,000 image scale results in a dense grid with a point approximately every 8 m. In order to investigate additional uses of this DTM in zones having vegetation and extending its applicability to different mapping scales, a test model close to Montreal is chosen. The DTM is compared to a DTM using a 1:5,000 map of the same region, giving a good idea of its accuracy with different topography and vegetation. On the basis of statistical tests, conclusions are drawn as to the possibility of using the relatively dense DTM for larger scales, especially for cadastral related maps in which allometry is usually without interest.


An international experiment carried out to determine the accuracy of digital data, the suitability of the data for mapping at larger scales, and the time required for data collection is described. It is noted that one test area (180 sq km) was covered by photography at scales of 1:50,000 and 1:15,000 and that a second area (3 sq km) was covered by photography at scales of 1:6,000 and 1:3,000. The digital data base was then created using two different software packages and was employed for digitization by the participants in the experiments; the large scales (1:15,000 and 1:3,000) were used in collecting 'standard' data against which the participants' results were tested. Software was developed to perform the test digitally. Two different algorithms were used in evaluating both the height and the planimetric accuracy. The algorithms are described, and a summary of the accuracy results and a time comparison of the different operations as reported by the participants are given.

It is noted that national land information, including elevation data, is available for combination with the geographically corrected Landsat MSS data. For a three-dimensional representation of the Landsat MSS data, the data given as a function of three-dimensional coordinates should be transformed to a plane by means of parallel or central projection through what is called hidden point projection. Methods of projective transformation and their subsequent processing, which consist mainly of interpolation procedures, are discussed. Examples of three-dimensional representation for Landsat imagery are given for two areas - the mountainous Yarigatake area in central Japan and the Sagami River basin with Mt. Fuji. Additional applications are shown for stereographs and animation. C.R.


It is noted that while black-and-white mosaics of aerial photographs involve less distinctive seams around their boundaries, color mosaics of color aerial photographs or color ortho-photographs involve more discontinuities of color tones. It is sought to remove the discontinuous seams of color mosaics using digital techniques for digital image processing of digitized color ortho-photographs and to establish the methodology of producing good mosaics of color ortho-photo maps with the aid of digital image output equipment. It is shown that seamless mosaics can be produced by the methodology proposed. C.R.


A description is given of co-ordinate coding, developed because key-board coding was considered insufficient to generate code digits with a frequency and rapidity equivalent to the capacity of photogrammetric work. It is pointed out that with co-ordinate coding the rapid way of generating a code digit (by pressing the foot-switch of the co-ordinate registration device) offers possibilities of introducing variations in the coding by giving 'sub-codes' to terrain details included in a 'primary code'. The hardware configuration of the mini-computer system in use in the project in Sweden aimed at developing a coding and data-processing system for digital mapping is shown in a block diagram. The data base used in the project is also described. C.R.


It is noted that data from Landsat I and II satellites were used in compiling and updating maps. Here, photogrammetric methods and equipment attaining an accuracy of approximately 65 m were used to compile maps having a scale as large as 1:200,000. The features of the latest sensing equipment (the efficiencies of which attain a geometric resolution of approximately 10 m) are discussed, as are various problems concerning error sources. C.R.


The interpretation of data is considered, taking into account a topographic content investigation of Landsat classified multispectral images, the connection between remote sensing and data-bank for the land thematic mapping, a method for temporal image analysis of conventional archives-photographs in relation to the study of soil marks, a spaceborne synthetic aperture radar for imaging sea ice, the detection and tracking of a low energy swell system off the U.S. East Coast with the Seasat SAR, and a comparison of classification methods for urban images interpretation. Attention is also given to the dependence of the spectral signature of sugar beets on the observation level and the reflection geometry, the Brazilian forest cover monitoring program, remote sensing technology transfer to operational use, and the digital system for remote sensing evaluation of habitat resources in a new town site, automation of space photo data interpretation in forest resources assessment, air photo interpretation for the measurement of changes in urban land use, computer classified Landsat data used as a forest stratifier, and map revision using SLAR imagery. G.R.


A description is presented of a procedure which makes it possible to print thematic maps in several colors within a few hours. The procedure utilizes data on Landsat magnetic tape and subjects them to a classification process. It is pointed out that the classification of Landsat data according to the methods of 'maximum-likelihood' and 'minimum-distance' requires much time, even if fast computers are used. In connection with certain limitations regarding the computer and the peripheral equipment available in the Federal Institute for Geosciences and Raw Materials, it was necessary to develop a new procedure to reduce the computing times to more acceptable levels. The new procedure makes use of special sorting processes for the 32-bit words containing the reflection data of an image element. G.R.

A81-34552 The visual interpretation of colour synthesis images. K. Herda (JENOPTIK Jena GmbH, Jena, East Germany), K.-H. John, and V. Krotzsch (Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, Potsdam, East Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July
mental investigations regarding inferences by analogy in visual aerial and satellite photographs. An important process in the West Germany). In: International archives of Photogrammetry; recognition of the individual objects which have been imaged in tee of the International Congress for Photogrammetry, 1980, p. 457-466. 7 refs.

The need for a quick reference data base on the source of worldwide available aerial and outer space imagery has become increasingly apparent in recent years, particularly for those concerned with natural resources surveys and management. With this in mind, FAO has held two expert consultations (1977, 1979). This paper reports on the findings of the consultations and outlines the measures needed to provide a world index of space imagery (WISI).


It is noted that severe statistical flattening of variances exists in two of the four Landsat thematic imagery channels and that the other two channels convey 95 percent of the data. The four channels are considered as coordinate axes of which only the stronger two of this inertia matrix are considered. The 'Analysis of Principal Components' is introduced wherein each of the four channels is color decomposed with an appropriate filter. A tint is chosen for which luminance is proportional to its value in one channel, color is proportional to its value in the other, and saturation is the highest possible. Information is then obtainable from two channels only and observed objects can be viewed in natural color. This result of the Karhunen-Loeve coding is investigated quantitatively and qualitatively and it is found that the transformed data are accurate when compared with ground truth. Near term observations of the Sudan zone of Africa are indicated.


The main problem in photograph interpretation is related to the recognition of the individual objects which have been imaged in aerial and satellite photographs. An important process in the interpretation procedure is also the inference by analogy. Experimental investigations regarding inferences by analogy in visual photography interpretation are discussed, taking into account a test area in Central Europe. The persons participating in the test included 14 scientists from 10 different fields, and a study group consisting of students. The objective of the test was the recognition of the structure of the landscape in the test area and the recognition of ecological factors.


Methods for determining object-specific spatial distributions of color density on aerial photographs are described. The distributions are obtained by adjustment calculation from density measurements on sample areas imaged at least twice on neighboring photographs. Examples of data on space-dependent color densities of tree species deduced by these methods are presented. Improvements in classification accuracy after preprocessing steps compensating these spatial variations are demonstrated. Finally, a classification method deliberating use of the object-specific spatial distributions of color density is described.


Methodological aspects of digital image processing that realize decision information provision in the process of automated visual interpretation are considered. Methods deriving from increasing image interpretability, primitive image segmentation, and extracting/measuring image structure elements are discussed. Data pertaining to the estimation of automated interpretation based on the developed methods are also presented.


Topics discussed include primary data acquisition, instrumentation for data reduction, mathematical analysis of data, and topographic and cartographic applications. Particular consideration is given to the radiometric correction of infrared aerial color film, optical imaging instruments for ESA's remote sensing program, the modeling of photogrammetric measuring systems, decision making in digital image processing, the Soviet remote sensing program, map revision in developing countries, and Stereolux (a global digital stereo imaging mission).

A81-34611 # A simple method for correcting the geometric distortion of airborne multispectral data. T. Oka, K. Yazawa, and T. Inagaki (National Aerospace Laboratory, Tokyo, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 88-97. Research supported by the Science and Technology Agency of Japan. An experimental study has been made to correct the geometric distortion of airborne multispectral imagery. Distorted images were corrected using measured attitude angles (Pitch & Yaw) by means of the newly developed program which was established by numerical simulations. Comparing the corrected images with the corresponding photographs clearly proves the advantage of this simple method for correction.

The mathematical formulas are derived for calculating the error which refraction introduces into the values for spatial coordinates that are determined for given points on the basis of two stereo aerial photographs. The distortion-producing effect of light-beam refraction is particularly pronounced when the spatial coordinates of points are to be determined on the basis of small-scale images, such as satellite images. The refraction effects are related to differences in temperature, density, and air pressure in the air layers through which the light beams are passing.

G.R.


Digital imagery obtained from multispectral scanner data over water bodies generally display low gradient features. The readability of such images is improved if continuous equidensity curves are superimposed onto the imagery. A series of algorithms to be used for generating such curves on noisy data is presented. These include procedures for reducing random line offset variations, and random noise, and for generating the contour curves. The described techniques can be implemented on minicomputers with limited address space. Applications on Coastal Zone Color Scanner data are shown. (Author)


The general concept of image processing as part of a decision-making procedure is examined. Examples are presented on how the mathematical tool of mapping can be used to convert raw data into color-coded class or state probabilities. It is also shown how spatial neighborhood mapping can be used to prove the local consistency of class probability and assist in spatial image segmentation as preclassification. The most interesting problems occur when the dynamics of processes on the earth’s surface is included as a movement of vectors in a feature space. The use of predictor-corrector methods, including hypothesis building and testing in a converging evidence method, are also considered.

B.J.


The objectives of the Stereosat mission are to obtain worldwide cloud-free stereo coverage at two base-height ratios and with a groundIFOV of 15 m; and to obtain stereo data in digital form that can be merged with monoscopic digital terrain models derived directly from the image data stream. This paper reviews Stereosat, with consideration given to the geological mapping requirements, digital data bases, the mission concept, system lifetime, instrument parameters, spacecraft parameters, and geometric accuracy.

B.J.


Recent developments in image data analysis demonstrate that linear in thematic interpretation capability are related to image quality. Questions of image quality definition are investigated, taking into account aspects of geometrical and amplitude quality. Attention is also given to the level of product quality. It is pointed out that in the case of the ESA remote sensing satellite program four levels of image quality have been identified, including the raw image, the system corrected image, the medium precision preprocessed quality, and the high-precision preprocessed quality. It is pointed out that the quality has to be monitored at the level of satellite design, checkout, and inflight control.

G.R.


The use of remote sensing for the determination of the state of a given object, such as the humidity of soil, is considered. The employment of remote sensing for investigations of this type appears particularly promising in connection with the need for the information involved and the difficulty to collect this information by other means. Attention is given to a statement of the problem, a state estimation algorithm, possibilities for obtaining a priori information, sensitivity estimation, exponential approximation, the enhancement of classification accuracy in remote sensing by taking into account state fluctuations, and the importance of the state-boundary relation.

G.R.


A method for the automated analysis of multispectral and color TV images of the earth’s surface is described which is based on the use of TV color filters. As an example, the method was applied to the processing of color images obtained on Salyut 5.

B.J.

An input-output device for the processing of remote sensing data is described. The device permits real-time digital input of satellite data to the computer and parallel output of results to the photoregistrators. The device includes a special data compression unit that makes it possible to increase the information channel capacity and the effective storage size by a factor of two.

B.J.

A81-35743


A computer procedure for detecting and finding the boundaries of blobs in noisy infrared images is described. Our evaluation of this procedure on a data base of 81 targets, 34 for design and 47 for test, resulted in only two false negatives (missed targets) and no false detections. Our procedure consists of an intensity normalizer, a dc notch filter, an edge detector, a spoke filter, a gradient-guided segmenter, an extractor of the standard deviation of the gray level in each blob, an extractor of the fraction of intense edge elements along the boundary of each blob, and a three-nearest-neighbor classifier. Among these processes, the spoke filter and the gradient-guided segmenter are new. Both of them contribute strongly to the effectiveness of our procedure. The spoke filter is sensitive to a wide variety of shapes of blobs within a specified range of sizes. The gradient-guided segmenter exploits the noise immunity of the direction of the digital gradient to find a best threshold for segmenting each detected blob.

(Author)

A81-35744


The perceptual significance of sampling distortions due to band limitation and aliasing was investigated. Sampling errors were investigated in two different scenes. A perceptual experiment comprising similarity judgements was designed. Four observers were asked to judge the similarity of pictures processed with different combinations of prefiltering and sampling frequency. The similarities were analyzed by a multidimensional scaling technique (INDSCAL). The obtained multidimensional solutions indicated that sampling distortions could be mapped in two perceptual dimensions. The perceptual dimensions were related both to the amount of aliasing and to band limitation. The subjective data indicated that the relative saliency of aliasing versus band limitation effects were different in the two scenes.

(Author)

A81-35746


The use of the color gradient magnitude as an aid in the classification of pixels in threshold selection is analyzed. It was hypothesized that in a scatter plot of frequencies of colors in the image two clusters corresponding to the object and background colors should be found, which could be separated into objects and background by classifying the pixels. Results show that suppression of high-gradient-points does improve the separation of clusters in some types of images, but the results for the Land Mosaic are not satisfactory. It was suggested that the technique can be effective for images that show piecewise constancy and regions with a narrow range of colors.

(Author)

A81-35966

Automated positioning of space imagery (Arto-

Various aspects of the digital processing of remote-sensing imagery are reviewed. Particular consideration is given to techniques developed for digital transformation of images, the processing of multispectral images, the improvement of automated interpretation on the basis of interactive processing, automated mapping, and the systems organization of digital processing.

B.J.

A81-35968


A81-36271


An active method using a pulsed external source is proposed for measuring thermal infrared emissivities of surfaces with a heterogeneity of less than two percent. The method avoids any surface temperature measurements and eliminates completely the effects of the surroundings. With a simple implementation, the method is shown to provide an accuracy of a few per thousand even for large emissivities. The implications of the proposed method for remote sensing are discussed.

V.L.

A81-36272


A study has been carried out in order to investigate the possibilities offered by Landsat imagery for characterization of tropical terrain units with respect to surface topography, vegetation, type of soil, and climate. The distribution of the radiometric values of the multispectral imagery calculated by PCA is represented in the plane of the two major axes (corresponding to the largest eigenvalues). The areas occupied by each terrain class are then defined within this plane.

V.L.

A81-36906


The problem of an optical representation of digital information arises in connection with the transfer of digital processing results on film and its further processing in a reproduction procedure. Possibilities of photographic reproduction have technological limitations. The adaptation of digital data in relation to a density function is inadequate. Correspondence relations are expressed with the aid of a transfer function. This transfer function depends on the employed film and its processing. The digital density function provides the relation between optical density and digital grey value. Attention is given to digital-analog conversion and exposure, the standardization of photographic processes, the relation between optical and digital density, the approximation of the density function, the determination of the transfer function, and the rational establishment of a transfer characteristic.

G.R.

A81-36906

The German aerospace research institute DFVLR looks after the interests of the German user in connection with the Earthnet program. Earthnet is the European network, established by the European Space Agency for the reception, processing, and dissemination of the data obtained by remote sensing satellites. These satellites include currently the NASA satellites Landsat, HCMM, Nimbus-7, and Seasat. Earthnet is to ensure access to the satellite data for the European user. Attention is given to the established ground stations, the various types of available data, the NPOC function of the DFVLR, and an example for interactive image processing. (Author)


Texture is seen as an important spatial feature useful for identifying objects or regions of interest in an image. While textural features have been widely used in analyzing a variety of photographic images, they have not been used in processing radar images. A procedure for extracting a set of textural features for characterizing small areas in radar images is presented, and it is shown that these features can be used in classifying segments of radar images corresponding to different geological formations. C.R.


It is reported that a number of states in the western U.S. are either in possession of, or moving to acquire, a capability for the routine computational processing of Landsat imagery and digital data as a tool for dealing with planning and resource management problems. Decisions have been made to fund the hardware, software and personnel needed for this capability despite current uncertainties as to the Landsat program's future; reflecting the success of many applications experiments conducted in recent years by state, local and regional government agencies in 14 western states. The experiments, some of which are still underway, have dealt with such issues as land cover and use, wildlife habitat, forest inventory and infestation, forest fire hazard assessment, water resources, coastal zone management, and surface mine detection. Color photographs demonstrating the amount and type of information made visible are included. O.C.


The Argos project is discussed in terms of past missions and possible performance capability for future application. Since the signing of the Franco-American agreement in 1974, the missions assigned have been: (1) to provide an operational data collection and platform location service for the Tiros-N/NOAA program (1979 until 1990), and (2) to attend to users' interests, coordinating the utilization and supervision of a subsystem, referred to as Service Argos. The system is composed of user's platforms equipped with sensors and platform transmitter terminals (PTTs), a space segment consisting of two satellites in orbit at any given time during the operational phase, and a data processing and results distribution center. The particular design configuration is suitable for environmental data collection in three broad areas, atmosphere, sea, and earth sciences. The technical data related to the user's platform, the orbit characteristics, data collection and processing, computer systems, and data distribution are discussed in detail. E.B.


Research supported by the Ministry of Forests of British Columbia; Natural Sciences and Engineering Research Council of Canada Grant No. A-3390.

Computer-based image analysis requires explicit models of the image-forming process in order to deal with the effects of variations in viewing direction, incident illumination, surface slope and surface material. A fixed illumination, surface material and imaging geometry is incorporated into a single model, called a reflectance map, that allows observed brightness to be written as a function of surface orientation. The reflectance map is used to generate synthetic images from digital terrain models. Synthetic images are used to predict properties of real images. This technique is illustrated using Landsat imagery. Accurate shadow regions are determined from a digital terrain model by calculating which surface elements are visible from the light source. Once shadows are determined, the effect of sky illumination and atmospheric haze is estimated. (Author)


Use of synthetic reference scene generation from geographic data bases requires an understanding of the represented natural and cultural patterns, as well as the conventions and specifications which guide data base preparation. Digital elevation and planimetric components of geographic data files can be illustrated using mini-computers, interactive graphics terminals, hardcopy plotters and digital image processing systems. Line graphics permits contour plots and isometric views to be generated directly from digital elevation data, while digital image processing displays the earth's surface with highlighting anomalies. Planimetric data is displayed by line graphic plotting, with point, linear and aerial features, and by color coding usingRaster display technology. A new U.S. Army computer program explores the issues of direct data entry to create geographic data bases from stereo aerial photography. It represents a link between the photo interpreter, aerial photo source material, and the derived digital data base which permits closed-loop data extraction, review, revision, and intensification. J.F.


Edge correlation between multisensor images is an efficient technique for scene matching. However, in aerial images, the question of which edges of a scene should be used in the correlation requires consideration. A method is presented which suggests a criterion for selecting the best shape for connected edges for edge correlation. The criterion is based on reducing any secondary correlation peaks. A basis for selecting the best edges directly from a knowledge of the edge shapes is also presented. (Author)


Images of objects and scenes on earth taken from high and low altitude aircraft have been used for many purposes including natural resource analysis, weather prediction and navigational aid. For an image of low contrast, the amplitude variations of the high frequency components of the video are small and can be masked by noise introduced during recording and transmission. Analog and digital enhancement techniques are used to enhance and retain the detail information of the scene represented by the high frequency components. Experimental results are presented for the processing of optical and radar images. (Author)
This paper presents the experimental results obtained with a Direct Electronic Fourier Transform (DEFT) device. Emphasis is placed on the use of DEFT spectra for terrain feature classification. These spectra indicate the potential of DEFT technology for distinguishing between natural features and cultural or man-made features. These same spectra appear to have potential for distinguishing between certain subclasses of terrain features, e.g., open fields, bodies of water, and woods. A potential application of DEFT spectra could be the preliminary analysis of aerial imagery to automatically flag certain photographs for subsequent detailed analysis by a human photointerpreter, and to automatically select or reject specific photographs before digitization for mapping or other purposes. New devices use surface acoustic waves to generate a two-dimensional limited bandwidth Fourier transform of an image in real time without the aid of a computer. These devices permit spectra analysis for a two-dimensional image as a communications engineer would analyze the RF spectrum of a radio signal. Appropriate references and a brief description of DEFT technology is presented. (Author)


The development of a new photographic film, 3412, with speed-gain relationship improvements over Panatomic-X film, is reported. Under normal conditions, the new film will allow for higher-altitude aerial mapping or reconnaissance at lower sun angles than currently possible, thereby gaining more available flight time. The improved sensitometric speed of 3412, combined with resolution and granularity approaching that of such high-definition films as 3414, extended red panchromatic sensitivity and simple, high-speed processing, make the film attractive for many routine applications.

O.C.


The National Oceanic and Atmospheric Administration (NOAA) requires high quality images from each of its two geostationary weather satellites at an average data rate of 57 kilohertz/second. These images are currently distributed to field stations over 3 kilohertz analog phone lines. The resulting loss in image quality renders the images unacceptable for proposed digital image processing. This paper leads to a current effort to implement a microprocessor-based universal noiseless coder/decoder to satisfy NOAA's requirements of high quality, good coverage and timely transmission of its infrared images. (Author)

N81-22446 Business and Technological Systems, Inc., Seabrook, N.H.

MAGSAT SCIENCE INVESTIGATIONS Quarterly Report, 9 Sep. - 30 Nov. 1980
30 Nov. 1980 4 p. ERTS (Contract NAS5-26228)
(E81-10109: NASA-CR-164103; QR-1) Avail. NTIS HC A02/MF A01 CSCL 058

Existing software is being modified to take any combination of component or scalar data in profile form and invert it to a discrete-source magnetization distribution for sources having arbitrary equal-area spacing. The option of constraining both source and directions and magnitude is included. Software for spectral depth-to-magnetic bottom estimates is under development. The software is to be thoroughly listed on synthetic data and applied to the NOO survey data and to NURE data for the southern Rio Grande Rift. Swanberg's silica geotemperature data for the U.S. was digitized for heat flow studies.

A.R.H.


Franz W. Lebert and Walter Kropatsch Nov. 1980 159 p. refs
(Grant DA-ERO-78-G-044: DA Proj. 171-61102-BH-57) (AD-A096132) Avail. NTIS HC A02/MF A01 CSCL 09/2

Analysis of digital remote sensing images can, and should employ all the information that is available about the area of interest. Maps often do exist, so that the question arises how map information can be automatically used to direct image analysis. With an appropriate organization of digital map data banks it becomes possible to merge image and map. Attention is concentrated on aerial features. The algorithms and data structures used for the task are described and experiences using specific examples of LANDSAT images in southern Germany and Austria to automatically recognize features for subsequent rectification are reported. GRA
pressed state has a higher or lower share of the total area than the original substance, depending on the training area. For all sigma values applied, the compressed classification percentages within one substance either stay totally above or totally below original percentages.

Author (ESA)

N81-23861*† Texas A&M Univ., College Station. Dept. of Mathematics.

BASIC RESEARCH PLANNING IN MATHEMATICAL PATTERN RECOGNITION AND IMAGE ANALYSIS Final Report


(Available: NTIS HC A05/MF A01 CSCL 05B

Fundamental problems encountered while attempting to develop automated techniques for applications of remote sensing are discussed under the following categories: (1) geometric and radiometric preprocessing; (2) spatial, spectral, temporal, syntactic, and ancillary digital image representation; (3) image partitioning, proportion estimation, and error models in object scene interference; (4) parallel processing and image data structures; and (5) continuing studies in polarization; computer architectures and parallel processing; and the applicability of "expert systems" to interactive analysis.

A.R.H.

N81-24487 Missouri Univ. -Columbia.

DEVELOPMENT OF AUTOMATED TECHNIQUES FOR CREATING A NATURAL RESOURCES INFORMATION SYSTEM Ph.D. Thesis

Tachpong Hotrabhavananda 1980 252 p

Avail: Univ. Microfilms Order No. 8108804

A system which analyzes LANDSAT multispectral data and digitizes various types of transparency maps which can then be integrated with the LANDSAT multispectral data was developed. The analysis of LANDSAT images consists of geometric correction and land cover classification. In the geometric correction procedure, the LANDSAT image is rescaled and registered to UTM coordinates by linear approximation method. The system features techniques for automatically digitizing the information contained in any map format such as soil, or slope maps. A special dynamic thresholding technique was developed for separating the distinctive areas from the background. An automatic line following routine for the purpose of digitizing line drawing maps technique to eliminate flaws in the contour line and a line thinning algorithm are included in the drawing map digitizing process. A method which integrates the LANDSAT classification and digitized data and demonstrates an example of a natural resources information data base system is also presented. Dissert. Abstr.

N81-26657*† Centre d'Etudes de Meteorologie Spatiale, Lannion (France).

Cyclogenesis in Western Europe and the Mediterranean [CYCLOGENESI SUR L'EUROPE DE L'OUEST ET LA MEDITERRANEE]


Avail: NTIS HC A14/MF A01

The Alpine experiment (Alpex), part of GARP, is discussed. The potential for development and testing of products from satellite data is emphasized. Specifics on the study of lee cyclogenesis in the Mediterranean are mentioned, and the use of radar in the Alpex project is considered. The necessity to use satellite data for the detection and analysis of mesoscale weather phenomena is stressed. Also highlighted are the volume of satellite data that will be generated during Alpex, the commitment of various agencies to extract the smaller scale products, and the time and procedures needed to make satellite images available.

Author (ESA)

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CYCLOGENESIS IN WESTERN EUROPE AND THE MEDITERRANEAN [CYCLOGENESI SUR L'EUROPE DE L'OUEST ET LA MEDITERRANEE]


Avail: NTIS HC A14/MF A01

Cyclogenesis is studied, using satellite imagery. Two examples are offered: (1) evolution in cold air around an eddy center, and (2) development on collision of a cold front with advected warm air of tropical origin. The second type of cyclogenesis is illustrated, citing two events. The first treats a cyclone, developing over the Atlantic and moving towards northern Europe. The second describes a cyclone in the Mediterranean around the Gulf of Gabes. The atmospheric turbulence which results is shown to be very similar to that of a tropical cyclone.

Author (ESA)

N81-26749*† Lockheed Engineering and Management Services Co., Inc., Houston, Tex.


Edward H. Schlosser Sep. 1980 668 p (Contract NAS9-15800)

(Available: NTIS HC A03/MF A01 CSCL 09B

The package is an integrated set of manual procedures, computer programs, and graphic devices designed for efficient
production of precisely registered and formatted maps from digital LANDSAT multispectral scanner (MSS) data. The software can be readily implemented on any Univac 1100 series computer with standard peripheral equipment. This version of the software includes predefined spectral limits for use in classifying and mapping surface water for LANDSAT-1, LANDSAT-2, and LANDSAT-3. Tape formats supported include X, AM, and PM.

N81-28750# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 4B: SOFTWARE SYSTEM MANUAL PART 2 Final Report
Edward H. Schlosser Sep. 1980 721 p
(NASA NAS9-15800)
Avail: NTIS HC A99/MF A01 CSCL 09B

Computer programs, graphic devices, and an integrated set of manual procedures designed for efficient production of precisely registered and formatted maps from digital data are presented. The software can be used on any Univac 1100 series computer. The software includes pre-defined spectral limits for use in classifying and mapping surface water for LANDSAT-1, LANDSAT-2, and LANDSAT-3.

N81-27170# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.

DATA COLLECTION AND LOCATION BY SATELLITE
1979 107 p Conference held at Lanham, Maryland. 13-14 Sep. 1979
Avail: NTIS HC A06/MF A01

User applications and salient features of the Tiros-N/ARGOS data collection system are reviewed. Topics touch on technical data concerning orbits, data acquisition, and platform location. Also discussed are data processing and distribution of results. Data collection platform which employ ARGOS are described. Data acquisitions are used for ice reporting, meteorological balloon location, and for monitoring conditions aboard a twin-hull canoe, traversing the Pacific, along with its location. Numerous first GARP Global Experiment ARGOS system uses are mentioned as well.

N81-27575# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.

BASIC PRINCIPLES OF REMOTE SENSING

Avail: NTIS HC A09/MF A01

The general flow of remote sensing data from airborne or satellite sensors to the data/imagery user is traced. This includes data collection, preprocessing, processing and interpretation. The most important spectral windows for Earth observations are identified, and their uses are described. Image enhancement and processing are shown by an example from LANDSAT multispectral reconnaissance in four bands. Image interpretation is also illustrated, citing LANDSAT techniques.

N81-27579# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.

ACTUAL PERFORMANCE OF THE ARGOS SYSTEM

Avail: NTIS HC A09/MF A01

The ARGOS platform location, data collection and distribution system is described. The ARGOS system comprises: user platforms equipped with sensors and platform transmitter terminals; a space segment consisting of two satellites in orbit at any one time during the operational phase; and a data processing and results distribution center located in Toulouse, France. The Tiros-N and NOAA-6 orbit characteristics are given. Data collection is discussed as to the elementary probability of message acquisition and bit error rate. The principle of platform location is explained, and location accuracy is specified. Operational data processing is discussed including the interval between data collection and availability. Current applications of the ARGOS system are summarized.

Author (ESA)
08
INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.


It is shown that the proper interpretation of multifrequency microwave measurements can permit the estimation of rainfall rates over both ocean and land surfaces. The physical model and the radiative transfer model are developed, and results of model computations are presented. It is found that, over ocean background, the rainfall retrieval is more accurate because thermal emission from rain is more pronounced against the radiometrically cold ocean background. Over land background, higher frequency sensors are needed in order to observe radiometric cooling due to the scattering effect from precipitation-size droplets.

B.J.


The effect of scattering on active and passive remote sensing of earth terrain is accounted for by modelling the terrain material as layered scattering medium. The radar backscattering cross-sections and radiometric brightness temperatures are calculated with the radiative transfer theory as well as rigorous wave approach. The theoretical results are then used to interpret experimental data collected with radars and radiometers at microwave frequencies. (Author)


Attention is given to passive methods for the remote sensing of the earth's atmosphere, particularly at altitudes below 80 km, where the atmosphere can be considered as a perfect gas of constant molecular weight which is very slightly ionized and in local thermodynamic equilibrium. The various possible techniques available for passive atmospheric remote sensing are examined in relation to the requirements of the intended experiments in the areas of spectral range, resolution, viewing angle and platforms, and sources of error in inverting data to model atmospheric characteristics are indicated. Types of instruments currently in use are briefly surveyed, and the development of passive sensing methods for the visible and UV, far IR and microwave, and near IR regions is reviewed. Specific satellite instruments for passive remote sensing experiments are then described, including the UV spectrometer on board OSO-8, and the Limb Infrared Monitor of the Stratosphere, Solar Backscatter Ultraviolet, Total Ozone Mapping Spectrometer, and Stratospheric and Mesospheric Sounder, all on board Nimbus 7, the Spacelab IR spectrometer and CIRRIS experiment, currently under development, and the Microwave Limb Sounder and Laser Heterodyne Spectrometer, currently in production. A.L.W.


Data from the Electrically Scanning Microwave Radiometer on Nimbus-5 (ESMR-5) have been used to calculate total tropical cyclone Latent Heat Release (LHR) and rainfall parameters for over 70 satellite observations of 21 tropical cyclones during 1973, 1974, and 1975 in the North Pacific oceanic region. The data were found to be useful in determining the rainfall characteristics of these storms and appear to be potentially useful in monitoring and making short-term prediction of their intensity. Case studies as well as composite studies indicate that the increase in the ESMR-5 derived LHR corresponds to storm intensification. It also appears that the ESMR-5 derived rainfall parameters can be used to detect the beginning of tropical cyclone intensification. G.R.


The concepts of finite state machines and cellular array processors are examined to show that multispectral multitemporal data processing tasks can be performed with integer multiply arithmetic logic units, table look-up, and word-shift memory. The proposed concept of a cellular array of finite state machines leads to a unifying approach of software and hardware design, and is illustrated with examples of Landsat multispectral scanning data processing that include radiometric and geometric correction, spectral and spatial correlation, color coding, and pixelwise classification. A minicomputer with an array of microprocessors is suggested as a possible solution of the problems inherent in the use of pipeline processors and general purpose computers. O.C.


It is shown that the overall performance of the Distributed Array Processor (DAP) in earth resources imagery preprocessing is very high, and that single-instruction, multiple-datastream (SIMD) processors are nearly ideal for such image processing. Although the DAP could pre-process up to six multispectral scanner frames per hour to the highest precision, it is thought unlikely that such a throughput will be required in a British computing facility until the late 1980s. Characteristics of the LANDSAT imaging system, of preprocessor operations such as radiometric correction, resampling, principal component transformation, and automatic registration, and of image processor architectures like that of the AP-1208, are considered in detail. O.C.


The major development of visible and IR sensors for earth resources observation will be undertaken in the next decade to meet the demands of increased resolution, higher radiometric sensitivity, spectral band diversity, and greater geometric precision without sacrificing the terrain coverage available from current systems. This development will attempt to incorporate advances in large-scale, integrated circuits as applied to detector arrays, optical technology, and image data processing in order to produce a new generation of sensors based on pushbroom scanning. This paper examines the system architecture implied by the requirements for these sensors and suggests configurations and performance characteristics that may result. P.T.H.
Space Shuttle program and in high-altitude aircraft programs. This cartographic camera, has been designed for operational use in the resolutions. B.J. well as me design features used to minimize environmental degrada-

Future trends in microwave sensing are identified with reference to the workshops organized by the Active Microwave Remote Sensing Research Program. The workshops demonstrated that (1) microwave techniques have great potential for earth observations of renewable and nonrenewable resources and (2) existing research does not adequately assess microwave sensor measurement capabilities. The need for synoptic information includes such areas as cloud-free, surface-roughness and electrical-properties data. Attention is given to applications including all-weather imaging, sensitivity to vegetation and soil-moisture conditions. Research tasks to be accomplished during the next five years are discussed. S.C.S.


Topics discussed include the utilization of Landsat data at the CNES, a total system for evaluating aerial survey cameras, aerial cameras of the TES type for topographic surveying, in-water photogrammetry, an empirical study of the visibility of targets in remote sensing, and quality analysis methods for Spacelab mission film selection. Consideration is also given to environmental factors in the design of the Large Format Camera, new studies for European earth resources satellites and earth-oriented Spacelab missions, and aerial film granularity and its influence on visual performance. B.J.


A new imaging device for remote sensor applications is produced by a German aerospace company for employment on space platforms. The principles of operation of the device are based on the scanning action performed by high-resolution imaging sensors using the charge coupled concept. The scanning operation takes place in several spectral channels in the wavelength range from 0.45 to 1.0 micrometer. The image signal is corrected in real time with respect to differences in the sensitivity of the individual detectors and the brightness decline due to the characteristics of the objectives. The digitized and corrected data are stored on high-density digital tape. G.R.


The NASA Large Format Camera, a 30.5-cm focal length cartographic camera, has been designed for operational use in the Space Shuttle program and in high-altitude aircraft programs. This paper examines the potential impact of environmental factors on the resolution performance and geometrical stability of the camera, as well as the design features used to minimize environmental degradations. B.J.


Present activities in the European and German remote sensing programs are focused primarily on the development of instruments for the first Spacelab mission. The most important new development is the Microwave Remote Sensing Experiment. Feasibility studies are underway for the conceptual design and definition of more advanced instruments to be included in Spacelab and Shuttle missions in an earth-oriented measurement mode. Particular emphasis in the German program is placed on the Synthetic Aperture Radar Facility. The definition of future European remote sensing satellite systems has commenced with feasibility studies on the satellites and their payload instruments. B.J.


The MKF-6M, a six-channel multispectral camera designed for use in satellites as well as aircraft is discussed. The electronically monitored camera is equipped with six magazines, a suspension unit, a control console, an unit, and the electronic package. Six high-performance lenses with optimum geometrical resolution, each adapted to the respective spectral band and the same linear magnification through equally calibrated focal lengths, are described. Electrically driven rotating disc shutters with large exposure time ranges, full electronic control of the set exposure time, high synchronization by mechanical coupling of all shutters, and the ability to adapt to different filter factors, are explained, noting the diaphragm setting mechanisms and the data exposure facilities. The function of the control console with three control components capable of operating an additional aerial survey camera, the MRB-9/2323 besides regular MKF-6M, is discussed in detail as a special feature. E.B.


The reported investigation is concerned with a practical problem of Landsat imagery users, who have to transfer image data to an existing map. Methods of planimetric restitution of Landsat images, based on a linear affine transformation, are described. These methods use the Stereotop and the PG2, and require little or no instrument modification. Experiments indicate very good agreement of the plotted points with a topographic map at 1:250,000. Attention is given to theoretical considerations, a method based on the Stereotop, two methods based on the PG2, and some tests. The feasibility of restitution with the Stereotop has been tested by plotting hydrological details in a Landsat image of the Brisbane region on an existing 1:250,000 scale topographic map. Both methods using the PG2 are shown to be sufficiently accurate for planimetric map revision at 1:250,000. G.R.

A mathematical model for the reconstruction of objects using a multisens camera with a focal plane shutter and FMC. H. Ebner and M. Stephani (München, Technische Universität, Munich, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers.


An investigation is conducted regarding the use of thermal infrared (TIR) remote sensing technology by photogrammetrists and civil engineers as complementary airborne survey tools. Attention is given to the history of TIR development, basic principles, details of technology, problem definition and application evaluation, heat loss surveys, the detection of seepage through dams and dikes, geotechnical and siting surveys, and a synopsis of wideband TIR imagery applications. It is pointed out that TIR surveys in areas with sparse vegetation and thin soil cover provide optimum conditions for obtaining detailed imagery of near surface bedrock structure. G.R.

A81-34945

An extensive and detailed assessment of the state-of-the-art and foreseeable developments in aerial triangulation are presented in the form of questions and answers. Among the topics covered are: (1) cameras and films; (2) point transfer devices; (3) measuring instruments such as universal plotters, precision and topographic plotters, mono and stereo comparators, and analytical plotters; (4) auxiliary data, with particular reference to statorope and airborne profile recorder; (5) the correction of systematic errors; (6) quality control and reliability in aerial triangulation procedures; (7) gross error detection; and (8) such aspects of software as programs for identification and elimination of gross and systematic errors and for the combined adjustment of photogrammetric and nonphotogrammetric data. O.C.

A81-35733

The use of Culback's information measure for the selection of spectral ranges for remote sensors is discussed. A correlation between information increment and the increase of the number of channels was established. Conditions were also determined under which the addition of a channel does not improve the recognition of sensed objects. B.J.

A81-35963

The main remote-sensing tasks of the Salyut-6 mission are described. These tasks involved the refinement of requirements on remote sensing instrumentation, research on multispectral photography techniques, the development of photointerpretation methods, and the development of photographic, photogrammetric, and photoanalytic techniques of image processing. Also considered are studies of the radiation resistance of photographic film under conditions of prolonged space flight, and the acquisition of additional information about the earth's surface by means of visual and instrumental observations. B.J.

A81-37682

Among the topics discussed in the field of infrared imaging systems are: spectral imaging with the Michelson interferometer, thermal IR imaging with a CCD array, pushbroom and whiskbroom scanners, and staring mosaic sensor system design. Also covered are optimum-performance focal plane array design, dual active/passive IR imaging systems, reflective IR imager optics, precision diamond machining, and prototype designs for a wide-field, low-scatter image device. Consideration is also given to such topics in the analysis and test evaluation of IR imaging devices as errors due to reflected ambient flux, coherent and incoherent imaging comparisons, visible-to-infrared image conversion, reflected background effects on radiometry, and simulation studies of IR images from remote sensors. O.C.

A81-37685

A detailed description is presented of thermal infrared 'pushbroom' scanners being developed for NASA's earth resources survey experiments in the middle to late 1980's. The devices offer high spectral, temporal and spatial resolution, and great reliability as well, due to simplicity of design. Their mode of operation does not require moving optics, since chopping and calibration are integral. The specific device described, a 90-element IR/CCD instrument, was developed to demonstrate scan imagery in the 8-14 micron spectral region in simulated aircraft tests. The scanning operation covers a straight-line path with a linear array of solid-state IR detectors, whose elements are activated sequentially in the cross-track direction while being swept forward along a flight path that, at an aircraft altitude of 10 km, is 7 km wide. O.C.

A81-37686

A detailed account is given of recent advances in integrated focal plane array technology, wide-field-of-view optics, and lightweight structures; and a review is presented of possible tradeoffs between 'pushbroom' and 'whiskbroom' (thematic mapper) wide-field imagers for earth resources applications. Among the topics covered are: (1) first-order differences between the two types of sensor; (2) the design of integrated focal plane arrays with CCD readout; (3) wide-field-of-view optics; (4) resolution; (5) data rates; (6) SNR analyses; (7) IR-CCD injection efficiency and noise; and (8) radiometric error analysis. O.C.

A81-39390

This paper comprises a description of Synthetic Aperture Radar (SAR) processing approaches and a discussion on the processor complexity measures. The objective of the paper is to provide basic system knowledge on the design of a real-time signal processor for spaceborne synthetic aperture radar. A review of SAR sensor performance capability and general electronic processing approaches will be given first. The discussion of SAR processor complexity is divided into two areas: the arithmetic complexity and the control complexity. A generalized treatment of these subjects is provided. The results could be readily extended to special cases. (Author)
The low-flying MAGSAT spacecraft, launched October 30, 1979, included a Vector Magnetometer to accurately map the magnitude and direction of the magnetic field of the earth. Calibration of the magnetometer included arc-second precision determination of the relative orientations of the three sensor axes in a coordinate system defined by optical references. This determination began with laboratory measurements of the relative alignments of optical components mounted with the magnetometer. The actual calibration procedure then consisted basically of accurate and repeatable positioning of the Vector Magnetometer within a unique magnetic test facility which nulls the earth's magnetic field, then generates magnetic fields of various orientations and strengths. Analysis of the magnetometer sensor outputs together with the position and alignment data then gave the axes orientations. We used precision theodolites and methods related to surveying techniques to achieve the accurate positioning and optical component alignment measurements. The final calibration accuracy exceeded results previously achieved in the facility.

Data processing is required to transform the raw sensor data to measurements that are suitable for analysis. The magnitude and direction of the magnetic field of the earth generates magnetic fields of various orientations and strengths. Analysis of the magnetometer sensor outputs together with the position and alignment data then gave the axes orientations. We used precision theodolites and methods related to surveying techniques to achieve the accurate positioning and optical component alignment measurements. The final calibration accuracy exceeded results previously achieved in the facility.

A SIMULATION ANALYSIS OF BIDIRECTIONAL REFLECTANCE DETERMINATION IN THE REFLECTED AND THERMAL INFRARED SPECTRUM. RADIANCE IMPLICATIONS FOR THE MRS Sensor. A simulation of the MRS sensor was performed using a radiative-transfer model. The simulation provides the spectral radiance at the satellite sensor in terms of various optical parameters, such as optical thickness, solar zenith angle, nadir view angle, relative azimuth angle, bi-directional reflectance of the target, background albedo, and wavelength. Atmospheric correction algorithms were also developed for the MRS sensor. The algorithms were designed to determine which mathematical algorithms should be used in the calculation of atmospheric parameters, such as optical thickness, solar zenith angle, nadir view angle, relative azimuth angle, bi-directional reflectance of the target, background albedo, and wavelength. Atmospheric correction algorithms were also developed for the determination of the total spectral optical thickness of the atmosphere for: (1) homogeneous (horizontal) hazy atmospheres with diffuse targets; (2) inhomogeneous (horizontal) hazy atmospheres with diffuse targets; and (3) homogeneous (horizontal) hazy atmospheres with non-diffuse targets. S.F.

A SIMULATION ANALYSIS OF BIDIRECTIONAL REFLECTANCE DETERMINATION IN THE REFLECTED AND THERMAL INFRARED SPECTRUM. RADIANCE IMPLICATIONS FOR THE MRS Sensor. A simulation of the MRS sensor was performed using a radiative-transfer model. The simulation provides the spectral radiance at the satellite sensor in terms of various optical parameters, such as optical thickness, solar zenith angle, nadir view angle, relative azimuth angle, bi-directional reflectance of the target, background albedo, and wavelength. Atmospheric correction algorithms were also developed for the determination of the total spectral optical thickness of the atmosphere for: (1) homogeneous (horizontal) hazy atmospheres with diffuse targets; (2) inhomogeneous (horizontal) hazy atmospheres with diffuse targets; and (3) homogeneous (horizontal) hazy atmospheres with non-diffuse targets. S.F.
A study was performed to evaluate the geometrical implication of a Multispectral Resource Sampler: a pointable sensor. Several vegetative targets representative of natural and agricultural canopies were considered in two wavelength bands. All combinations of Sun and view angles between 5 and 85 degrees zenith for a range of azimuths were simulated to examine geometrical dependence arising from seasonal as well as latitudinal variation. The effects of three different atmospheres corresponding to clear, medium and heavy haze conditions are included. An extensive model database was generated to provide investigators with means for possible further study of atmospheric correction procedures and sensor design questions.

S.F.

A MICROWAVE REMOTE SENSING EXPERIMENT (MRSE) ON BOARD SPACELAB [DAS MRSE (MICROWAVE REMOTE SENSING EXPERIMENT), EIN MIKROWELLEN-FERNERKUNDUNGS-EXPERIMENT IM SPACELAB] Marian Werner In its Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 71-79 In GERMAN

The MRSE design and development are discussed. The equipment allows for three operating modes: scatterometry, synthetic aperture radar, and microwave radiometry. Sea state measurement, radar imagery, and passive detection of terrestrial radiation are planned. Author (ESA)

EXAMPLES OF EXPERIMENTAL USES OF AVHRR IMAGES

Examples of experimental uses of advanced very high resolution radiometer (AVHRR) images are shown. The value of these images for coastal zone activities, land use planning and hydrology is demonstrated. Different clusters (sea, land, clouds) are recognized by means of two dimensional histogram analysis followed by color coding of the infrared radiances. Examples are based on TIROS N imagery. Author (ESA)


Studies included in this volume deal with spectral responses for remote sensing of the earth's surface and applications of remote sensing to mineral exploration. Consideration is given to the spectral responses of vegetation, bare land, water, and snow. Papers are presented on spectral reflectance characteristics of agricultural crops and application to crop growth monitoring, detection of volcanic ash coverage from Landsat MSS data, application of multispectral data to the detection of sea surface phenomena, and ore-controlling structures in volcanic regions observed on space images.

V.L.


A criterion for estimating the remote-sensing efficiency of aircraft and satellites is proposed, and a semiemipirical method for the computation of this criterion is described. The proposed method is used to estimate the comparative efficiency of the An-30 aircraft, the Tu-134 aircraft, and Meteor satellites. It is shown that, in general, no one of these vehicles is more effective in terms of remote sensing than any of the others, and that it is possible to delineate conditions under which the use of one of the vehicles would be optimal. B.J.


The SPOT experimental satellite remote sensing system is presented with particular emphasis on provisions for information dissemination to the international user community. The objectives and space equipment of the first SPOT mission, intended to take place in 1984 for purposes of land use mapping using two high-resolution instruments, are reviewed, and the options of direct and time-deferred telemetry available for the transmission of satellite data to the user are indicated. The SPOT image correction center at Toulouse, at which SPOT data is corrected for radiometric and geometric effects and put into a form that may be used as the basis of photointerpretation is then presented, and the three levels of image quality obtainable after processing are indicated. The specialized autonomous organizational structure at Toulouse charged with the promotion and distribution of SPOT data to French and foreign users, which will provide catalog, quick look, distribution, consultant, and observation programming services, is then discussed.

A.L.W.


A number of renewable resource applications in the areas of agriculture, land, and water are summarized; and some of the current and future research efforts designed to enhance the utility of this tool are explored. Programs to incorporate microwave sensors with higher resolutions into the resource planning and management processes are also considered. Particular consideration is given to experience with LACIE and AgRISTARS; the current hydrologic land use, watershed physiography, and snow covered area applications of Landsat; and land cover mapping with MSS technology. Needed improvements are discussed with regard to goals of fundamental research, data acquisition requirements, and data handling and merging with other data sources.

P.T.H.

N81-22454* # National Aeronautics and Space Administration, Washington, D.C.


Information on the use of LANDSAT data by Argentina is presented. Details on a Swedish satellite to be completed in 1984 and to be called VIKING are reported. Attempts to contact other civilizations in space by the use of radio telescopes are discussed.

T.M.


Topic areas cover: Geology, Geotechnics, Geomorphology.
Hydrogeology, Soil conservation and watershed management. Land use and agriculture, and Forest resources inventory. Instrumentation and methodology are also covered. GRA


Accomplishments of research and data analysis conducted to study physical parameters and processes inside the Earth and on the Earth's surface, to define techniques and systems for remotely sensing the processes and measuring the parameters of scientific and applications interest, and the transfer of promising operational applications techniques to the user community of Earth resources monitors, managers, and decision makers are described. Research areas covered include: geobotany, magnetic field modeling, crustal studies, crustal dynamics, sea surface topography, land resources, remote sensing of vegetation and soils, and hydrological sciences. Major accomplishments include: production of global maps of magnetic anomalies using Magsat data; computation of the global mean sea surface using GEOS-3 and Seasat altimetry data; delineation of the effects of topography on the interpretation of remotely-sensed data; application of snowmelt runoff models to water resources management; and mapping of snow depth over wheat growing areas using Nimbus microwave data. J.M.S.


Several transition plans for moving to a fully integrated satellite-based land remote sensing program were examined. Central to establishing a plan is the need to involve the private sector and seek ways to further private sector opportunities in the operational system. Views from major private industries are presented. T.M.

N81-26525# Vermont Univ., Burlington. School of Natural Resources. REMOTE SENSING PROGRAM Annual Report, 1 Jun. 1978 - 31 May 1980 Roy A. Whitmore, Jr., Principal Investigator 31 May 1980 64 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS (Grant NsG-7453) (E81-10135, NASA-CR-164123) Avail: NTIS HC A04/MF A01 CSCL 05B

A syllabus and training materials prepared and used in a series of one-day workshops to introduce modern remote sensing technology to selected groups of professional personnel in Vermont are described. Success in using computer compatible tapes, LANDSAT imagery and aerial photographs is reported for the following applications: (1) mapping defoliation of hardwood forests by tent caterpillar and gypsy moth; (2) differentiating conifer species; (3) mapping ground cover of major lake and pond watersheds; (4) inventorying and locating artificially regenerated conifer forest stands; (5) mapping water quality; (6) ascertaining the boat population to quantify recreational activity on lakes and waterways; and (7) identifying potential aquaculture sites. A.R.H.
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The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.
Freie Univ., Berlin (West Germany).

Applications of remote sensing for monitoring of the environment in arid areas with particular reference to natural vegetation for desert locust surveillance and control.

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CROP-PHENOLOGY AND LANDSAT-BASED IRREGULAR VEGETATION INVENTORY IN THE HIGH PLAINS.

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Computer-processed Landsat data used as a forest fire hazard tool.

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The application of LANDSAT remote-sensing technology to natural resources management.

Introduction to VlCAR - Image classification module.

Humboldt State University.

LANDSAT-3 Multispectral Scanner, part 2 of 2.

Indian Photo-Interpretation Inst., Dehra Dun.

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Instituto de Pesquisas Espacais, Sao Jose Dos Campos, Brazil.

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Crop phenology and LANDSAT-based irrigated lands inventory in the high plains.

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Oceanic wind vector determination using SEASAT satellite.

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Digital preprocessing of SEASAT imagery.

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Radar reflectivity of bare and vegetation-covered soil.

Microwave response of snow.


Linear filtering models for terrain image segmentation.

Performance measurements for the services on orbit.

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Development of a universal water signature for the LANDSAT-3 Multispectral scanner.

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MAGSAT data and aeromagnetic data.

Michigan State Univ., East Lansing.

An evaluation of satellite data for estimating the area of forestland in the southern section of the upper peninsula of Michigan.

MNHISTOIRE NATIONALE DE L'AGRICULTURE ET DES FORÊTS. OTTOBRUNN (WEST GERMANY).

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