## Previous Earth Resource Bibliographies

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

A Continuing Bibliography
With Indexes
Issue 25

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between January 1 through March 31, 1980 in

- Scientific and Technical Aerospace Reports (STAR)
- International Aerospace Abstracts (IAA).
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 380 reports, articles, and other documents announced between January 1 and March 31, 1980 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:

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Subject Categories

Abstracts in this Bibliography are grouped under the following categories:

01 AGRICULTURE AND FORESTRY
Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES
Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

03 GEODESY AND CARTOGRAPHY
Includes mapping and topography.

04 GEOLOGY AND MINERAL RESOURCES
Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

05 OCEANOGRAPHY AND MARINE RESOURCES
Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

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

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS
Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

08 INSTRUMENTATION AND SENSORS
Includes data acquisition and camera systems and remote sensors.

09 GENERAL
Includes economic analysis.

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TYPICAL CITATION AND ABSTRACT FROM STAR

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CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report

Robert H. Alexander, Principal Investigator 26 Sep. 1979

384 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

The author has identified the following significant results. LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1:250,000 scale and corresponding manually interpreted land use maps.

TYPICAL CITATION AND ABSTRACT FROM AIAA

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The NASA Geodynamics Program is developing a variety of techniques in support of national programs in geodynamics, geomagnetics and earthquake hazard reduction. Global tectonics are to be observed by satellite laser tracking and radio interferometry, which will be used to measure the movements of extended (greater than 200 km) regions to an accuracy of 3 cm, while for shorter distances, lasers enable a more rapid measuring of regional strain accumulation patterns than ground systems. The techniques of Doppler tracking between two satellites to measure the gravity field over the ocean is also under NASA study.

J.P.B.
A80-10171  

The paper gives results of a machine experiment relating to the digital processing of aerial photographs of forest land. A color selection algorithm is presented for determining the parameters that influence the machine interpretation of tree types in a mixed evergreen forest, with an evaluation of the accuracy of such determination. An algorithm is also developed for the identification of damage to recently planted trees; the possibility of determining the portion of pines in pine/birch areas and of evaluating the degree of pollution damage of pines is examined.

B.J.

A80-10877  

It is well known that one of the main factors limiting the acquisition of aerial photographs of extensive areas in the tropics is the prevalence of cloud and mist cover. SLAR is especially useful for forest vegetation mapping in tropical regions where the acquisition of aerial photographs is difficult and often impossible due to adverse weather conditions. SLAR imagery can be interpreted for the production of thematic maps, and the paper considers this aspect of radar usefulness, with particular reference to training in forest type mapping. By carrying out a prescribed training exercise, foresters discover for themselves the difficulties and limitations associated with the interpretation of currently available radar images. The importance of reliable ground truth and the use of accurately located "photo-truth" keys is discussed.

S.D.

A80-11708  

There are currently three systems in use within the Forest Service that use Digital Terrain Data (DTD) as source material. TOPAS (TOpographic Analysis System) was developed in-house in 1975 and is heavily used by resource managers to evaluate impacts of alternate land uses of National Forest lands. Digital Terrain Information System (DTIS) is a secondary set of programs within TOPAS that has been enhanced to handle more rigorous analyses related to site-specific projects, often involving engineering reconnaissance and design. Method of Scenic Alternative Impacts by Computer (MOSAIC) was written under contract, and is a photomontage system that employs computer graphics to depict proposed landscape alterations to overlay on a terrestrial photograph of an existing area. The basic features of each system, and the primary uses of output products are discussed.

(Author)

A80-13136  

Interactions of crop configurations with sun angle and sun azimuth influencing the spectral reflectances of wheat are investigated. Plots of wheat were planted in a dense stand with no rows, and in rows spaced 0.3 m apart running north-south and east-west. Radiances were measured when the plants were 0.35 m in height and covered 70% of the ground in the row plots by means of a radiometer having bandpass intervals similar to those of the Landsat multispectral scanner during the course of one day as the solar elevation angle and azimuth angles changed. Measurements reveal essentially no changes in IR radiances (0.8 to 1.1-micron and 0.7 to 0.8-micron bands) in the no-row plot with solar angle, with slightly greater reflectance in the afternoon than the morning, and similar variations for both row orientations. For the visible (0.6 to 0.7 and 0.5 to 0.6 micron) bands, the reflectance of the no-row plot increased about 2.3 times as the sun neared solar noon. It is concluded that crop configuration is a major determinant of wheat spectral reflectance and should be considered in interpreting imagery spanning a significant time.

A.L.W.

A80-13141  

As an aid in the interpretation of remotely sensed data from row crops with incomplete canopies, a model was developed that allowed
the calculation of the fractions of sunlit soil, shaded soil, sunlit vegetation, and shaded vegetation for each resolution element in a scan of a remote sensor for a given set of conditions (plant cover, plant height/width ratio, row spacing, row orientation, time of day, day of year, latitude, and size of resolution element). Using measured representative reflectances of the four surfaces, composite reflectances were calculated as a function of view angle. Also, representative temperatures for each surface were used to simulate composite temperatures viewed by an IR scanner. With composite reflectances and temperatures known as a function of view angle, ways were explored to extract plant cover and plant temperature data from the composite data. (Author)


An experimental evaluation is presented of the look direction modulation function, which describes the dependence of the radar backscattering coefficient on the orientation of the radar look direction relative to the row direction of agricultural fields. The look direction modulation function was investigated for angles of incidence from 0 deg (nadir) to 60 deg, microwave frequencies from 1 GHz to 18 GHz (30 cm to 1.67 cm in wavelength) and for all linear polarization configurations (HH, HV, and VV). Based on experiments conducted for fields of corn, wheat, and soybeans under several different growth conditions, the results indicate a strong dependence of the linear-polarized radar backscattering coefficient on look direction at 1 GHz, decreasing exponentially with frequency to an insignificant dependence above 4 GHz. The cross-polarized radar backscattering coefficient shows no significant dependence on look direction at any frequency or angle of incidence. (Author)


Within the frame of a cacao plantation project in the southern rain forest of Cameroon a general use of Landsat-MSS-imagery was tested for agricultural planning. Test basis was a geometrical analysis in three characteristic regions: Mangrove swamps, secondary rain forest, plantations and humid savanna. As geometrical figures points, distances and areas were tested by transformations and comparisons of image and map. The results found were some accuracy relations which admit conclusions for application of the photos in different measures of agricultural planning. (Author)


The results of works involving the use of microwave radiometry in solving the problems of forest and peat fire protection are generalized. Information is given concerning the microwave radiation of forest fires. The major tactical parts of a fire can be clearly identified through the use of airborne microwave radiometers under dense smoke conditions. The experimentally obtained spectral dependences of the absorption coefficient and emissivity of peat are presented. An estimate is given of the microwave radiation spectra of peat piles with hidden sources of dangerous heating. It is shown to be possible in principle to estimate the degree of fire danger in territories covered by forests and peat bogs by means of spectral measurements of their emissivity. (Author)


The albedo of four vegetated surfaces was investigated to derive its variability with differing distributions of the irradiance. The results are based on measured values of the spectral biconical reflectance factor, which are combined with calculated spectral irradiances for low and high atmospheric turbidity. The solar zenith angle is varied from 0 to 80 deg. The derived spectral albedos are then integrated with respect to wavelength in order to achieve the albedo. It is found that the variability of the albedo with respect to the atmospheric turbidity is less than 0.01 in nearly all cases. The variability of the albedo with respect to the solar elevation angle, however, is larger than 0.02 in many cases. For solar elevation angles from 20 to 60 deg, the variability of the albedo of the four surfaces can be represented by a mean curve which fits the individual variabilities with an accuracy of 0.015. (Author)


The temperature of a plant canopy, as seen by a scanning device, is determined by plant physiological processes and environmental conditions which interact in a complex manner not readily monitored by remote sensing devices. The physiology literature is briefly considered with a view to outlining factors that may be relevant in inferring soil water content from canopy temperature. Examples of energy fluxes and temperatures observed under field conditions are discussed. (Author)


Folage density is a valuable measurement for assessing crop growth, development, and yield. A relationship between folage density and spectral intensity has been noted in several studies. In this study, an empirical model is developed to estimate foliage density, i.e., leaf area index (LAI), using Landsat multispectral scanner data. LAI measurements of wheat from several fields in three Kansas counties during three growing seasons were correlated with various transformations of Landsat multispectral scanner data. The model performed well at LAIs above 0.5, but significantly poorer below 0.5. (Author)


The thermal emissivities of exposed soil surfaces for the major soil subgroups of Alabama, Georgia, and Florida were determined. It was found that brightness temperature sensed by narrow-band infrared radiometers (10.4-12.6 microns), as used on SMS-GOES spacecraft would not deviate from thermodynamic temperatures by more than -2 C as a result of surface emissivity. Emissivity effects on the brightness temperature determined with broadband radiometers (5-15 microns), however, could be as great as -6 C. (Author)

An experimental forest inventory was carried out in a tract of tropical rain forest of 2200 hectares on Pulau Laut, South Kalimantan, Indonesia. Shorea (Meranti) and Dipterocarpus (Keruing) are commercially the most important timber species. The spatial distribution of the species is heterogeneous with a pronounced tendency to grouping. The discussion covers sampling design, species group, analysis, and results. The tallying of data in record units afforded analysis per species group. Four species groups are distinguished: Shorea, Dipterocarpus, Euxideroxylon zwageri (ulin or ironwood), and all species. It is shown that the expected discrepancy is not significant for five record unit sizes and four species groups, which were indeed heterogeneous in their spatial distribution. Several tables supplement the text.

S.D.

A80-15560  Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil. B. Kemper (IAPAR, Londrina, Brazil). ITC Journal, no. 2, 1979, p. 292-301. 6 refs.


Erratic sub-tropical rainfall in the study area is very destructive on the erodible soils of this bare and rugged landscape. Soil erosion is further accelerated by poor management of agricultural resources, and is more pronounced where crops are cultivated in areas that are susceptible to erosion. The results of this study, which was carried out by air photo-interpretation and field checking, showed that about 60 per cent of the land area is subjected to severe erosion and about 37 per cent of the cultivated land is situated on it, posing an erosion hazard.

(Author)

A80-15776  //  Some applications of remote sensing in agricultural resources with reference to India. B. Dey (Ottawa, University, Ottawa, Canada). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 35, 37-42. 20 refs.

This paper examines the present experimental and quasi-operational remote sensing activities of the Indian Space Research Organization (ISRO) and the National Remote Sensing Agency (NRSAG) for their agricultural resource management programs. Airborne remote sensing with multiband and infrared false color photography has been used from various platforms, including helicopters, aircraft and balloons for crop identification, crop estimation, land use classification and the inventory of water resources. Studies in the United States, Canada and a few other countries have demonstrated the important role Landsat and NOAA provide in agricultural resources inventories and planning. Some of the satellite remote sensing techniques could be applied to India, such as the use of low resolution NOAA imagery to study the behavior of monsoon rainfall, and the use of Landsat imagery for agricultural resources inventories, land use classifications and small-scale thematic mapping for large areas. Moreover, Landsat imagery might be used to obtain the yearly estimate of India's crop acreage. By using Landsat color composites (MSS Bands 4, 5 and 7) of dry and wet seasons, a land use classification map for part of Bihar State has been prepared.

(Author)


Soil maps of northern India are generally inadequate and extremely difficult to locate. In addition, aerial photography is not available to scientists and administrators as a result of which information about the spatial distribution of land units, with their variation in quality, is extremely difficult to obtain. A study in Bulandshahr District in north-west India has shown that in the circumstances of this study area the spatial, spectral and temporal resolution of the Landsat system is sufficient for the delimitation of land units with soils which can support vigorous agriculture and of those where soils are degraded, or severely degraded, by saline-alkali conditions.

(Author)


Side-looking airborne radar, satellite imagery and aerial photography were used in a recent forest inventory carried out along part of the Trans-Amazonian Highway. The survey involved the examination of a 20-km wide strip centered on the line of the road starting 120 km east of the Rio Xingu and finishing 200 km west of the river. The area had several terrain forms and greenbelts that could be clearly demarcated on the SLAR though there were areas where the image reproduction seemed blurred. River lines, most important for location purposes, were better revealed on the satellite imagery which also amplified the geomorphological information found on the radar images. Geology was best revealed on the satellite imagery. Vegetation and the precise definition of the form of the geomorphology were observed on the aerial photography. The definition and classification of the forest types was achieved by stereo interpretation. It was found possible to identify different strata in the forests to describe the forms of the crowns, or combination of crowns in each layer, and to locate certain patterns of similarity. These were converted to horizontal diagrams. There appeared to be some correlation with the geological and geomorphological forms. Patterns located on photography could be identified on the satellite imagery in several cases, but the radar images at the scale available were less satisfactory. The use of all three media increased the confidence and accuracy of the survey considerably.

(Author)


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

(Author)


The scattered return of imaging radars is primarily sensitive to target structure or roughness and to composition of complex permittivity. The relative degree of penetration, or the depth of material to which the return is sensitive, also varies directly with the wavelength. Where vegetation can be eliminated as a factor, the
Surface return may be analyzed for variations in roughness or composition (primarily moisture content). L-band (25-cm) imagery has provided evidence that long-wavelength systems with improved penetration capability have the potential for minimizing the vegetation contribution and enhancing the surface return variations. However, the increased wavelength increases the sensitivity to large-scale structure. In the present paper, it is shown that addition of a cross polarized channel enables the interpreter to distinguish vegetation and orientation perturbations in the surface return.

V.P.


In order to devise a method to control the weed damage of crops, a study has been undertaken in the USSR to identify and classify weed types in grain fields. This summer-1978 study involved the identification of weed types according to their spectral reflectance characteristics, measured from an airborne photometer system. Data are used in developing an algorithm of weed identification. B.J.


The paper considers problems involved in remote sensing techniques in forest surveys in Nigeria with particular emphasis on the tropical high forest as an example of a complex tropical forest system. The value of remote sensing for forest surveys has not been realized in the tropics due to the persistent cloud cover which impeded photography and made satellite sequential sensing less meaningful, and to environmental conditions limiting the interpretation of remote sensing imagery. Operational remote sensing in tropical countries is often executed by expatriates (because of lack of trained personnel) who leave the country at the conclusion of their assignments, so that the country loses their experience. To benefit from the remote sensing technology, radar should be improved because of its near-all-weather capability, and adequately equipped central and multidisciplinary remote sensing units and personnel training programs should be established.

A.T.


Single polarization X-band side-looking airborne radar imagery has recently been acquired for the whole of Nigeria for the primary purpose of generating a reliable forestry inventory to provide a baseline for management of timber resources. A microwave remote sensor was employed because of the persistent cloud cover over the equatorial region and the superior speed of acquisition for large areas. Because of the single channel nature of the imagery, conventional multivariate spectral classification is not possible, and methods have been developed to analyze and quantify the spatial intensity relationships usually described as texture. In addition to the principal aim of providing the human interpreter with a tool to quantify tone and texture relationships, research has also been oriented towards an investigation of the dependence of these quantities on system parameters such as resolution and antenna response as well as processing algorithms. Examples are selected to illustrate the need for a careful evaluation of the effects of such variables.


The Large Area Crop Inventory Experiment (LACIE) is a joint undertaking of the U.S. Department of Agriculture, the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce, and the National Aeronautics and Space Administration. It is designed to verify an economically important application of remote sensing from earth orbital satellites. The first two phases of the experiment have been completed. A description of the experiment and a short discussion on the results and conclusions of the first two phases are presented. A description of the methods employed is included. Also selected to illustrate the potential of LACIE systems are results of specified agricultural observations. V.P.


The basic principles of a methodology based on a system landscape-statistical stocktaking and mapping methods are outlined. The correlation between the methods (and objects) of forest statistical and inventory items and organization of forestry is demonstrated. The complexity of the technological processes is illustrated, and the potentials of these processes are assessed. V.P.


Characteristic of phytocoenoses is a well-defined organization level which manifests itself in the spatial structure of tree arrangements and arrangements of groups of trees and also in the arrangement of phytocoenoses within recurrent forms of the relief. This structure is reflected on satellite photographs and can be studied by quantitative methods. In the present paper, the analysis of the frequency-spatial characteristics of wooded areas, obtained from aerial photograph density traces is demonstrated by an example. V.P.


The principles of mapping forest soils from aerial photographs are outlined, along with a structural-ecological approach to the decoding and interpretation of aerial and satellite photographs in the identification of forest soils. An effective procedure for mapping the structure of forest soil covers is proposed. V.P.


The current status of remote sensing techniques developed for combating forest fires is reviewed. Some results of the application of IR and microwave radiometry in forestry and in detection, mapping, and estimation of the rate of spread of forest fires are examined.

V.P.


In an experiment to classify crops based on L-band radar data a synthetic aperture radar (SAR) was flown over the test site at 2710 meters ms. L-band imagery with HH and HV polarization was obtained. Depression angle ranged from 31 degrees in the near range to 15 degrees in the far range. Radar return values were digitized as grey levels (128 steps) for classification purposes. The data obtained were normalized by range correction curves and a linear discriminant analysis was performed on the normalized data. In the classification analysis, each of the two discriminating variables, like polarization (HH) and cross polarization (HV) returns, were used singly and in combination. The analysis led to the following conclusions: it is possible to separate four categories—corn, soybeans, woods, and continuous cover - with a confident of 71 percent if both like (HH) and cross (HV) polarization returns are used; if only one polarization is used, HH yields good overall results (65 percent) and is able to separate corn, soybeans and continuous cover crops, but woods, however are confused with crops.

V.L.


Variables that characterize wheat canopies for the Spectra Model and spectral bidirectional reflectance measurements in the 450 to 1350 nm interval were determined approximately weekly throughout the growing season for two cultivars of wheat that achieved maximum leaf area index of 5.3 and 10.8. The Spectra Model plant variables were tabulated and experimental reflectance measurements were compared with the model predictions in the wavelength interval from 500 to 1150 nm at 50 nm increments for 17 measurement dates. The seasonal average coefficient of determination, r squared, was 0.88 between the Spectra spectral bidirectional reflectance model and field-measured reflectance data. Poorest agreement was found very early and very late in the growing season, possibly due to low green plant biomass and incomplete ground cover. (Author)


The use of large-scale aerial photographs for collecting and analyzing forest inventory data (tree heights, stem diameters and crown widths) is considered. Sharp images and improved accuracies of flying heights, essential for the determination of photographic scale, were obtained with fixed-base photography. Stereoscopic pairs of macro-scale photographs were taken simultaneously from heights of 200-500 ft using twin Vinten 70-mm cameras mounted on a 16-ft boom attached to a helicopter. Further development of this technique should be the use of cameras with between-the-lens shutters and could include twin-camera photography from fixed-wing aircraft with cameras mounted in the wings.

V.L.


A method is proposed for calculating the spectral irradiance of the entrance pupil of an earth surveying camera. For illustration, the method is applied to calculations for the photography of various types of soil.

V.P.


Vegetation community patterns were determined in Rock Creek Park from a combination of several types of aerial photography. No single date of photography provided the total picture because an eastern deciduous forest is a dynamic multilayered mixture of plant species. Natural differences in plant types, such as spring and fall foliage characteristics, and natural relationships, such as the affinity of a plant association for wet soils or exposed slopes were exploited by selecting the appropriate type of photography (color infrared, black-and-white, etc.) and the proper season coverage. A large part of the initial efforts were directed toward determining which combination of film and season was most useful for discriminating the various vegetation communities and their component layers.


Falls Church, Va., American Society of Photogrammetry, 1978, p. 221-231. 8 refs.

This study was conducted to compare estimates of forest acreages obtained by standard Forest Service procedures to estimates obtained through the application of computer-aided analysis techniques to Landsat data. A total of 156 counties in four states (Mich., Wis., N.Y., and Mo.) involving all or parts of 16 U.S.F.S. Survey Units were involved in the comparison. The results indicate that reasonably comparable acreage estimates can be obtained from the Landsat data, providing that proper analysis procedures are utilized.

(Author)


Falls Church, Va., American Society of Photogrammetry, 1978, p. 249-263. 7 refs.

Jordan's (1969) spectral method of leaf-area index determination from measurements of the transmitted light at the forest floor is evaluated under a wide variety of illumination conditions in the Luquillo Rain Forest of Puerto Rico, using a hand-held radiometer. Previously suggested 'correction factors' for temporal adjustment were found to degrade the data. Quantitative use of the method was found to be restricted to high sun periods. Data collected under uniformly overcast conditions were of greater stability than under clear skies, however, stability was impaired by changes in cloud thickness. Care must be taken to minimize irradiational variability and to adequately sample the spatial variability.

V.P.


Falls Church, Va., American Society of Photogrammetry, 1978, p. 329-342. 10 refs.

Spectral reflectance measurements over the 380-800 nm region in 10 nm bandwidths were made of randomly sampled plants in a...
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0.4-ha block of determinant-growth tomatoes having the early blight disease in various severity levels. The relative significance among the forty three 10 nm bands and the severity levels of defoliation was determined by ordinary least-square regression. Two spectral regions of strong statistical significance - 380-510 and 600-690 nm - were identified and subsequently integrated to simulate two broad bandwidths. These bandwidths were used separately and in combination to compare several discriminant functions with respect to the classification of various severity levels of defoliation.

V.P.


An investigation is made into the problems of mapping vegetation having low cover densities in arid environments. Three study sites in central Utah having different vegetation cover ranging from low to medium densities are described. Results of mapping with a definition of bare ground extending up to 20% cover showed improvement of other classes. Band ratios (R 5, 6 and R 5, 7) show capability for good estimates of cover density.

Gerald F. Zollars Jul. 1979 48 p INTS/PS-79/0735/0 Avail: NTIS HC $28.00/MF $28.00 CSCL 02D

This bibliography cites 193 articles from the international literature concerning remote sensing applications in the agricultural sector. The use of remote sensors for soil and vegetation mapping, soil moisture mapping, and the interpretation of agricultural land use is stressed.

GRA


LODGING OF GRAIN CROPS AND ITS DETECTION BY AERIAL PHOTOGRAPHY

V. Ye. Budanov (All-Union Scientific Res. Inst. of Cybernetics) In its USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 1-6 Transi into ENGLISH from Zashchita Rasteni (Moscow), no. 4. 1979 p 32-33

Copyright. Avail: INTS HC A06/MF A01

It was found that in several basic areas of grain production (northern Caucasus, nonchernozem areas, Kazakhstan, Ukraine, Belorusia and others) fermentative mycotic exhaustion especially increases under the influence of rainy weather, incessant dews and fogs. Investigations begun in various areas of the country in 1973 have made it possible to determine the basic features of the complicated biological mechanism causing the appearance, development and occurrence of the described phenomenon. The pathologic process occurs and develops under a certain combination of external and internal factors coming through successively and consists of the two following stages. The first stage is noninfectous and occurs during the phase of milk, wax and, less frequently, full ripeness of grain when the ears are moistened by rain, fog or continuous dews (with irrigated crops, during late watering when the grain is being formed). The second stage is infectious and is caused by saprophyte and semi-parasitic fungi from the genera of Alternaria, Cladosporium, Helminthosporium, Fusarium, etc.

F.O.S.

N80-12495 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

AERIAL PHOTOGRAPHY OF AGRICULTURAL FARMING LAND [UNTERSUCHUNG VON LUFTBILDERN LAND-WIRTSCHAFTLICHER KULTUREN].


Aval: Issuing Activity

Work conducted in the framework of a program for the recognition and determination of plant protection procedures and manure effects is described. Land divided into 2 x 5 sq m plots was studied. Various photographic conditions and vignetting effects made interpretation difficult. A procedure was developed to correct such effects, which relies on information contained in the image itself, and does not require any further measurement data.

Author (ESA)

N80-12497 Badische Anilin- und Soda-Fabrik A.G., Landwirtschaftliche Gesellschaft (West Germany).

FEASIBILITY OF USING REMOTE SENSING FOR DETE-RMINING NUTRITIONAL REQUIREMENTS, DISEASES AND PEST INFESTATIONS IN AGRICULTURAL CROPS [MOEG-LICHKEITEN DER FERNERKUNDUNG ZUR BESTIMMUNG VON NAEHRSTOFFVERSORGUNG, KRA...]


Aval: Issuing Activity

The radiobiological behavior of crops in the IR and visible spectrum was studied. It is shown that measurements made during the 1976 summer FMP program are satisfactory for classifying different types of culture. Concrete examples with various crops are presented and examined. The biological processes taking place are considered. In one case, it was possible to distinguish between different varieties of oats. It was, however, not possible to determine nutrition requirements for the dry 1976 summer. It was possible, though, in one instance, to detect pest infestation in winter corn. The results obtained indicate that optimum information is acquired from low altitude vertical flights. The data obtained must be processed quickly.

Author (ESA)

N80-12498 Freiburg Univ. (West Germany).

TEXTURE ANALYSIS AS A RECOGNITION PARAMETER FOR DIFFERENT TYPES OF FORESTS [ANALYSE DER TEXTUR ALS ERKENNUNGSPARAMETER ZUR IDENTIFIZIERUNG VON WALDTYPEN].


Aval: Issuing Activity

It is shown that quantitative and qualitative determinations of forest characteristics from textures are highly dependent on the sensors used and the aircraft altitudes, and at low altitudes, on the position within the image. Examples are given of results obtained using photographic and scanning techniques at varied heights with different forests. Similars are observed between the values of defined texture parameters determined at given heights with these two techniques.

Author (ESA)
VEGETATION COVERED SURFACES IN THE 400-1100

Establishing Inventories for Agricultural

for recording and processing the corresponding information so

MEN]

FERNKUNDUNG VERSCHIEDENER VEGETATIONSFOR-

PHENOLOGY AS A FACTOR IN THE DETERMINATION OF

variations are discussed. 	 Author (ESA)

APPLICABILITY OF MULTISCANNING TECHNIQUES IN

ESTABLISHING INVENTORIES FOR AGRICULTURAL

FARMING AND FORESTRY [EINSATZMOEGLICHKEITEN

DES MULTISPEKTRALS CANNERS FUER LAND- UND

FORSTWIRTSCHAFTLICHE INVENTUREN]

P. G. Reichert In Tech. Hochschule On Meas. from Aircraft

Jun. 1978 p 331-344 refs In GERMAN

Avail: Issuing Activity

Multiscanning results obtained with a preselected test region are

presented. Computerized maximum likelihood and minimum
distance methods (DIBIAS system) permit the identification and
classification of different crops and types of forest together with
the regions over which they extend. The problems encountered
and the factors to be taken into consideration are discussed.
Author (ESA)

N80-12500

Freiburg Univ. (West Germany).

N80-12500-

Freiburg Univ. (West Germany).

THE ROLL-AND-SLIT TECHNIQUE IN MULTISPECTRAL

PHOTOGRAPHY: A NEW APPROACH TO THE

SPECTRAL CLASSIFICATION OF VEGETATION

FROM AERIAL PHOTOGRAPHS

A. Kadro In Tech. Hochschule On Meas. from Aircraft

Jun. 1978 p 345-350 refs In GERMAN

Avail: Issuing Activity

Multispectral methods for classifying different crops are

compared with classical procedures. The introduction of an
ellipsoidal probability distribution enables a critical parametric
function to be obtained from mean values and the covariance
matrix (maximum likelihood classification). A practical example
(bend in the Main, near Frankfort) with two scanning channels
is studied. It is concluded that reliability and applicability could
be enhanced by combining multispectral methods with local
parameters. Author (ESA)

N80-12512

Institut fuer Physikalische Weltraumforschung,
Freiburg (West Germany).

ON THE SIGNIFICANCE OF SPECTRAL SIGNATURES OF

VEGETATION COVERED SURFACES IN THE 400-1100

NANOMETER REGION [ZUR SIGNIFIKANZ VON SPEKT-

RALEN SIGNATUREN BEWACHSENER OBERFLAECHEN IM

BEREICH 400-1100 NANO METRER]

W. Fischer In Tech. Hochschule On Meas. from Aircraft

Jun. 1978 p 427-437 refs In GERMAN

Avail: Issuing Activity

The effect of the sun zenith and sun azimuth angles on the
spectral reflection factors of fodder beet, corn and other crops is
investigated using measurements from a spectroradiometer.
Overall radiation effects and variations with time of day and
seasonal advances were studied. Results obtained, primarily in
the Gottenheim region, are presented as a series of curves. The
optical directional, and morphological reasons behind the observed
variations are discussed. Author (ESA)

N80-12513

Freiburg Univ. (West Germany).

SPECTRAL REFLECTION FROM AGRICULTURAL AND

FOREST REGIONS DURING THE VEGETATION PERIOD

[SPEKTRALE REFLEXION LAND- UND FORSTWIRTS-

SCHAFTLICHER KULTUREN WAEHRENDE DER VEGETAT-

IONS PERIODE]

A. Kadro In Tech. Hochschule On Meas. from Aircraft

Jun. 1978 p 439-448 refs In GERMAN

Avail: Issuing Activity

Reflection measurements made in the 400 to 1100 nm
region with a radiometer are discussed. The highly maneuverable
apparatus developed to maintain the radiometer at a height of
17 meters while allowing measurements to be carried out at
various angles is described. Investigations performed on
different dates, established typical qualitative and quantitative
differences between reflection factor curves corresponding to the
different regions studied. Author (ESA)
THE RELATIONSHIP OF RED AND PHOTOGRAPHIC INFRARED SPECTRAL DATA TO GRAIN YIELD VARIATION WITHIN A WINTER WHEAT FIELD


Two band hand-held radiometer data from a winter wheat field, collected on 21 dates during the spring growing season, were correlated within field final grain yield. Significant linear relationships were found between various combinations of the red and photographic infrared radiance data collected and the grain yield. The spectral data explained approximately 64 percent of the within field grain yield variation. This variation in grain yield could not be explained using meteorological data as these were similar for all areas of the wheat field. Most importantly, data collected early in the spring were highly correlated with grain yield, a five week time window existed from stem elongation through anthesis in which the spectral data were most highly correlated with grain yield, and manifestations of wheat canopy water stress were readily apparent in the spectral data. Author


LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 3 DIRECT WHEAT STUDY OF NORTH DAKOTA

M. C. Kinser, J. D. Nichols, and A. L. O'Nan, Principal Investigators Apr. 1979 158 p refs Sponsored by NASA, NOAA, and USDA EREP (Contract NAS9-15800) (E80-10014; NASA-CR-160340; JSC-14744; LEC-12980) Avail: NTIS HC A02/MF A01 CSL 02C

The author has identified the following significant results.

The green number and brightness scatter plots, channel plots of radiance values, and visual study of the imagery indicate separability between barley and spring wheat/ oats during the wheat mid-heading to mid-ripe stages. In the LACIE Phase 3 North Dakota data set, the separation time is more specifically the wheat soft dough stage. At this time, the barley is ripening, and is therefore, less green and brighter than the wheat. Only 4 of the 18 segments studied indicate separation of barley/other spring small grain, even though 11 of the segments have acquisitions covering the wheat soft dough stage. The remaining
seven segments had less than 5 percent barley based on ground truth data.


LARGE AREA CROP INVENTORY EXPERIMENT (LACIE), PHASE 3 LABELING ERROR CHARACTERIZATION Final Report
N. James Clinton, Principal Investigator Mar. 1979 77 p refs Sponsored by NASA, NOAA, and USDA EREP (Contract NAS9-15800)

(E80-10015; NASA-CR-160334; JSC-14745; LEC-13012) Avail: NTIS HC A03/MF A01 CSCL 02C


LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). A REVISED SCREENING PROCEDURE FOR LACIE PHASE 3 DATA IN THE US GREAT PLAINS
R. S. Chikara, Principal Investigator Aug. 1979 9 p refs Sponsored by NASA, NOAA, and USDA EREP (Contract NAS9-15800)

(E80-10016; NASA-CR-1603313; JSC-14852; LEC-12723) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The screening procedure resulted in a substantial decrease in the official LACIE winter acreage estimate, bringing the two estimates into better agreement with corresponding USDA/ESCS estimates.

N80-13597# Institut National de la Recherche Agronomique, Paris (France).

ESTIMATES OF REGIONAL ET FROM HCMM DATA: SUMMARY OF 1977 EXPERIMENT AND FINAL ARRANGEMENT FOR 1978 IN SOUTHEASTERN FRANCE TEST SITE
Bernard Seguin, Principal Investigator [1979] 29 p refs Sponsored by NASA ERTS (Rept. 1003) Avail: NTIS HC A03/MF A01 CSCL 08M

N80-13598# Commission of the European Communities, Ispra (Italy).


N80-13599# Institute of Hydrology, Wallingford (England).

THE ESTIMATION OF SOIL MOISTURE CONTENT AND ACTUAL EVAPOTRANSPIRATION USING THERMAL INFRA-RED REMOTE SENSING
R. J. Gurney, Principal Investigator 1978 20 p refs Sponsored by NASA ERTS (Proj. TELLUS) (E80-10021; NASA-CR-1692393) Avail: NTIS HC A02/MF A01 CSCL 08M

N80-13600# Commission of the European Communities, Ispra (Italy).

BEAUCE TELLUS PROJECT [CAMPAGUE TELLUS BEAUC]

30 Sep. 1977 21 p In FRENCH Sponsored by NASA ERTS (E80-10024; NASA-CR-162396) Avail: NTIS HC A02/MF A01 CSCL 05B

01 AGRICULTURE AND FORESTRY

N80-13616# Instituut voor Cultuurtechnieen en Waterhuisstonding, Wageningen (Netherlands).

ESTIMATION OF REGIONAL EVAPOTRANSPIRATION AND SOIL MOISTURE CONDITIONS USING REMOTELY SENSED CROP SURFACE TEMPERATURES
G. J. R. Soer Sep. 1977 31 p refs (Rept-1003) Avail: NTIS HC A03/MF A01

The application of thermal infrared scanning to the measurement of aerial heat and water budgets of crop lands is considered. Emphasis is placed on obtaining regional evapotranspiration estimates, making water balance analyses for large areas more feasible. Also, crop production as correlated with the actual crop transpiration rate can be estimated.

J.M.S.

N80-14424 State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.

THE MAPPING OF IMPORTANT FARMLAND USING REMOTE SENSOR AND SOCIO-ECONOMIC VARIABLES
Ph.D. Thesis
Jon Laurence Roberts 1979 233 p
Available: Univ. Microfilms Order No. 7920317

A comprehensive digital data base of physical (land use) and socio-economic (zoning, agricultural districts, rental/ownership patterns) factors important to farming was created. LANDSAT land use data was collected over the Ontario County, New York study area and grouped into agriculture and forest classes. The socio-economic data was converted into an image-based format by causing the outlines of zones and districts to be digitized and filled in with pixels of a certain grey level. These images are then stored to create the data base. An accuracy check was made on the LANDSAT data using a color infrared U-2 image of the study area. A spectral land use classification was also performed using digitized U-2 data. LANDSAT classification accuracy is 64% correct for the forest class. U-2 classification accuracy is 82% correct for the forest class.

Dissert. Abstr.

N80-14425# Forest Service, Washington, D. C.

FORESTER'S GUIDE TO AERIAL PHOTO INTERPRETATION
Agriculture Handbook no. 308
Thomas Eugene Avery Nov. 1978 47 p refs
Available: NTIS HC A03/MF A01

A practical reference on techniques of aerial photo interpretation in forest inventory is provided. While oblique photographs are occasionally useful for interpretation, this manual emphasizes stereoscopic interpretation of vertical aerial photographs available from various agencies of the U.S. Department of Agriculture.

A.R.H.

N80-14440# European Space Agency, Paris (France).

SATELLITE REMOTE SENSING: APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY
(ESA-SP-1020; ISSN-0379-6566) Available: NTIS HC A09/MF A01

The principles and potentials of satellite remote sensing as applied to agroclimatological and agrometeorological techniques are considered. Major subjects of discussion include the theory behind remote sensing instrumentation and the interpretation of satellite observations. Various remote sensing programs are covered, such as the Earthnet program and the Agro-Ecological Zones Project. Also presented are numerous mathematical models which can be readily used with inputs of satellite imagery data.

N80-14441# Food and Agriculture Organization of the United Nations, Rome (Italy).

OVERVIEW OF AGROMETEOROLOGY
Michel Frere. *In ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol.* 1979 p 3-7

Avail: NTIS. HC A09/MF A01

Agrometeorology, a branch of science which aims at using meteorological information to develop quantitatively and improve qualitatively the products of agriculture by taking maximum advantage of the favorable aspects of climate and minimizing the harmful effects of weather, is reviewed. Strategic aspects of agrometeorology, affecting long-term planning of agriculture when envisaging agricultural projects or crop diversification in a given area, are considered. Tactical aspects of agrometeorology, concerning the short-term influences of day-to-day weather on the development of crops and the evolution of their yield, are also discussed. Emphasis is placed on the interdisciplinary aspect of agrometeorology.

*Author (ESA)*

**N80-14442#** Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.

**OVERVIEW OF REMOTE SENSING FOR AGRICULTURAL AND AGROMETEOROLOGY**


Avail: NTIS. HC A09/MF A01

The evolution of civilian applications of satellite remote sensing is reviewed. Emphasis is on the greater availability of sensing equipment and the application of more readily obtainable data to agrometeorology as well as to agroclimatolgy. A forward look into the development of satellite remote sensing is offered, considering Earth resources satellites and environmental satellites. It is shown that good data on land surfaces, ocean surfaces, clouds, and atmospheric composition are now at the disposition of researchers and that emphasis should be placed on improving the quality and uniformity of these data.

*Author (ESA)*

**N80-14445#** Food and Agriculture Organization of the United Nations, Rome (Italy).

**THE AGRO-ECOLOGICAL ZONES PROJECT**


Avail: NTIS. HC A09/MF A01

An estimate is made of what the production of the world's arable lands must be to support the world population in the year 2000. Different crops with widely varying climatic and soil requirements as well as different levels of agricultural technology are reviewed in order to assess the real-world food production potential. The eleven crops considered are pearl millet, sorghum, maize, rice, wheat, phaseolus bean, soybean, cassava, sweet potato, white potato, and cotton. Results include a generalized map of agroclimatic suitability for the various crops and a land suitability assessment.

*Author (ESA)*

**N80-14446#** Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.

**REMOTE SENSING APPLIED TO AGRICULTURE**


Avail: NTIS. HC A09/MF A01

The ways in which remote sensing can be used to assist in providing information useful to food production are considered. In this respect remote sensing for agricultural crop estimates is seen as one of the most important inputs. The diagnostic characteristics used in analogizing remote sensing imagery, whether airborne or obtained by an Earth resources satellite, are discussed. They are summarized according to the type of sensing being undertaken. The formulation of agricultural crop estimates in then shown.
practicality of satellite remote sensing as an aid in their assessment, are: (1) rainfall, (2) temperature, (3) weather type and variability, and (4) cloud cover (radiation balance). For convenience, a differentiation is made between the atmospheric and pedologic environments of crops. In the first case the emphasis is on the utilization of weather satellite data for the extension of selected conventional meteorological statistics, the available and calibrated by the conventional data. In the second case there is a similar association of conventional and satellite soil intelligence, though in this case techniques to interdigitate the two have been less fully developed.

Author (ESA)

CROP MONITORING AND PREDICTION USING SATELLITE DATA
E. C. Barrett In ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 149-156 refs
Avail: NTIS HC A09/MF A01
Analysis techniques used in making estimates of biomass (usually of natural or seminatural vegetation, especially in areas exploited for grazing) and in forecasting expected crop production (usually cultivated cereal crops) are studied. The use of LANDSAT spectral reflectance curves as prediction model inputs is emphasized. The use of statistical methods, agroclimatological methods, agrometeorological methods with crop prediction models is then considered. Results show advantages in the use of satellite data inputs for the monitoring of crops and in making harvest predictions. It is recommended that global schemes, based on these results, be initiated at least for certain crops in the near future in order to optimize agricultural resources.

Author (ESA)

SATELLITE REMOTE SENSING IN HAZARD MONITORING AND DISASTER EVALUATION
Avail: NTIS HC A09/MF A01
The potential applicability of satellite remote sensing to short term disaster monitoring is discussed. Emphasis is on different types of agricultural disasters, such as drought, high-intensity short-period rainfall and subsequent flooding as well as hurricanes or monsoons. It is shown that remote sensing can also be of assistance in the assessment of the areas, and therefore, the volumes and values of the crops involved. Finally, the use of satellite data as a check against qualitative data from other sources, especially for countries with an inadequate conventional network for the observation and reporting of environmental conditions, is suggested.

Author (ESA)

SATELLITE REMOTE SENSING FOR AGRICULTURAL ADVISORIES AND PLANNING
E. C. Barrett In ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 164-165
Avail: NTIS HC A09/MF A01
How an input of remote sensing data might be achieved to improve agroclimatological and related services in the various countries which stand to benefit from this technology is considered. Problems which commonly arise in the face of the implementation of new technologies are discussed. In spite of the individuals and organizations which would be interested in remote sensing data (farmers, farming communities, commercial firms, political organizations, humanitarian agencies), significant problems are foreseen in the widespread acceptance of remote sensing technology.

Author (ESA)

N80-15448#  National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEEDINGS OF TECHNICAL SESSIONS, VOLUMES 1 AND 2, THE LACIE SYMPOSIUM
The technical design of the Large Area Crop Inventory Experiment is examined and data acquired over 3 global crop years is analyzed with respect to (1) sampling and aggregation; (2) growth size estimation; (3) classification and mensuration; (4) yield estimation; and (5) accuracy assessment. Seventy-nine papers delivered at conference sessions cover system implementation and operation; data processing systems; experiment results and accuracy; supporting research and technology; and the USDA application test system.

Author (ESA)

N80-15449#  National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SAMPLING, AGGREGATION, AND VARIANCE ESTIMATION FOR AREA, YIELD, AND PRODUCTION IN LACIE
An approximately 2% sampling error was achieved in LACIE by sampling only approximately 2% of the sampling frame. The sample design in the yardstick region for which historical data were available down to a subnational level to support missing data resulting from cloud cover provided the most accurate estimate possible. The implemented strategy provided data of sufficient quality and quantity to support required performance levels and also to satisfy the existing constraints. The allocation scheme appeared to provide the most efficient usage of the available data and gave segment coverage of major producing areas and thus improved the probability of an accurate estimate.

Author

N80-15450#  Department of Agriculture, Columbia, Md.
ECOMETRIC MODELS FOR PREDICTING CONFUSION CROP RATIOS
Avail: NTIS HC A99/MF A01 CSCL 02C
Results for both the United States and Canada show that econometric models can provide estimates of confusion crop ratios that are more accurate than historical ratios. Whether these models can support the LACIE 90/90 accuracy criterion is uncertain. In the United States, experimenting with additional model formulations could possibly improve methods in some CRD's, particularly in winter wheat. Improved models may also be possible for the Canadian CD's. The more aggressive province/state models outperformed individual CD/CRD models. This result was expected partly because acreage statistics are based on sampling procedures, and the sampling precision declines from the province/state to the CD/CRD level. Declining sampling precision and the need to substitute province/state data for the CD/CRD data introduced measurement error into the CD/CRD models.

A.R.H.

N80-15451#  National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE SAMPLING DESIGN
A. H. Feiveson, R. S. Chihikara (Lockheed Electronics Co., Houston, Tex.), and C. R. Hallum, Principal Investigators In its Proc. of
The sampling design in LACIE consisted of two major components, one for wheat acreage estimation and one for wheat yield prediction. The acreage design was basically a classical survey for which the sampling unit was a 5- by 6-nautical mile segment; however, there were complications caused by measurement errors and loss of data. Yield was predicted by sampling meteorological data from weather stations within a region and then using those data as input to previously fitted regression equations. Wheat production was not estimated directly, but was computed by multiplying yield and acreage estimates. The allocation of samples to counties is discussed as well as the allocation and selection of segments in strata/substrata.

N80-15452# Lockheed Electronics Co., Houston, Tex.

LACIE AREA SAMPLING FRAME AND SAMPLE SELECTION

C. J. Lisscz, Principal Investigator

The basic requirements for the LACIE processing system are to extract specified test sites (sample segments) from LANDSAT MSS data, and to apply geometric corrections and perform image corrections. Registration between successive data acquisitions to within 1 pixel (root mean square). The general flow within the LACIE processing system is described with emphasis on (1) determination of line and pixel location of a search area within an MSS frame; (2) determination of the geometric correction coefficient and the application of geometric corrections; (3) edge detection; and (4) correlation by coincidence of edges.

A.R.H.

N80-15453# National Aeronautics and Space Administration.

LACIE AREA ACREAGE ESTIMATION

R. S. Chihikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigators

The basic requirements for the LACIE processing system are to extract specified test sites (sample segments) from LANDSAT MSS data, and to apply geometric corrections and perform image corrections. Registration between successive data acquisitions to within 1 pixel (root mean square). The general flow within the LACIE processing system is described with emphasis on (1) determination of line and pixel location of a search area within an MSS frame; (2) determination of the geometric correction coefficient and the application of geometric corrections; (3) edge detection; and (4) correlation by coincidence of edges.

A.R.H.

N80-15454# National Aeronautics and Space Administration.

LARGE AREA ACREAGE AND MEAN SQUARED PREDICTION ERROR ESTIMATION FOR LACIE YIELD AND PRODUCTION FORECASTS

R. S. Chihikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigators

The basic requirements for the LACIE processing system are to extract specified test sites (sample segments) from LANDSAT MSS data, and to apply geometric corrections and perform image corrections. Registration between successive data acquisitions to within 1 pixel (root mean square). The general flow within the LACIE processing system is described with emphasis on (1) determination of line and pixel location of a search area within an MSS frame; (2) determination of the geometric correction coefficient and the application of geometric corrections; (3) edge detection; and (4) correlation by coincidence of edges.

A.R.H.

N80-15455# National Aeronautics and Space Administration.

CLASSIFICATION AND MENSURATION OF LACIE SEGMENTS


The the theory of classification methods and the functional steps in the manual training process used in the three phases of LACIE are discussed. The major problems that arose in using a procedure for manually training a classifier and a method of machine classification are discussed to reveal the motivation that led to a redesign for the third LACIE phase.

A.R.H.

N80-15456# National Aeronautics and Space Administration.

LACIE REGISTRATION PROCESSING

Gerald J. Grebowski, Principal Investigator

The advantages and disadvantages of the casual (phenological, dynamic, physiological), statistical regression, and analog approaches to modeling for grain yield are examined. Given LACIE’s primary goal of estimating wheat production for the large areas of major wheat-growing regions, the statistical regression approach of correlating historical yield and climate data offered the Center for Climatic and Environmental Assessment the greatest potential return within the constraints of time and data sources. The basic equation for the first generation yield-trend model is given. Topics discussed include truncation, trend variable, selection of weather variables, episodic events, strata selection, operational data flow, weighting, and model results.

A.R.H.

N80-15457# National Aeronautics and Space Administration.

DEVELOPMENT OF LACIE CCEA-1 WEATHER/WHEAT YIELD MODELS

N. D. Strommen, C. M. Sakamoto (Environmental Data and Information Service, Columbia, Mo.), S. K. LeDuc (Environmental Data and Information Service, Columbia, Mo.), and D. E. Umberger, Principal Investigators

The three candidate approaches to adjustment of the crop calendar to account for year-to-year weather differences, the Robertson triquadratic unit, a function of a nonlinear function of maximum and minimum temperature and day length, best described the rate of phenological development of wheat. The adjustable crop calendar (ACC) as implemented for LACIE is used to calculate the daily increment of development through
cloud/snow rejection rate experienced throughout the last 3 years has approached 50%, as expected in most LANDSAT data use situations.

_N80-15462*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. AGRICULTURE AND FORESTRY_ 


Avail: NTIS HC A99/MF A01 CSCL 02C

The design, implementation, and operational functions of the three phases of LACIE supported the data needs of all other elements of the project and required several types of data in addition to LANDSAT multispectral digital data. The nonelectronic data base consisted of statistical data, printed reports, periodicals, ground observed data received from intensive test sites and operational segments, and full-frame multispectral scanner ORI photographs. The following data were collected for the test sites in the United States and Canada: land use inventories, periodic crop observations, solar radiometer measurements; rainfall, and wheat yield for selected fields. A.R.H.

_N80-15463*# Lockheed Electronics Co., Houston, Tex. AGRICULTURE AND FORESTRY_ 


Avail: NTIS HC A99/MF A01 CSCL 02C

Techniques implemented to facilitate processing of LANDSAT multispectral data between 1975 and 1978 are described. The data that were handled during the large area crop inventory experiment and the storage mechanisms used for the various types of data are defined. The overall data flow, from the placing of the LANDSAT orders through the actual analysis of the data set, is discussed. An overview is provided of the status and tracking system that was developed and of the data base maintenance and operational task. The archiving of the LACIE data is explained. Author

_Author_
The organization and products of the yield estimation subsystem (YES) are described with particular emphasis on meteorological data acquisition, yield estimation, crop calendars, weekly weather summaries, and project reports. During the three phases of LACIE, YES demonstrated that it is possible to use the flow of global meteorological data and provide valuable information regarding global wheat production. It was able to establish a capability to collect, in a timely manner, detailed weather data from all regions of the world, and to evaluate and convert that data into information appropriate to the project's needs.

**A.R.H.**

**N80-15469**
National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**THE CROP ASSESSMENT SUBSYSTEM: SYSTEM IMPLEMENTATION AND APPROACHES USED FOR THE GENERATION OF CROP PRODUCTION REPORTS**

**Avail:** NTIS HC A99/MF A01 CSCL 02C

The primary responsibility of the crop assessment subsystem (CAS) during the three phases of LACIE was to produce crop reports that included estimates of wheat area, yield, and production, as well as a specified set of associated statistical descriptors. The operations of CAS are described with emphasis on sampling strategy, input/output data, evolution of aggregation/reporting system capabilities, and CAS aggregation procedures.

**A.R.H.**

**N80-15470**
National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**LACIE STATUS AND TRACKING**

**Avail:** NTIS HC A99/MF A01 CSCL 02C

The operational requirements and development of a system designed to meet LACIE needs for data to be available at given stations simultaneously, to measure throughput rates, and perform efficiency analyses are described. The final automated status and tracking system (ASATS) is defined and problems encountered during its evolutionary process are discussed.

**A.R.H.**

**N80-15471**
National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**LACIE QUALITY ASSURANCE**

**Avail:** NTIS HC A99/MF A01 CSCL 02C

Topics covered include (1) development of the LACIE quality assurance program; (2) LACIE quality assurance responsibilities of all organizational elements; (3) internal quality assurance support; and (4) accomplishments.

**A.R.H.**

**N80-15472**
National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**ACCURACY ASSESSMENT SYSTEM AND OPERATION**

**Avail:** NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of LACIE estimates of wheat production, area, and yield is determined at regular intervals.

**A.R.H.**

**N80-15466**
National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

**CONCEPTS LEADING TO THE IMAGE-100 HYBRID INTERACTIVE SYSTEM**

**Avail:** NTIS HC A99/MF A01 CSCL 02C

As LACIE Procedure 1 evolved from the Classification and Mensuration Subsystem smallfields procedures, it became evident that two computational systems would have merit-the LACIE/Earth Resources Interactive Processing System based on a large IBM-360 computer oriented for operational use with high computational throughput, and a smaller, highly interactive system based on a PDP 11-45 minicomputer and its display system, the IMAGE-100. The latter had advantages for certain phases; notably, interactive spectral aids could be implemented quite rapidly. This would allow testing and development of Procedure 1 before its implementation on the LACIE/Earth Resources Interactive Processing System. The resulting minicomputer system, called the Classification and Mensuration Subsystem IMAGE-100 Hybrid System, allowed Procedure-1 operations to be performed interactively, except for clustering, classification, and automatic selection of best acquisitions, which were offloaded to the LACIE/Earth Resources Interactive Processing System.

**Author**

**N80-15467**
Department of Agriculture, Houston, Tex.

**USDA ANALYST REVIEW OF THE IMAGE-100 HYBRID SYSTEM TEST**

**Avail:** NTIS HC A99/MF A01 CSCL 02C

Fifty operational segments from the U.S.S.R., 40 test segments from Canada, and 24 test segments from the United States were used to provide a wide range of geographic conditions during its evolutionary process are discussed.

**A.R.H.**

**N80-15468**

**OPERATION OF THE YIELD ESTIMATION SUBSYSTEM**

**Avail:** NTIS HC A99/MF A01 CSCL 02C

The organization and products of the yield estimation subsystem (YES) are described with particular emphasis on meteorological data acquisition, yield estimation, crop calendars, weekly weather summaries, and project reports. During the three phases of LACIE, YES demonstrated that it is possible to use the flow of global meteorological data and provide valuable information regarding global wheat production. It was able to establish a capability to collect, in a timely manner, detailed weather data from all regions of the world, and to evaluate and convert that data into information appropriate to the project's needs.
throughout the year by the accuracy assessment subsystem which also investigates the various LACIE error sources, quantifies the errors, and relates them to their causes. Timely feedback of these error evaluations to the LACIE project was the only mechanism for error reductions, and relates then to their causes. Timely feedback of these error evaluations to the LACIE project was the only mechanism for error reductions, and relates then to their causes.

A.R.H.

**N80-15473**

National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, Tex.

**LACIE APPLICATIONS EVALUATION SYSTEM EFFICIENCY REPORT**

Timothy T. White, Principal Investigator In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 281-288 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The scope of the three LACIE phases is discussed as well as the system efficiencies which had to be implemented to cope with the resulting LANDSAT data load. The methodologies used in system analysis, some of the specific data collected, and the inferences of these data and their implication on future systems are also discussed.

A.R.H.

**N80-15474**

Lockheed Electronics Co., Houston, Tex.

**CARTOGRAPHY: LACIE'S SPATIAL PROCESSOR**


Avail: NTIS HC A99/MF A01 CSCL 02C

The spatial processing needs of LACIE include the location of agricultural test sites, and the registration of ground truth to LANDSAT imagery. The technological aspects of LACIE cartographic support, the need for cartography in satellite crop surveys, and proposed improvements which would enhance support of future programs are discussed.

A.R.H.

**N80-15475**


**THE LACIE DATA BASES: DESIGN CONSIDERATIONS**


Avail: NTIS HC A99/MF A01 CSCL 02C

The implementation of direct access storage devices for LACIE is discussed with emphasis on the storage and retrieval of image data. Topics covered include the definition of the problem, the solution methodology (design decisions), the initial operational structure, and the modifications which were incorporated. Some conclusions and projections of future problems to be solved are also presented.

A.R.H.

**N80-15476**


**MAN-MACHINE INTERFACES IN LACIE/ERIPS**


Avail: NTIS HC A99/MF A01 CSCL 02C

One of the most important aspects of the interactive portion of the LACIE/ERIPS software system is the way in which the analysis and decision-making capabilities of a human being are integrated with the speed and accuracy of a computer to produce a powerful analysis system. The three major man-machine interfaces in the system are (1) the use of menus for communications between the software and the interactive user; (2) the checkpoint/restart facility to recreate in one job the internal environment achieved in an earlier one; and (3) the error recovery capability which would normally cause job termination. This interactive system, which executes on an IBM 360/75 mainframe, was adapted for use in noninteractive (batch) mode. A case study is presented to show how the interfaces work in practice by defining some fields based on an image screen display, noting the field definitions, and obtaining a film product of the classification map.

A.R.H.

**N80-15477**


**LACIE/ERIPS SOFTWARE SYSTEM SUMMARY**

C. L. Johnson, Principal Investigator In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 317-332 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The Earth resources interactive processing system (ERIPS) supports LACIE by classifying LANDSAT sensed data on the basis of the statistical similarity to those portions which were identified by analysts. The development and capabilities of the ERIPS software system are described with emphasis on (1) system requirements; (2) LACIE/ERIPS hardware; (3) system functions; (4) pattern recognition concept; and (5) LACIE/ERIPS data bases. Algorithms used in LACIE/ERIPS for statistics, divergence, feature selection, classification, registration, adaptive clustering, iterative clustering, clustering report functions, Sun angle correction, mean level adjustment, and bias correction are appended.

A.R.H.

**N80-15478**


**A LOOK AT COMPUTER SYSTEM SELECTION CRITERIA**


Avail: NTIS HC A99/MF A01 CSCL 02C

There is no difficulty in identifying the criteria involved in the computer selection process: complexity arises in objectively evaluating various candidate configurations against the criteria, based on the user's specific needs. A model for formalizing the selection process consists of two major steps: verifying that the candidate configuration is adequate to the user's programming requirements, and determining an overall system evaluation rating based on cost, usability, adaptability, and availability. A 36 step instruction for computer sizing evaluation is included in the appendix along with a sample application of the configuration adequacy model. Selection criteria and the weighting process are also discussed.

A.R.H.

**N80-15481**

Mitre Corp., Houston, Tex.

**COST AND PERFORMANCE CHARACTERISTICS OF DATA SYSTEM CONFIGURATIONS FOR PROCESSING REMOTELY SENSED DATA**

P. J. Gregor and J. F. Spitzer, Principal Investigators In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 397-408 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Some alternative approaches to constructing a large remote-sensing data system are explored. The cost and performance implications of using a collection of "small" computers versus using one large computer are examined. Several architectures and associated costs for the large data system supporting a single data center are presented. Recurring cost factors (maintenance and operations) currently slightly favor the single large-machine architecture, but other factors may dictate the choice of one of the two multimachine architectures discussed.

A.R.H.
N80-15482 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. 
Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C
Meteorological data and LANDSAT spectral data from growing regions in the U.S. Great Plains, the U.S.S.R. and Canada were used to assess growing conditions and to document where anomalies such as drought, floods, and freezes were impacting the crop yield and appearance of spring and winter wheat. In the United States, the weekly rainfall and temperature data were used to estimate soil moisture, which was then related to crop needs by a crop moisture index. The transformation of LANDSAT digital data into a green index number provided a procedure whereby data from a LACIE segment could be classified as drought affected or not. The growing seasons encountered in each LACIE country during the three phases are described.
A.R.H.
N80-15483 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
Avail: NTIS HC A99/MF A01 CSCL 02C
A technique utilizing transformed LANDSAT digital data for detection of agricultural vegetative water stress was developed during the 1976 South Dakota drought, and expanded to the U.S. Great Plains the following year to evaluate its effectiveness in detecting and monitoring vegetative water stress over large areas. This technique, the green index number (GIN), indicated when the vegetation within a segment was undergoing stress. Segments were classified as either moisture-stressed or normal using remote sensing techniques combined with a knowledge of crop condition. The remote sensing-based information was compared to a weekly ground-based index (the crop moisture index) provided by the U.S. Dept. of Commerce. The approaches used and the results from the GIN monitoring program are presented.
A.R.H.
N80-15484 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S. GREAT PLAINS
Avail: NTIS HC A99/MF A01 CSCL 02C
The accuracy and reliability of the LACIE design was tested using the nine states of the U.S. Great Plains where comparison data was available. The three phases of LACIE are discussed with respect to the scope; sampling; LANDSAT data; estimates of area, yield, and production; accuracy of the estimates; and technical issues related to each phase.
A.R.H.
N80-15485 Department of Agriculture, Houston, Tex.
LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S.S.R.
Avail: NTIS HC A99/MF A01 CSCL 02C
No estimates were generated for the U.S.S.R. during LACIE phase 1. Phase 2 effort was limited to two indicator regions: winter wheat areas where 385 segments were allocated, and spring wheat areas with 362 allocated segments. The level of activity for phase 3 was extended to the entire country which automatically increased the segment workload from 747 to 1947 segments. Production, area, and yield estimates, and their accuracy are discussed for phases 2 and 3 with emphasis on scope, sampling strategy, data base, LANDSAT data, yield analysis for winter and spring wheat, area and production analysis for winter and spring wheat, and technical issues and problems.
A.R.H.
N80-15486 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE AREA, Yield, and Production Estimate Characteristics: Canada
Avail: NTIS HC A99/MF A01 CSCL 02C
Sampling segment allocation for Canada placed 283 segments within three provinces: Saskatchewan (170), Alberta (75), and Manitoba (38). The data base was comprised of five data sets: allocation, historical, ratio, LANDSAT, and yield. In-season area, yield, and production estimates were generated only during phase 2. These data are presented and analyzed.
A.R.H.
N80-15487 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A C C U R A C Y A N D P E R F O R M A N C E O F L A C I E AREA ESTIMATES
Avail: NTIS HC A99/MF A01 CSCL 02C
Results for the three crop years between 1974 and 1977 are presented in 25 tables for four regions of the U.S. Great Plains. Topics covered include error source analyses and special studies during each phase. Abnormal signature and boundary problems still under investigation are examined.
A.R.H.
N80-15488 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A C C U R A C Y A N D P E R F O R M A N C E O F L A C I E YIELD ESTIMATES IN MAJOR WHEAT PRODUCING REGIONS OF THE WORLD
Avail: NTIS HC A99/MF A01 CSCL 02C
The LACIE yield models developed, implemented, and tested during the three phases of the experiment represent the first generation of models designed for the large-scale prediction of wheat production. The models are capable of supporting the stated project goal of being within 10 percent of the actual wheat production 90 percent of the time. The limitations of the models are inherent in their nature. The temporal resolution limits their ability to handle the erratic weather occurring in critical situations. The relatively large spatial resolution of the individual models limits the capture of localized but important episodic events.
A.R.H.
N80-15489 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A C C U R A C Y A N D P E R F O R M A N C E O F L A C I E CROP DEVELOPMENT MODELS
ref. ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C
Of the three principal phenological crop calendar models evaluated for LACIE, Robertson’s triquadratic model which predicts the rate of progression of wheat through its biological development, was selected. Daily maximum and minimum temperatures and day length are the input variables, and the principal output is a daily increment of development through six physiological growth stages. Because wheat corresponds differently to the environment during each growth stage, five different equations were compared in order to establish a measure of confidence in the model and to identify consistent discrepancies that would adversely affect LACIE operation. Although the model provided reliable estimates for various wheat growing regions of the world, it was found that there are still areas in need of further model improvement or development.

A.R.H.

N80-15490*# Department of Agriculture, Washington, D.C.
ECONOMIC EVALUATION: CONCEPTS, SELECTED STUDIES, SYSTEM COSTS, AND A PROPOSED PROGRAM
Frank H. Osterhoudt, Principal Investigator In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 605-616 ref. ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C
The more usual approaches to valuing crop information are reviewed and an integrated approach is recommended. Problems associated with implementation are examined. What has already been accomplished in the economic evaluation of LACIE-type information is reported including various studies of benefits. The costs of the existing and proposed systems are considered. A method and approach is proposed for further studies.

A.R.H.

N80-15491*# National Aeronautics and Space Administration.
METODS FOR SEGMENT WHEAT AREA ESTIMATION
Avail: NTIS HC A99/MF A01 CSCL 02C
The major research conducted during the three years of LACIE to solve problems associated with segment wheat area estimation is reviewed. Topics covered include proportion estimation, clustering, feature extraction, and signature extension. It would appear that LANDSAT-1 and LANDSAT-2 data do not contain enough information to discriminate between crop types perfectly all the time and, therefore, a basic problem arises when no ground truth data on crop types in the area are available. New approaches are needed to reduce labeling error. Perhaps better use of multiyear LANDSAT data, a more detailed understanding of the cropping practices in the area, better crop calendar prediction, and a better understanding of the limiting sources of error in LANDSAT data related to crop discrimination may provide the insight required to develop improved designs.

A.R.H.

N80-15492*# National Aeronautics and Space Administration.
LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.
ESTIMATING CROP PROPORTIONS FROM REMOTELY SENDED DATA
A. H. Feiveson, Principal Investigator In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 633-646 ref. ERTS
Avail: NTIS HC A99/MF A01 CSCL 02C
The classification/pixel-count method for estimating the proportion of wheat in each segment is theoretically biased even if all distributional assumptions are met. Alternative ways to estimate crop proportions are examined and their performance testing is considered. Topics covered include general linear functional estimates, the method of moments, and maximum likelihood estimators.

A.R.H.
and MLEST algorithms were also tested for their capability to geographically extend signatures using LANDSAT imagery.

**Author**

**N80-15501** Environmental Research Inst. of Michigan, Ann Arbor.

**SIGNATURE EXTENSION METHODS IN CROP AREA ESTIMATION**


Avail: NTIS HC A99/MF A01 CSCL O2C

The Procedure B multispectral processing system is both multisegment and multistratum. It uses data from several LACIE-sized segments together and makes a proportion estimate for the entire group of segments as well as for the individual segments. In the clustering of data features, Procedure B produces multiple classes or strata rather than just two strata (as in Procedure 1), and performs stratified sampling on each of these multiple strata in order to make a proportion estimate. Tests results for the components and for the overall performance of Procedure B are presented, and conclusions that can be drawn from these tests are discussed. The rationale for signature extension for crop area estimation is summarized. A.R.H.

**N80-15502** National Aeronautics and Space Administration.

Lyndon B. Johnson Space Center. Houston, Tex.

**AN EVALUATION OF PROCEDURE 1**


Avail: NTIS HC A99/MF A01 CSCL O2C

LACIE Procedure 1 has undergone continuous testing and evaluation, starting with analytical and experimental studies even before it was implemented in ENRIPS software and continuing to the present with performance evaluations using blind-site data. The strengths and weaknesses of the procedure are indicated and some areas for possible improvement are identified. Results from three of the experiments performed and an evaluation of LACIE Procedure 1 proportion estimates for some blind-site segments are discussed. A.R.H.

**N80-15503** Department of Agriculture. Houston, Tex. Foreign Agricultural Service

**THE VEGETATIVE INDEX NUMBER AND CROP IDENTIFICATION**

P. Ashburn, Principal Investigator *in NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979* p 843-855 refs Original contains imagery. Original photography may be purchased from the EROS Data Center. Sioux Falls. S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL O2C

A vegetative index number of numerical value was calculated from the digital values of the LANDSAT system to provide some measure of green growing vegetation. The usefulness of the green numbers for schemes in crop identification and acreage estimation is investigated and the Ashburn vegetation index (AVI) is compared with the Kauth-Thomas vegetation index (KVI) for crop identification schemes. Results of wheat acreage estimation using LACIE Procedure 1 and the AVI for eight sample segments are given. Tables show comparisons between the AVI and the KVI as well as visual results of the AVI. A.R.H.

**N80-15504** California Univ. at Berkeley.

**MANUAL LANDSAT DATA ANALYSIS FOR CROP TYPE IDENTIFICATION**


Avail: NTIS HC A99/MF A01 CSCL O2C

The process of manual identification of crop type by human analysts and problems associated with manual crop identification measurement procedures are described. Research undertaken in cooperation with LACIE operations by the supporting research community to effect solutions to, or obtain greater understanding of the problems is discussed. A.R.H.

**N80-15505** Lockheed Electronics Co., Houston, Tex.

**LACIE ANALYSIS INTERPRETATION KEYS**


Avail: NTIS HC A99/MF A01 CSCL O2C

Two interpretation aids, 'The Image Analysis Guide for Wheat/Small Grains Inventories' and 'The United States and Canadian Great Plains Regional Keys', were developed during LACIE phase 2 and implemented in the data format so as to provide analysts with a better understanding of the expected ranges in color variation of signatures for individual biostages and of the temporal sequences of LANDSAT signatures. The keys were tested using operational LANDSAT data, and the results demonstrate that their use provides improved labeling accuracy in all analyst experience groupings, in all geographic areas within the U.S. Great Plains, and during all periods of crop development. A.R.H.

**N80-15506** National Aeronautics and Space Administration.

Lyndon B. Johnson Space Center. Houston, Tex.

**COLORIMETRIC CONSIDERATION OF TRANSPARENCIES FOR A TYPICAL LACIE SCENE**


Avail: NTIS HC A99/MF A01 CSCL O2C

The production film converter used to produce LACIE imagery is described as well as schemes designed to provide the analyst with operational film products. Two of these products are described from the standpoint of color theory. Colorimetric terminology is defined and the mathematical calculations are given. Topics covered include (1) history of product 1 and 3 algorithm development; (2) colorimetric assumptions for product 1 and 3 algorithms; (3) qualitative results from a colorimetric analysis of a typical LACIE scene; and (4) image-to-image color stability. A.R.H.

**N80-15507** National Aeronautics and Space Administration.

Lyndon B. Johnson Space Center. Houston, Tex.

**GENERATION OF UNIFORM CHROMATICITY SCALE IMAGERY FROM LANDSAT DATA**


Avail: NTIS HC A99/MF A01 CSCL O2C

An algorithm is presented for generating uniform chromaticity scale (UCS) imagery from multispectral data. A computer program was written to implement the algorithm, and UCS film products were generated. The colors in the film and their temporal changes are consistent with those expected for the particular scaling of Kauth components into the (ab) color space. The film product was not subjected to the practical test of competing with previous transformations. Preliminary examination indicates that the product offers the following possibilities: (1) a single film product that will supplant two film products in current use; (2) improved visualization of regions in data space that are critical to crop identification; and (3) an analytic route to the determination of data-space transformations that will be optimal for particular discrimination problems. A.R.H.
A PROGRAMMED LABELING APPROACH TO IMAGE INTERPRETATION


Avail: NTIS HC A99/MF A01 CSCL 02C

Manual labeling techniques require the analyst-interpreter to use not only production film converter products but also agrucultural and meteorological data and spectral aids in an integrated, judgmental fashion. To control an anticipated high variance in these techniques, a semiautomatic labeling technology was developed. The product of this technology is label identification from statistical tabulation (LIST) which operates from a discriminant basis and has the ability to measure the reliability of the label and to introduce an arbitrary bias. The development of LIST and its properties are described. Numerical results of an application are included and the evaluation of LIST is discussed.

A.R.H.


Avail: NTIS HC A99/MF A01 CSCL 02C

Multiple regression models were studied in order to determine their yield estimation capability for any arbitrary unit area and to obtain greater responsiveness and accuracy through the use of additional data sources applied at small spatial and temporal scales. It was concluded that data base inadequacy was the factor limiting performance in the models studied and that each of the models has more yield predicting capability than was reached during LAdE.

K.L.


A universal wheat yield model applicable to both fall- and spring-planted wheat was developed to show separate and joint effects of weather and culture on yields. Data from state experiment stations in a wide range of climates in the U.S. Great Plains were used to build basic relationships among yields, weather and culture. The application of the model on a macroclimatic scale in the U.S., the U.S.S.R., and India is discussed along with potential improvements.

K.L.


Avail: NTIS HC A99/MF A01 CSCL 02C

The adaptation of the law of the minimum (LOM) to wheat yield estimation is discussed. It is demonstrated through a trial application that the LOM concept is a valuable tool for model building when regression tools are inadequate.

K.L.

N80-15513*# National Oceanic and Atmospheric Administration, Columbia, Mo. Center for Climatic and Environmental Assessment.


Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of estimating wheat yields for years with unusual planting dates and/or unusual phenological development is investigated. A yield model developed for hard red winter wheat in North Dakota using historical yields for crop reporting districts in conjunction with meteorological predictor variables based on weekly data is assessed.

K.L.
method of variance component estimation is described. A general theorem concerning weighted least squares, referred to as the Aiken method, is proved.

J.M.S.

N80-15518*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

WEIGHTED AGGREGATION

A. H. Feiveson, Principal Investigator In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1029-1036 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The use of a weighted aggregation technique to improve the precision of the overall LACIE estimate is considered. The manner in which a weighted aggregation technique is implemented given a set of weights is described. The problem of variance estimation is discussed and the question of how to obtain the weights in an operational environment is addressed.

J.M.S.

N80-15519*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

DESIGN, IMPLEMENTATION, AND RESULTS OF LACIE FIELD RESEARCH


Avail: NTIS HC A99/MF A01 CSCL 02C

The capability to acquire, process, and interpret remotely sensed multispectral measurements of the energy reflected and emitted from crops, soils, and other Earth surface features is considered. The LACIE Field Measurements Project is described including project objectives, the experimental approach, the data acquisition program, and selected results based on field data. The key accomplishments and results of the experiment and recommendations for future field research are summarized.

J.M.S.

N80-15520*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE APPLICATION TEST SYSTEM: AN APPROACH TO TECHNOLOGY TRANSFER


Avail: NTIS HC A99/MF A01 CSCL 02C

The latest satellite and computer processing and analysis technologies were tested and evaluated in terms of their application feasibility. Technologies evaluated include those developed, tested, and evaluated by the LACIE, as well as candidate technologies developed by the research community and private industry. The implementation of the applications test system and the technology transfer experience between the LACIE and the applications test system is discussed highlighting the approach, the achievements, and the shortcomings.

J.M.S.

N80-15521*# Department of Agriculture, Houston, Tex.

FUNCTIONAL DEFINITION AND DESIGN OF A USDA SYSTEM


Avail: NTIS HC A99/MF A01 CSCL 02C

The fundamental definition and design of a U.S.D.A. system utilizing the LACIE technology available as of June 1976, is discussed. The organization and methods described are focused on LACIE technology in terms of its transfer for use applications. The simulation of a feasible system design provided timely answers to system design questions, such as the ability of a minicomputer to handle the proposed geometrical correction of MSS data.

M.M.M.

N80-15522*# Department of Agriculture, Houston, Tex.

DATA BASE DESIGN FOR A WORLDWIDE MULTICROP INFORMATION SYSTEM


Avail: NTIS HC A99/MF A01 CSCL 02C

A description of the USDA Application Test System data base design approach and resources is presented. The data is described in detail by category, with emphasis on those characteristics which influenced the design most. It was concluded that the use of a generalized data base in support of crop assessment is a sound concept. The IDMS11 minicomputer base system is recommended for this purpose.

M.M.M.

N80-15523*# Ford Aerospace and Communications Corp., Houston, Tex.

THE APPLICATION TEST SYSTEM: TECHNICAL APPROACH AND SYSTEM DESIGN


Avail: NTIS HC A99/MF A01 CSCL 02C

An insight is provided of the technical approach which was applied to the system design of the USDA Applications Test Program. Included are: identification of requirements, assessment of remote sensing contributions, evaluations of existing techniques, and cost effective development of a system design which utilizes techniques and procedures consistent with requirements.

M.M.M.

N80-15524*# Department of Agriculture, Houston, Tex.

RESOURCE MODELING: A REALITY FOR PROGRAM COST ANALYSIS


Avail: NTIS HC A99/MF A01 CSCL 02C

The approach, implementation, operation, and utilization of a model to establish capital investment and operational costs for the Program is presented. These are based on their interrelationships, dependencies, and alternative actions.

M.M.M.

N80-15525*# Department of Agriculture, Houston, Tex.

THE APPLICATION TEST SYSTEM: EXPERIENCES TO DATE AND FUTURE PLANS


Avail: NTIS HC A99/MF A01 CSCL 02C

The ATS analysis component is presented focusing on methods by which the varied data sources are used by the ATS analyst. Analyst training and initial processing of data is discussed along with short and long plans for the ATS.

M.M.M.

N80-15527*# Instituto Geografico Nacional, Madrid (Spain).

THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN Progress Report

Rudolfo NuñezdelasCuevas, Fernando LopezdeSagrado, D. Joaquin Melia Miralles, D. Pedro Herranz Araujo, D. Jesus Paredes Parladero, D. Antonio Parrilla, D. J. Luis Picon, D. J. Luis Labrandero, and F. Gonzalez Bernaldez, Principal Investigators 30 Sep. 1979 47 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(E8O-10032: NASA-CA-162443: PR-1) Avail: NTIS HC A03/MF A01 CSCL 08F

20
N80-15530# Canada Centre for Remote Sensing, Ottawa (Ontario).

USE OF THERMAL INFRARED AND COLOUR INFRARED IMAGERY TO DETECT CROP MOISTURE STRESS Interim Report
R. C. McKenzie, N. F. Clark, and J. Cihlar, Principal Investigators

The author has identified the following significant results. In the presence of variable plant cover (primarily percent cover) and variable available water content, the remotely sensed apparent temperatures correlate closely with plant cover and poorly with soil water. To the extent that plant cover is not systematically related to available soil water, available water in the root zone values may not be reliably predicted from the thermal infrared data. On the other hand, if plant cover is uniform and the soil surface is shown in a minor way, the thermal data indicate plant stress and consequently available water in the soil profile.


HCM/M SOIL MOISTURE EXPERIMENT Progress Report

N80-15534# Environmental Research Inst. of Michigan, Ann Arbor.

ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 7 Jun. - 14 Sep. 1979

N80-15535# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

DEMONSTRATION OF WETLAND VEGETATION MAPPING IN FLORIDA FROM COMPUTER-PROCESSED SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA

The success of remotely mapping wetland vegetation of the southwestern coast of Florida is examined. A computerized technique to process aircraft and LANDSAT multispectral scanner data into vegetation classification maps was used. The cost effectiveness of this mapping technique was evaluated in terms of user requirements, accuracy, and cost. Results indicate that mangrove communities are classified most cost effectively by the LANDSAT technique, with an accuracy of approximately 87 percent and with a cost of approximately 3 cent per hectare compared to $48.50 per hectare for conventional ground survey methods.


Audrey S. Hundemann Oct. 1979 245 p Supersedes NTIS/PS-78/0969; NTIS/PS-77/0867; NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068 (NTIS/PS-79/0993); NTIS/PS-79/0969; NTIS/PS-77/0867; NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068) Avail: NTIS HC $28.00/MF $28.00 CSCL 03D

Results of agricultural resources surveys using remote sensing techniques for crop identification, acreage measurement, land mapping, and forest density studies are discussed. A few abstracts pertain to identification of plant diseases and insect pests and fishery resource assessment. This updated bibliography contains 239 abstracts, 28 of which are new entries to the previous edition.


OBTAINING TIMELY CROP AREA ESTIMATES USING GROUND-GATHERED AND LANDSAT DATA
George Hanuschak, Richard Sigman, Michael Craig, Martin Ozga, and Raymond Luebbe Aug. 1979 35 p refs (PB-300825/7; TB-1609) Avail: NTIS HC A03/MF A01 CSCL 02C

The NASA Earth resources monitoring satellites, LANDSAT 2 and 3, were used with conventional ground-gathered data to estimate planted crop areas for the 1978 Iowa corn and soybean crops. Estimates that used LANDSAT data and ground data jointly were substantially more precise than those made from ground data alone. These estimates were one of several data sources used in determining the official year-end Annual Crop Summary for Iowa. Problems associated with total project cost, timely delivery of LANDSAT data to the USDA, and cloud cover must be solved prior to any planning for an operational program.
ENVIROMENTAL CHANGES AND CULTURAL RESOURCES

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


The measurement of environmental pollutants involves the use of both continuous and integrated analyzers. A combination of sensor instrumentation, sampling system, and data acquisition system comprises an environmental monitoring system for sampling either air or water. The nature of ambient air monitoring systems will be discussed. Techniques used to measure various pollutants and principles of continuous sensor instrumentation will be discussed. Both sophisticated and simple environmental monitoring systems will be shown. Environmental monitoring systems for water will also be described giving the nature of and reason for integrated samplers.

Recent advances in electronics and computer technology on environmental systems continue to have an impact. Finally, the application of various systems to monitoring programs and widely varying objectives, the basis for selection of systems, and the trade-offs which can be used will be given with some illustrative examples.


A recent NASA satellite is obtaining high spatial resolution thermal infrared data at times of day appropriate for the study of the urban heat island effect. Quantitative estimates of the extent and intensity of urban surface heating are obtained by analysis of digital data acquired over the New York City-New England area. In many large cities satellite sensed temperatures are 10-15 C warmer than in surrounding rural areas. A thorough interpretation of the elevated urban surface temperature will require studies of (1) the relationship between remotely sensed surface temperatures and air temperatures, and (2) compensation for observed very localized heating due to industry and/or power plants.


Rapid methods of terrain appraisal are becoming increasingly important in developing countries in helping transport planners and highway engineers to make early and effective decisions about the location and design of new roads. Recent developments in the collection and analysis of terrain data recorded by remote sensing systems have resulted in a new era in the application of surveillance techniques to the planning, design, construction and maintenance of highways in different overseas environments. This paper discusses the advantages of using these new remote sensing methods for highway engineering surveys and gives examples of recent applications of the techniques to projects in Botswana, Ethiopia and Nepal.


In productive areas where deteriorations of resources are already in an advanced stage, planning and rehabilitation requires an assessment of resources and the determination of their vulnerability to further damage, as well as their potential for rehabilitation and development. In the present paper, it is shown how remote sensing technology can be used to obtain many of the early diagnostic indicators of desertification, as well as an assessment of resources and their potential in cases where the processes are advanced.


The LANCHAD mapping project was initiated under a joint research effort of both the Chad University and Paris 1 University. The aim of this project was to develop research and teaching in land use and cartography using remote sensing from satellites. The LANCHAD acronym (land use in Chad) clearly indicates that the subject of this study was to produce maps of use to local land managers. The kind of information obtained from Landsat is particularly useful in the planning of urban development, in this case in the Sahel environmental zone of Chad. The concentration of population with traditional ways of life is inducing rapid changes in the natural environment surrounding the large towns. Desertification and increased erosion in deforested areas, as well as the need for new agricultural areas, are typical problems which can be approached by multitemporal classification of satellite data. The first results have been obtained for the N’Djamena area which is the capital city of Chad, but the study will be extended to the entire country during a five year survey.

A80-20025 Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos. H. Turner (Toronto, University, Mississauga, Ontario, Canada) and D. Steiner (Zürich, Eidgenössische Technische Hochschule, Zürich, Switzerland). Photogrammetria, vol. 35, Nov. 1979, p. 141-160. 17 refs. National Research Council of Canada Grant No. A-7501.

This paper investigates the use of shadows on aerial photographs to obtain ground parameters (length, width, height, area and volume) of buildings by image processing technique. The assumptions of flat ground and true vertical photography are made in the study, and the investigation is performed on a scale model of an urban environment. Only the case of separate shadows is examined, and no attempt is made to deal with the cases of overlapping shadows and shadows falling on other buildings. The numerical values of the building parameters obtained by image processing are compared with the corresponding 'true' values measured directly on the scale model and a statistical error analysis is performed. The presence of a systematic error is detected in the height and volume residuals. A working model, based upon regression analysis, is suggested for use with actual aerial photographs.

(Author)

Major programs of sand fixation and afforestation have been undertaken by the Libyan Government. The purpose of these programs is to prevent sand dune encroachment over developing agricultural projects in the southern part of the country. Analysis of the imagery available from Landsat 1 and 2 for the period between 1972 to 1977 using digital and analogue techniques over selected test areas in the Libyan Desert has been undertaken. The results of this analysis have demonstrated that desert spreading can be estimated effectively and most economically through the use of Landsat imagery if proper image analysis techniques are used.

Author


Manipulation of a land-use map product generated by computer-aided analysis of Landsat digital data has been used, in a test case, to delimit the boundary of an urbanized area. Delimitation was determined by invoking rules adapted from the U.S. Census to encompass exalves and to close embayments. The units of generalization were single urban pixels, groups of four, and groups of nine. The urbanized boundary was smoothed to varying degrees depending on whether the 'rule of one,' the 'rule of two' or the 'rule of three' was employed. This detailed set of systematic rules was developed with the hope of having universal applicability.

Author


The paper deals with an airborne self-contained low-cost remote sensing system, called the Enviro-Pod (Pod), developed for monitoring the environment of the United-States territory to ensure the validity of environmental standards and assure legal compliance. The results of feasibility tests and demonstrations indicate that the camera-configured Pod will acquire cost effectively, high-quality high-resolution imagery in routine monitoring of point targets, stream segments, and small areas of generally less than 25 square miles. In its current configuration, the Pod provides high-resolution panoramic imagery in both the oblique and vertical camera positions. At a typical flight altitude of 3000 ft, the resolution of panchromatic film at nadir is 18 cm.

V.P.


The South Dakota State Planning Bureau recently completed a land capability study for Spearfish, South Dakota. This effort concentrated on the utilization of remote sensing data and computer composite mapping techniques. NASA high altitude aerial photogra-phy was interpreted to obtain land use information within the Spearfish area for 1969 and 1976. Detailed soils and surficial geology data were digitized, interpreted, and composited to determine the physical limitations in the area. The land capability data and the land use data were then composited to produce maps and statistics that related the area's physical limitations to actual, historical, and changing land use patterns.

Author


Avail: NTIS HC A99/MF A01 CSCL 08B

The Western Desert of Egypt was selected for detailed study as a type locality of the north African desert environment. In addition to astronaut observations, 55 color photographs of Egypt were obtained during the Apollo-Soyuz mission using 70 and 35 mm cameras. These photographs showed regional and local color zones that were mapped and checked in the field. The Apollo-Soyuz color data were used in the selection of areas for field investigations and in the extrapolation of knowledge to unphotographed areas of the Western Desert. One of the results, the mapping of an arable zone west of the Nile Delta, attests to the potential value of color photographs in desert study.

Author


Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz Test Project photographs of the Western Desert of Egypt were studied to discover the usefulness of orbital imagery in delineating sand deposits. A strip of Apollo-Soyuz mapping-camera photographs was used to map sand distribution patterns. Information from this strip was extrapolated to the rest of Egypt using a falsecolor mosaic of LANDSAT images.

Author


The Corps of Engineers and NASA's Earth Resources Laboratory conducted a joint demonstration of the production of land cover classification data from LANDSAT data. This report describes Phase III of the demonstration, in which classification maps and data were produced for two Corps of Engineers Districts at Wilmington District, an area along the route of the Cross Florida Barge Canal. The report includes the Districts: evaluations of the accuracy and applicability of the classifications and cost information for Phase III of the demonstration. The report also includes cost information for the application of interdisciplinary analysis of aerial photography as a means of obtaining land cover and environmental data. LANDSAT data may be cost-effective for identifying and showing the distribution of general types of land cover for large areas, although some land cover types may not be identifiable on a particular LANDSAT scene. Interdisciplinary analysis of aerial photography identifies and explains in a technical report the distribution of land cover. The extra detail of the report and the ability to ensure that specific land cover types are studied may make interdisciplinary analysis of aerial photography cost-effective for limited study areas.

GRA

N80-12484 Regionale Planungsgemeinschaft Utermain, Frankfurt (West Germany).

FUTURE REMOTE SENSING TASKS IN REGIONAL PLANNING (ZUKUNFTIGE AUFGABEN DER FERNERKUNDUNG IN DER REGIONALPLANUNG)


Avail: Issuing Activity

Remote sensing techniques when used at the beginning of a whole variety of projects can provide notable advantages. Country, regional and town planning activities have, up until now, because of increasing population characteristics, employed quantitative planning procedures. The need for qualitative planning is becoming increasingly apparent. Financial and administrative problems are ever present. The maximum efficiency in the use of the information so acquired is essential. Suggestions put forward include promoting the availability of DIBIAS systems among experimental workers, making aircraft flights more easily available and encouraging exchanges of information.

Author (ESA)

N80-12485 Ruhr Planning Authority, Essen (West Germany).

INTERPRETATION OF IR AND MSS DATA FOR TOWN AREAS (INTERPRETATION VON IR- UND MSS-DATEN IM STADTERBEIT)


Avail: Issuing Activity

While the classification of open spaces and areas of vegetation is relatively easy, it is difficult to identify building and other built-up area elements (such as houses, roads and automobile parks) as they are not associated with any precise spectral characteristics. A maximum likelihood method is used to separate vegetation, asphalt, rooftop and shade. Preliminary experiments using digital data processing suggest important new applications for town and regional planning in builtup areas. Author (ESA)

N80-12517 Institut fuer Angewandte Geodaesie, Singlingen (West Germany).

THE DETERMINATION OF LAND USAGES FOR PLANNING AND CARTOGRAPHY (DIE GEWINNUNG VON NUTZUNGSKATEGORIEN AUS MULTISPEKTRALEN ABSTASTERAUZZEICHNUNGEN FUR PLANUNG UND KARTOGRAPHIE)


Avail: Issuing Activity

Analog and digital processing of data for regional planning and small scale map production purposes is described. The analog procedure is used for applications with diazo layers in which color compositions are generated. The digital processing employs the DIBIAS system and the maximum likelihood method for classification. Ground maps are produced by both methods. Multispectral scanning and the classification of LANDSAT 2 data are treated. Examples are given covering the classification of a variety of crops.

Author (ESA)

N80-12524# Texas A&M Univ., College Station. Remote Sensing Center.

APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Final Report


The author has identified the following significant results. Rangelands in southwest Texas were used to establish threshold values and limitations on measuring herbaceous biomass under typical arid and semi-arid range conditions. Previous regression relationships established between ND6 and green biomass for two different ecosystems were similar. The west Texas data set for brush-free sites was too small to be statistically conclusive. It appears that a line with a third (and steeper) slope would be best for the west Texas data, and that line would intersect the other two. Results show that similar relationships exist between ND6 and green biomass under low brush canopy cover conditions, but local variations require a calibration to determine the best fit for an ecosystem. The brush canopy has a detrimental effect on the ND6 vs. herbaceous green biomass relationship.

N80-12622# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

A MULTISPECTRAL LOOK AT OIL POLLUTION DETECTION MONITORING AND LAW ENFORCEMENT


The problems of detecting oil films on water, mapping the areal extent of slicks, measuring the slick thickness, and identifying oil types are discussed. The signature properties of oil in the ultraviolet, visible, infrared, microwave, and radar regions are analyzed.

K.L.


REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1984 - Jul. 1979


The application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarial problems. This updated bibliography contains 167 abstracts, 11 of which are new entries to the previous edition.

GRA


REMOTE SENSING APPLIED TO URBAN AND REGIONAL PLANNING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1984 - Jul. 1979


Urban and regional planning using aerial photography and satellite remote sensing methods is discussed. Abstracts cover the use of remote sensing in land use mapping, traffic surveys...
and urban transportation planning, and taking inventories of natural resources for urban planning. Abstracts dealing with land use and residential quality associated with and acting as an influence on health and physical well-being are included. This updated bibliography contains 65 abstracts, 2 of which are new entries to the previous edition.

CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report

The author has identified the following significant results. LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1:250,000 scale and corresponding manually interpreted land use maps.
03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A80-10172 Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements (K voprosu o sovremennoi primenenii kartograficheskogo i aerokosmicheskogo metodov pri izuchenii noveishikh i sovremennych tektonicheskikh dvizhenii). V. I. Mikhailov (Belo-russki Politekhnicheskii Institut, Minsk, Belorussian SSR). Geodeziia i Aeroftos'emka, no. 3, 1979, p. 82-87. In Russian.


The Brazilian LANDSAT program is reviewed with respect to geodetic support, future plans in cartographic applications, and ongoing mapping projects using LANDSAT data. Attention is given to a discussion of the software/hardware phases of the program. Illustrative examples are provided. Continued research along certain lines will provide a system to update existing survey and cartographic maps and refine thematic mapping productions over a wide range of land and water resources applications. S.D.


The concept of a computer program system for automatic recording of digital satellite images using a digital cartographic data bank is described. This concept is developed on the basis of a survey of literature on image recording, on digital line detection, and on structural pattern recognition. The computer program system is basically modular so that additional features can be added, and it has a learning capability so that accumulated experience can improve its performance. The proposed system is described along with its various elements. The entire system is based on a digital image processing system called DIDAk which was developed for a general-purpose computer environment (Wiesel, 1977). Programming for this system is under way. S.D.


Space imagery is already making a practical contribution to topographical mapping at very small scales. Several examples of the use of LANDSAT, space photography and radar for mapping at scales between 1:1 million and 1:100,000 are described and illustrated. (Author)


The paper deals with integration of LANDSAT CCT data and digital terrain data in cartographic application. Georeferenced (scene correction) of LANDSAT MSS data with high accuracy which enables the overlay of LANDSAT data upon the national digital terrain model, automated relief shading using both LANDSAT data and digital terrain data, pseudo stereoscopic LANDSAT images and their three dimensional representation are major themes in the study. (Author)


One of the new technologies being investigated and used to study and resolve earth resources and environmental problems is remote sensing. The Latin American cartographic institutions became aware of the potential of remote sensing technology and space-derived imagery together with the need for a multidisciplinary mapping approach, and since 1972 have experimented with satellite imagery to prepare cartographic products. In this paper attention is given to a review of the historical evolution of satellite imaging systems. During the 1981-1985 period, it is planned to place LANDSAT D in orbit with an advanced multispectral scanner. A 1:250,000 scale unified hemispheric map with unified data, grid systems, and similar symbology will provide earth resource and environmental scientists a cartographic and geographic base which can be used to yield the information necessary to their disciplines. S.D.

In recent years, the U.S. Landsat program has provided a small but continuing source of information for the production of new maps and the revision of existing maps for Canada. More recently, experiments have been conducted to examine the usefulness of new map products based on Landsat data. These are based on digitally enhanced and/or geometrically corrected MSS scenes. The discussion focuses on operational use of Landsat in mapping and on refining Landsat data for mapping. It is hoped that the derived maps will prove to be useful references for investigators in many disciplines. An assessment will be made by the Canadian Advisory Committee on Remote Sensing. If warranted by this evaluation and other comments received, additional maps may be produced in the future, with possible changes in format whenever necessary.


An interactive composite mapping system called GMAPS (General Map Analysis and Planning System), has been used to evaluate energy development plans, and make resource and environmental assessments. GMAPS is superior to the traditional transparent overlay methods because it is much cheaper, faster and more quantitative. Using GMAPS, variables and interactions can be easily modified to rapidly investigate an unlimited range of development alternatives. An associated mapping system GCAI'S, (Generalized Computer Aided Route Selection), can generate a set of alternative corridors between specified termini by applying linear programming methods to GMAPS models. The corridors are ranked for suitability according to environmental and socio-economic criteria.

Method for increasing the accuracy of an airborne geodetic range finder (Metod povysheniia tochnosti samoletnogo geodezicheskogo radiodal'nomera), A. I. Belov, A. M. Rasin, and L. S. Goldobina, Geodezija i Aerofotos'ema, no. 4, 1979, p. 42-49. 5 refs. In Russian.

The paper analyzes the accuracy of an airborne two-antenna range finder, with a view to reducing errors associated with reflections from the underlying surface. Two components of range error are investigated: fluctuating and determinate. The analysis makes it possible to determine basic design and operational parameters for the range finder system.

A80-16560 • Structure of taiga landscapes and its study by remote sensing techniques (Struktura taizhnvykh landshaftov i metody ee distantsionnogo izucheniia), D. M. Kireev, In: Remote sensing studies of taiga regions, Novosibirsk, Izdatel'stvo Nauka, 1979, p. 11-44, 185, 9 refs. In Russian.

The applications of remote sensing to the study of taiga landscapes is demonstrated by the example of a region in western Siberia. Landscapes and land forms are identified by the method of ecological indicators using land forms of various scales. Landscape and morphological studies, in conjunction with analyses of thematic maps, confirmed the correctness of natural territorial identifications on a structural-morphological basis.


The paper discusses needs for smart sensing in terrestrial and atmospheric remote sensing as related to current technology and a scheduled Shuttle experiment. An approach is outlined involving Shuttle-borne experiments to develop earth feature identification and tracking technology including a Feature Identification and Location Experiment (FILE) scheduled for flight on the NASA Shuttle with an objective of classifying earth features into categories of bare land, water, vegetation, and clouds, snow, and ice. The plan for evolution of the FILE-related technology leads to capabilities for pointing instruments to predetermined sites, reacquiring earth features or landmarks, and tracking features such as coastlines and rivers. Technology concepts relative to an overall system transfer function is discussed, and the development status outlined.


In the study described, a phase-type profilograph employing an He-Ne laser and an interference filter with a passband of 15 A was used onboard an aircraft to record the contours of a factory and a wooded slope. The profilograph was found to provide contour recordings, not only of a wooded area but also of the underlying earth surface, with a high resolution with respect to height.

The paper deals with the method and results of a study which involved an examination of the statistical relationships between selected ground properties and Landsat MSS data, and whose aim was to assess the applicability of Landsat data to surface cover mapping in areas characterized by high-frequency spatial variations of surface cover type over small areas. The results indicate that by systematic ground data collection it is possible to understand the basic relationships between ground properties and Landsat sensor data in areas of complex surface cover and terrain, and to classify the cover types.

V.P.

N80-105656# Smithsonian Institution, Washington, D. C.
TEMPORAL CHANGES AS DEPICTED ON ORBITAL PHOTOGRAPHS OF ARID REGIONS IN NORTH AFRICA Marie H. Slezk and Farouk El-Baz / In NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 263-272

Avail: NTIS HC A99/MF A01 CSCL 08B
Processes typical of arid environments can be monitored from space by comparing orbital photographs taken over a period of years. Oblique photographs can be used, but best results are obtained with vertical or near-vertical photographs. Changes observed by comparing the 1975 Apollo-Soyuz photographs with data from previous missions include (1) an increase in vegetation west of the Nile Delta of approximately 1108 sq km in 10 years; (2) an average shift of 2.5 km over a 6 year period in the sand patterns of the Oweinat Mountain region at the borders between Egypt, Libya, and Sudan; and (3) a reduction in the water level of Lake Chad and dune encroachment upon the lake over a period of 9 years. R.E.S.

N80-14443# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.

PHYSICAL BACKGROUND OF REMOTE SENSING W. D. Langerar / In ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 14-19

Avail: NTIS HC A08/MF A01
The physical principles of remote sensing are reviewed. After a brief discussion of the evolution of sensory data acquisition and interpretation, instruments, such as infrared detectors, seismometers, geiger-counters, and magnetometers, are considered. Emphasis is on the role of electromagnetic radiation in the detection of signals which would otherwise not be perceivable by human senses. Multispectral scanning data, like that available from LANDSAT, is taken as an example and spectral signatures are discussed. Finally, the spectral bands utilized by METEOSAT are also briefly treated. Author (ESA)

N80-14482# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).


The preparation of topographic maps is discussed. The technique where topographic maps are first prepared in the form of graphic manuscripts by applying photogrammetric methods is briefly reviewed. It is shown that attempts at a rationalization of map production leads, with the aid of digital data, to automated procedures. The measurements, the computations by means of electronic data processing equipment, and the output of field comparison documents are discussed. Author (ESA)

N80-14603# National Aeronautics and Space Administration. Pasadena Office, Calif.

SYSTEM FOR REAL-TIME CRUSTAL DEFORMATION

A system is described for use in detecting earth crustal deformation using an RF interferometer technique for such purposes as earthquake predictive research and eventual operational predictions. A lunar based RF transmission or transmissions from earth orbiting satellites are received at two locations on Earth, and a precise time dependent phase measurement is made of the RF signal as received at the two locations to determine two or three spatial parameters of the antenna relative positions. The received data are precisely time tagged and land-line routed to a central station for real-time phase comparison and analysis. By monitoring the antenna relative positions over an extended period of months or years, crustal deformation of the Earth can be detected.

Official Gazette of the U.S. Patent and Trademark Office


A precision geodetic experiment was conducted on a segment of the Calaveras fault near Hollister, Calif., which had been previously instrumented for surface creep. The experiment utilized a multi-wavelength distance measuring (MWDM) device which produced daily distance determinations of nine baselines ranging from 3 to 9 km in length with a measurement precision approaching 0.1 micron strain. Analysis of the MWDM data reveals the following: (1) Long-term trends over the 2-1/2 years sampled are consistent with rigid block displacement across the Calaveras fault zone. (2) The present strain release mechanism appears to be episodic aseismic slip on the Calaveras fault with a characteristic time of about one month. (3) Maximal inversion of the baseline displacement shows that Calaveras slip episodes could result from either a small amount of slip distributed over a large fault area or a large amount distributed over a small fault area. Dissert. Abstr.

N80-15446# Lamont-Doherty Geological Inst., Palisades, N. Y.

A new set of 1 deg x 1 deg mean free air anomalies was used to construct a gravimetric geoid by Stokes' formula for the Indian Ocean. Utilizing such 1 deg x 1 deg geoid comparisons were made with GEOS-3 radar altimeter estimates of geoid height. Most commonly there were constant offsets and long wavelength discrepancies between the two data sets; there were many probable causes including radial orbit error, scale errors in the geoid, or bias errors in altitude determination. Across the Aleutian Trench the 1 deg x 1 deg gravimetric geoids did not measure the entire depth of the geoid anomaly due to averaging over 1 deg squares and subsequent aliasing of the data. After adjustment of GEOS-3 data for the role of long wavelength discrepancies, agreement between the altimeter geoid and gravimetric geoid was between 1.7 and 2.7 meters in rms errors. For purposes of geological interpretation, techniques were developed to directly compute the geoid anomaly over models of density within the Earth. In observing the results from satellite altimetry it was possible to identify geoid anomalies over different geologic features in the ocean. Examples and significant results are reported. R.C.T.
GEOLOGY AND MINERAL RESOURCES

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


The NASA Geodynamics Program is developing a variety of techniques in support of national programs in geodynamics, geodynamics from satellites. W. M. Kaula


In contrast to shorter wavelength radars, the range of returns from vegetated surfaces is appreciably less at L-band frequencies. However, the evaluation of differences in image quality due to changes in operational frequency is hindered by several system dissimilarities. In particular, a comparison of the Ka, X- and L-band radar imagery is difficult because of differences in 'effective' resolution. Though the physical resolution of these systems may be dissimilarities. In particular, a comparison of the Ka, X- and L-band radar imagery is difficult because of differences in 'effective' resolution. Though the physical resolution of these systems may be somewhat comparable, the inherent averaging of the real aperture systems (X- and Ka-) provides an apparent wider range of gray tones. This effect is related to the fact that at a scale where the resolution cell is discernable, the coherent scintillation of 'speckle' of the synthetic aperture L-band system masks tonal variations. This mismatch of effective resolution impedes detection of small changes in gray tone and makes subtle boundary changes less distinct. V.P.

N80-10542* # Amherst Coll., Mass.

EVALUATION OF SATELLITE IMAGES OF THE LEVANTINE RIFT ZONE
Richard M. Foose In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 37-43 refs

N80-10543* # Texas Univ. at Austin.

ANALYSIS OF SKYLAB AND ASTP PHOTOGRAPHS OF THE LEVANTINE (DEAD SEA) FAULT ZONE
W. R. Muehleberger, L. K. Goetz, and R. C. Belcher In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 45-62 refs

N80-10544* # Missouri Univ. at Rolla.

ANALYSIS AND SYNTHESIS OF SPACE IMAGERY OF THE SOUTHEASTERN-TURKEY/NORTHWESTERN-IRAN MOBILE BELT
Paul Dean Proctor, Douglas C. Melton, Jr., Ah bieken (Momie Eastern Technical Univ., Ankara, Turkey), and L. K. Abrams In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 63-85 refs

N80-10545* # Ain Shams Univ., Cairo (Egypt).

STRUCTURAL PATTERN OF THE NORTHERN PART OF THE EASTERN DESERT OF EGYPT
Mohamed A. Abdel-Rahman and Hassan A. El-Etr In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 87-96 refs

ApoIlo-Soyuz color photographs of the northern part of the eastern desert of Egypt were excellent for regional structural mapping because of their color fidelity and large areal coverage. The oblique Apollo-Soyuz photographs were used for the identification of faults, whereas enlarged LANDSAT images were used for planimetric mapping. Aerial photographs were also examined to verify the mapped fault lines, and it was revealed that several of the lines detected on Apollo-Soyuz photographs were, in fact, zones of narrowly spaced, parallel faults. The results support the contention that vertical tectonics were responsible for the development of the fault pattern of the area. J.M.S.
PHOTOLINEAMENTS IN THE ASTP STEREOSTRIP OF THE WESTERN DESERT OF EGYPT

Hassan A. El-Etr, Adel R. Moustafa, and Farouk El-Baz

In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 97-105 refs

Avail: NTIS HC A99/MF A01 CSCL 088

Photolineaments displayed on the Apollo-Soyuz stereostrip covering part of the western desert of Egypt were studied. Virtually all of the photolineaments detected on LANDSAT images (black-and-white as well as false-color composites) were also detected on Apollo-Soyuz photographs of the same scale and approximately the same resolution. The drawbacks of Apollo-Soyuz photographs include (1) the low base/height ratio, which limited the effective stereovision; (2) the high sun-elevation angle, which limited the shadows required to easily identify linear features; and (3) the overexposure of the central parts of the frames, particularly over the Great Sand Sea. Recommendations are made to remedy this on future earth-orbital photographic missions.

J.M.S.

PHOTOLINEAMENTS IN THE ASTP STEREOSTRIP OF THE WESTERN DESERT OF EGYPT

Hassan A. El-Etr and Farouk El-Baz (Smithsonian Institution)

In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 107-118 refs

Avail: NTIS HC A99/MF A01 CSCL 088

Geologic structures of the northern part of the western desert of Egypt were studied utilizing enlargement of Apollo-Soyuz Test Project color photographs. The Apollo Soyuz photographs of Abu Rawash clearly show structural uplifts that brought white chalk deposits to the surface, depict the distribution of dark volcanic rocks in the region, and clearly delineate complex structures including several domes and plunging anticlines. The Apollo Soyuz photographs of Wadi el Natrun display its structures as well as the string of salt lakes within it and the barren nature of the northern and southern extremities of the depression. The photographs reveal that there is a potential for increasing the area of cultivated land on the eastern slope of the depression.

J.M.S.

PHOTOTECTONIC ANALYSIS OF SOUTHEASTERN SPAIN FROM ASTP PHOTOGRAPHS AND LANDSAT IMAGES

Paul Dean Proctor, Kenneth B. Hollard, Douglas C. Melton, Jr., and David F. Thompson

In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 119-148 refs

Avail: NTIS HC A99/MF A01 CSCL 088

The tectonic characteristics of southeastern Spain were analyzed using the Apollo Soyuz Test Project oblique color photographs and LANDSAT vertical images. Four distinct tectonic provinces were identified along with three orders of fold dimensions and two orders of lineament sets. Thrust faults and normal were shown to occur in the region. A discussion of the geologic setting of southeastern Spain is given along with the results of the phototectonic analysis.

J.M.S.

PHOTOTECTONIC ANALYSIS OF SOUTHEASTERN SPAIN FROM ASTP PHOTOGRAPHS AND LANDSAT IMAGES

Paul Dean Proctor, Kenneth B. Hollard, Douglas C. Melton, Jr., and David F. Thompson

In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 157-181 refs

Avail: NTIS HC A99/MF A01 CSCL 088

Excellent ASTP color prints and transparencies of the North Finders Ranges and the adjacent Lake Torrens-Lake Blanche basin areas of South Australia were analyzed to determine the characteristics of the regional fold structures. Major folds, faults, and other lineaments were identified. Tectonic patterns and their relationships to mobile belt-plate tectonics were examined. In addition, basin forms and features were analyzed and related to the desert environment of the area. Possible rock types and the character of the widespread alluvial materials surrounding the bedrock areas were predicted. An interpretive photogeologic map covering the area of the ASTP photographs was produced.

J.M.S.

PHOTOTECTONIC ANALYSIS OF SOUTHEASTERN SPAIN FROM ASTP PHOTOGRAPHS AND LANDSAT IMAGES

Paul Dean Proctor, Kenneth B. Hollard, Douglas C. Melton, Jr., and David F. Thompson

In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 193-202 refs

Avail: NTIS HC A99/MF A01 CSCL 088

In north-central Brazil, the Apollo crewmembers photographed a 4 km wide circular ground pattern. Although the feature was not visible on airborne radar and in near-infrared satellite images, it was clearly seen from space in the visible part of the spectrum. A ground reconnaissance of this location and of a second circular structure nearby strongly supports a meteoritic origin for both sites.

Author

PHOTOGEOLOGIC ANALYSIS OF ASTP PHOTOGRAPHS OF THE LAKE TORRENS FLINDERS RANGES-LAKE BLANCHE AREA. SOUTH AUSTRALIA

Paul Dean Proctor and Robert Sickler

In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 157-181 refs

Avail: NTIS HC A99/MF A01 CSCL 088

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J.M.S.

PHOTONEOGRAPHIC ANALYSIS OF THE LAKE TORRENS FLINDERS RANGES-LAKE BLANCHE AREA. SOUTH AUSTRALIA

Paul Dean Proctor and Robert Sickler

In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 157-181 refs

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J.M.S.

PHOTOTECTONIC ANALYSIS OF SOUTHEASTERN SPAIN FROM ASTP PHOTOGRAPHS AND LANDSAT IMAGES

Paul Dean Proctor, Kenneth B. Hollard, Douglas C. Melton, Jr., and David F. Thompson

In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 157-181 refs

Avail: NTIS HC A99/MF A01 CSCL 088

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J.M.S.
Desert has the highest percentage of calcareous grains originating from local limestone outcrops. Samples from the central part of the Western Desert contain numerous iron-rich grains originating from the iron deposits of Bahariya and are locally concentrated in shaley fragments from the Dakhla Shale. Sands of the Great Sand Sea are relatively homogeneous, quartz-rich deposits that vary little in percentage of minor components.

**N80-10557** Smithsonian Institution, Washington, D. C.
Astromatography of South Eastern Angola

Avail: NTIS HC A99/MF A01 CSCL OB

Apollo-Soyuz photographs of southeastern Angola were studied to provide a preliminary description of landforms in this remote and sparsely populated region. These photographs were useful in distinguishing drainage patterns, lineament trends, rock types, and the distribution of unusual play-like features. Author

**N80-10558** Smithonian Institution, Washington, D. C.
Color of Desert Surfaces in the Arabian Peninsula
Farouk El-Baz, In NASA. Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979 p 285-299 refs

Avail: NTIS HC A99/MF A01 CSCL OB

A detailed analysis of the Apollo-Soyuz photographs is presented. The following facts were established: (1) available charts and maps can be updated using the orbital photographs, particularly of coastal zones; (2) geologic maps can be improved by use of the natural color photographs, which clearly delineate major geologic features and their characteristics; (3) the photographs can be used in characterizing sand fields and classifying dune forms; and (4) enlargements of the photographs can be used in detailed studies of small areas, such as the city of Ad Dawhah (Doha), Qatar, and its environs. Author

**N80-10559** Smithsonian Institution, Washington, D. C.
Monte Desert of San Juan, Argentina, as Photographed by Astsp

Avail: NTIS HC A99/MF A01 CSCL OB

The photographs by the Astsp reveal that the physiographic setting of the study area is characterized by mountain-and-basin topography controlled mainly by faulting. Most of the lineaments detected on the photographs appear to correspond to faults, and some of them may provide evidence of recent fault movement in the area. Typical topographic features include barren, deeply dissected block mountains bordered by slopes of alluvial materials that descend to a flat-floored desert basin. Author

Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona
C. S. Breed and W. J. Breed (Museum of Northern Arizona, Flagstaff), In NASA. Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979 p 319-358 refs

Avail: NTIS HC A99/MF A01 CSCL OB

Internal structures of linear dunes that were examined in central Australia and in northern Arizona are mainly medium-scale, thin cross-beds or cross-laminas with dips commonly less than 20 deg. Astronauts aboard the Apollo spacecraft identified the same hue, chroma, and value of red sand in dunes of central Australia that ground survey teams found in the main body of the Simpson Desert. Ground examination confirms that within each field of dunes, relative degrees of redness can help discern sequences of depositional events in that area given a uniform sand supply and climatic zone. It was concluded that reconnaissance of space is ideal for identifying key sites for field studies of specific geomorphic problems in remote desert regions. Author

**N80-10571** Ain Shams Univ., Cairo (Egypt).
Detection of a Probable Ancestral Delta of the Nile River
Mohamed A. Abdel-Rahman and Farouk El-Baz, (Smithsonian Institution), In NASA. Johnson Space Center, Apollo-Soyuz Test Project, Vol. 2, 1979 p 511-520 refs

Avail: NTIS HC A99/MF A01

Interpretation of a near vertical Apollo Soyuz photograph of the present Nile Delta in northern Egypt is presented. The interpretation determines an ancestral delta of the Nile River. The limits, shape, position, and age of the ancestral Nile Delta are identified. The mineralogy of the delta is reported and the geochemistry data is analyzed. Author

Geophysics, Astronomy and Space, No. 450
2 Aug. 1979 47 p refs Transl. into English from selected Russian articles (JPRS-73946). Copyright: Avail: NTIS HC A03/MF A01

Articles concerning the earth's crust under the ocean, and the upper atmosphere are reported.

**N80-12482** Technische Universitaet, Munich (West Germany),
Quantitative Determination of Morphological Structures in Sand Bank Regions from Image Structure Analysis (Quantitative Erfassung morphologischer Strukturen in Wattgebieten durch Anwendung von Verfahren der Bild-Strukturanalyse)

Avail: Issuing Activity

Several factors must be taken into consideration: variations in the altitude of the sun, the position of the object in the image field, the release of residual water from the sand bank's surface, drying out of the sand bank, and relief characteristics (micro, intermediate and macro features). Surface and texture variations are discussed. The way in which the problems encountered are overcome is described together with the computerized treatment of the data obtained. Examples are given. Author (ESA)

**N80-12483** Technische Universitaet, Munich (West Germany),
Making Morphological Maps of Sand Banks from Aerial Photographs (Morphologische Wattkartenierung nach Luftbildern)

Avail: Issuing Activity

Different current distribution and direction regions can be distinguished in aerial photographs of water sand banks. These regions correspond to different sedimentary disposions of the sand bank surfaces. The materials and methods used are described together with the interpretation of color and texture characteristics. Studies of the Cubedensiel sand banks are treated in detail; the corresponding are given and interpreted. Author (ESA)

**N80-12521** Geological Survey, Denver, Colo.
REMOTE SENSING APPLIED TO GEOLOGY AND MINERALOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Jul. 1979
Audrey S. Hundemann Aug. 1979 189 p Updates NTIS/PS-76/0500 Supersedes NTIS/PS-77/0791; NTIS/PS-77/0676 (NTIS/PS-79/0844/5; NTIS/PS-78/0791; NTIS/PS-77/0676) Available: NTIS HC $28.00/MF $28.00 CSCL 08G
The use of LANDSAT satellites and other remote sensing methods in geological and mineralogical applications is discussed. Abstracts cover rock and soil mapping, terrain analysis, direct and indirect mineral exploration, fault tectonics, and general geologic studies of various countries. A few abstracts pertain to equipment and techniques used in the studies. This updated bibliography contains 180 abstracts, 33 of which are new entries to the previous edition.

REMOTE SENSING APPLIED TO GEOLOGY. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Jun. 1979
Gerald F. Zollars Aug. 1979 53 p Sponsored by NTIS (NTIS/PS-79/0822/1) Available: NTIS HC $28.00/MF $28.00 CSCL 08G
This bibliography cites 215 articles concerning LANDSAT images, satellite-borne photography, aerial photography, and radar techniques being used to conduct geological surveys. Articles concerning photomapping and photo interpretation techniques relating to resource exploration are stressed.

GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A. HEAT CAPACITY MAPPING MISSION Progress Report, 1 Jul. - 30 Sep. 1979

GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jul. - Sep. 1979

34
OCEANOGRAPHY AND MARINE RESOURCES

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


The book deals with the application of visible and infrared optical methods to the study of oceans and inland waters. Some aspects of oceanographic optics and remote sensing are examined, along with the color and spectrum of the outgoing light as a means of evaluating the oceanic chlorophyll and suspensions. Optical methods of studying swell, pollution, and radiation temperature are outlined. Optical methods for evaluating the oceanic chlorophyll and suspensions. Optical methods for studying swell, pollution, and radiation temperature are outlined.

V.P.


Principal satellite remote sensing techniques and instruments are described and attention is given to the application of such techniques to ocean current measurement. The use of radiometers, satellite tracking drifters, and altimeters for current measurement is examined. Consideration is also given to other applications of satellite remote sensing in physical oceanography, including measurements of surface wind stress, sea state, tides, ice, sea surface temperature, salinity, ocean color, and oceanic leveling.

B.J.


The study of atmosphere-ice-ocean interaction in East Antarctica which will use newly developed satellite systems is presented. In particular, the ARGOS system will provide quick access to data transmitted by platforms deployed on the Antarctic continent over an area bordered by the Terre Adelie coast and extending 1000 km inland. The LandSat imagery will be used to study pack ice, and the Nimbus meteorological satellite data will be utilized to characterize the lower troposphere over the area under study. It will also determine ice surface temperatures and the radiation balance, but the platform data (surface pressure and temperature) may also be used as a reference for the correction of satellite information.

A.T.


A chlorophyll density map of an ocean area 25 x 30 km is presented, and the procedure used in generating the map from high-altitude ocean-color-scanner data is discussed. Data were ob-

tained from a ten-channel radiometer on board a U-2 aircraft flying at 19.8 km above the coastal waters of Monterey Bay, California under conditions of clear skies and clear and deep water; the processing algorithms should be useful for satellite data as well. The total radiance measured at high altitude was separated into an atmospheric and sea-surface component and a water component, which is associated with chlorophyll content, for each pixel using the upwelling radiance of a near IR channel to estimate the atmospheric effect. Chlorophyll data were extracted by taking the ratio of the difference of intensities in the 472 and 506 nm channels to the sum of the channels, and are found to agree with shipboard chlorophyll determinations at a depth of 5 m.

A.L.W.


A theory for the radar imaging of ocean waves is presented under the assumptions that a swell propagates through an ensemble of Bragg scatterers and that the integration time of the synthetic aperture radar (SAR) is small compared to the angular velocity of the swell. Results are presented which show image development and distortions caused by the radial velocities and accelerations of the swell. Neglecting small wave bunching and tilts due to the longer underlying waves, and considering only one-dimensional geometries, the mechanism of wave motions are considered and their efforts on the production of the usual intensity pattern representing the wave image are studied. The analysis shows that in certain situations a processed image can appear which has twice the spatial period of the actual long wave on the ocean, which can confuse the interpretation of ocean wave analysis.

(Author)


Cost-effective methods for an aerial inventory of submerged beds of vegetation 2 hectares or more in area using 35 mm film/filter/exposure combinations and the effects of environmental conditions on image interpretability were developed. Eckehardt 200 Professional (daylight) and Eckehardt 1R film were tested, where the natural color Eckehardt 200 film with Watten No. 4 or 8 filtration, exposed at +1 or +2 f-stop(s) at an altitude of 1500 m, gave reasonable image densities and target definition of 1:27000 scale transparencies, making possible the detection of submerged vegetation at depths of up to 2 m in the highly turbid waters. The mapped distribution of submerged beds in a test area correlated well with ground truth data, demonstrating the potential usefulness of aerial photographic methods for the delineation of marine plant resources in a comprehensive statewide estuarine survey.

(Author)


Detailed observations of the structure of shelf sea fronts have been made by means of an undulating towed CTD. The high resolution data reveal a complex pattern of variability in both space and time; seasonal development and the effects of wind stirring on the frontal structure are also illustrated. An estimate of the variation in the efficiency of tidal mixing, on the basis of the observed
potential energy, \((V)\), distribution is suggestive of a positive feedback process in the establishment of stratification. Such a process would be consistent with recent observations which show that the fronts do not adjust significantly during the spring-neap cycle as predicted by the vertical mixing model of James (1977).

(Author)


The potential of ground-wave radar with high-resolution spectral analysis for sea-state sensing and surface current measurements is outlined and some experiments with a MF radar on a peninsular site in the UK are presented. Analysis of the observations made with an omnidirectional antenna shows that at such a site, ground attenuation limits the sector of ocean surveyed. Directional observations were made by two synthetic aperture techniques. A new technique using synthetic aperture measurements and bistatic geometry is also briefly discussed.

V.T.


Satellite infrared data and in situ data were used to study eddies off the east coast of Florida. The surface thermal manifestation of the eddies identified in the infrared data were alternating cold and warm tongues, conforming to the cyclonic spin-off eddies observed by Lee (1975); however, the eddies identified in the satellite data were larger than those observed by Lee. Statistics derived from the satellite data indicated that the eddies had average major and minor axes of 136 and 36 km, respectively, assuming an elliptic shape. They moved northward at an average speed of 30 km/day, and the average period was 9 days.

(Author)


Recent remote sensing experiments in the United States' coastal waters indicate that certain biological and water quality parameters have distinctive spectral characteristics. Data outputs from remote sensors, to date, include: (1) high resolution measurements to determine concentrations and distributions of total suspended particulates, temperature, salinity, chlorophyll a, and phytoplankton color group associations from airborne and/or satellite platforms, and (2) low resolution measurements of total suspended solids, temperature, ocean color, and possibly chlorophyll a from satellite platforms. A summary of platforms, sensors and parameters measured is given. Remote sensing, especially when combined with conventional oceanographic research methods, can be useful in such high priority research areas as estuarine and continental shelf sediment transport dynamics, transport and fate of marine pollutants, marine phytoplankton dynamics, and ocean fronts.

V.L.


The application of earth satellites and manned spacecraft to the study of the world's oceans is reviewed. Attention is given to the atmospheric transfer function in the visible, near-IR, middle-IR and microwave regions and the use of satellites in ocean data acquisition and transmission systems. The measurement of sea level and the topography of the ocean surface by means of orbital radar altimeters is discussed, together with IR and microwave measurements of ocean surface temperature and the study of surface roughness, surface evidence of internal waves, oil pollution and ice fields. Consideration is also given to the determination of ocean chlorophyll content and color, distribution, coastal region characteristics, ocean salinity and other biological parameters from space.

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A.L.W.
east of Spain. The analysis show that observations by man from orbiting space platforms have an important role in the development of synoptic oceanography.

K.L.

N80-10565*# Smithonian Institution, Washington, D. C.
MALTESE FRONT AND STRAIT OF SICILY OCEAN PATTERN ANALYSIS
Daniel Jean Stanley In NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 431-440 refs

Avail: NTIS HC A99/MF A01 CSCL OB8
Ocean surface phenomena related to turbulence, including possible internal waves, are observed in Apollo-Soyuz Test Project color photographs of the eastern part of the Strait of Sicily between Djerba and the southeastern corner of Sicily. The convergence of the eastward flowing, less saline upper water of Atlantic origin and the dense intermediate water flowing underneath it in the opposite direction gives rise to the Maltese Front clearly visible off Cape Passero, Sicily. The investigation shows that the geographic position of these ocean surface features is in part related to sea floor topography. The vertical coverage made from an altitude of 226 km allows good definition of turbulence phenomena and serves to supplement earlier physical oceanographic observations made of the central region of the Mediterranean Sea.

K.L.

OCEAN COLOR OBSERVATIONS

(Contracts NAS5-22948; E(11-1)-253B)

Avail: NTIS HC A99/MF A01 CSCL OB8
Apollo astronauts were briefed on four features that could alter ocean color: (1) phytoplankton chlorophyll; (2) dissolved yellow substance; (3) suspended sediments; and (4) bottom reflection. Before and during the Apollo-Soyuz mission, the crew was alerted to the possibility of a red tide occurrence along the coast of new England. They were unable to obtain useful photographs because of heavy fog and cloud cover. The astronauts were successful in observing ocean discolorations, and their verbal comments indicate that they were aware of the causes and sources of these color changes. Experience on this mission suggests that ground crews can work with astronauts in attempts to locate discolorations and to determine their extent and their sources.

K.L.

N80-10568*# McGill Univ., Montreal (Quebec).
ASTP AT BARBADOS: MESOSCALE POOLS OF AMAZON RIVER WATER IN THE WESTERN TROPICAL ATLANTIC
G. Borstad In NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 481-497 refs

Avail: NTIS HC A99/MF A01 CSCL OB8
Sea surface data was obtained at Barbados for temperature, salinity, chlorophyll concentration, clarity, color, and plankton concentration. The data suggest a successive passage of pools of brackish Amazon River water until late August. Hence, it is unlikely that the discolored water observed by the Apollo crew during the Apollo Soyuz Test Project was due to the Orinoco River. The expansive freshening of the Western Tropical Atlantic by brown colored Amazon water in July would mask any effect by the smaller Orinoco.

K.L.

ESTIMATE OF TOTAL REFLACTANCE FROM THE ORINOCO RIVER OUTFLOW
C. S. Yentsch and Farouk El-Baz (Smithsonian Institution) In NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 499-503 refs

(Contracts NAS5-22948; E(11-1)-253B)

Avail: NTIS HC A99/MF A01 CSCL OBH
The Orinoco River Delta was photographed by Apollo astronauts. The photographs show discrete water color zones that reflect the mixing of the sediment laden Orinoco outflow with the water of the tropical Atlantic. A datacolor/edge enhancer analysis, assuming a 5-percent reflectance value for the open ocean water, showed the reflectance of the area varied between 4 percent for the jungle and approximately 13 percent for sediment laden river outflow. These values approximate those obtained by direct measurements of the Mississippi River Delta water. The results confirm that the reflectance from coastal waters is not high enough to saturate instruments onboard unmanned satellites such as the Coastal Zone Scanner.

K.L.

N80-10570*# National Oceanic and Atmospheric Administration, Seattle, Wash.
OBSERVATIONS OF INTERNAL-WAVE SURFACE SIGNA- TURES IN ASTP PHOTOGRAPHS
John R. Apel In NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 505-509 refs

Avail: NTIS HC A99/MF A01 CSCL OB8
Three Apollo Soyuz Test Project photographs are presented which show indications of oceanic internal gravity waves. The features are indicated by periodic changes in the optical reflectivity of the ocean surface overlying the waves. Position and conditions of the internal wave photographs are presented and theories of the structure and existence of the surface signatures are reviewed.

A.W.H.

USE OF APOLLO-SOYUZ PHOTOGRAPHS IN COASTAL STUDIES
M. T. El-Ashry In NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 531-543 refs

Avail: NTIS HC A99/MF A01 CSCL OB8J
The use of spaceborne photography in coastal studies is examined. Apollo Soyuz photographs of coastal zones are provided to demonstrate various areas of application in coastal studies. These include shoreline features such as barrier islands, beach ridges, salt marshes, tidal inlets, and tidal deltas; shoreline changes including identification of major areas of erosion or accretion and prediction of future changes along rapidly changing shorelines; and information regarding littoral drift.

A.W.H.

N80-10583*# Coast Guard Research and Development Center. Groton, Conn.
LONG-TERM TRACKING OF ARCTIC ICEBERGS Final Report
R. D. Robe and D. C. Maier Apr. 1979 41 p. refs

(AD-A072473; CGR/DC-B-78/ USCG-D-36-79) Avail: NTIS HC A03/MF A01 CSCL OB8/12

Seven Greenland icebergs were tracked, two in 1977 and five in 1978, using ADRAMS (Air-Deployable Random Access Measurement System) ice buoys. The ice buoys transmit a signal to the NIMBUS-6 satellite which is used in computing the buoy’s position. Observation periods ranged from 138 days to 202 days. The tracking of two icebergs began near Disko Island, Greenland, and the tracking of the other five began on the Baffin Island side of Baffin Bay near Davis Straits. The icebergs initially located near Disko Island did not appear to be influenced by any well-defined current system, the drift track of each was erratic and the drift speeds generally less than 0.20 m/s. The icebergs initially located along the coast of Baffin Island followed the prevailing currents southward. These icebergs drifted at speeds as high as 0.8 m/s with model speeds generally falling between 0.10 m/s and 0.20 m/s. Groundings occurred frequently occupying 40 percent of the observed time. Data processing
methods, accuracy of the ice buoy system, and a detailed analysis of each iceberg’s drift is presented. It was estimated using the drift data obtained, that approximately 190 days are needed for an average size iceberg to travel the 1100 nautical miles from Cape Dyer, Baffin Island, to the outer limits of the Grand Banks of Newfoundland. 

N80-11532# Battelle Columbus Labs., Ohio. 

Despite its failure, SEASAT-1 acquired a reasonable volume of data that can be used by industrial participants on a non-real-time basis to prove the concept of microwave sensing of the world’s oceans from a satellite platform. The amended version of 8 experimental plans are presented, along with a description of the satellite, its instruments, and the data available. Case studies are summarized for the following experiments: (1) Beaufort Sea oil, gas, and Arctic operations; (2) Labrador Sea oil, gas, and sea ice; (3) Gulf of Mexico pipelines; (4) U.S. East Coast offshore oil and gas; (5) worldwide offshore drilling and production operations; (6) Equatorial East Pacific Ocean mining; (7) Bering Sea ice project; and (8) North Sea oil and gas A.R.H.

N80-12479 Deutsches Hydrographisches Institut, Hamburg (West Germany). 

Avail: Issuing Activity

In the example selected, regularly introduced quantities of waste solution released by a titanium dioxide fabricant situated in northwest Helgoland since 1969 are studied. Remarkable coloration phenomena are observed; these phenomena have been investigated over a period of several years. Measurements made in the sea and results from aerial and satellite photography are discussed together with image analysis techniques. Images of ships wakes and their digital treatment are presented. 

Author (ESA)

N80-12516 Deutsches Hydrographisches Institut, Hamburg (West Germany).


Avail: Issuing Activity

The spectral distribution, transmission scattering, and CIE coordinate characteristics of the sea were investigated in the framework of the 1976 FMP program. The region between Helgoland and Sylt, and the Elb estuary were studied. The sea on the southern boundary of the Verklappung’s region was shown to be very dirty. Relations between color metric magnitudes Gelbstoff, Chlorophyll, and suspended matter contents were shown to exist. Comparisons were made with ERTS satellite photographs. A high degree of correlation in some of these relations was seen for the Elb estuary. The DIBIAS system is used in the calculations performed. 

Author (ESA)

N80-12535# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OCEAN CHLOROPHYLL STUDIES FROM A U-2 AIRCRAFT PLATFORM

An experiment designed to collect in situ physical oceanographic and meteorological data for verification and evaluation of SEASAT sensor performance is described. The experiment was carried out from ships, aircraft, and buoys. An inventory of all physical oceanographic and meteorological surface truth data collected during the experiment from each of the participating platforms is presented. 

J.M.S.

N80-12546# National Oceanic and Atmospheric Administration, Washington, D.C.

SEASAT: GULF OF ALASKA EXPERIMENT. SURFACE TRUTH DATA INVENTORY
John C. Wilkerson and S. Lynn McNutt 15 Feb. 1979 100 p (PB-294616: NOAA-79031609) Avail: NTIS HC A05/MF A01 CSCL 05B

An experiment designed to collect in situ physical oceanographic and meteorological data for verification and evaluation of SEASAT sensor performance is described. The experiment was carried out from ships, aircraft, and buoys. An inventory of all physical oceanographic and meteorological surface truth data collected during the experiment from each of the participating platforms is presented. 

J.M.S.

N80-13753# EG and G Washington Analytical Services Center, Riverdale, Md.


The statistical variations in the sample gate outputs of the GEOS-3 satellite altimeter were studied for possible sea state information. After examination of a large number of statistical characteristics of the altimeter waveform, it was found that the best sea predictor for H-1/3 in the range of 0 to 3 meters was the 75th percentile of sample and hold gate number 11. 

R.E.S.

N80-14390# Naval Ocean Research and Development Activity, Bay St. Louis, Mo. Mapping, Charting and Geodesy Development Group.


This note is intended to acquaint interested parties with the anticipated deployment of Hydrographic Airborne Laser Sounder (HALS). Data acquisition, data processing, data reduction rationale,
data density, test results, and environmental considerations are covered. The document is intended primarily as presolicitation information for the HALS procurement.

**N80-14663#** Naval Postgraduate School, Monterey, Calif.

A STUDY OF THE RELATIONSHIP BETWEEN OCEANIC CHEMICAL MESOSCALE AND SEA SURFACE THERMAL STRUCTURE AS DETECTED BY SATELLITE INFRARED IMAGERY M.S. Thesis
Don Alan Nestor Jun. 1979 93 p refs (AD-A074186) Avail: NTIS HC A05/MF A01 CSCL 08/10

In recent years the study of ocean fronts and eddies has become increasingly important to the U.S. Navy for they are of vital importance in understanding underwater sound transmission. From the history of satellite pictures for the area of the ocean off the central California coast, it appears that cold water which has come to the surface as a result of upwelling has become intertwined within the California current. The persistent thermal features in the sea surface which are formed were the subject area of this study. Direct telephone contact was established with the satellite receiving station which afforded real time satellite information as to the thermal structure of the sea surface on a mesoscale. This satellite sensed thermal structure was then compared with in situ nutrient and temperature data collected on three cruises on board the research vessel ACANIA. The agreement between the in situ data and the satellite imagery was very strong and the utilization of satellite imagery was shown to be a very effective method to locate an ocean front.

**N80-14664#** Polar Research Lab., Inc., Santa Barbara, Calif.

ARCTIC RESEARCH IN ENVIRONMENTAL ACOUSTICS (AREA). TECHNICAL REPORT NO. 8: ARCTIC LEAD-AIRDROP DATA BUOY

Arctic data buoys are capable of data collection that is impractical of accomplishment by manned-station techniques primarily because of high logistics costs. These cost differentials can be even further reduced by buoya paradrop. Size, weight, and power limit the usefulness of such devices, but their most serious drawback has been automatic deployment of sensors under the ice. A new concept which employs a data buoy that is designed for airdrop into open water leads of opportunity, is powered for up to a year's life, and uses the new TIROS-N ARGOS system for position and data recovery which offers promise in solving these problems. The configuration of the buoy, called 'LAD' (Lead Air Droppeable), is described along with the results of preliminary Arctic field tests of the concept. Because of the limited nature of those tests, viability of the approach is not yet established, and additional trials are planned for spring 1980.


OCEAN WAVE SPECTROMETER MEASUREMENTS IN THE GULF STREAM EXPERIMENT Final Report

By assuming finite conducting, Gaussian-distributed, statistically stationary and homogeneous ocean surface, the ocean wave spectrometer measurements made in the Gulf Stream Experiment have demonstrated the capability of inferring the directional wave number slope spectra by using the specular point model for look-angles of less than 20 degrees. These measurements have also demonstrated the necessity of independent measurements of wind direction, mean square surface slope, and foam and spray. The results also indicate that at least four independent directional measurements with spatial resolution of 0.1 meters or smaller and spatial coverage of 750 to 1000 meters are necessary.

**N80-15543#** National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.

SURVEY OF SATELLITE SENSORS AND DATA WITH APPLICATION TO OTEC RESOURCE AND OPERATIONS REQUIREMENTS
George A. Maul, Fred M. Vukovich, Mark Bushnell, and Bobby W. Crissman Mar. 1979 80 p refs (PB-300297/9; NOAA-TM-ERL-AOM-L37; NOAA-79081002) Avail: NTIS HC A05/MF A01 CSCL 22A

The existing instruments and the capability of those instruments for observing geophysical variables that contribute to surface thermal resource fluctuations, the operating environment, and the impact of an ocean thermal energy conversion plant on the ocean are summarized. It is emphasized that remote sensing is not capable at this stage in its development to independently provide all the observations necessary for measurement of a given variable. Only an integrated in situ and remotely sensed measurement system can offer high quality data needed for environmental research.

**N80-15603#** Research Triangle Inst., Research Triangle Park, N. C.

SEA-SURFACE TEMPERATURE VARIABILITY ANALYSIS OF POTENTIAL OTEC SITES UTILIZING SATELLITE DATA Final Report

An analysis of the constancy of the sea-surface temperature in candidate locations for ocean thermal energy conversion (OTEC) siting was performed. Satellite infrared data were used to identify and locate major thermal fronts at the sea surface. These data were then used to glean certain statistics on these fronts. In situ data were used, when available, to determine temperature difference across specified thermal fronts. The study was performed in three regional locations of interest to OTEC. The specific regions are: Region I, Eastern Gulf of Mexico (bounded by 22 N to 30 N and 91 W to the west coast of Florida including the Straits of Florida); Region II, the east coast of Florida (bounded by 23 N to 32 N and the east coast of Florida to 79 W); and Region III, Puerto Rico and vicinity, (bounded by 17 to 19 N, 64 to 68 W). Results are presented and discussed.

**N80-15772#** Environmental Data and Information Service, Washington, D. C.

INTERNATIONAL DECADE OF OCEAN EXPLORATION, VOLUME 7 Progress Report, Apr. 1977 - Apr. 1978

A number of programs concerned with the use of the ocean and it's resources are presented. Specific programs dealing with environmental quality, improving environmental forecasting, expanding sea bed assessment activities, and developing an ocean monitoring system are described. Information, data inventories, and lists of scientific reports derived from U.S. IDOE projects are presented. A.W.H.
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.


The book deals with experience and practical use of aerial measurements of snow water equivalent from passive terrestrial gamma radiation. The potentialities of such methods in the solution of various hydrological and agricultural-meteorological problems is discussed and the principles of snow gauging by airborne radiological surveys are examined. A gamma radiation system for aerial snow surveying is examined and the error of the system is assessed. V.P.


The present study was carried out in order to determine the nature of seaward dispersion of estuary waters and suspended sediments during spring tide and high river flow in the Gironde inlet area. On June 3, 1977, three flights were made over the inlet at mid-ebb, low tide, and mid-flood. Thermal IR coverage was obtained along with black and white photographs. These data were correlated with accompanying measurements of current velocity, salinity, temperature, and suspended sediment concentration. B.J.


Enhanced nighttime thermal infrared imagery and digital data from a NOAA polar orbiting satellite were used to map drainage patterns and landforms in North and South Dakota. Features delineated include the Missouri Escarpment from Saskatchewan to the Nebraska border, the Manitoba Escarpment, Coteau des Prairies, recessional moraines on the Coteau du Missouri and partial drainage boundaries for the following rivers: James, Big Sioux, Minnesota, Red of the North, Souris, and the main stem of the Missouri plus its western tributaries in the Dakotas. In several instances drainage from gentle slopes in the Midwest was discerned and correlated with local relief. Analyses of satellite digital thermal data for western tributaries of the Missouri River revealed north-facing slopes to be warmer than south-facing slopes by an average of 1.5 C. Comparisons of ground and satellite temperatures for 11 stations in South Dakota showed good agreement.

(Author)


The combined use of additive viewing and digital processing of Landsat-2 imagery of part of the Pantanal of Brazil has allowed detailed maps of the drainage network to be constructed. The distributions have been made of wet and dry areas, including differentiations of clear water, water containing suspended sediments, and categories of land with differing moisture conditions. Some unconventional use of color filters and MSS band combinations are suggested in order to extract maximum information from the imagery. Density slicing has allowed gray-scale values to be placed on the three categories of land identified. The distributions of the identified categories are verified by comparing the information from the visual classification with the classes isolated by density slicing.

(Author)


The determination by aircraft of the euphotic depths of three lakes in distinct trophic states is presented. Numbers of white panels, analogous to Secchi disks, submerged in Lakes Monate, Comabbio and Varese in northern Italy to various depths that were visible from an altitude of 1000 feet were counted, and the depths at which the panels were visible were compared with on-site conventional Secchi disk depth determinations in order to obtain a relation between panel visibility and euphotic depth. The reliability and reproducibility of the method are discussed, and it is noted that the depths obtained are considered to be predominantly functions of plankton content in the oligotrophic, eutrophic and polluted lakes.

A.L.W.


Research supported by the Tennessee Technological University and U.S. Department of the Interior.


Techniques for snow-cover mapping from imagery acquired by satellites are discussed. Multispectral scanners aboard the satellites of the Landsat series provide high-resolution imagery (80 m ground resolution) which can be interpreted visually, directly or using...
different image-enhancement techniques, and which is also available in digital form for computerized mapping systems. The imagery covers 185- by 186 km areas and is almost orthographic when used for direct mapping at the common scale of 1:1,000,000. The main limitation is that only one observation is available every 9 days. Meteorological satellites provide small-scale imagery in the visible and infrared parts of the spectrum on a daily basis and have horizon-to-horizon coverage. This imagery is used for operational snow-cover mapping in large watersheds. The main disadvantages are low resolution and geometric distortion, though recent research indicates that geometric correction, image enhancement and snow-cover measurements could be accomplished by computer processing of the satellites’ digital data. V.P.


The chronological development and diminution of six floods in eastern Australia during January, February, and March 1974 were mapped for the first time by the Nimbus Electrically Scanning Microwave Radiometer (ESMR). Day and nighttime ESMR (19.35 GHz) coverage was analyzed for the low gradient, flooded Darling River system in New South Wales. Apparent movement of surface water as indicated by low brightness temperatures (less than 250 K, day and less than 240 K, night) was easily followed around the curved runoff basin along the northern shoreline of the flooded Darling River during this 3-month period. This pattern was in good agreement with flood crest data at selected river height gage stations, even under cloudy conditions. (Author)


A year-long study of four river deltas, using color infrared photography at three-month intervals, showed clearly the impact of damming the lower river or channelizing its outlet on the wetland environment. An important result of the season's photography was the dramatic appearance of the detrital material being flushed out of the deltaic wetlands by flood waters, and moved down into the lower estuaries for use by the marine organisms in the lower tropical levels. The species makeup and relative vigor of the deltaic plant communities were well recognizable on the imagery, as was the flushing mechanism in one stillivable delta marsh. V.P.


Landsat digital data from the July 24, 1976 overflight was used in conjunction with existing water quality information to produce color coded maps of Secchi Disc depths and chlorophyll a concentrations within the lakes of north central Minnesota. Regression analysis of the radiance values and the water quality data indicated a relationship between Secchi depth and the ratio of Landsat band 4 to 5, and a relationship between chlorophyll a to band 6. The Landsat water quality data has provided local land use/water managers with a useful data base so they may better implement the policies fashioned by the decision makers. (Author)


A possible solution to the present fragmentary climatic record is the measurement of closed-basin or Playa lakes - water bodies with no physical outward flow nor evaporative outflow. Remote sensing offers methods by which such measurements can be made over large parts of the earth, possibly using automated technique. In the present paper, the theoretical and practical bases of Playa lake measures are discussed. It is suggested that the nature of these measures, resulting from a combination of meteorological variables and such things as soil properties and landform, may constitute an ideal source of information on actual available water - providing data far more useful than those resulting from meteorological instruments. V.P.


Lakes of various sizes, depths and ice thicknesses in Alaska, Utah and Colorado were overflown with passive microwave sensors providing observations at several wavelengths. A layer model is used to calculate the microwave brightness temperature, T sub B (a function of the emissivity and physical temperatures of the object), to calculate the microwave brightness temperature, T sub B (a function of the emissivity and physical temperatures of the object), or snowcovered ice underlying water. Calculated T sub B's are comparable to measured T sub B's. At short wavelengths, e.g., 0.8 cm, T sub B data provide information on the near surface properties of ice covered lakes where the long wavelength, 21.0 cm, observations sense the entire thickness of ice including underlying water. Additionally, T sub B is found to increase with ice thickness. 1.55 cm observations on Chadar Lake in Alaska show a T sub B increase of 38 K with an approximate 124 cm increase in ice thickness. (Author)

N80-10567* Smithsonian Institution, Washington, D.C. ANALYSIS OF WATER COLOR AS SEEN IN ORBITAL AND AERIAL PHOTOGRAPHS OF CAPE COD, NANTUCKET, AND MARTHA'S VINEYARD, MASSACHUSETTS Tracey Tisdall and Farouk El-Baz In NASA Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 455-480 refs

Avil: NTIS HC A99/MF A01 CSCL O8J

Coastal water color was analyzed in two Apollo-Soyuz photographs. The natural color of the photographs enabled recognition of shoals and suspended sediments, sediment transport
N80-10572#Smithsonian Institution, Washington, D. C. SUSPENDED SEDIMENT DISPERSAL PATTERNS OF RIVER DELTAS PHOTOGRAPHED BY ASTP. Ted A. Maxwell In NASA Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 521-530 refs
Avail: NTIS HC A99/MF A01 CSCL 08H
Orbital photographs of five river deltas are presented. Suspended sediment plume patterns are identified and are related to models of sedimentation in a deltaic environment. The relative effects of river inertia, buoyancy of suspended matter, and turbulent bed friction are evaluated using delta geometry and plume pattern.
A.W.H.

N80-10574#Texas Univ. at Austin. SOUTH AMERICAN RIVER MORPHOLOGY AND HYDROLOGY. R. K. Holz. V. R. Baker, S. M. Sutton, Jr., and M. M. Penteado-Orellana Fundacao Unin. de Brasilia / In NASA Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 545-594 refs
Avail: NTIS HC A99/MF A01
A guide to the hydrologic properties of streams in the Amazon and Paraguay Basins is presented. Photographs are presented from the Apollo Soyuz Test Project of the Amazon Basin. Stream regimes, including analyses of meander wavelengths, floodplain development, and basin morphology are discussed. Basin size, drainage network density, floodplain width, vegetation types and density, climatic factors, and terrain variability are assessed. Adjustments of changes in river morphology caused by altered water and sediment discharges and by quaternary climatic changes are discussed.
A.W.H.

Avail: NTIS HC A99/MF A01 CSCL 08L
Photographs from the Apollo Soyuz Test Project of snow covered areas in the northwestern United States and Canada, the Chilean Andes, and the southern Alps of New Zealand are discussed. The photographs are analyzed and a tendency for the snowline elevations to be lower in the areas surrounding the permanent snowfields and glaciers than in areas of seasonal snowpack is examined.
A.W.H.

N80-10590#University of Eastern Michigan, Ypsilanti. Dept. of Geography and Geology IMPACT OF GREAT LAKES WATER LEVEL FLUCTUATIONS ON COASTAL WETLANDS Final Report, 1 Oct. 1976 - 30 Nov. 1978 Eugene Jaworski, C. Nicholas Raphael, P. J. Mansfield, and Brooks B. Williamson Apr. 1979 364 p refs (Contract D1-14-0001-7183) (PB-296403/9; W79-07001; OWRT-B-045-MICH1) Avail: NTIS HC A16/MF A01 CSCL 08H Field measurements were collected at seven study areas along Lakes Michigan, Huron, St. Clair, and Erie. Surface landforms were mapped and models of the four coastal wetland types were developed. With the aid of aerial photography and field sites, the zonal plant communities were identified and three historical distribution maps were constructed which represented various lake level conditions. Field data indicate that water level, wave energy, and substrate type are important factors in determining the shifting of plant communities in response to lake level fluctuations.
A.W.H.

This report discusses the application of several modern geophysical techniques to groundwater exploration in areas in permafrost. These methods utilize the principles of magnetic induction and radiowave Surface impedance in the 10- to 400-kHz band, the techniques of impulse and side-looking radar in the 50- to 10,000-MHz band, and also some optical techniques using imagery obtained from a satellite. Low frequency case studies demonstrate the use of the techniques for detecting free water under an ice cover in shallow, almost completely frozen lake basins, and thaw zones within lake beds, stream channels, and in permafrost in general. The radar studies demonstrate the use of these techniques for determining depth of free water and ice cover thickness on lakes and rivers.
A.W.H.

The use of aerial and satellite imagery in hydrologic studies, including water resources planning and management, is discussed. The abstracts cover remote sensing studies of water quality, soil moisture, floodplain delineation, ice cover, and determination of snow depth and water equivalent. This updated bibliography contains 210 abstracts, 22 of which are new entries to the previous edition.
A.W.H.

Avail: Issuing Activity Measurements devised to determine the characteristics and concentrations of three groups of substances (those producing a yellow/brown coloration, suspended matter and phytoplankton) are described. If qualitative and quantitative information is to be deduced, account must be taken of contributions to the measured signal arising from ground surfaces, interfaces and the atmosphere. Backscattered radiation fields are related to concentration levels.
Author (ESA)
N80-12493# Freiburg Univ. (West Germany).
INTERPRETATION OF WATER QUALITY USING REMOTE SENSING TECHNIQUES [ZUR INTERPRETATION DER QUALITÄTEN VON WASSERKÖRPERN AUS FERNERKUN- DUNGSJAUZIFICHEN]
Avail: Issuing Activity

HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Jul. - Sep. 1979
Donald G. Moore, Principal Investigator and J. L. Heilman Sep. 1979 3 p ERTS
(Contract NA55-24206)
(E80-10002; NASA-CR-162379; SD SU-RSI-79-15) Avail: NTIS HC A02/MF A01 CSCL 08H

N80-12520# National Oceanic and Atmospheric Administration, Washington, D.C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENTS Quarterly Report
Donald R. Wesner, Principal Investigator. David F. McGinnis, and Michael Matson 2 Oct. 1978 9 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E80-10004; NASA-CR-162381) Avail: NTIS HC A02/MF A01 CSCL 08B
The author has identified the following significant results. Additional analyses of Luvene, Minnesota ground data revealed that soil moisture variations are independent of elevation effects. Tidal fluctuations in the Potomac River and Delaware Bay were examined as a function of surface temperature. Preliminary findings suggest that temperature boundaries are sufficient to detect various stages of the tidal cycle in Delaware Bay, but are as yet uncertain for prediction in the Potomac River. At least three additional cases are needed to completely evaluate the tidal cycle. An alphanumeric printout at a scale of 1:1,000,000 compares closely with a 1:1,000,000 scale DMD image of the Chesapeake Bay region.

N80-12522# Commission of the European Communities, Ispra (Italy).
MAPPING THERMAL INERTIA, SOIL MOISTURE AND EVAPORATION FROM AIRCRAFT DAY AND NIGHT THERMAL DATA
J. Dejace, Principal Investigator. J. Meger, M. Kohl, G. Maracci. P Reinhoer, G. Tassone, and J. Huygen 1978 10 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Proj. TELLUS)
(E80-10006; NASA-CR-162383) Avail: NTIS HC A02/MF A01 CSCL 08G

N80-12527# Pennsylvania State Univ., University Park. Dept. of Meteorology.
REMOTE ESTIMATION OF SURFACE MOISTURE OVER A WATERSHED M.S. Thesis
Paul Jeffrey Kocin, Principal Investigator Nov. 1979 70 p refs Sponsored by NASA ERTS
(E80-10025; NASA-CR-162368) Avail: NTIS HC A04/MF A01 CSCL 08H
The author has identified the following significant results. Contoured analyses of moisture availability, moisture flux, sensible heat flux, thermal inertia, and day and nighttime temperatures over a Missouri watershed for a date in June and in September show that forests and creeks exhibit the highest values of moisture availability, whereas farmlands and villages are relatively dry. The distribution of moisture availability over agricultural districts differs significantly between the two cases. This difference is attributed to a change in the surface's vegetative canopy between June and September, with higher moisture availabilities found in the latter case. Horizontal variations of moisture, however, do indicate some relationship between moisture availability and both local rainfall accumulations and the nature of the terrain.

U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: BEAVER CREEK WATERSHED Janet Bonner, comp. 1979 99 p refs
(PB-297442/6) Avail: NTIS HC A05/MF A01 CSCL 08B
Remotely sensed data gathered from spacecraft and aircraft is presented.

N80-13606# Edgerton, Germershausen and Grier, Inc., Las Vegas, Nev.
DEVELOPMENT OF AN AIRBORNE GAMMA RADIATION SYSTEM FOR SNOW SURVEYS
(EGG-1183-1679: CONF-790495-1) Avail: NTIS HC A02/MF A01
The use of NaI(Tl) gamma detectors with a full gamma energy spectrum pulse height analyzer together with a small computer provides a self contained and flexible system for snow surveys. The dual detector method determines atmospheric radon perturbations in the detection system. Detailed calibration experiments must be performed to determine twenty parameters that describe the physical nature of the system. Multiple high altitude and lake flights are used to obtain background components. Simulation pads, loaded with varying concentrations of K-40, Th-232, and U-238, yield photopoeue stripping coefficients and basic system sensitivity. Multiple altitude flights over land lines provide air attenuation coefficients which may be converted to water attenuation coefficients.

N80-13609# World Meteorological Organization, Geneva (Switzerland). Hydrology and Water Resources Dept.
SPACE OBSERVATIONS FOR WATER RESOURCES: A POTENTIAL TO BE DEVELOPED
Avail: NTIS HC A02/MF A01
Information is presented concerning the data requirements that were established for work in hydrology and water resources and mention is made of the use of spacecraft for the transmission of hydrological data. It was concluded that a dialogue should be established between those supplying the data and investigating their potential uses and those actually engaged in the assessment and management of water resources. Author (ESA)

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SNOW MAPPING FROM SPACE PLATFORMS

K. I. Itten 1979 23 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979 Submitted for publication

Present knowledge of snow mapping from space is reviewed, discussing the problems of optimum resolution, periodicity, features to be measured, and wavelength bands to be used. The requirements for analog and digital data analysis are described, recommendations given, and questions on the economic implementation of such methods raised. It is concluded that the various newly developed satellites for meteorology, Earth and marine resources do not yet constitute a major breakthrough in solving the task of snow mapping.

Author (ESA)

STRATEGIES FOR THE SURVEILLANCE OF COASTAL WATERS OF THE FEDERAL REPUBLIC OF GERMANY Final Report


Strategies for surveillance of anorganic and organic pollutants in coastal waters are necessary to fulfill international conventions. The development of a realistic strategy for the surveillance of low and slowly changing concentration levels is intended. The analysis of collected data show that the knowledge of anorganic pollutants surpasses the knowledge of organic pollutants. The necessary detection limits are in the range of ppb for anorganic and ppt for organic pollutants. Existing measuring devices are presented and discussed with regard to their useful ranges and merits. In addition, the possible potential and use of biological indicators as well as of remote sensing is discussed. The resulting strategy consists of a three element approach (coordination of existing activities, installment of a central institution, special activities regarding accidents with pollutants) based on sampling, preparation, the use of laboratories, and scientific interpretation.

Author (ESA)

TOPOGRAPHICAL CHARACTERISTICS THROUGH THE STUDY OF THE THERMAL AND HYDROLOGICAL DISUNIFORMITY OF THE SOIL FROM THE MESOSCALE. AN APPLICATION TO LOCAL FORECASTING OF AMBIENT TEMPERATURE FROM THE TELLUS PROJECT [IL TELERILEVAMENTO PER LO STUDIO A MESOSCALA DELLE DISUNIFORMITÀ TERMICHE ED IDRICHE DEL SUOLO. APPLICAZIONE ALLA PREVISIONE LOCALE DEI TEMPERATI"

E. Rosini and P. Caponigro. Principal Investigators 1977 6 p In ITALIAN

Early results of an experimental and theoretical investigation into the technical aspects of airborne laser bathymetry are presented in the following papers: (1) Laser Bathymetry for Near-Shore Charting Application (A Status Report); (2) Laser Hydrography; (3) Bathymetry Intercomparison: Laser vs. Acoustic; (4) Laser Application for Near-Shore Nautical Charting; (5) Laser Bathymetry for Near-Shore Charting Application (Preliminary Field Test Results); and (6) Theoretical Characterization of Bottom Returns for Bathymetric Lidar.

Author (NASA)
**DATA PROCESSING AND DISTRIBUTION SYSTEMS**

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

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The paper presents an analytical method for determining object coordinates from photographs obtained from an infrared line-scanning system with mechanical scanning, under the condition that the image geometry is known. The method is useful in remote sensing studies of earth resources.

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At present, an important problem preceding the application of satellite multispectral scanning (MSS) data for inventory of earth resources surveys is the selection of the most relevant scenes for interpretation purposes. The most promising satellite MSS data for multitemporal studies of earth resources can only be obtained if careful consideration is given to the following factors: cloud cover, image quality, snow cover, bioclimatic (soil moisture), vegetation/crops, and sidelap. These factors are necessary for both visual interpretation and digital analysis of Landsat MSS data. As outlined in the paper, a terminal connected to data bases of space imagery, e.g., EROS (USA) or ESRIN (Italy), may speed up the time-consuming iterative process of selection of satellite imagery. A data base, obtained by the coordination, standardization and exchange of data of the various receiving stations, distribution centers and documentation institutes, would be an essential step in optimizing the selection, interpretation and application of satellite MSS data.

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The paper examines an inexpensive radar mapping technique employing a real aperture side-looking airborne radar. The fundamental principles of real aperture SLAR are reviewed, noting that experience has shown that good radar maps can be achieved with radar installed in a light business aircraft without sophisticated antenna stabilization. Attention is given to the following major applications: oil spill mapping, sea ice mapping, ship detection, including supervision of fishing, monitoring of borders, and supervision of sea traffic. In addition, use for land mapping is also covered. It is concluded that such a system is flexible and has high availability.

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The digital terrain data produced at the Defense Mapping Agency Aerospace Center (DMAAC) supports a wide variety of products, including input to radar simulators, guidance systems and automated cartographic systems. To facilitate the display of the data bases for analysis, DMAAC has developed the capability for computer generation of digital image displays of the terrain data in the form of gray level elevation coding, contouring, variable sun angle shaded relief and computer generated sensor scenes, including perspective views, stereopairs, and synthetic radar displays. All of the examples shown in this paper were generated at DMAAC on a UNIVAC 1000 series computer and reimagined onto film format using an Optronics scanning, digitizing and reimaging (SDR) system. It is shown that digital terrain data bases may be effectively displayed in various image formats. This capability has proven to be a valuable editing and analysis tool for the production and specification refinement of digital terrain data.

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**A80-11697** // Combined Skylab and high altitude aircraft photography space triangulation. M. E. O. Ali and A. J. Brandenberger (Université Laval, Quebec, Canada). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 354-373. 6 refs. Research supported by the National Research Council of Canada and Department of Energy, Mines and Resources.

The paper is concerned with an investigation designed to study a combination of high-altitude aircraft photography and Skylab photography aerial triangulation. The discussion covers a brief description of the materials used in the investigation, selection of an appropriate number of control and/or pass points, bundle adjustment algorithm for aerial triangulation of space photography, and tests and results. The various procedures studied and developed produced a planimetric accuracy of approximately 20 m in the best case. Such a ground control accuracy would be sufficient for 1:100,000 mapping and even for 1:50,000 (reconnaissance) mapping. The Skylab photography appears to be useful in areas of the earth were there is no control vary of any type except the coordinates of some points which can be measured on small-scale maps.

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The paper discusses the development and features of the French SPOT remote sensing satellite (SPOT standing for Satellite Probatoire d'Observation de la Terre, i.e., Earth Observation Test Satellite). Attention is given to an assessment of the geometric quality of the images using computer simulation with allowance for the satellite dynamics and ground data processing. The assessment of the geometric quality of the SPOT imagery is made by comparison with usual map projections. The simulation indicated the potential accuracy of the SPOT level 1 images and was effective in defining the ground data processing required.

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Analysts conducting supervised land-cover classification often rely solely on statistical divergence or separability measures for feature selection. Consequently, they may fail to appreciate the relatively consistent spatial clustering and degree of overlap among training class spectra. A graphic method of analyzing training class statistics is presented which allows analysts to view parallelepipeds in
three-dimensional space and interactively vary viewing azimuth and elevation angles for optimum visual examination. Up to three channels may be examined at one time. It is hoped that the graphic method will supplement statistical measures, resulting in improved feature analysis and selection. (Author)


A methodology for enhancing the significant spectral features in Landsat data is introduced. The process, by which significant spectral features are determined, uses a minimum entropy model to guide subsequent analysis efforts. Classification results using traditional and minimum entropy method are presented and discussed. (Author)


A simple method for generating digital terrain surfaces as a function of only the terrain standard deviation is presented. This is accomplished by fitting a postulated autocorrelation model to actual terrain data. Observed relations between model parameters are used to obtain a one-parameter model. (Author)


The present paper describes the compilation of land systems, geomorphology, soils, vegetation and land use maps of some 80,000 sq km in the Southern Darfur Province of Western Sudan, from 1/250,000 scale color-composite bulk-processed Landsat 1 imagery. Manual methods of interpretation and map compilation were used and backed by field studies. Particular attention is given to the problem of locating interpreted boundaries in the field and other practical constraints likely to be encountered when using satellite imagery for regional studies in remote and inaccessible areas. The mapping examples include a comparative study of resource maps compiled from conventional aerial photography and ground survey with those compiled from satellite imagery of a part of the survey area. (Author)

**A80-15773**  The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory. C. J. Lawrance (Department of the Environment, Transport and Road Research Laboratory, Crowthorne, Berks., England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 13, 15. 16.

The practice of using aerial photographs to map terrain and materials is well established, but the ability of land classification to predict soil conditions is most successful in areas of stable geomorphic environment, dry climate, simple geology and soil relief. Ethiopia for the most part possesses these attributes, and has, therefore, been the subject of a high level terrain classification at 1.2 million, using Landsat imagery. Geological, topographic and soils maps, and local experience provided background information. Sixty-seven 'natural regions' were defined, describing the geology, topography, climate and drainage of each region, with comments on engineering soils and construction materials. The space imagery provided detail that was impossible to achieve by any other means, but a limitation was found to be the lack of resolution at the small scale used. A scale of 1:1 million or 1:500,000 would have considerably aided interpretation. (Author)


A program involving the use of aerial photography and remote sensing data for resource management is detailed. The program, adopted by the Department of Natural Resources of the State of Washington, includes the acquisition, at various scales and emulsion types, of photographs of over 70 percent of the State on a 8-10 year schedule. Nearly a quarter of a million photographs dating back 25 years are on file now. Some applications of this multidata photography are: monitoring forest resource and forest management activities, forest fire detection, and monitoring beds of navigable waters and areas of potential land subsidence. Remote sensing data collected by thermal scanning sensors are used for fire spotting and mapping, and multispectral Landsat data are used for forest inventory and productivity monitoring. V.L.


Landsat digital data are presently available by frames whose size and location are determined by satellite orbit. The utility of Landsat data was increased by the image processing support for JPL's planetary program which provided the basic software and procedures necessary for image mosaicking. The computer software has been extended to perform this task on Landsat Multi-spectral scanner imagery and a ten frame digital mosaic of the Southern California desert has been completed. Major processing steps include location of geographic points in the digital frame and of common geographic points in adjacent frames, conversion to a map projection, lateral 'rubber sheet' correction of the digital frames, brightness correction of adjacent frames, and mosaicking of the frames to eliminate overlap and produce a single large frame. (Author)


An approach to digital processing, as developed at ITC, is outlined and examples of its application to the Himalayas and Central Java are given. The central theme in the approach is the reduction of the dimensionality for generating color coded hard copies for interpretation and for carrying out automatic classification. Methods to achieve this aim are discussed. Black box methods are avoided and the interpreter guides all steps of the procedures by using the reduced feature space as a medium for decisions. As applied to land-use mapping of complex areas in the developing countries, the results indicate that where automatic classification partly fails visual interpretation, transfer of data from other sources, or temporal
data, can be done in the same line of operations. In both test areas the processed imagery form excellent base maps for incorporating results of selected field traverses.

(Author)


A80-17540

This volume addresses problems associated with achieving image recording in the face of various types of distortion. Papers reporting recent and ongoing research and development activity in techniques and analysis, devices and systems, as well as future concepts, are presented. Six problem areas are considered: scene matching (two sessions), aerial image techniques, digital processing of aerial images, image understanding, feature operators, and synthetic reference image preparation. Topics of interest include scene matching with feature detection, optimum filters and windows for image registration, computer modeling of optical trackers, performance evaluation of image correlation techniques, measuring scene content from aerial images, edge and line enhancement by adaptive lattice filtering, and automatic stereo reconstruction of manmade targets.

S.D.


Vegetation in a variety of wetland types in the Shelburne Pond, Vermont area was mapped using small scale aerial photographs. Color infrared, conventional color, and black-and-white multi-band photographs were studied using a zoom stereoscope and additive color enhancement techniques. The floristic composition of plant canopy associations and corresponding recognition characteristics are presented. Emphasis is given to ground control and a familiarity with plant ecology, as requisite elements in the interpretive process. Selected observations are made regarding the ecological significance of signature patterns. Film types were evaluated based on three parameters: association discrimination, size of minimum mapping unit, and ease of interpretation. Color infrared was found superior for this application, and conventional color was better than the color enhanced multi-band, which was at much smaller scale. However, the color enhanced multi-band imagery did offer more information about some plant groups than did color, especially where long wave reflectance was a key recognition element. The use of actinic infrared is recommended for future wetland vegetation investigations.

(Author)

A80-19923 # Orientation problem of SLAR imagery. A. Okamoto (Kyoto University, Kyoto, Japan). Kyoto University, Faculty of Engineering, Memoirs, vol. 41, July 1979, p. 293-307. 6 refs.

This report treats the orientation and restitution problem of SLAR imagery theoretically. The orientation problem is discussed for both single and stereo SLAR configurations. For the former, an analytical orientation method constructed on the geometrical basis of SLAR imagery already studied is proposed. For the latter, an orientation technique is developed to calculate the exterior orientation parameters of the antenna for stereo SLAR imagers simultaneously. With this method the analysis of SLAR imagery may be performed three-dimensionally and more accurately than before. In both cases, some functional form, such as polynomials or Fourier series, is used to model the behaviors of the exterior orientation elements of the antenna along the flight path, as in the analysis of MSS imagery. By linearizing the equations for the orientation problem of single SLAR imagery, error equations for the restitution problem of SLAR imagery are obtained. Simple restitution methods of SLAR imagery for a flat terrain and also for a hilly ground surface are introduced, and some characteristics are clarified.

(Author)


The papers deal with the application of aerial-photography, image-scanning, thermal infrared remote sensing, multispectral photography, and radar technologies to environmental monitoring, digital mapping, and other photogrammetric applications. Among the topics covered are: the principles of thermal infrared remote sensing for heat cost determination; aerial photographic methods for the detection of submerged vegetation; remote sensing for monitoring resources for development and conservation of desert and semi-desert areas; a long-wave radar for geological analysis of vegetated terrain; densitometry in photogrammetry; and microprocessor and minicomputer assisted photogrammetric systems.

V.P.


Compared to certain European countries, the United States National Map Accuracy Standards are by far the loosest. Even so the thematic maps in the United States have not been designed to meet the standards. The technological advancements in remote sensors, photogrammetric instruments, digital precision processing have laid a sound foundation for producing base maps that meet the standards for thematic mapping. The Landsat imagery at the scale of 1:250,000 is one of the excellent resources for preparing a new generation of precision thematic maps. To reach this goal, it is proposed that a rule be established requiring the cartographer to label in the map legends whether efforts have been made to utilize precision base maps for preparing the thematic map.

(Author)


N80-10539# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. SUMMARY OF SIGNIFICANT RESULTS Farouk El-Baz (Smithsonian Institution). Delia M. Warner, and R. Thomas Giuli In its Apollo-Soyuz Test Project. Vol. 2 1979 1-8 ref Avail: NTIS HC A99/MF A01 CSCL 05B A summary of the visual and photographic study of specific earth features is presented. The areas selected were in the fields of geology, desert studies, oceanography, hydrology, and meteorology.

F.O.S.
Specific texture parameters were determined and an appropriate combination of parameters was selected in order to classify objects with the use of multispectral analysis. Forest and built-up regions were investigated. The methods employed involve gray scale evaluations, differentiating image data, line information and Fourier spectrum techniques. Preprocessing and image transformation procedures are applied. Some concrete examples and their treatments are presented. Author (ESA)


TEXAS APPLICATIONS SYSTEM VERIFICATION AND TRANSFER REMOTE SENSING INFORMATION SUBSYSTEM: FUNCTIONAL DESIGN

(Contract NAS9-15800)

(EBO-10017; NASA-CR-160342; LEC-13258; JSC-14785) Avail: NTIS HC A05/MF A01 CSCL 05B

N80-15478† Lockeandel Electronics Co., Houston, Tex.

CONSIDERATIONS FOR DESIGN OF FUTURE RESEARCH AND DEVELOPMENT INTERACTIVE IMAGE ANALYSIS SYSTEMS

Avail: NTIS HC A09/MF A01 CSCL 02C

Future interactive image analysis systems must provide for the increased processing requirements imposed by a thermal channel to LANDSAT-3 and the increased number of spectral channels with significantly higher spatial resolution provided by the LANDSAT-D thematic mapper. Other design considerations must include the rapidly changing technology in memories and special purpose processors, as well as the analyst-machine interface and the human factors involved. The centralized and distributed system approaches are examined in relation to the optimum design configuration of future systems. A.R.H.

N80-15493‡ Texas A&M Univ., College Station.

ON THE CLUSTERING OF DIMENSIONAL PICTORIAL DATA

J. D. Bryant, Principal Investigator in NASA. Johnson Space Center. Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 647-859 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57196 ERTS
(Contract NAS9-14689)
Avail: NTIS HC A09/MF A01 CSCL 02C

Obvious approaches to reducing the cost (in computer resources) of applying current clustering techniques to the problem of remote sensing are discussed. The use of spatial information in finding fields and in classifying mixture pixels is examined.
and the AMOEBA clustering program is described. Internally, a pattern recognition program, from which AMOEBA appears to be an unsupervised clustering program. It is fast and automatic. No choices (such as arbitrary thresholds to set split/combine sequences) need be made. The problem of finding the number of clusters is solved automatically. At the conclusion of the program, all points in the scene are classified; however, a provision is included for a reject classification of some points which, within the theoretical framework, cannot rationally be assigned to any cluster. A.R.H.

CLASSY: AN ADAPTIVE MAXIMUM LIKELIHOOD CLUSTERING ALGORITHM


(Contract NASA-15200) Avail: NTIS HC A99/MF A01 CSCL 02C

The CLASSY clustering method alternates maximum likelihood iterative techniques for estimating the parameters of a mixture distribution with an adaptive procedure for splitting, combining, and eliminating the resultant components of the mixture. The adaptive procedure is based on maximizing the fit of a mixture of multivariate normal distributions to the observed data using its first through fourth central moments. It generates estimates of the number of multivariate normal components in the mixture as well as the proportion, mean vector, and covariance matrix for each component. The basic mathematical model for CLASSY and the actual operation of the algorithm as currently implemented are described. Results of applying CLASSY to real and simulated LANDSAT data are presented and compared with those generated by the iterative self-organizing clustering system algorithm on the same data sets. A.R.H.

INTERPRETATION

LANDSAT is discussed. Related open questions are mentioned. Janet Bonner. comp. 1979 45 p

GRA

US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT ALEUTIAN ISLANDS NATIONAL WILDLIFE RANGE. PROJECT 8: CONSERVATION OF NATURAL AREAS AND OF THE GENETIC MATERIAL THEY CONTAIN

Janet Bonner. comp. 1979 45 p (PB 287931/8) Avail: NTIS HC A03/MF A01 CSCL 08G

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for changes and trends in forest cover, water area, and other diagnostic landscape features. Each data report lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

GRA
INSTRUMENTATION AND SENSORS
Includes data acquisition and camera systems and remote sensors.


A number of microwave superheterodyne semiconductor radiometers with input mixers have been developed for remote sensing of the atmosphere and underlying surfaces. The radiometers operate at frequencies of 89, 37, and 20 GHz. This paper presents a brief description of radiometer units and subunits. B.J.


This paper describes the first remote sensing data obtained from the indigenous satellite, 'BHASKARA', using a passive microwave remote sensor. The payload, Satellite Microwave Radiometer (SAMIR), is a three-channel microwave radiometric system, two of them operating in the 19-GHz band and the third in the 22-GHz band. SAMIR is one of the primary payloads on-board Bhaskara and its chief objectives are investigations of sea state, water vapor and liquid water content in the atmosphere and over the oceans adjoining the Indian subcontinent. The overland data gives synoptic information to soil moisture, snow cover and biomass studies of interest to applications in earth resources. The characteristics of the payload and the data obtained in the initial operations of the satellite are presented. (Author)


The paper deals with a unique aerial photographic acquisition program that contracts the collection of several scales of photography over approximately seventy percent of the state on a repetitive basis. The program is designed to provide a wide range of photographic products to meet the needs of resource managers at a reduced cost. The discussion covers the history and evolution of the program, types of photographic materials collected, cooperative aspects and advantages, and the administration of the program. V.P.


The papers deal with applications of remote sensing from aircraft and satellites to the surveying of extended taiga regions. Some aspects of the theory of landscape-structural interpretation of satellite imagery are reviewed, and mathematical methods of processing information obtained from image interpretation are outlined. Attention is given to methodological aspects of mapping extended forest and marsh areas, soils, and fire devastated regions. V.P.


The use and current status of multispectral recognition techniques for conducting wide-area environmental surveys are examined. It is shown that the difficulties arising due to changes in the reflection coefficient of a test site, caused by changes in position of the sun, can be eliminated by measuring the reflected radiation in a direction antiparallel to the direct solar rays. V.P.


A standard high-speed, field-portable spectroradiometric measurement system built around a programmable microprocessor has been adapted to the form of a Reflectometer/Comparator. In this configuration, the instrument makes passive measurements of the absolute reflectance of agricultural plant canopies over a spectral range of 0.4 to 2.5 micrometers. Real-time absolute measurements are made possible by an optical chopper which constantly compares the target with the sun, and makes extensive measurements of solar reflectance from a variety of these targets. The paper describes the instrumentation and measurement procedures, reviews the software programming and discusses the results. (Author)


The new generation of satellite-borne earth resources scanners, the Thematic Mapper, is being built for launch on the Landsat-D spacecraft. It will gather data for applications such as crop inventory, land use planning, forest management, and geography. This paper gives an overall design description, further discussion of principal design features, performance achievements where data are available, and system performance predictions. (Author)


An experimental pushbroom scan sensor, the Multispectral Resource Sampler (MRS), being developed by NASA for a future earth orbiting flight is presented. This sensor will provide new earth survey capabilities beyond those of current sensor systems, with a
ground resolution of 15 m over a swath width of 15 km in four bands. The four arrays are aligned on a common focal surface requiring no beam splitters, thus causing a spatial separation on the ground which requires computer processing to register the bands. Along track pointing permits stereo coverage at variable base/height ratios and atmospheric correction experiments, while across track pointing will provide repeat coverage, from a Landsat type orbit, of every 1 to 3 days. The MRS can be used for experiments in crop discrimination and status, rock discrimination, land use classification, and forestry.


Schneiter and Thompson have described the multispectral resource sampler - a visible and near visible sensor system for spaceborne assessment of earth resources, based on established technologies. In the present paper, it is shown how established technologies can be used to design an advanced earth resource sensor system in the 1985-1990 time frame.


Preprocessing that enables accurate matching of two images taken by sensors located at different points in space is presented. Separation between the sensors results in perspective changes that appear as geometric distortion. Two methods for removing the distortion are described. One method applies to sensors that measure range. The second method applies to sensors that do not measure range. Descriptions of the applicable sensor data formats, rationale for the preprocessing approaches and transformations used to implement the approaches are included. Examples comparing images before and after preprocessing are shown. (Author)


The paper considers the reduction and interpretation of satellite magnetometer data and details its morphology. These data are useful in the compilation, reduction, and analysis of magnetic survey data; suitable analysis such as screening and reduction to common altitude and inclination and consideration of the vector nature of the background field can provide valuable information for crustal studies. However, the reduction and interpretation techniques for satellite magnetometer measurements differ from methods applied to conventional data; they require modifications of several standard techniques although the unequal spacing, in three dimensions, of the satellite data and the variation in direction and intensity of the main geomagnetic field pose some interpretation problems. The variation in altitude of the satellite measurements can also be used in some analyses.

A.T.

An empirical method was developed to measure how solar and atmospheric conditions affect Landsat images by comparing Landsat MSS data with terrestrial reflectance. Terrain reflectance was measured with a four-channel radiometer designed to measure radiance in wavelength bands matched to the Landsat MSS data. Other instrumentation included a digital data logger, an irradiance meter, and a video camera. Reflectance of many terrain elements which could be registered to the Landsat digital data were measured from a low-flying aircraft. Correlations of reflectance with Landsat radiance verified a linear atmospheric model with an additive (path radiance) term and a multiplicative (transmittance) term. Coefficients from this model permit the extension of spectral signatures in computer-aided classification of Landsat images. (Author)


The digital sampling and playback capabilities of the PDS Microdenisometer are utilized to differentially rectify photographic images to produce orthophotos, stereomates, and other simulated-perspective reconstructions. A method is described whereby the input imagery can be non-orthogonally scanned, eliminating the necessity of resampling the digitized pixel data, and thus enabling high-resolution reconstructions while obviating the need for a large capacity, therefore expensive, control computer. Examples are given of the performance which can be expected of this system, in terms of resolution vs. throughput. (Author)

N80-11547 Technical Research Centre of Finland, Espoo. Lab. of Ocean Use. AUTOMATED EARTH RESOURCES SURVEYS USING SATELLITE AND AIRCRAFT SCANNER DATA: A FINNISH APPROACH


A tree-year multidisciplinary earth resources oriented remote sensing project was carried out to develop automated environment monitoring and natural resources inventory methods for Finnish conditions and to study the technical feasibility of such methods in the fields of water resources, geology, agriculture, and forestry. Both satellite (LANDSAT) and aircraft scanner data from several test sites in southern Finland were used in the study. Data acquisition and analysis procedures as well as the results obtained are discussed. The results justify more detailed remote sensing research on various problems in all fields cited. (Author ESA)

N80-12034 Office National d'Etudes et de Recherches Aerospatiales, Paris (France). SPECTROMETER FOR THE FIRST SPACELAB PAYLOAD


Avail: NTIS HC A06/MF A01
The grille spectrometer for measuring stratospheric and mesospheric composition, which will be mounted on board permits infrared measurements of active atmospheric constituents in the altitude range where their local concentration is higher than 100 million mol/cu cm. The instrument operates in two modes: in absorption with the sun as a source and in emission in the spectral ranges corresponding to the thermal emission of atmospheric gases. The instrument consists of a sighting system (tiltable front mirror), a radiation collector, a monochromator with output optics and detectors, and electronic subassemblies for the instrument command and its connection with the Spacelab electronic system. 

Author (ESA)

N80-12468 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

AIMS AND TASKS OF THE AIRCRAFT TEST PROGRAM [ZIELE UND AUFGABEN DES FLUGZEUGMESSPROGRAMS]


Avail: Issuing Activity

Studies were carried out for developing German remote sensing equipment for future participation in international satellite projects for global and regional environmental monitoring systems. Emphasis is given to work in the following fields: multispectral imaging techniques, development of systems for the digital treatment of images, applications to geoscience problems, evaluations for future technological developments, balanced organizational and interdisciplinary teams. Author (ESA)

N80-12469 Technische Universität, Hanover (West Germany).

ON THE CURRENT STATE OF REMOTE SENSING TECHNIQUES [ZUM GEGENWAERTIGEN STAND DER FERNERKUNDE]


Avail: Issuing Activity

Several different aspects of current work are discussed: radiation characteristics of various objects, choice of sensors, choice of platform, data processing (analog and digital), and the handling and interpretation of complex information. A specific problem which benefits from the exploitation of such techniques is then exposed: the Jade coast region. The economic importance of the region is underlined. It is concluded that a high resolution thermal sensor and an even higher resolution optical sensor are invaluable for coastal water and engineering studies. Author (ESA)

N80-12515 Freiburg Univ. (West Germany).

THE MULTISPECTRAL SCANNER AS AN INSTRUMENT FOR SIGNATURE DETERMINATIONS


Avail: Issuing Activity

The identification of objects by multispectral scanning supposes a knowledge of the spectral reflection characteristics of the surface investigated. The determination in situ of these characteristics has the disadvantage of requiring considerable apparatus and employing systems that enable only a few objects to be measured in a working day. A method of overcoming this difficulty is described, which enables various different objects in different regions to be studied under different image conditions. Examples are given. Author (ESA)

N80-12530 Texas A&M Univ., College Station. Remote Sensing Center.

THE SYSTEM AND HARDWARE DESIGN OF REAL-TIME FAN BEAM SCATTEROMETER DATA PROCESSORS Final Report

John P. Clasessen, Robert O. Stroud, Billy V. Clark, B. Randall Jean, and Richard W. Newton, Principal Investigator Mar. 1979 286 p refs EREP (Contract NAS8-15311)

(E80-10028; NASA-CR-160350; RSC-3556) Avail: NTIS HC A13/MF A01 CSCL 14B

N80-12533 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EXAMINATION OF LAMBERTIAN AND NON-LAMBERTIAN MODELS FOR SIMULATING THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA

Chris Justice and Brent N. Holben Sep. 1979 25 p refs Submitted for publication (NASA-TM-80557) Avail: NTIS HC A02/MF A01 CSCL 05B

As a preliminary step to developing a technique to eliminate the topographic effect from remotely sensed data, two radiance simulation models were examined and compared: A Lambertian and a non-Lambertian model were tested using hand-held radiometer measurements from a uniform surface at different slope angle aspect orientations. Linear correlation coefficients for the non-Lambertian model and the field spectra were calculated to be greater than 0.92 for all cases; whereas correlation coefficients for the Lambertian model varied from 0.06 to 0.98.

An assumption regarding an empirical constant within the non-Lambertian equation was found to be invalid and the model was improved by using subsets of the data to derive the empirical value. Author

N80-12534 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INTERIM CALIBRATION REPORT FOR THE SMMR SIMULATOR


The calibration data obtained during the fall 1978 Nimbus-G underflight mission with the scanning multichannel microwave radiometer (SMMR) simulator on board the NASA CV-990 aircraft were analyzed and an interim calibration algorithm was developed. Data selected for the analysis consisted of in flight sky, first-year sea ice, and open water observations, as well as ground based observations of fixed targets with varied temperatures of selected instrument components. For most of the SMMR channels, a good fit to the selected data set was obtained with the algorithm.

K.L.

N80-13608 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

THE GEOSCIENTIFIC AIRBORNE REMOTE SENSING PROGRAM Final Report


The Airborne Remote Sensing program, carried out from 1974 to 1977 in the Federal Republic of Germany, is part of an international operational system of earth observation satellites. Within five selected test areas, numerous flights were performed using different multispectral sensors. The data were systematically evaluated using advanced image processing procedures. The extensive results verify the significant contribution of remote sensing to the solution of application-oriented problems, such as environmental monitoring, and justify the continuation of this space program. Author (ESA)
**SPOT, FRENCH PREOPERATIONAL REMOTE SENSING SATELLITE SYSTEM**

Alan A. Scribot 1978 15 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979 Avail: NTIS HC A02/MF A01

The SPOT remote sensing satellite system is described, including mission objectives, choice of orbit parameters for the first SPOT mission, the SPOT system architecture, the payload and choice of sensor parameters, the standard platform, and the ground segment. The payload consists of two high resolution visible sensors scanning 60 km each with 20 m resolution in several bands and 10 m resolution in the 0.5 to 0.9 micron (panchromatic) band. SPOT is suited for vegetation and water studies, cartographic applications, and geology. Author (ESA)

**THE EARTHNET PROGRAMME**

L. Marelli In its Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 20-27

A European network for the acquisition, preprocessing, archiving, and distribution of remote sensing satellite data is described. Emphasis is placed on distribution of LANDSAT data and increased utilization of space derived remote sensing imagery, Establishment of a basic capacity to handle data from both American and European remote sensing satellites, to provide high standard products tailored to the needs of users, and to include second generation remote sensing missions such as LANDSAT-D, Seasat-B and C, space shuttle based remote sensing experiments, and planned European remote sensing missions for the first Spacelab flight is outlined.

**METEOSAT AND REMOTE SENSING APPLICATION**


The main characteristics of Meteosat and its associated ground system are described. The spacecraft orbit and attitude, mission objectives, and radiometer capabilities and image processing on the ground are discussed along with near real time image dissemination and the data collection platform sub-system. Remote sensing applications of Meteosat data are surveyed.

**PRESSURE MODULATOR RADIOMETER (PMR) TESTS**


The pressure modulator technique was evaluated for monitoring pollutant gases in the Earth's atmosphere of altitude levels corresponding to the mid and lower troposphere. Using an experimental set up and a 110 cm sample cell, pressure modulator output signals resulting from a range of gas concentrations in the sample cell were examined. Then a 20 cm sample cell was modified so that trace gas properties in the atmosphere could be simulated in the laboratory. These gas properties were measured using an infrared sensor.

**POSSIBLE METHODS FOR DISTINGUISHING ICEBERGS FROM SHIPS BY AERIAL REMOTE SENSING**

Walton L. Howes Dec. 1979 36 p refs (NASA-TM-79310; E-266) Avail: NTIS HC A03/MF A01 CSCL 08L

The simplest methods for aerial remote sensing which are least affected by atmospheric opacities are summarized. Radar is preferred for targets off the flight path, and microwave radiometry for targets along the flight path. Radar methods are classified by ability to resolve targets. Techniques which do not require target resolution are preferred. Among these techniques, polarization methods appear most promising, specifically those which differentiate the expected relatively greater depolarization by icebergs from that by ships or which detect doubly-reversed circular polarization.

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09

GENERAL
Includes economic analysis.

A80-14792 Landsat applications in Georgia - A successful example of technology transfer between NASA and state government. B. Q. Rado (Georgia Dept. of Natural Resources, Atlanta, Ga.) and L. E. Jordan, Ill (Georgia Institute of Technology, Atlanta, Ga.). In: Space - The best is yet to come; Proceedings of the Sixteenth Space Congress, Cocoa Beach, Fla., April 25-27, 1979. Cocoa Beach, Fla., Canaverall Council of Technical Societies, 1979, p. 6-8 to 6-14.

Following a formal request by the State of Georgia for technology transfer assistance, NASA agreed to a plan (the Regional Application Program) with the following two objectives: phase I, to determine the feasibility of using Landsat-derived landcover information for resource management applications using NASA's computers and programs, essentially cost-free to the state; and phase II, to transfer the NASA application technology and computer software to Georgia. Landcover classifications of interest, as determined by Georgia's Department of Natural Resources, included high- and low-density urban, bare ground, agricultural production lands row crops, pasture or grasslands, forested areas, production forests, marshes, and surface water. The accuracy attained in locating each type of landcover is discussed. Other considerations involved determining the best time of year for visually separating each type of landcover from the others, and choosing the graphic display format, including the number of colors it contains.

J.P.B.


Papers are presented on applications of remote sensing to the exploitation, management, and monitoring of the resources of developing nations. Specific topics include the use of Landsat imagery for natural resources mapping in western Sudan, the use of remote sensing for transport planning and highway engineering in developing nations, a photointerpretation study of erosion in rural Lesotho, reconnaissance soil mapping in India using Landsat imagery, side-looking airborne radar, satellite imagery and aerial photography for a forest survey in the Amazon basin, digital analysis of radar imagery for vegetation detection in Nigeria and an assessment of LACIE and related crop inventory methodologies.

A.L.W.


The book deals with the international aspects of space activity. The discussion is centered on the use of space for remote sensing of earth resources, for purposes of national economy, and for communications, navigation, geodetic, and meteorological applications. Attention is given to a new industrial discipline - the manufacture of products in space. The influence of space research on science and technology is reviewed.

V.P.


The problem is formulated of developing a system of earth resource satellites capable of providing answers to numerous economic questions. The system must consist of several autonomous subsystems, and is required to function under a variety of conditions. A method, based on an optimization theory for multipurpose systems, is proposed to solve the problem.

V.P.

N80-10537 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EDUCATOR'S GUIDE FOR MISSION TO EARTH: LANDSAT VIEWS THE WORLD
Margaret A. Tindall 1978 56 p refs Contains color illustrations (NASA-SP-360) Avail: NTIS MF AO1, SOD HC CSCL 08B

This teacher's guide is specifically designed to provide information and suggestions for using LANDSAT imagery to teach basic concepts in several content areas. Content areas include: (1) Earth science and geology; (2) environmental studies; (3) geography; and (4) social and urban studies.

R.E.S.

N80-11530 Committee on Science and Technology (U. S. House).

EARTH RESOURCES DATA AND INFORMATION SERVICE

The implementation of and an earth resources data and information service is discussed. Policy issues surrounding the remote sensing of earth resources are presented. The role of the government versus the role of the private sector, the needs of private industry, state-and-local governments, and the international community are examined in relation to the formation of the earth resources and data information service.

A.W.H.

N80-11533 Battelle Columbus Labs., Ohio.

AN ECONOMIC ANALYSIS OF FIVE SELECTED LANDSAT ASSISTED INFORMATION SYSTEMS IN OREGON Final Report

A comparative cost analysis was performed on five LANDSAT-based information systems. In all cases, the LANDSAT system
was found to have cost advantages over its alternative. The information sets generated by LANDSAT and the alternative method are not identical but are comparable in terms of satisfying the needs of the sponsor. The information obtained from the LANDSAT system in some cases is said to lack precision and detail. On the other hand, it was found to be superior in terms of providing information on areas that are inaccessible and unobtainable through conventional means. There is therefore a trade-off between precision and detail, and considerations of costs. The projects examined were concerned with locating irrigation circles in Morrow County; monitoring tansy ragwort infestation; inventoring old growth Douglas fir near Spotted Owl habitats; inventoring vegetation and resources in all state-owned lands; and determining and use for Columbia River water policies.

A.R.H.

N80-11995# Committee on Space Research (COSPAR), Berne (Switzerland).

SPACE RESEARCH IN SWITZERLAND, 1978

Swiss space research is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participating in international cooperation programs. Main subjects include satellite geodesy, middle atmosphere studies, magnetosphere studies, solar wind composition, investigations on fine materials and rocks returned from the moon, solar physics, astronomic photometry, and earth resources studies.

Author (ESA)


REPORT TO THE CONGRESS ON COASTAL ZONE MANAGEMENT. TRANSITION QUARTER AND FISCAL YEAR 1977
Jan. 1979 113 p (PB-298537/2; NOAA-79061803) Avail. NTIS HC A06/MF A01 CSCL 138

This report contains separate sections on: identification of the state programs approved during the preceding Federal fiscal year and a description of those programs, listing of the states participating and a description of the status of each state’s program and its accomplishments during the preceding Federal fiscal year, itemization of the allocation of funds to the various coastal states and a breakdown of the major projects and areas; an identification of any state programs which have been reviewed and discontinued and which grants have been terminated and a statement for the reasons for such action; activities and projects which are not consistent with an approved state management program; and a summary of regulations issued by the Secretary or in effect during the preceding Federal fiscal year.

GRA

N80-14166# Centre National d’Etudes Spatiales, Toulouse (France).

FRENCH SPACE PROGRAMS [PROGRAMME SPATIAL FRANCAIS. RAPPORT AU COSPAR]

French activities during 1979 in space research and correlated programs are summarized. The work accomplished in the fields of astronomy, solar system, planet studies, interplanetary medium, ionosphere and magnetospheric physics, aeronomy, meteorology, earth resources, geodesy, life sciences, and material sciences are discussed. Author (ESA)

N80-14449# European Space Agency, Paris (France).

THE ESA REMOTE SENSING PROGRAM: PRESENT ACTIVITIES AND FUTURE PLANS
earth resources information system
Earth resources data and information system
Earth resources survey program
Earth surface
Earth features identification and tracking technology
data management systems
earth observation (from space)
earth observations
earth observations from space
Earth remote sensing
Earth remote sensing
Earth remote sensing
Earth remote sensing
earth remote sensing
Earth Resources Information System
Earth Resources Survey Program
Earth Surface
Earth features identification and tracking technology
data management systems
earth observation (from space)
earth observations
earth observations from space
Earth remote sensing
Earth remote sensing
Earth remote sensing
Earth remote sensing
earth remote sensing
Earth Resources Information System
Earth Resources Survey Program
Earth Surface
Earth features identification and tracking technology
data management systems
earth observation (from space)
earth observations
earth observations from space
Earth remote sensing
Earth remote sensing
Earth remote sensing
Earth remote sensing
earth remote sensing
The estimation of soil moisture content and actual evapotranspiration for soil infra-red remote sensing - Buckinghamshire, England

Crop monitoring and prediction using satellite data

GRAVIMETRY
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results

GRAVITATIONAL FIELDS
Geodynamics of the Earth's interior: GEOS-3 results

HEAT CAPACITY MAPPING MISSION
Accuracy assessment system and operation

GEOGRAPHIC DATA LIBRARY

GROUND WATER
Detection of arctic water supplies with geophysical techniques

GULF ALASKA
SEASAT: Gulf of Alaska experiment. Surface truth data

GULF OF MEXICO

GULF STREAM
Estuary boundary eddies off the east coast of Florida

HABITATS
An economic analysis of five selected LANDSAT assisted information systems in Oregon

HEAT BALANCE
Principles of mapping hydrological parameters from natural systems, using satellite photography

HEAT BUDGET
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest - Italy, France, Germany, The United Kingdom, and the Benelux Countries

HEAT CAPACITY MAPPING MISSION
HOAM energy budget data as a model input for assessing regions of high potential groundwater pollution

APPLICATIONS

AERIAL PHOTOGRAPHY OF AGRICULTURAL LAND USE

Aerial photography of agricultural farming land

Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops

Texture analysis as a recognition parameter for different types of forests

Phenology as a factor in the determination of different forms in vegetation by remote sensing

Applicability of multisensing techniques in establishing inventories for agricultural forestry and farming

What are the advantages of multispectral classification/ - for crop identification

On the classification of spectral signatures of covered surfaces in the 400-1100 nanometer region

The multispectral scanner as an instrument for signature determinations

Determination of the optical properties of the German bight

The determination of land uses for planning and cartography

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest - Italy, France, Germany, The United Kingdom, and the Benelux Countries

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest - France, Germany, The United Kingdom, and the Benelux Countries

Government Procurement

GRAINS (FOOD)

agricultural crops 

Crop monitoring and prediction using satellite data

Obtaining timely crop area estimates using forms in vegetation by remote sensing (NASA.CR-15685)

Crop A area Inventory Experiment (LACE). Plan 3: Determination of the crop area for the years 1977 and 1978

Crop A area Inventory Experiment (LACE). Plan 2: Determination of the crop area for the years 1977 and 1978

Crop A area Inventory Experiment (LACE). Plan 1: Determination of the crop area for the years 1977 and 1978

Evaluation of the LACE transition year crop calendar model - Wheat growth in the Great Plains Corridor, North America

Large Area Crop Inventory Experiment (LACE). Phase 3: Great wheat study of North Dakota

Large Area Crop Inventory Experiment (LACE). Phase 2: Large Area Crop Inventory Experiment (LACE). Phase 1: Table

Large Area Crop Inventory Experiment (LACE). Phase 0: Large Area Crop Inventory Experiment (LACE).

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest - Italy, France, Germany, The United Kingdom, and the Benelux Countries

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Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest - Italy, France, Germany, The United Kingdom, and the Benelux Countries
HEAT ISLANDS

Estimates of regional ET from HCMC data. Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site - A River Valette aviation, France [E80-10010]

Remote sensing and soil heat budget evaluation in selected European zones of agricultural and environmental interest - France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019]

Remote sensing of soil moisture content and actual evapotranspiration using thermal infrared remote sensing - Buckinghamshire, England [E80-10020]

Beauce TELLUS project - France [E80-10024]

The application of thermal infrared remote sensing to soil moisture and evaporation determination - [E80-10044]

Topographical characteristics through the study of the thermal and hydrological discontinuity of the soil from the mesoscale. An application to local forecasting of evaporation temperature from the TELLUS project [E80-10025]

Thermal mapping, geothermal source location, natural effluents, and plant stress in the Mediterranean coast of Spain [E80-10022]

Geological and geothermal data used for investigations for application explorer mission-A, heat capacity mapping mission [E80-10033]

Geologic application of thermal imagery using HCMC - Cupit, Elko, and Goldfield test areas - Nevada [E80-10035]

HCMC soil moisture experiment - Alberta [E80-10037]

Heat Capacity Mapping Mission [E80-10039]

HEAT ISLANDS

Assessment of the urban heat island effect through the use of satellite data [p0023 N80-15566] Internal heat island heat budget and sensitivity [p0015 N80-15522]

The natural conditions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory [p0048 A80-15773]

The use of remote sensing for transport planning and highway engineering in developing countries [p0023 A80-15774]

MISALAYA

The ICT approach to digital processing applied to land use mapping in the Himlayas and Central Java [p0048 A80-15781]

HUCIDITY

Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data - Grand Underwood Experimental Catchment, north west of London, U.K. [E80-10060]

The use of remote sensing for transport planning and highway engineering in developing countries [p0023 A80-15774]

HYDROLOGIC

Selection of a probable ancestral delta of the Nile River [p0033 N80-10571]

Suspended-sediment dispersal patterns of river deltas physical processes [p0034 N80-10572]

HYDROLOGY

Local methods for investigating oceans and inland basins - Russian book [p0005 A80-15664]

Applications of HCMC data to soil moisture and eddaceous current studies - soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004]

Operating scenario for a Hydrographic Airborne Laser Sounder (HALS) [p0038 N80-14390]

Technical papers on airborne laser hydrometry [PB-239121/0] [p0045 N80-15648]

Weather

Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation - Russian book [p0004 A80-10175]

Remote sensing study of seaward dispersion of estuary sediments in Canada [p0042 A80-19987]

Implementation of remote-sensing systems for exploration, environmental monitoring, and land management [p0015 N80-15481]

Remote sensing of mangrove and coastal wetland areas by satellite photography [p0009 N80-15789] A-10

Digital analysis of radar imagery for vegetation detection in India [p0048 A80-15780]

The ITC approach to digital processing applied to Landsat data and use mapping in the Himalayas and Central Java [E80-10035]

Remote-sensing studies of taiga regions - Russian [E80-10037]

Mapping the soil cover of taiga landscapes by remote sensing techniques [p0048 A80-15655]

A study of the landscape-ecology relationships of Siberian silvicultural immigration areas, using aerial and satellite photography [p0048 A80-15656]

Earth feature identification and the use of remote-sensing data development - [p0028 A80-17403]

Arctic Research in Environmental Acoustics (AREA). New developments in satellite oceanography and current mapping [p0007 A80-17514]


Geometric preprocessing of sensor data used for cartographic matching [p0054 A80-17516]

Digital image processing techniques to extract metric data on buildings from shadows on simulated aerial photographs [p0028 A80-20025]

A suggested method for delimiting urbanized areas using digital Landsat data [p0028 A80-20246]

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