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NASA SP-7041(13)

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EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

ISSUE 13

APRIL 1977

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

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NASA SP-7041(13)

EARTH RESOURCES

A Continuing Bibliography
With Indexes
Issue 13

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 1977 and March 1977

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

Scientific and Technical Information Office
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APRIL 1977

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INTRODUCTION

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

This literature survey lists 524 reports, articles, and other documents announced between January and March 1977 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

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

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

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

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

IAA entries identified by accession number series A77-10,000 in ascending accession number order;

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After the abstract section, there are five indexes:

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

AVAILABILITY OF CITED PUBLICATIONS

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All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies are available at $5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche[1] are available at the rate of $1.50 per microfiche for documents identified by the # symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is $1.00. Please refer to the accession number, e.g., (A77-12255), when requesting publications.

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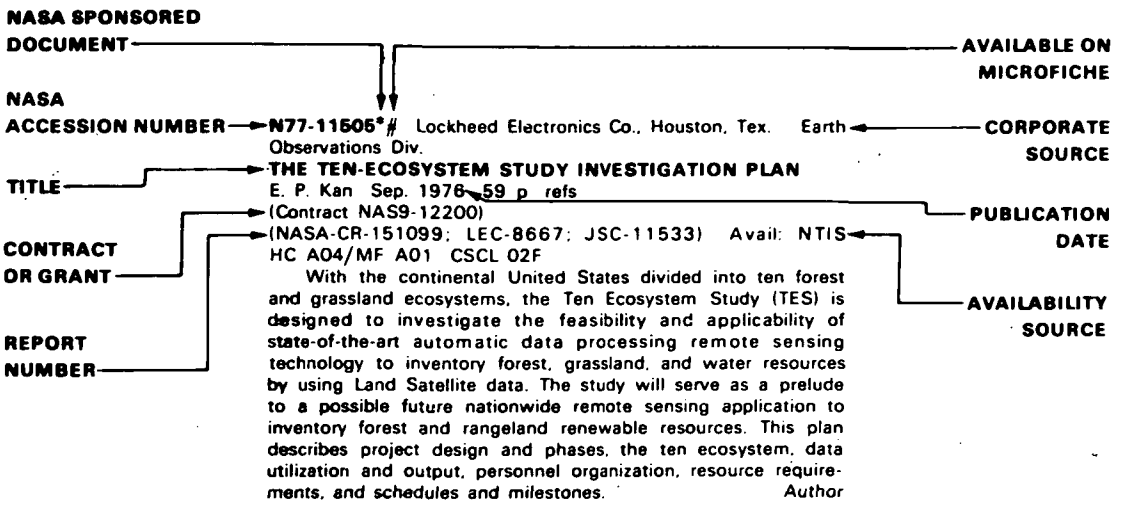

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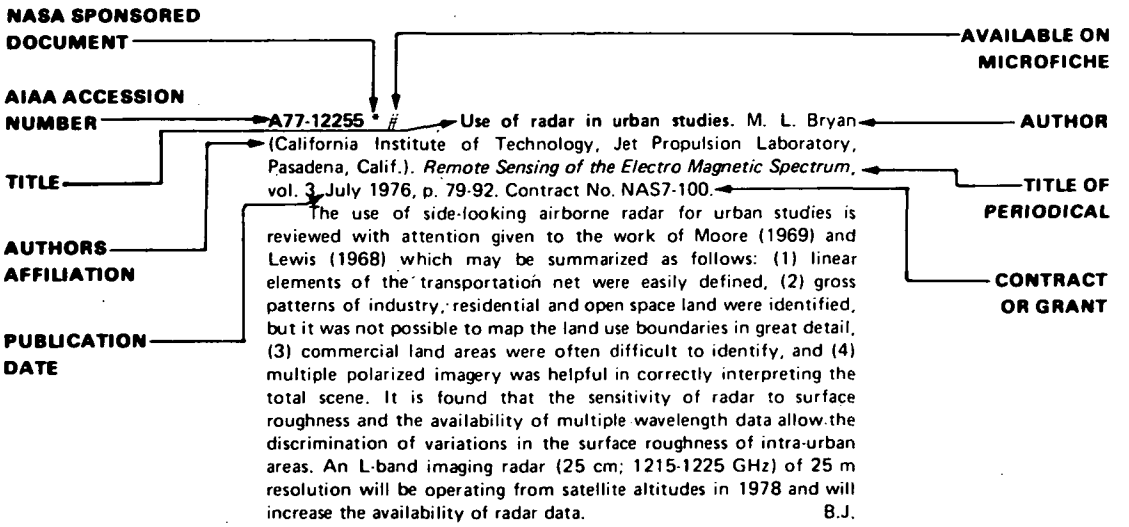

EARTH RESOURCES

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01
AGRICULTURE AND FORESTRY

Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

A77-10116 **Spruce budworm damage evaluations using aerial photography.** M. D. Ashley, J. Rea, and L. Wright (Maine, University, Orono, Me.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Oct. 1976, p. 1265-1272. 12 refs. Research supported by the Maine State Department of Conservation.

The paper reports on a study which indicates that budworm damage to the spruce-fir forest of northeastern North America can be evaluated by means of color and color infrared aerial photography. Summer color imagery at scales of 1320 ft/inch and larger was found best for evaluating current defoliation at the time insect clipped needles were brown and still held within the budworm's webbing on the branches. Color infrared photography taken when the clipped needles had fallen from the branches was found to be best for evaluating overall tree condition and identifying mortality. The accuracy of evaluations also depended on viewing techniques and scale: except where excessive shadow existed, the best interpretations of current and past feeding were made during a 7 x monocular magnifier on the backlighted outer portions of the frame. B.J.

A77-10119 * **Evaluation of Landsat image registration accuracy.** T. Kaneko (IBM Corp., Federal Systems Div., Houston, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Oct. 1976, p. 1285-1299. 7 refs. Contract No. NAS9-14350.

The Large Area Crop Inventory Experiment (LACIE) is an attempt to demonstrate the capability to forecast the annual production of major crops such as wheat and corn. Good image registration of data acquired on different dates is one of the key assumptions made in LACIE. This paper describes an algorithm to measure the accuracy of the current registration procedure. This algorithm employs a modified version of sequential similarity detection algorithm (SSDA). Based on over 264 registration checks, it was found that the root-mean-square of registration errors was 1.0 pixel. The failure rate of our registration checking algorithm was less than 10 per cent and the standard deviation of the accuracy of this algorithm was less than 0.2 picture element. (Author)

A77-10832 **Digital profile to contour converter and display.** R. R. Real (National Research Council, Physics Div., Ottawa, Canada). *Applied Optics,* vol. 15, Nov. 1976, p. 2855-2859. 7 refs.

A real-time profile to contour converter has been developed which is used to construct contour maps of the earth surface from photogrammetrically processed stereo aerial photographs. The device is a solid state scan converter which can convert stereo imagery profiles into a family of orthogonally projected contours for the purpose of display, editing, planning, and data processing. Using this converter, it is possible to obtain a real time optical feedback check of the profiling prior to dismantling the stereo model and proceeding to the next, a verification up to now unobtainable except in a time consuming off-line mode. B.J.

A77-10870 **Meteorological satellite coverage of Florida Everglades fires.** J. F. Snyder, J. P. Ashman, and H. W. Brandli (USAF, Air Weather Service, Patrick AFB, Fla.). *Monthly Weather Review,* vol. 104, Oct. 1976, p. 1330-1332.

A77-10891 # **Microwave experimental investigations of the vegetation cover scattering properties.** A. E. Basharinov, E. N. Zotova, M. I. Naumov, and V. A. Uglov (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-052.* 6 p.

K-band side-looking airborne radar was used to remotely sense ploughed areas, winter wheat, spring wheat, spring barley and sugar beet near Kursk, USSR. Radar image processing revealed significant variations of the scattering properties of different areas depending on the type of vegetation and season. Radar scattering from cereals decreases with increase of biomass weight, while scattering from sugar beets increases significantly during the appearance of leaf cover. B.J.

A77-12254 # **Use of radar for vegetation analysis.** S. A. Morain (Technology Application Center, Albuquerque, N. Mex.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 3, July 1976, p. 61-78.

A dichotomous matrix key for identifying vegetation using two-polarization K-band imagery is presented (the key is for Horsefly Mountain, Oregon). HH tone and texture form the X axis, while HV tone and texture form the Y axis. The intersections of these attributes define the location of vegetation types within the matrix. The effects of HH and HV polarization on radar image tone and texture are examined. B.J.

A77-12323 # **Some aspects of determining the biomass of pasture areas in deserts and agricultural crops from aircraft and satellites (Nekotorye voprosy opredeleniia s samoletov i sputnikov biomassy pustynnykh pastbishch i posevov sel'skokhoziaistvennykh kul'tur).** V. I. Rachkulik and M. V. Sitnikova (Sredneaziatskii Regional'nyi Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Tashkent, Kazakh SSR). *Meteorologiia i Gidrologiia,* June 1976, p. 82-91. 28 refs. In Russian.

The influence of various factors on the spectral luminance factor (SLF) of landscape and vegetation objects and on the color of their photographic image is examined. The influence of the anisotropy of reflected light on the tone of images is studied. Particular attention is given to the effect of the atmosphere on the measurements of the soil's SLF. It is shown that the influence of such factors can complicate significantly the determination of characteristics of vegetation objects from aircraft and satellites. The use of reflection spectra for identifying vegetation types is discussed. S.N.

A77-12434 **Man and machine - A matching problem.** N. J. Mulder (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: Conference on Decision and Control, 6th, and Symposium on Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 264-267. 15 refs.

Man-machine matching for the proposed Agricultural Real Time Imaging Satellite System (ARTISS) of the Netherlands is discussed. This MSS system would require data compression and color display for human interpretation as well as a minicomputer for quantitative information and preprocessing. In hardware, there is a need for onboard data compression and a fast color hardcopy unit. Color hardcopies should be used along with existing map data and previous interpretations by means of an optical comparator with flicker presentation option. Interaction can take place via data tablets or x-y digitizers and the fast hardcopy unit (order of 1 min/frame). B.J.

A77-12880 **Stratification for timber volume calculation.** D. A. Stellingwerf (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 2, 1975, p. 186-204.

A study was performed to determine the mean volume of conifers (mainly spruce with some fir) in two or three mixture strata, with an allowable error of five per cent, separately for two age classes: 40-80 years and 81-120 years. The area, of 1500 hectareas, in Austria, north of Salzburg, is covered by twenty 1:10,000 black and white aerial photographs. A 1:10,000 orthophoto mosaic was constructed from these photographs. After indication of stratus boundaries for the two strata and the three strata, these boundaries were transferred to the orthophoto mosaic. In the unstratified population and in the strata, one maximum volume plot and one minimum volume plot for each age class were selected on the photographs. B.J.

A77-12887 **Nothing other than Landsat...** T. F. Rijnberg and J. M. M. van den Broek (International Institute for Aerial Survey and Earth Sciences, The Hague, Netherlands). *ITC Journal,* no. 3, 1975, p. 374-380.

In the first phase of a survey aimed at the selection of areas suitable for mechanized rain-fed farming in the south west of the Sudan, use was made of ERTS-1 (now Landsat-1) imagery in the absence of reliable topo maps and aerial photographs. The imagery was used not only for basic data collection, but also for the planning of future survey activities and proposals for follow-up studies in the selected areas. (Author)

A77-12896 **Visual interpretation of Landsat imagery for a reconnaissance soil survey of the Ganges River fan, south west of Hardwar, India.** F. W. Hilwig (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 1, 1976, p. 26-43. 20 refs.

A77-12899 **The application of airphoto interpretation to the identification of areas planted to vines in different seasons.** K. Feldner and J. A. Allan (London, University, London, England). *ITC Journal,* no. 1, 1976, p. 98-110.

A77-12900 **Mean annual volume growth from sequential volume determination on permanent aerial photographic plots.** D. A. Stellingwerf (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) and D. Benessalah (Ecole Nationale Forestière d'Ingenieurs, Morocco). *ITC Journal,* no. 2, 1976, p. 125-138.

Two phase sampling methods, both using an optimum ratio of field to photo plots for a given cost ratio between them, are applied to the interpretation of quantitative forestry data collected via aerial photography. Both methods were used to determine the mean annual volume growth of coniferous (spruce and fir) trees, method one using only one conditioned linear regression equation in applying photo and field plots, while method two used only one unconditioned linear regression equation. B.J.

A77-12907 **The dry deciduous forests of Bastar, Central India, on Landsat-1.** E. van Es (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 2, 1976, p. 332-340.

A77-13216 **Sensor design for monitoring vegetation canopies.** C. J. Tucker and E. L. Maxwell (Colorado State University, Fort Collins, Colo.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Nov. 1976, p. 1399-1410. 17 refs. NSF Grants No. GB-31862X2; No. GB-41233X; No. BMS-73-02027A02.

Results are presented for an investigation intended to evaluate various wavelengths and bandwidths, corresponding to simulated sensors, by integrating narrow bandwidth (0.005 micron) spectral reflectance curves of blue gramma grass plots for two sample periods, one early and one late in the growing season. Grass canopies were selected because they are morphologically one of the least complex vegetation types. Regression screening was used to evaluate the relationship between the various integrated reflectances and the plot variables in terms of coefficients of determination. Major conclusions are that the spectral regions of 0.37-0.50, 0.63-0.69, and 0.75-0.80 micron are statistically significant in a regression sense, and that inclusion of a bandwidth involving orange-red absorption and enhanced reflectance result in a near total degrading of any spectral sensitivity and should be avoided. An evaluation of Landsat channels is included. S.D.

A77-14712 **Corn growth as monitored by radar.** F. T. Ulaby and T. F. Bush (University of Kansas Center for Research, Inc., Lawrence, Kan.). *IEEE Transactions on Antennas and Propagation,* vol. AP-24, Nov. 1976, p. 819-828. 11 refs.

Results of an experiment to determine the feasibility of monitoring corn growth with radar are reported. Radar backscattering data were acquired with a ground based 8-18 GHz radar spectrometer during the summer of 1974. Supporting ground truth data were also collected. During the month of July the crop suffered from a water deficit, although by no means was the crop destroyed by this lack of moisture. At angles of incidence 40 deg or greater, the results of the data analysis indicate a strong correlation between the radar backscattering coefficient and the 'normalized plant water content' (mass of water in the corn plant divided by its height). The correlation coefficient was calculated for each of 176 different combinations of the radar parameters (signal frequency, angle of incidence and polarization), peaking (0.96) at 17.0 GHz, 50 deg VV polarization. The high correlation of 0.96 points to a promising future for radar as a tool for monitoring corn development. (Author)

A77-14723 **Variability in the measurement of radar backscatter.** T. E. Bush and F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). *IEEE Transactions on Antennas and Propagation,* vol. AP-24, Nov. 1976, p. 896-898; Comments, p. 899. 22 refs.

Radar is currently being considered as a potential tool for remotely sensing croplands and woodlands from satellite altitudes. Data are presented concerning the radar backscattering coefficient ranges reported by nine researchers for various types of vegetation. Attention is given to wheat, woodlands, alfalfa, corn, milo, soybeans, cotton, irrigated farmland, oats, and grass. Stubble and mature and immature forms of vegetation are considered. The sources of apparent bias noted between the various data sets are discussed. G.R.

A77-15057 * **PROCAMS - A second generation multi-spectral-multitemporal data processing system for agricultural mensuration.** J. D. Erickson and R. F. Nalepka (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics

Engineers, Inc., 1976, p. 1A-23 to 1A-27. 6 refs. Contract No. NAS9-14123.

PROCAMS (Prototype Classification and Mensuration System) has been designed for the classification and mensuration of agricultural crops (specifically small grains including wheat, rye, oats, and barley) through the use of data provided by Landsat. The system includes signature extension as a major feature and incorporates multitemporal as well as early season unitemporal approaches for using multiple training sites. Also addressed are partial cloud cover and cloud shadows, bad data points and lines, as well as changing sun angle and atmospheric state variations. B.J.

A77-15061 * Linear dimensionality of Landsat agricultural data with implications for classification. S. G. Wheeler, P. N. Misra (IBM Corp., Federal Systems Div., Houston, Tex.), and Q. A. Holmes (NASA, Johnson Space Center, Houston, Tex.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 2A-1 to 2A-9. 5 refs.

A model for the Landsat multispectral scanner data, representing a generalization of the commonly used Gaussian model, has been formulated and analyzed. The model hypothesizes that the data for different crop types essentially lie on distinct hyperplanes in the feature space. Tests of this model reveal that: (1) the agricultural data from any single acquisition (i.e., four-channel) of Landsat are essentially two dimensional, regardless of the crop type; and (2) the data from different sites and different stages of crop development all lie on planes which are parallel. These findings have significant implications for data display, classification, feature extraction, and signature extension. (Author)

A77-15067 Landsat estimation with cloud cover. G. A. Hanuschak (U.S. Department of Agriculture, Statistical Reporting Service, Washington, D.C.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. PB-11 to PB-13.

The problem addressed in this paper is crop acreage estimation techniques which utilize Landsat imagery that is not cloud free. Several statistical techniques are proposed that would allow inferences about the population even if cloud cover is an extensive problem. These techniques are entirely dependent upon a random sample of ground data from the total population of interest. (Author)

A77-15068 * Illinois crop-acreage estimation experiment. R. M. Ray, III (Illinois, University, Urbana, Ill.) and H. F. Huddleston (U.S. Department of Agriculture, Statistical Reporting Service, Washington, D.C.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. PB-14 to PB-21. 12 refs. Research supported by the U.S. Department of Agriculture; Grant No. NGR-14-005-202.

The University of Illinois and the U.S. Department of Agriculture have collaborated to examine the feasibility of Landsat imagery analysis for USDA crop-acreage estimation purposes. The region chosen for the experiment was ten western counties of Illinois. Preliminary crop-acreage estimates derived from the ILLIAC IV-ARPA Network analysis of Landsat data are presented for these ten counties. Assuming the practicality of similar analyses covering the entire state, a procedure is discussed for evaluating statistically the information to be gained by estimating state crop-acreage totals from Landsat imagery classification results where SRS sample survey data are used as ground truth information for classification training as opposed to estimating state crop-acreage totals directly from SRS survey data alone. B.J.

A77-15071 * Selecting class weights to minimize classification bias in acreage estimation. W. M. Belcher and T. C. Minter (Lockheed Electronics Co., Inc., Aerospace Systems Div., Houston, Tex.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 3A-11 to 3A-15. Contract No. NAS9-12200.

Preliminary results of experiments being performed to select optimal class weights for use with the maximum likelihood classifier in acreage estimation using remote sensor imagery are presented. These weights will be optimal in the sense that the bias will be minimized in the proportion estimate obtained from the classification results by sample counting. The procedure was tested using Landsat MSS data from an 8 by 9.6 km area of ground truth in Finney County, Kansas. B.J.

A77-15073 * Bayes estimation on parameters of the single-class classifier. G. C. Lin and T. C. Minter (Lockheed Electronics Co., Inc., Aerospace Systems Div., Houston, Tex.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 3A-22 to 3A-27. Contract No. NAS9-12200.

Normal procedures used for designing a Bayes classifier to classify wheat as the major crop of interest require not only training samples of wheat but also those of nonwheat. Therefore, ground truth must be available for the class of interest plus all confusion classes. The single-class Bayes classifier classifies data into the class of interest or the class 'other' but requires training samples only from the class of interest. This paper will present a procedure for Bayes estimation on the mean vector, covariance matrix, and a priori probability of the single-class classifier using labeled samples from the class of interest and unlabeled samples drawn from the mixture density function. (Author)

A77-15075 * Effects of misregistration on multispectral recognition. R. C. Cicone, W. A. Malila, J. M. Gleason, and R. F. Nalepka (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4A-1 to 4A-8. 7 refs. Contracts No. NAS9-14123; No. NAS9-13280.

Spatial misregistration of multispectral scanner data occurs when two or more spectral band signals supposedly representing the same location are in fact data values generated from two or more overlapping or entirely different ground locations. A study was performed at the Environmental Research Institute of Michigan to determine what effect spatial misregistration may have on the accuracy of recognition processing of agriculturally oriented scanner data. It was found that misregistration severely reduces the availability of field center pixels and introduces significant errors in the classification accuracy and correct proportion estimation of a scene containing an inflated number of mixture pixels. B.J.

A77-15081 Automatic detection and classification of infestations of crop insect pests and diseases from infrared aerial color photographs. M. Ali and J. K. Aggarwal (Texas, University, Austin, Tex.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4B-1 to 4B-11. 38 refs. NSF Grant No. GK-42790; Grant No. AF-AFOSR-72-2371; Contract No. F44620-70-C-0091.

This paper describes a system designed to analyze aerial color infrared photographs of citrus orchards. The input to the system is a 35 mm transparency of the infrared aerial photograph mounted in a 3-color film digitizer which is controlled by an XDS 930 computer. An algorithm locates the outline of each individual tree in the photograph and then cluster analysis is applied. For the trees of a transparency, center of gravity (C.G.) of the set of these trees is

determined and then the distance of each individual tree from C.G. is computed by using an empirical distance function which we have derived. Sorting, performed on the basis of the computed distances, clusters the trees. The cluster identifying algorithm separates out the individual clusters which are then grouped together into a smaller number of classes by applying the same algorithm. Fifteen transparencies having mealybugs, brown soft scale, gummosis and root rot infestations, were analyzed and experimental results show very satisfactory classification of the infestations. (Author)

A77-15082 * Landsat forest and range inventory of southeast Texas counties by administrative boundaries. C. A. Reeves, T. Austin, and A. Kerber (Lockheed Electronics Co., Inc., Aerospace Systems Div., Houston, Tex.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4B-12 to 4B-23. 9 refs. Contract No. NAS9-12200.

A77-15083 * Evaluation of classification procedures for estimating wheat acreage in Kansas. L. M. Flores and D. T. Register (Lockheed Electronics Co., Inc., Aerospace Systems Div., Houston, Tex.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. (A77-15051 04-43) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4B-24 to 4B-33. Contract No. NAS9-12200.

This report presents the results of experiments which were performed to evaluate procedures for estimating wheat acreage in intensive test sites (ITS's) in Kansas. An analyst/interpreter (AI) selected and labeled fields from Landsat-1 satellite imagery. Statistics were generated for each selected ITS, and the imagery was classified using a maximum likelihood classifier. Various components of the classification process were tested. (Author)

A77-15084 Machine estimation of timber volumes for use in sampling surveys - A method for high flight and space imagery, interface considerations, and results. J. W. van Roessel (Earth Satellite Corp., Berkeley, Calif.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4B-34 to 4B-40. 11 refs.

The digital timber volume estimation method was developed primarily for use with Landsat MSS scanner data. The technique makes use of a vector field clustering algorithm, nearest neighbor classification, and regression analysis. When such a technique is to be applied to reduce the cost for a given level of precision in a forest inventory, the interface between sampling methods and the digital estimation model must be considered. The candidate models and sampling methods must be evaluated using test data as closely related to actual circumstances as possible. (Author)

A77-15085 * The tasselled cap - A graphic description of the spectral-temporal development of agricultural crops as seen by Landsat. R. J. Kauth and G. S. Thomas (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4B-41 to 4B-51. 9 refs. Contract No. NAS9-14123.

The time trajectories of agricultural data points as seen in Landsat signal space form a pattern suggestive of a tasselled woolly cap. Most of the important crop phenomena can be described using this three dimensional construct: the distribution of signals from bare soil, the processes of green development, yellow development, and shadowing and harvesting. A linear preprocessing transformation which isolates green development, yellow development and soil brightness is used to reduce the dimension of the signal space. Specific measurable pattern elements of the tasselled cap are used to estimate and correct atmospheric haze and moisture effects. B.J.

A77-15728 # Scattering of radiowaves by an underlying surface with plant cover (Rasseianie radiovoln podstilaiushchei poverkhnost'iu s rastitel'nym pokrovom). V. A. Andrianov, N. A. Armand, and I. N. Kibardina. *Radiotekhnika i Elektronika,* vol. 21, Sept. 1976, p. 1816-1821. 7 refs. In Russian.

Results of experimental measurements of spectral power density of signals scattered from a forest region are described. The experiment was performed for three types of wooded areas with different types of trees: birch, alder, and pine. An exponential relation was obtained for the spectral density of the scattered signal as a function of frequency for small differences between the scattered spectral components and the incident carrier frequency, and a power law dependence was found for large frequency differences. The width of the spectra of the scattered signal depends on both the wind velocity and the type of vegetation. P.T.H.

A77-17388 Optical properties of the leaves of some African crop plants. J. F. Farrar and O. P. Mapunda (Dar es Salaam, University, Dar es Salaam, Tanzania). *Applied Optics,* vol. 16, Jan. 1977, p. 248-251. 14 refs. Research supported by the University of Dar es Salaam.

The fate of radiation incident on the leaves of some African crop plants is examined. Transmission coefficients for photosynthetically active radiation are 0.05-0.10 for mature leaves and 0.09-0.39 for young leaves. Increasing the angle of incidence of radiation results in a rise in reflectivity and a fall in absorptivity. Transmissivity rises to angles of incidence of 60 deg and then falls sharply. Absorptivity and reflectivity are cubic functions of the angle of incidence of radiation. Consequences of these findings for photosynthesis are discussed. (Author)

A77-18279 Use of night vision systems by the land manager. H. J. Shields (U.S. Department of Agriculture, Equipment Development Center, San Dimas, Calif.). In: Low light level devices for science and technology; Proceedings of the Seminar, Reston, Va., March 22, 23, 1976. Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1976, p. 48-54.

Helicopter firefighting operations utilizing IR technology are described. Systems hardware, training of pilots for nighttime firefighting operations, basic operations, and some examples of practical use are covered in the article. The INFANT low level light (LLL) system, the AAQ-5 forward looking IR (FLIR) system, PVS-5 night vision goggles (NVG), an IR floodlight, FLIR thermography, and other hardware and their practical use are described. Basic operations and pilot training schedules are detailed. Practical use of the hardware in firefighting operations is illustrated, and use in surveying, nocturnal game inventory, search and rescue missions, reconnaissance, and police operations is recommended. R.D.V.

A77-18964 Some problems and solutions related to ground truth measurements for thermal infrared remote sensing. F. J. Bonn (Sherbrooke, Université, Sherbrooke, Quebec, Canada). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 1-11. 20 refs.

Field measurements have been made since 1971 in order to establish interpretation keys for remotely sensed thermal infrared radiation in the 9.5-11.5 microns spectral range. The infrared radiation emitted by different land surfaces has been measured with a Barnes PRT5 radiometer and compared with different environmental parameters (solar radiation, net radiation, air and soil temperature at various depths, air and soil moisture, etc.). The parameters that give the closest correlation with the remotely sensed thermal radiation vary with the type of vegetal cover and with the seasons. These relations should be tested in other areas before going into quantitative interpretation of thermal infrared remote sensing data over terrestrial surfaces. (Author)

N77-10586*# Agricultural Research Service, Weslaco, Tex.
SOIL, WATER, AND VEGETATION CONDITIONS IN SOUTH TEXAS Quarterly Progress Report, 13 Jul. - 13 Oct. 1976
Craig L. Wiegand, Harold W. Gausman, Ross W. Leamer, Arthur J. Richardson, James H. Everitt, and Alvin H. Gerbermann, Principal Investigators Oct. 1976 21 p refs ERTS
(NASA Order S-53876-AG)
(E77-10002; NASA-CR-148818; QPR-7) Avail: NTIS HC A02/MF A01 CSCL 08F

The author has identified the following significant results. Reflectance measurements with a field spectroradiometer on nine dates (between December 9 and April 8) during the growing season of two wheat varieties, Milam and Penjamo, showed that the reflectance curves had the characteristic shape of vegetated surfaces by 4 weeks after the emergence. Green light (0.55 micron) reflectance was maximal and between water absorption bands (1.65 and 2.2 microns) reflectance was minimal when green vegetation development was greatest. Computer classification was accomplished for 81,000 hectare coastal rangeland area for October 13 and December 10, 1975, overpass dates. A hard freeze occurred between these two dates and many of the deciduous woody species defoliated so that more light penetrated to the herbaceous understory in December than in October.

N77-10589*# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
EXTENSIVE INVENTORY OF FOREST RESOURCES BY MULTISTAGE SAMPLING Progress Report, 7 Jun. - 6 Sep. 1976
Robert C. Aldrich, Robert W. Dana, and Edwin H. Roberts, Principal Investigators 22 Sep. 1976 4 p ERTS
(NASA Order S-54053-A)
(E77-10006; NASA-CR-148977; PR-6) Avail: NTIS HC A02/MF A01 CSCL 02F

N77-10593*# Michigan State Univ., East Lansing.
ECONOMIC EVALUATION OF CROP ACREAGE ESTIMATION BY MULTISPECTRAL REMOTE SENSING
Lester V. Manderscheid, R. Nalepka, Principal Investigators (Environmental Res. Inst. of Michigan), Wayne Myers, Gene Safir, Douglas Ilhardt, J. Morgenstern (Environmental Res. Inst. of Michigan), and J. Sarno (Environmental Res. Inst. of Michigan) 1976 138 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13332)
(E77-10010; NASA-CR-150976) Avail: NTIS HC A07/MF A01 CSCL 02C

The author has identified the following significant results. Photointerpretation of S190A and S190B imagery showed significantly better resolution with the S190B system. A small tendancy to underestimate acreage was observed. This averaged 6 percent and varied with field size. The S190B system had adequate resolution for acreage measurement but the color film did not provide adequate contrast to allow detailed classification of ground cover from imagery of a single date. In total 78 percent of the fields were correctly classified but with 56 percent correct for the major crop, corn.

N77-10607*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
WHEAT SIGNATURE MODELING AND ANALYSIS FOR IMPROVED TRAINING STATISTICS: SUPPLEMENT. SIMULATED LANDSAT WHEAT RADIANCES AND RADIANCE COMPONENTS Final Report, 15 May 1975 - 14 May 1976
W. A. Malila, R. C. Cicone, and J. M. Gleason May 1976 190 p refs
(Contract NAS9-14123)
(NASA-CR-151087; Rept-109600-66-F) Avail: NTIS HC A09/MF A01 CSCL 02C

Simulated scanner system data values generated in support of LACIE (Large Area Crop Inventory Experiment) research and development efforts are presented. Synthetic inband (LANDSAT) wheat radiances and radiance components were computed and are presented for various wheat canopy and atmospheric conditions and scanner view geometries. Values include: (1) inband bidirectional reflectances for seven stages of wheat crop growth; (2) inband atmospheric features; and (3) inband radiances corresponding to the various combinations of wheat canopy and atmospheric conditions. Analyses of these data values are presented in the main report. Author

N77-10612*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
RADAR BACKSCATTER PROPERTIES OF MILO AND SOYBEANS
T. F. Bush, Fawwaz T. Ulaby, and T. Metzler Oct. 1975 59 p refs
(Contract NAS9-10261)
(NASA-CR-151029; RSL-TR-177-59) Avail: NTIS HC A04/MF A01 CSCL 17I

The radar backscatter from fields of milo and soybeans was measured with a ground based radar as a function of frequency (8-18 GHz), polarization (HH and VV) and angle of incidence (0 deg-70 deg) during the summer of 1974. Supporting ground truth was gathered contemporaneously with the backscatter data. At nadir sigma deg of milo correlated highly, r = 0.96, with soil moisture in the milo field at 8.6 GHz but decreased to a value of r = 0.78 at a frequency of 17.0 GHz. Correlation studies of the variations of sigma deg with soil moisture in the soybean fields were not possible due to a lack of a meaningful soil moisture dynamic range. At the larger angles of incidence, however, sigma deg of soybeans did appear to be dependent on precipitation. It is suggested this phenomenon was caused by the rain altering plant geometry. In general sigma deg of both milo and soybeans had a relatively small dynamic range at the higher angles of incidence and showed no significant dependence on the measured crop parameters. Author

N77-11505*# Lockheed Electronics Co., Houston, Tex. Earth Observations Div.
THE TEN-ECOSYSTEM STUDY INVESTIGATION PLAN
E. P. Kan Sep. 1976 59 p refs
(Contract NAS9-12200)
(NASA-CR-151099; LEC-8667; JSC-11533) Avail: NTIS HC A04/MF A01 CSCL 02F

With the continental United States divided into ten forest and grassland ecosystems, the Ten Ecosystem Study (TES) is designed to investigate the feasibility and applicability of state-of-the-art automatic data processing remote sensing technology to inventory forest, grassland, and water resources by using Land Satellite data. The study will serve as a prelude to a possible future nationwide remote sensing application to inventory forest and rangeland renewable resources. This plan describes project design and phases, the ten ecosystem, data utilization and output, personnel organization, resource requirements, and schedules and milestones. Author

N77-11627# Army Engineer Topographic Labs., Fort Belvoir, Va.
INFERENTIAL TECHNIQUES FOR SOIL DEPTH DETERMINATIONS. PART 1: COLEOGYNE RAMOSISSIMA TORR. (BLACK-BRUSH)
Miklos Treiber and Alan E. Krusinger Nov. 1975 25 p refs
(DA Proj. 4A1-61102-B-52)
(AD-A024355; ETL-0036) Avail: NTIS HC A02/MF A01 CSCL 08/13

Inferential techniques for soil depth determinations in a high desert environment, Lake Powell, Arizona/Utah, were investigated. The use of vegetation as 'indicator species' to facilitate determinations of soil depth and soil type was examined. Coleogyne ramosissima Torr., commonly called black-brush, has been established as a reliable indicator of the depth of soil to bedrock. Over 375 soil-depth to-bedrock measurements were performed. The soil depths to bedrock within Coleogyne ramosissima communities have a mean of 21 cm with a maximum of 100 cm; the mean of soil depths to bedrock outside Coleogyne ramosissima communities was 120 cm, with a maximum measured depth of 180 cm. GRA

N77-12480*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE)
R. B. MacDonald 1976 20 p refs Presented at 2d Ann. William T. Pecora Memorial Symp., Sioux Falls, S. Dak., 25-29 Oct. 1976
(NASA-TM-X-74225) Avail: NTIS HC A02/MF A01 CSCL 02C

A Large Area Crop Inventory Experiment (LACIE) was undertaken to prove out an economically important application of remote sensing from space. The experiment focused upon determination of wheat acreages in the U.S. Great Plains and upon the development and testing of yield models. The results and conclusions are presented. Author

N77-12481*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 1: EVALUATION REPORT
May 1976 100 p refs
(NASA-TM-X-74226; LACIE-00418; JSC-11663) Avail: NTIS HC A05/MF A01 CSCL 02C

It appears that the Large Area Crop Inventory Experiment over the Great Plains, can with a reasonable expectation, be a satisfactory component of a 90/90 production estimator. The area estimator produced more accurate area estimates for the total winter wheat region than for the mixed spring and winter wheat region of the northern Great Plains. The accuracy does appear to degrade somewhat in regions of marginal agriculture where there are small fields and abundant confusion crops. However, it would appear that these regions tend also to be marginal with respect to wheat production and thus increased area estimation errors do not greatly influence the overall production estimation accuracy in the United States. The loss of segments resulting from cloud cover appears to be a random phenomenon that introduces no significant bias into the estimates. This loss does increase the variance of the estimates. Author

N77-13491*# Lockheed Electronics Co., Houston, Tex. Dept. of Life Sciences Applications.
REMOTE SENSING FOR CONTROL OF TSETSE FLIES
L. E. Giddings Sep. 1976 38 p refs
(Contract NAS9-12200)
(NASA-CR-151136; LEC-9155; JSC-11652) Avail: NTIS HC A03/MF A01 CSCL 06F

Remotely sensed information is discussed which has potential for aiding in the control or eradication of tsetse flies. Data are available from earth resources meteorological, and manned satellites, from airborne sensors, and possibly from data collection platforms. A new zone discrimination technique, based on data from meteorological satellites may also allow the identification of zones hospitable to one or another species of tsetse. For background, a review is presented of the vegetation of Tanzania and Zanzibar, and illustrations presented of automatic processing of data from these areas. In addition, a review is presented of the applicability of temperature data to tsetse areas. Author

N77-13492*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
ADDITIONAL STUDIES OF FOREST CLASSIFICATION ACCURACY AS INFLUENCED BY MULTISPECTRAL SCANNER SPATIAL RESOLUTION
Franklin E. Sadowski and Jane E. Sarno Aug. 1976 56 p ref
(Contract NAS9-14988)
(NASA-CR-151138; ERIM-122700-4-R) Avail: NTIS HC A04/MF A01 CSCL 02F

First, an analysis of forest feature signatures was used to help explain the large variation in classification accuracy that can occur among individual forest features for any one case of spatial resolution and the inconsistent changes in classification accuracy that were demonstrated among features as spatial resolution was degraded. Second, the classification rejection threshold was varied in an effort to reduce the large proportion of unclassified resolution elements that previously appeared in the processing of coarse resolution data when a constant rejection threshold was used for all cases of spatial resolution. For the signature analysis, two-channel ellipse plots showing the feature signature distributions for several cases of spatial resolution indicated that the capability of signatures to correctly identify their respective features is dependent on the amount of statistical overlap among signatures. Reductions in signature variance that occur in data of degraded spatial resolution may not necessarily decrease the amount of statistical overlap among signatures having large variance and small mean separations. Features classified by such signatures may thus continue to have similar amounts of misclassified elements in coarser resolution data, and thus, not necessarily improve in classification accuracy. Dissert. Abstr.

N77-14553*# Alaska Univ., Fairbanks. Cooperative Wildlife Research Unit.
USE OF LANDSAT IMAGERY FOR WILDLIFE HABITAT MAPPING IN NORTHEAST AND EASTCENTRAL ALASKA Final Report, Jun. 1975 - Dec. 1976
Arthur J. L. LaPerriere, III, Principal Investigator 5 Dec. 1976 54 p refs ERTS
(Contract NAS5-20915)
(E77-10054; NASA-CR-149262) Avail: NTIS HC A04/MF A01 CSCL 08B

N77-14556*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
INVESTIGATION OF LANDSAT FOLLOW-ON THEMATIC MAPPER SPATIAL, RADIOMETRIC AND SPECTRAL RESOLUTION Final Report, Nov. 1975 - Apr. 1976
Richard F. Nalepka, Principal Investigator, James P. Morgenstern, Edward R. Kent, and Jon D. Erickson Apr. 1976 228 p refs EREP
(Contract NAS9-14819)
(E77-10057; NASA-CR-150943; ERIM-119300-10-F) Avail: NTIS HC A11/MF A01 CSCL 08B

The author has identified the following significant results. Fine resolution M7 multispectral scanner data collected during the Corn Blight Watch Experiment in 1971 served as the basis for this study. Different locations and times of year were studied. Definite improvement using 30-40 meter spatial resolution over present LANDSAT 1 resolution and over 50-60 meter resolution was observed, using crop area mensuration as the measure. Simulation studies carried out to extrapolate the empirical results to a range of field size distributions confirmed this effect, showing the improvement to be most pronounced for field sizes of 1-4 hectares. Radiometric sensitivity study showed significant degradation of crop classification accuracy immediately upon relaxation from the nominally specified values of 0.5% noise equivalent reflectance. This was especially the case for data which were spectrally similar such as that collected early in the growing season and also when attempting to accomplish crop stress detection.

N77-14557*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
FOREST CLASSIFICATION ACCURACY AS INFLUENCED BY MULTISPECTRAL SCANNER SPATIAL RESOLUTION Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, F. Sadowski, and J. Sarno May 1976 130 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14123)
(E77-10058; NASA-CR-150998; ERIM-109600-71-F) Avail: NTIS HC A07/MF A01 CSCL 02F

The author has identified the following significant results. A supervised classification within two separate ground areas of the Sam Houston National Forest was carried out for two sq meters spatial resolution MSS data. Data were progressively coarsened to simulate five additional cases of spatial resolution ranging up to 64 sq meters. Similar processing and analysis of all spatial resolutions enabled evaluations of the effect of spatial resolution on classification accuracy for various levels of detail

and the effects on area proportion estimation for very general forest features. For very coarse resolutions, a subset of spectral channels which simulated the proposed thematic mapper channels was used to study classification accuracy.

N77-14559*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
EVALUATION OF ALGORITHMS FOR ESTIMATING WHEAT ACREAGE FROM MULTISPECTRAL SCANNER DATA Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, Wyman Richardson, and Alex P. Pentland May 1976 100 p refs EREP
(Contract NAS9-14123)
(E77-10060; NASA-CR-151000; ERIM-109600-69-F) Avail: NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results. Fourteen different classification algorithms were tested for their ability to estimate the proportion of wheat in an area. For some algorithms, accuracy of classification in field centers was observed. The data base consisted of ground truth and LANDSAT data from 55 sections (1 x 1 mile) from five LACIE intensive test sites in Kansas and Texas. Signatures obtained from training fields selected at random from the ground truth were generally representative of the data distribution patterns. LIMMIX, an algorithm that chooses a pure signature when the data point is close enough to a signature mean and otherwise chooses the best mixture of a pair of signatures, reduced the average absolute error to 6.1% and the bias to 1.0%. QRULE run with a null test achieved a similar reduction.

N77-14561*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SYSTEM FOR ANALYSIS OF LANDSAT AGRICULTURAL DATA: AUTOMATIC COMPUTER-ASSISTED PROPORTION ESTIMATION OF LOCAL AREAS Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, R. J. Kauth, and G. S. Thomas May 1976 102 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14123)
(E77-10062; NASA-CR-151002; ERIM-109600-67-F) Avail: NTIS HC A06/MF A01 CSCL 02C

The author has identified the following significant results. A conceptual man machine system framework was created for a large scale agricultural remote sensing system. The system is based on and can grow out of the local recognition mode of LACIE, through a gradual transition wherein computer support functions supplement and replace AI functions. Local proportion estimation functions are broken into two broad classes: (1) organization of the data within the sample segment; and (2) identification of the fields or groups of fields in the sample segment.

N77-14563*# Mekong Committee Secretariat, Bangkok (Thailand).
AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report, Sep. - Nov. 1976
W. J. VanderOord, Principal Investigator Nov. 1976 40 p Sponsored by NASA ERTS
(E77-10064; NASA-CR-149263) Avail: NTIS HC A03/MF A01 CSCL 08H

N77-14577# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
EVALUATION OF ERTS-1 DATA FOR FOREST AND RANGELAND SURVEYS Final Report
Robert C. Heller 1975 78 p refs Sponsored by the Dept. of Agriculture
(PB-257029/9; FSRP-PSW-112) Avail: NTIS HC A05/MF A01 CSCL 02F

Tests were done using data gathered by the first Earth Resource Technology Satellite. Results on sites in Georgia, Colorado, and South Dakota indicated that ERTS enlargements, preferably color, would be useful to forest managers of large ownerships for broad area planning. Forest land was distinguished from non-forest land with 90 to 95 percent accuracy, in both photointerpretation and computer-assisted analysis. Further breakdowns of cover types could not be made with acceptable accuracy by either method. Forest disturbances from natural causes or human activity could be detected with 90 percent accuracy when ERTS imagery was compared with 6-year-old aerial photos. Stress from mountain pine beetle could not be detected; ERTS wavebands are too broad to identify dying foliage. Color illustrations reproduced in black and white. GRA

N77-15568# California Univ., Livermore. Lawrence Livermore Lab.
CONSEQUENCES OF REDUCED FOOD SUPPLY INDUCED BY LOSS OF STRATOSPHERIC OZONE
R. C. Maninger and D. W. Dorn Apr. 1976 6 p refs Presented at 7th Ann. Conf. on Modeling and Simulation, Pittsburgh, 26 Apr. 1976
(Contract W-7405-eng-48)
(UCRL-77679; Conf-760435-3) Avail: NTIS HC A02/MF A01

The structure of the normal world as represented by WORLD 3 is such that a substantial perturbation of the global food supply does not trigger any unexpected drastic changes in the world socioeconomic system. The time responses of the world in general are somewhat delayed and slower than the perturbing function, OZONLY. The world system also displays capacity to recover in direct proportion to changes in OZONLY. The ozone reduction functions discussed represent worst case assumptions. More realistic ozone reduction factors are in the range of 10 percent for the Freon case and 5 percent for the SST case (versus this paper - 50 percent for both). These simulations suggest that there is essentially no current crisis to be considered with respect to stratospheric ozone depletion.ERA

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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.

A77-10672 Comparison between two methods for weighing dust in the air - Gravimetry and reflectometry /SF 8/ (Comparaison entre deux méthodes de mesure du poids de poussières dans l'air - La gravimétrie et la réflectométrie /SF 8/). A. Renoux, A. Mouden (Association pour la Prevention de la Pollution Atmospherique; Brest, Université, Brest, France), and J.-Y. Barzic (Brest, Université, Brest, France). *Pollution Atmosphérique,* vol. 18, July-Sept. 1976, p. 241-244. 7 refs. In French.

A special device for taking round-the-clock samples on a nucleoporous membrane was used to obtain a comparison between black fume measurements by reflectometry and direct ponderal measurements of dust particles. At Brest, France, where there is sea influence, the ratio of fume to dust particles varied between 0.2 and 0.65, with an average of 0.4. A one-year statistical study demonstrated a lack of correlation between the black fume and dust distributions, their maxima and minima being for the most part shifted. P.T.H.

A77-11080 * # System design consideration for the Nimbus-G observatory mission. G. D. Hogan (NASA, Goddard Space Flight Center, Greenbelt, Md.). *American Institute of Aeronautics and Astronautics, Systems Design Driven by Sensors, Pasadena, Calif., Oct. 18-20, 1976, Paper 76-960.* 10 p.

The objectives of the Nimbus-G mission are to study air pollution, ocean parameters, and weather and climate on a global scale. The observations required to meet these objectives include nadir viewing and scanning, and limb viewing and scaling techniques. Each of these approaches requires that the spacecraft provide a sensor mounting surface that maintains a fixed orientation relative to the nadir and the orbit track and that the orientation of the orbit plane remain constant with respect to the sun for maximum space cooler efficiency. The tradeoffs necessary to satisfy the conflicting instrument payload requirements within the constraints placed on the Nimbus design are discussed, along with the modifications necessary to meet the unique needs of the instrument complement. V.P.

A77-11084 * # Stratospheric air sampling platform/sensor tradeoffs. R. D. Arno and W. Page (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Systems Design Driven by Sensors, Pasadena, Calif., Oct. 18-20, 1976, Paper 76-965.* 8p. 16 refs.

Results of a study are described in which in-situ and remote sensing instrumentation are considered for accommodation on airborne platforms capable of reaching stratospheric altitudes. The instrumentation measures trace species of importance to present concerns regarding stratospheric pollution and possible ozone depletion. The platforms examined were the U-2, modified U-2, balloon, rocket, F-15 flown in a zoom-climb maneuver, YF-12, and remotely piloted vehicle (RPV). The sensors and performance characteristics of the platforms are described and special problems of sensor-platform integration are discussed. A typical latitudinal sampling mission is utilized to describe platform logistics problems and how the platforms might perform such missions. (Author)

A77-11221 Proton flux increases, flares, and sudden commencements. C. Sawyer (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla.). *Journal of Geophysical Research,* vol. 81, Oct. 1, 1976, p. 5157-5162. 8 refs.

Data obtained by Explorer 34 near a solar-activity maximum for the solar-proton monitoring experiment are analyzed. Englade's (1971) model of solar-proton emission and propagation is described, and observed proton-fluxincreases are identified. Associations of flux increases detected by Explorer 34 with solar flares are discussed, and the relation of flux increases to geomagnetic-storm sudden commencements (sc's) and to crossings of interplanetary magnetic sector boundaries (sb's) is investigated. The results of the analysis show that flux maxima clearly tend to occur near sc's, that the occurrence of a Forbush decrease enhances the probability of an association of an sc with an increase in a 10-MeV proton flux, and that flux increases tend to occur on the day before a sector-boundary crossing. It is found that of 77 observed flux increases, 44 are associated directly with flares, 19 are associated with sc's, and nine are associated with sb's. Differences in the characteristics of increases associated with flares, sb's, and sc's are summarized. F.G.M.

A77-11517 * A study of satellite observations of ozone and stratospheric temperatures during 1970-1971. A. Ghazi, A. Ebel (Köln, Universität, Cologne, West Germany), and D. F. Heath (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Geophysical Research,* vol. 81, Oct. 20, 1976, p. 5365-5373. 24 refs. Research supported by the Deutsche Forschungsgemeinschaft.

A comparison is made between backscatter ultraviolet ozone data and the stratospheric radiance measurements made by the satellite infrared spectrometer on board Nimbus 4 for the period April 1970 to April 1971. These simultaneous measurements have been used to study the temporal and spatial behavior of ozone and the thermal structure of the stratosphere on a global basis. The most significant feature of the total ozone distribution observed is the strong increase in ozone values at the high latitudes of the Northern Hemisphere during the stratospheric warming of January 1971. B.J.

A77-11518 * The solar occultation technique for remote sensing of particulates in the earth's atmosphere. I - The inversion of horizon radiances from space. D. W. Schuerman, F. Giovane (New York, State University, Albany, N.Y.), J. M. Greenberg (Leiden, Rijksuniversiteit, Leiden, Netherlands). *Journal of Geophysical Research,* vol. 81, Oct. 20, 1976, p. 5375-5388. 24 refs. Contract No. NAS9-12539.

The aerosol scattering coefficient as a function of height can be recovered from a direct inversion of the single-scattering horizon radiance provided the sun is above the horizon and an independent measurement of extinction as a function of height is made. Aerosol detection is effected by means of spacecraft measurements of the horizon radiance made during periods of spacecraft twilight. A solar occultation technique which allows the twilight measurements to be made when the sun is still above the horizon greatly reduces the complexity of the inversion problem. The second part of the paper reports on the use of a coronograph aboard Skylab to photograph the horizon just before spacecraft twilight in order to monitor the aerosol component above the tropopause. The coronograph picture, centered on 26.5 degrees E longitude and 63.0 degrees S latitude, shows that the aerosol layer peaks at a height of 48 plus or minus 1 km. B.J.

A77-12253 # Use of radar in small scale land use mapping. F. M. Henderson (New York, State University, Albany, N.Y.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 3, July 1976, p. 46-60.

The use of side-looking airborne radar for small scale general land use mapping is discussed. The general advantages of radar imagery over conventional photography (synoptic view, weather

independence, and scale) are examined. Efforts at radar land use mapping since the 1960s are reviewed and the key elements relevant to the creation of radar land use regions are condensed into the following five components: surface configuration, natural vegetation, field patterns and size, settlement pattern, and transportation/communication network. B.J.

A77-12255 * # **Use of radar in urban studies.** M. L. Bryan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 3, July 1976, p. 79-92. Contract No. NAS7-100.

The use of side-looking airborne radar for urban studies is reviewed with attention given to the work of Moore (1969) and Lewis (1968) which may be summarized as follows: (1) linear elements of the transportation net were easily defined, (2) gross patterns of industry, residential and open space land were identified, but it was not possible to map the land use boundaries in great detail, (3) commercial land areas were often difficult to identify, and (4) multiple polarized imagery was helpful in correctly interpreting the total scene. It is found that the sensitivity of radar to surface roughness and the availability of multiple wavelength data allow the discrimination of variations in the surface roughness of intra-urban areas. An L-band imaging radar (25 cm; 1215-1225 GHz) of 25 m resolution will be operating from satellite altitudes in 1978 and will increase the availability of radar data. B.J.

A77-12877 **Rural population estimates from air photographs - An example from Wolamo, Ethiopia.** J. A. Allan (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) and T. Alemayehu (Ministry of Land Reform and Administration, Addis Ababa, Ethiopia). *ITC Journal,* no. 1, 1975, p. 85-100. 12 refs.

A77-12893 **Cyclic erosion in volcanic ash soils - Some observations on dry soils showing volcanic influence, and the occurrence of accelerated erosion.** G. W. W. Elbersen and E. Nieuwenhuis (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 4, 1975, p. 498-510. 9 refs.

A soil formation which occurs if volcanic ashes weather in a relatively dry environment, superimposing their pedogenetic characteristics on any substratum, is discussed with reference to aerial photographs of landscapes at the margin of Sabana de Bogota in the region of Mosquera and Guatavita in Colombia. An attempt was made to correlate such soils with erosion cycles, and it is determined that erosion cycles are probably caused by the pedogenesis in question. B.J.

A77-12898 **The first national demographic survey of Afghanistan - The role played by air photos and photo-counting techniques.** H. H. Dayal (Johns Hopkins University, Baltimore, Md.) and B. A. Khairzada (Town Planning Authority, Afghan Demographic Studies, Kabul, Afghanistan). *ITC Journal,* no. 1, 1976, p. 84-97.

A77-12903 **Urban survey with aerial photography - A time for practice.** C. A. de Bruijn, W. G. L. de Haas, P. Hofstee, A. B. M. Hijl, and V. F. L. Pollé (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 2, 1976, p. 184-224. 44 refs.

Standard and ad hoc applications of aerial photography for urban survey in the USA, Europe and the Third World are discussed along with new applications and current research geared to developing countries which include data on urban population and housing, urban land use, and urban information systems. Types of photography - black and white panchromatic, and color - are discussed together with photomaps, and orthophoto maps. Hardware (optical mechanical instruments and instruments for electronic data processing) and software (visual interpretation and automatic processing of imagery) development for photointerpretation are examined. B.J.

A77-13545 **Actual space use map of Enschede - Urban 'land use' inventory with photo interpretation.** P. Hofstee (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* vol. 4, no. 3, 1976, p. 431-456. 18 refs.

A description is presented of a project that involved the production of a map which shows the spatial pattern of activities of the City of Enschede in the Netherlands. The space use classification system employed is considered, taking into account general site development, site adaptation, actual use, the economic function performed by the enterprise using the premises, and the activity characteristics. Attention is also given to usual land use classifications, a proposal for standardization on urban planning maps, the NIROV space use classification and its modifications, the application of the space use classification, the delineation of areas, an inventory with photointerpretation and field check with mobile radio, a pilot survey, the recording of inventory data, and the introduction of corrections. G.R.

A77-14731 # **Lidar energetics during remote detection of oil slicks on the sea (Energetika lidara pri distantsionnom obnaruzhenii neftianykh plenok na more).** I. Ia. Gurevich (Gosudarstvennyi Okeanograficheskii Institut, Leningrad, USSR) and K. S. Shifrin (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR). *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,* vol. 12, Aug. 1976, p. 863-867. 11 refs. In Russian.

An estimate is made of the energy entering the input of a lidar receiver system, utilizing a CO2 laser, during remote sounding of the sea. Allowance is made in the calculations for attenuation of a 10.6-micron laser beam in the atmosphere as well as for variation of the sea-surface brightness coefficient as a function of wind speed. It is found that the energy entering the input decreases with an increase in wind speed from 2 to 15 m/s during nadir ranging, but sharply increases during ranging at an angle of 20 deg. This is attributed mainly to the variation in the brightness coefficient of a choppy sea. A concrete example is examined which allows estimation of the ranging height from which an oil slick on the sea can be detected with a medium-power CO2 lidar system. F.G.M.

A77-15054 * **IBIS - A geographic information system based on digital image processing and image raster datatype.** N. A. Bryant and A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. (A77-15051 04-43) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 1A-1 to 1A-7. 20 refs.

IBIS (Image Based Information System) is a geographic information system which makes use of digital image processing techniques to interface existing geocoded data sets and information management systems with thematic maps and remotely sensed imagery. The basic premise is that geocoded data sets can be referenced to a raster scan that is equivalent to a grid cell data set. The first applications (St. Tammany Parish, Louisiana, and Los Angeles County) have been restricted to the design of a land resource inventory and analysis system. It is thought that the algorithms and the hardware interfaces developed will be readily applicable to other Landsat imagery. B.J.

A77-15060 **The automated recognition of urban development from Landsat images.** P. Carter (Atomic Energy Research Establishment, Materials Physics Div., Harwell, Oxon, England), M. Jackson (Department of the Environment, London, England), and T. F. Smith (Department of the Environment, Harwell, Oxon, England). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. (A77-15051 04-43) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 1B-15 to 1B-24. 24 refs.

The problems and progress made in the development of automated methods for the recognition and extraction of urban land use features from Landsat digital data of the UK are described. In the data examined so far density slicing in one waveband appears to be

almost as effective as multiwaveband classification in selecting the urban areas. While absolute boundaries may be difficult to delineate, new developments may be recognizable which would be adequate for monitoring needs. It appears important to include the effects of seasonal change and make use of texural analysis in the classification process. (Author)

A77-15837 A method for inferring total ozone content from the spectral variation of total optical depth obtained with a solar radiometer. M. D. King and D. M. Byrne (Arizona, University, Tucson, Ariz.). *Journal of the Atmospheric Sciences,* vol. 33, Nov. 1976, p. 2242-2251. 24 refs. NSF Grant No. DES-75-1551; Contract No. N00014-75-C-0370.

A solar radiometer has been used to monitor solar irradiance at eight discrete wavelengths. From these monochromatic measurements at varying zenith angles, the total optical depth has been deduced by a computerized curve-fitting method. A technique is described whereby the ozone-absorption optical depths, and total ozone content of the atmosphere, can be inferred directly from the spectral variation of total optical depth. This procedure permits a systematic determination of total ozone content on a daily basis when other measurements are not available. Using the ozone-absorption optical depths determined in this manner, the values of aerosol optical depth may be obtained more accurately by subtracting the molecular-scattering and estimated ozone-absorption contributions from the total optical depth. A technique is also described for estimating the absorption optical depths at wavelengths where additional molecular absorption other than ozone occurs. Results are presented as daily values of total ozone content and molecular-absorption optical depths due to water vapor and oxygen at two of the radiometer wavelengths. The total ozone content exhibits the characteristic seasonal cycle with peak values in April. (Author)

A77-15867 Air analysis with quick, reliable results. P. A. Wilks, Jr. (Wilks Scientific Corp., South Norwalk, Conn.). *Environmental Science and Technology,* vol. 10, Dec. 1976, p. 1204-1208.

Portable infrared gas analyzers useful for rapid qualitative/quantitative analyses of a wide variety of industrial gases with characteristic IR fingerprints are described, with a brief review of IR absorption spectroscopy principles. Examples of utilization of the MIRAN-1A 'Supernose' gas analyzer in leak detection, area concentration mapping, stack monitoring, time-weighted averaging, and specific problems are cited. Employee protection for chronic cumulative exposure to toxic agents and hazardous concentrations is described. The fail-safe feature of interference monitoring, with readings never lower than actual, is mentioned. Improvements in IR gas analyzers derived from actual industrial contamination events are cited. MIRAN-201 Multi-Point Infrared Monitor built-in circuits for high-level alarm, flow failure, and error annunciation are mentioned. R.D.V.

A77-16072 Remote measurement of HCl, CH4, and N2O using a single-ended chemical-laser lidar system. E. R. Murray, J. E. van der Laan, and J. G. Hawley (Stanford Research Institute, Menlo Park, Calif.). *Applied Optics,* vol. 15, Dec. 1976, p. 3140-3148. 19 refs. Research supported by the U.S. Geological Survey and NSF.

A single-ended (monostatic) lidar, whose beam is backscattered from a foliage or other topographical target, was used to study the applicability of high-energy discretely tuned DF lasers for remote measurement of HCl, CH4, and N2O. Selective absorption of the backscatter signal was used to infer concentration of gaseous species. The lowest measurable material concentration for each gas was inferred from random fluctuations in the measured concentration. Lidar sensitivity to HCl, CH4, and N2O was 0.05, 6.0, and 0.24 ppm-km, respectively. To demonstrate system effectiveness under typical field conditions, an N2O plume was measured in the open atmosphere between the lidar system and a foliage target. Performance predictions indicate that total burden and range-resolved species concentration measurements are feasible within a range of 10 km with commercially available components. V.P.

A77-17021 * # LTA - Recent developments. N. J. Mayer (NASA, Office of Aeronautics and Space Technology, Materials and Structures Div., Washington, D.C.). *Astronautics and Aeronautics,* vol. 15, Jan. 1977, p. 58-64.

NASA-sponsored studies of existing and new LTA missions showed that airships looked very promising for some two dozen civil and military applications. These include surveillance of rural and urban areas, in the form of forest and police patrols; transport of very heavy large-volume maritime, industrial, and military payloads; coastal patrol and sea control; seismographic surveys; air pollution monitoring; and moving goods to remote areas; along with a number of less important but still attractive missions. A figure of merit of productivity (payload weight, ton moles per hour) was used to compare airships of various type and size. In each case, this criterion established an index of efficiency for evaluating not only conceptual approaches but also modes of flight. Some, in part unexpected, results of these studies are described. V.P.

A77-17096 Effect of gases, aerosols and clouds on the atmospheric absorption of solar radiation. G. Major (Institute for Atmospheric Physics, Budapest, Hungary). *Beiträge zur Physik der Atmosphäre,* vol. 49, no. 3, 1976, p. 216-221. 25 refs.

The role of gases, aerosols, and clouds in the absorption of solar radiation in the atmosphere is analyzed. The absorption characteristics were determined from global radiation data obtained at the earth's surface and from daily albedo data transmitted by the Nimbus 3 satellite. The influence of cloud cover was evaluated by comparing the total atmospheric absorption during clear and cloudy days. V.P.

A77-17838 SMS/GOES visible images detect a synoptic-scale air pollution episode. W. A. Lyons (COMPUMET, Minneapolis, Minn.) and R. B. Husar (Washington University, St. Louis, Mo.). *Monthly Weather Review,* vol. 104, Dec. 1976, p. 1623-1626. 8 refs. U.S. Environmental Protection Agency Contract No. R-800873.

An SMS/GOES 1 n mi visible image taken on 30 June 1975 reveals a massive area of atmospheric turbidity over the central and eastern United States. This was during the midpoint of a two-week air stagnation episode engulfing the Plains to the East Coast. It is shown that image 'haziness' is correlated to midday surface visibility reports, which are in turn possibly correlated to sulfate aerosol concentrations. It appears that geosynchronous satellite data can play a major role in determining the areal extent of sulfate aerosol episodes. (Author)

A77-18370 Tracking pollutants from a distance. S. H. Melfi (U.S. Environmental Protection Agency, Las Vegas, Nev.), J. D. Koutsandreas (U.S. Environmental Protection Agency, Washington, D.C.), and J. Moran (Public Health Service, National Institute for Occupational Safety and Health, Morgantown, W. Va.). *Environmental Science and Technology,* vol. 11, Jan. 1977, p. 36-38.

EPA's program of pollution monitoring by the use of remote sensors can be divided into four basic approaches: satellite monitoring, aerial sensing, continuous monitoring at fixed sites, and grab sampling. The Remote Sensing Program in the agency's Office of Research and Development is divided into two major activities: it provides operational remote sensing technical support to the rest of the agency, and it is developing advanced remote sensing techniques to meet the critical monitoring needs of the agency. Examples of operational remote sensing are given and modes of its utilization are described. Attention is given to the development of new laser techniques including conventional lidar, differential absorption lidar, and laser fluorescence. B.J.

A77-18983 * Remote sensing, land use, and demography - A look at people through their effects on the land. C. K. Paul (NASA, Washington, D.C.) and A. J. Landini (Los Angeles City, Dept. of City Planning, Los Angeles, Calif.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 349-367. 20 refs.

Relevant causes of failure by the remote sensing community in the urban scene are analyzed. The reasons for the insignificant role of remote sensing in urban land use data collection are called the law of realism, the incompatibility of remote sensing and urban management system data formats is termed the law of nominal/ordinal systems compatibility, and the land use/population correlation dilemma is referred to as the law of missing persons. The study summarizes the three laws of urban land use information for which violations, avoidance, or ignorance have caused the decline of present remote sensing research. Particular attention is given to the rationale for urban land use information and for remote sensing. It is shown that remote sensing of urban land uses compatible with the three laws can be effectively developed by realizing the 10 percent contribution of remote sensing to urban land use planning data collection. S.D.

A77-18985 * Conversion of prime agricultural land to urban land uses in Kansas City. R. V. Shaklee (Kansas, University, Lawrence, Kan.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 373-378. 6 refs. Research supported by the Mid-America Regional Council; Grant No. NGL-17-004-024.

In an expanding urban environment, agriculture and urban land uses are the two primary competitors for regional land resources. As a result of an increasing awareness of the effects which urban expansion has upon the regional environment, the conversion of prime agricultural land to urban land uses has become a point of concern to urban planners. A study was undertaken for the Kansas City Metropolitan Region, to determine the rate at which prime agricultural land has been converted to urban land uses over a five year period from 1969 to 1974. Using NASA high altitude color infrared imagery acquired over the city in October, 1969 and in May, 1974 to monitor the extent and location of urban expansion in the interim period, it was revealed that 42% of that expansion had occurred upon land classified as having prime agricultural potential. This involved a total of 10,727 acres of prime agricultural land and indicated a 7% increase over the 1969 which showed that 35% of the urban area had been developed on prime agricultural land. (Author)

A77-18986 Land use survey comparison of Hidalgo County, Texas, for January 21 and May 27, 1973 LANDSAT-1 overpasses. A. J. Richardson, C. L. Wiegand, R. J. Torline, and M. R. Gautreaux (U.S. Department of Agriculture; Texas A & M University, Weslaco, Tex.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 379-394. 13 refs.

Multispectral scanner (MSS) data collected by the first Earth Resources Technology Satellite (LANDSAT-1) on January 21 and May 27, 1973, were used for classification and acreage estimation studies of crop and soil categories in Hidalgo County, Texas. Classification results, based on approximately 1,400 fields, improved, using fields larger than 15 acres, with more than 25% plant cover, and with plants taller than 30 cm in both January and May 1973. Ground truth and computer acreage estimates for citrus, combined cotton and sorghum, and idle cropland categories were not significantly different for the respective dates of January, May, and January. The computer acreage estimates for citrus, combined cotton and sorghum, and winter vegetable categories differed from the Texas Crop and Livestock Reporting Service acreage estimates by 32, 8, and 47%, respectively. Thus, these results indicate a potential for an agricultural LANDSAT survey system for land use categories like citrus, combined cotton and sorghum, idle cropland, and vegetables. (Author)

A77-19171 # Regional evaluation of evapotranspiration with the infrared radiometer aboard the Nimbus 5 satellite (Evaluation régionale de l'évapotranspiration avec le radiomètre à infrarouge du satellite Nimbus 5). R. Bossard and Y. Vuillaume (Bureau de Recherches Géologiques et Minières, Orléans, France). *ESA Scientific and Technical Review*, vol. 2, no. 3, 1976, p. 209-219. 9 refs. In French.

This article examines the evaluation of evapotranspiration by remote-sensing techniques. The data used were provided by NASA's Nimbus 5 satellite for the semi-arid zone of Senegal. For clear weather and a certain number of points in the area considered, the energy involved in the evapotranspiration process is calculated by a balance method. For this purpose, a 'model' of the globe has been developed using electromagnetic radiation theory as well as the energy balances of the earth's surface. One of the latter (atmosphere/space) takes account of the thermal measurements carried out on board the satellite, the other (ground/atmosphere) is associated with the evapotranspiration process. With certain simplifying assumptions concerning the atmosphere's properties, the two balances are combined to extrapolate the evapotranspiration from the satellite data. The results thus obtained are in agreement with those given by Brunt's 'conventional' method based on the local meteorological data. (Author)

N77-10504# Sandia Labs., Albuquerque, N.Mex.
CONSTRUCTION AND OPERATION OF THE SURFACE CONTAMINANT DETECTOR MOD 2
R. E. Cuthrell, V. D. Nogle, and D. W. Tipping Mar. 1976 43 p refs
(Contract AT(29-1)-789)
(SAND-76-0099) Avail: NTIS HC A03/MF A01

Detailed construction and operating instructions, a parts list, and cost estimates for a surface contaminant detector are presented. The instrument is sensitive to the condensible contaminant content of environments and has been used for monitoring industrial facilities where contaminant sensitive parts are processed. ERA

N77-10585*# Texas Univ., Austin.
DEVELOPMENT AND APPLICATION OF OPERATIONAL TECHNIQUES FOR THE INVENTORY AND MONITORING OF RESOURCES AND USES FOR THE TEXAS COASTAL ZONE Quarterly Report, Mar. - May 1976
Peggy Harwood, Principal Investigator (General Land Office, Austin), Robert Finley, Samuel McCulloch (Texas Water Development Board, Austin), David Marphy (Texas Water Development Board, Austin), and Bill Hupp (Texas Water Development Board, Austin) Jun. 1976 47 p refs ERTS
(Contract NAS5-20986)
(E77-10001; NASA-CR-148843) Avail: NTIS HC A03/MF A01 CSCL 08F

The author has identified the following significant results. Image interpretation mapping techniques were successfully applied to test site 5, an area with a semi-arid climate. The land cover/land use classification required further modification. A new program, HGROUP, added to the ADP classification schedule provides a convenient method for examining the spectral similarity between classes. This capability greatly simplifies the task of combining 25-30 unsupervised subclasses into about 15 major classes that approximately correspond to the land use/land cover classification scheme.

N77-10595*# Virginia Univ., Charlottesville. Dept. of Environmental Sceinces.
LANDSAT APPLICATION OF REMOTE SENSING TO SHORELINE-FORM ANALYSIS Quarterly Report, 2 Jun. - 1 Sep. 1976
Robert Dolan, Bruce Hayden, Jeffrey Heywood, Principal Investigators, Clark Hewitt, and Jeffrey Michel 28 Sep. 1976 32 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20999)
(E77-10013; NASA-CR-148983) Avail: NTIS HC A03/MF A01 CSCL 08B

The author has identified the following significant results. LANDSAT imagery of the southern end of Assateague Island, Virginia, was enlarged to 1:80,000 and compared with high altitude (1:130,000) and low altitude (1:24,000) aerial photography in an attempt to quantify change in land area over a nine

month period. Change in area and configuration was found with LANDSAT and low altitude photography. Change in configuration, but no change in area was found with high altitude photography. Due to tidal differences at time of image obtention and lack of baseline data, the accuracy of the LANDSAT measurements could not be determined. They were consistent with the measurements from the low altitude photography.

N77-10596*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 2, PARTS A AND B: NORFOLK AND ENVIRONS; A LAND USE PERSPECTIVE Final Report
Robert H. Alexander, Principal Investigator, Peter J. Buzzanell, Katherine A. Fitzpatrick, Harry F. Lins, Jr., and Herbert K. McGinty, III Sep. 1975 364 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS 13 Vol.
(NASA Order S-70243-AG)
(E77-10014; NASA-CR-148984) Avail: NTIS HC A16/MF A01 CSCL 08B

The author has identified the following significant results. The Norfolk-Portsmouth metropolitan statistical area in southeastern Virginia was the site of intensive testing of a number of land resources assessment methods. Land use and land cover data at three levels of detail were derived by manual image *interpretation from both aircraft and satellite sources and used* to characterize the 1,766 sq km (682 sq mi) area from the perspective of its various resource-related activities and problems. Measurements at level 1 from 1:100, 000 scale maps revealed 42 percent of the test area (excluding bays and estuaries) to be forest, 28 percent agriculture, 23 percent urban and built-up, 4 percent nonforested wetlands, and 2 percent water. At the *same scale and level of detail, 10 percent of the area underwent* change from one land use category to another in the period 1959-70, 62 percent of which involved the relatively irreversible change from forest or agriculture to urban uses.

N77-10597*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 3: TOWARD A NATIONAL LAND USE INFORMATION SYSTEM Final Report
Robert H. Alexander, Principal Investigators Sep. 1975 76 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E77-10015; NASA-CR-148985) Avail: NTIS HC A05/MF A01 CSCL 08B

N77-10598*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 5: INTERPRETATION, COMPILATION AND FIELD VERIFICATION PROCEDURES *IN THE CARETS PROJECT* Final Report
Robert H. Alexander, Principal Investigator, Peter W. DeForth, Katherine A. Fitzpatrick, Harry F. Lins, Jr., and Herbert K. McGinty, III Sep. 1975 115 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS 13 Vol.
(NASA Order S-70243-AG)
(E77-10016; NASA-CR-148986) Avail: NTIS HC A06/MF A01 CSCL 08B

The author has identified the following significant results. Level 2 land use mapping from high altitude aircraft photography at a scale of 1:100,000 required production of a photomosaic mapping base for each of the 48, 50 x 50 km sheets, and the *interpretation and coding of land use polygons on drafting film* overlays. To enhance the value of the land use sheets, a series of overlays was compiled, showing cultural features, county boundaries and census tracts, surface geology, and drainage basins. In producing level 1 land use maps from LANDSAT imagery, at a scale of 1:250,000 drafting film was directly overlaid on LANDSAT color composite transparencies. Numerous areas of change were identified, but extensive areas of false changes were also noted.

N77-10599*# *Geological Survey, Reston, Va.*
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 6: COST, ACCURACY AND CONSISTENCY COMPARISONS OF LAND USE MAPS MADE FROM HIGH-ALTITUDE AIRCRAFT PHOTOGRAPHY AND ERTS IMAGERY Final Report
Robert H. Alexander, Principal Investigator and Katherine A. *Fitzpatrick Sep. 1975 63 p refs ERTS 13 Vol.*
(NASA Order S-70243-AG)
(E77-10017; NASA-CR-148987) Avail: NTIS HC A04/MF A01 CSCL 08B

The author has identified the following significant results. Level 2 land use maps produced at three scales (1:24,000, 1:100,000, and 1:250,000) from high altitude photography were *compared with each other and with point data obtained in the* field. The same procedures were employed to determine the accuracy of the Level 1 land use maps produced at 1:250,000 from high altitude photography and color composite ERTS imagery. Accuracy of the Level 2 maps was 84.9 percent at 1:24,000, 77.4 percent at 1:100,000 and 73.0 percent at 1:250,000. Accuracy of the Level 1 1:250,000 maps was 76.5 *percent for aerial photographs and 69.5 percent for ERTS imagery.* The cost of Level 2 land use mapping at 1:24,000 was found to be high ($11.93 per sq km). The cost of mapping at 1:100,000 ($1.75) was about two times as expensive as mapping at 1:250,000 ($.88), and the accuracy increased by only 4.4 percent.

N77-10600*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 7: LAND USE *INFORMATION AND AIR QUALITY PLANNING* Final Report
Robert H. Alexander, Principal Investigator, Wallace E. Reed, and John E. Lewis Sep. 1975 100 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS 13 Vol.
(NASA Order S-70243-AG)
(E77-10018; NASA-CR-148988) Avail: NTIS HC A05/MF A01 CSCL 08B

The author has identified the following significant results. The pilot air quality system provided data for updating information on the sources of point and area emissions of SO2 and particulate matter affecting the Norfolk-Portsmouth area of Virginia for 1971-72 winter and the annual 1972 period. During the 1971-72 winter, estimated SO2 amounts over an area with a SW-NE axis in the central section of Norfolk exceeded both primary and secondary levels.

N77-10601*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 9: SHORE ZONE LAND USE AND LAND COVER; CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE Final Report
Robert H. Alexander, Principal Investigator, R. Dolan, B. P. Hayden, and C. L. Vincent Sep. 1975 55 p ERTS 13 Vol.
(NASA Order S-70243-AG)
(E77-10019; NASA-CR-148989) Avail: NTIS HC A04/MF A01 CSCL 08B

The author has identified the following significant results. Analysis of the land use and land cover maps provides a stratification of the CARETS shore area into regions which have a similar environmental organization. Different elements of the landscape are altered less frequently moving inland. Near the beach, higher frequency of monitoring is needed than is needed in the inland areas, including the marsh and estuarine areas.

N77-10602*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL

INFORMATION SYSTEM. VOLUME 10: ENVIRONMENTAL PROBLEMS IN THE COASTAL AND WETLANDS ECOSYSTEMS OF VIRGINIA BEACH, VIRGINIA Final Report
Robert H. Alexander, Principal Investigator, Peter J. Buzzanell, and Herbert K. McGinty, III Sep. 1975 20 p refs ERTS 13 Vol.
(NASA Order S-70243-AG)
(E77-10020; NASA-CR-148990) Avail: NTIS HC A02/MF A01 CSCL 08B

N77-10603*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 11: POTENTIAL USEFULNESS OF CARETS DATA FOR ENVIRONMENTAL IMPACT ASSESSMENT Final Report
Robert H. Alexander, Principal Investigator and Peter J. Buzzanell Sep. 1975 78 p refs ERTS 13 Vol.
(NASA Order S-70243-AG)
(E77-10021; NASA-CR-148991) Avail: NTIS HC A05/MF A01 CSCL 08B

N77-10604*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 12: USER EVALUATION OF EXPERIMENTAL LAND USE MAPS AND RELATED PRODUCTS FROM THE CENTRAL ATLANTIC TEST SITE Final Report
Robert H. Alexander, Principal Investigator and Herbert K. McGinty, III Sep. 1975 182 p refs ERTS 13 Vol.
(NASA Order S-70243-AG)
(E77-10022; NASA-CR-148992) Avail: NTIS HC A09/MF A01 CSCL 08B
The author has identified the following significant results. Recommendations resulting from the CARETS evaluation reflect the need to establish a flexible and reliable system for providing more detailed raw and processed land resource information as well as the need to improve the methods of making information available to users.

N77-10605*# Geological Survey, Reston, Va.
CARETS: A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM. VOLUME 13: UTILITY OF CARETS PRODUCTS TO LOCAL PLANNERS; AN EVALUATION Final Report
Robert H. Alexander, Principal Investigator, Stuart W. Bendelow, and Franklin F. Goodyear Sep. 1975 56 p ERTS 13 Vol.
(NASA Order S-70243-AG)
(E77-10023; NASA-CR-148995) Avail: NTIS HC A04/MF A01 CSCL 08B

N77-10620*# Texas Univ. Health Science Center, Houston.
REMOTE SENSING UTILITY IN A DISASTER STRUCK URBAN ENVIRONMENT Final Report
Marjorie Rush and Alfonso Holguin 1 Sep. 1976 55 p refs School of Public Health.
(Grant NGL-44-084-003)
(NASA-CR-149103) Avail: NTIS HC A04/MF A01 CSCL 05A
Six major public health areas which might be affected by a natural disaster were identified. The functions and tasks associated with each area following a disaster, potential ways remote sensing could aid these functions, and the baseline data which would expedite problem solving associated with these functions are discussed. Author

N77-10692# California Univ., Livermore. Lawrence Livermore Lab.
ENVIRONMENTAL MONITORING PROBLEM: OPTIMAL SOLUTIONS FOR CONTROL AND SURVEILLANCE APPLICATIONS IN THE CASE OF INFREQUENT SAMPLING
Kenneth D. Pimentel Mar. 1976 10 p refs Presented at Conf. on Modelling of Environ. Systems, Amagi-Tokyo, 26 Apr. 1976
(Contract W-7405-eng-48)
(UCRL-775286; Conf-760417-1) Avail: NTIS HC A02/MF A01
Environmental monitoring for environmental feedback control applications and for surveillance or pollutant limit violation detection are considered. The main results are for the special case of infrequent sampling. If the required measurements are spaced far enough apart in time, certain terms in the estimation error equations dominate the asymptotic response yielding mathematically elegant solutions for infrequent sampling monitors. ERA

N77-10697# California Univ., Livermore. Lawrence Livermore Lab.
METHODS IN ENVIRONMENTAL SAMPLING FOR RADIONUCLIDES
R. C. Ragaini 1 Feb. 1976 16 p refs Presented at Proc. on Radionuclides in the Environment, Palto Alto, Calif., 22 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77722; Conf-751174-2) Avail: NTIS HC A02/MF A01
Methods of environmental sampling for radionuclides around operational and preoperational nuclear power plants are reviewed. The implications of the established radiation standards and their effect on sampling procedures are examined in detail. Transport mechanisms of radionuclides in liquid effluent, and the deposition of airborne radionuclides onto soil and vegetation are discussed. Water and soil sampling procedures are evaluated. The Lawrence Livermore Laboratory program of terrestial gamma ray surveys at preoperational nuclear power plants is described. ERA

N77-10725# Tereco Corp., College Station, Tex.
SEA-LEVEL MONITORING OF THE INCINERATION OF ORGANIC CHLORIDE WASTE BY M/T VULCANUS IN THE NORTHERN GULF OF MEXICO SHELL WASTE BURN NUMBER 2
10 Jan. 1975 62 p
(Contract EPA-68-01-2829)
(PB-253365/1) Avail: NTIS HC A04/MF A01 CSCL 13B
Shell Chemical Company began to explore alternative methods for the disposal of vinyl chloride during the interval when a land-based incinerator could be fabricated and put into use. The most promising of these alternatives appeared to be incineration of the wastes at sea aboard an incinerator ship such as M/T Vulcanus. A sea level monitoring program to determine whether or not the products of combustion would affect the marine environment adversely is discussed. GRA

N77-10800# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OUTLINE OF A DATA BANK SYSTEM FOR NATIONAL AND REGIONAL PLANNING

K. Hahne, H. Welscheid, and M. C Pistorius Sep. 1975 88 p refs
(CSIR-WISK-181; ISBN-0-7988-0764-4) Avail: NTIS HC A05/MF A01

Nine information systems for urban or regional planning in five European countries and the United States were studied. An analysis was made of output types and programs, available and desired data, user interface to the system, and the protection of data against abuse and damage. A model is presented for a national and regional planning system. A.H.

N77-11485*# Minnesota State Planning Agency, St. Paul.
ERTS-B APPLICATIONS TO MINNESOTA RESOURCE MANAGEMENT Progress Report, 25 Mar. - 25 Jun. 1976
Joseph E. Sizer, Principal Investigator 15 Sep. 1976 21 p ERTS
(Contract NAS5-20985)
(E77-10005; NASA-CR-148976) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. The shape, pattern, and extent of surface water (e.g. lakes) can be readily mapped. Comparing detailed maps of several lakes in Itasca County with the areas classified as water by the LANDSAT data show that some lakes have changed considerably since they were mapped. Due to several droughts this year (1976), the water level in most lakes has dropped. At this time, it seems feasible that LANDSAT digital tape data estimate lake water level change, due to the 1976 drought conditions.

N77-11486*# Delaware Univ., Newark. Coll. of Marine Studies.
SPECTRAL REFLECTANCE SIGNATURES OF COASTAL POLLUTANTS Progress Report
V. Klemas, Principal Investigator and W. Philpot 18 Oct. 1976 83 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-1149)
(E77-10011; NASA-CR-148981) Avail: NTIS HC A05/MF A01 CSCL 13B

N77-11488*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN Quarterly Progress Report, Jul. - Sep. 1976
Takakazu Maruyasu, Hiroaki Ochiai, Yasuhiro Sugimori, Daitaro Shoji, Kaname Takeda, Kiyoshi Tsuchiya, Iwao Nakajima, Takamasa Nakano, Shigechika Hayashi, Seiji Horikawa, Principal Investigators et al 29 Oct. 1976 18 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10025; NASA-CR-149128) Avail: NTIS HC A02/MF A01 CSCL 04B

The author has identified the following significant results. A detailed land use classification for a large urban area of Tokyo was made using MSS digital data. It was found that residential, commercial, industrial, and wooded areas and grasslands can be successfully classified. A mesoscale vortex associated with large ocean current, Kuroshio, which is a rare phenomenon, was recognized visually through the analysis of MSS data. It was found that this vortex affects the effluent patterns of rivers. Lava flowing from Sakurajima Volcano was clearly classified for three major erruptions (1779, 1914, and 194-) using MSS data.

N77-11499*# Academy of Scientific Research and Technology, Cairo (Egypt).
GEOLOGICAL AND ENVIRONMENTAL RESOURCES INVESTIGATIONS IN EGYPT USING LANDSAT IMAGES Quarterly Progress Report
M. Abdel-Hady, Principal Investigator [1976] 21 p refs Sponsored by NASA ERTS
(E77-10039; NASA-CR-149140; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

N77-11508*# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Remote Sensing Programs for Earth Resources Surveys
RESOURCE AND ENVIRONMENTAL SURVEYS FROM SPACE WITH THE THEMATIC MAPPER IN THE 1980'S
1976 129 p refs
(Contract NASw-2895)
(NASA-CR-149191; NRC/CORSPERS-76/1) Avail: NTIS HC A07/MF A01 CSCL 08F

The selection of observation of vegetation is the primary optimization objective of the thematic mapper. The following are aspects of plans for the thematic mapper: (1) to include an appropriately modified first generation MSS in the thematic mapper mission; (2) to provide assured coverage for a minimum of six years to give agencies and other users an opportunity to justify the necessary commitment of resources for the transition into a completely valid operational phase; (3) to provide for global, direct data read-out, without the necessity for on-board data storage or dependence on foreign receiving stations; (4) to recognize the operational character of the thematic mapper after successful completion of its experimental evaluation; and (5) to combine future experimental packages with compatible orbits as part of the operational LANDSAT follow-on payloads.
Author

N77-11516# Resource Planning Associates, Inc., Cambridge, Mass.
IDENTIFICATION AND ANALYSIS OF MID-ATLANTIC ONSHORE OCS IMPACT
Feb. 1976 284 p refs Prepared for the Middle Atlantic Governors' Coastal Resources Council
(Contract FEA-CA-05-50078-00)
(PB-254925/1; RA-75-46C) Avail: NTIS HC A13/MF A01 CSCL 08I

Literature on onshore socioeconomic and environmental impacts related to Outer Continental Shelf oil and gas recovery is reviewed. Management decisions and policy choices for the next decade, and additional study needs are discussed. GRA

N77-11569*# Mitre Corp., Bedford, Mass.
EVALUATION OF SATELLITES AND REMOTE SENSORS FOR ATMOSPHERIC POLLUTION MEASUREMENTS
J. Carmichael, R. Eldridge, E. Friedman, and E. Keitz Sep. 1976 367 p refs
(NASA Order L-88328; Contract F19628-76-C-0001)
(NASA-CR-144970; MTR-7170) Avail: NTIS HC A16/MF A01 CSCL 13B

An approach to the development of a prioritized list of scientific goals in atmospheric research is provided. The results of the analysis are used to estimate the contribution of various spacecraft/remote sensor combinations for each of several important constituents of the stratosphere. The evaluation of the combinations includes both single-instrument and multiple-instrument payloads. Attention was turned to the physical and chemical features of the atmosphere as well as the performance capability of a number of atmospheric remote sensors. In addition, various orbit considerations were reviewed along with detailed information on stratospheric aerosols and the impact of spacecraft environment on the operation of the sensors. Author

N77-11571# Oak Ridge National Lab., Tenn.
***MIUS* SYSTEMS ANALYSIS: EFFECTS OF UNFAVORABLE METEOROLOGICAL CONDITIONS AND BUILDING CONFIGURATIONS ON AIR QUALITY**
L. Breitstein and R. E. Grant Feb. 1976 69 p refs
(Contract W-7405-eng-26)
(ONRL/HUD/MIUS-29-Add-2) Avail: NTIS HC A04/MF A01

An analytical study was made to compare the highest ground-level concentrations of atmospheric pollutants that would result from the exhaust gases of the thermal-electric subsystems of a hypothetical reference modular integrated utility system (MIUS) and conventional utility system model. Both systems

served a large complex of garden type apartments under a variety of meteorological conditions, with emphasis being given to those conditions which were most likely to induce poor air quality. The possible effects of aerodynamic downwash of exhaust gases and of building configurations on air quality within an apartment complex served by MIUS are also estimated. Calculated concentrations of pollutants are compared to the appropriate air quality standards established by the Environmental Protection Agency. ERA

N77-11595# National Inst. of Scientific Research, Rancho Santa Fe, Calif.
DESIGN OF POLLUTANT-ORIENTED INTEGRATED MONITORING SYSTEMS. A TEST CASE: ENVIRONMENTAL LEAD Interim Report
Dale W. Jenkins Apr. 1976 62 p refs
(Contract EPA-68-03-0443)
(PB-255103/4; EPA-600/4-76-018) Avail: NTIS HC A04/MF A01 CSCL 13B

An integrated monitoring system is a systems approach for providing the information necessary to permit efficient control of those sources of pollutants causing major threats to the population of highest risk. A workship for the design of a pollutant-oriented integrated monitoring system convened by EPA in March 1974 summarized the elements of such a systems approach and discussed those information needs yet to be satisfied by basic monitoring research. GRA

N77-11601# Environmental Monitoring and Support Lab., Las Vegas, Nev.
AIRBORNE LIDAR RAPS STUDIES, FEBRUARY 1974
John A. Eckert, James L. McElroy, Donald H. Bundy, John L. Guagliardo, and S. H. Melfi Jun. 1976 24 p refs
(PB-255886/4; EPA-600/4-76-028) Avail: NTIS HC A02/MF A01 CSCL 13B

During February 1974, an airborne downlooking lidar system was flown in support of the regional air pollution study being conducted by the U.S. Environmental Protection Agency (EPA) in St. Louis, Missouri. The lidar system was used primarily to measure mixing layer height over the metropolitan area during the morning and evening transition periods. The flight plan consisted of south to north and west to east traverses with horizontal data resolution of 1.5 kilometers and a vertical resolution of 30 meters. Final data are presented in computer-generated, iso-scattering curves plotted for altitude versus ground-distance along the particular traverse. GRA

N77-11681# GCA Corp., Bedford, Mass. Technology Div.
DESIGN, DEVELOPMENT, FABRICATION AND TESTING OF A PORTABLE SELF-CONTAINED RESPIRABLE DUST MASS MONITOR
Pedro Lilienfeld 25 Oct. 1974 58 p refs
(Contract H0232039)
(PB-254503/6; BM-OFR-73-76) Avail: NTIS HC A04/MF A01 CSCL 14B

An airborne mass monitor for unattended and recording measurements of the concentration of dust in mining environments is described. Sensing collection are performed by beta-radiation attenuation and inertial implementation, respectively. The instrument is portable, battery or line operated provides a digital printout of the mass concentration during each selection sampling period, as well as the accumulated mass of dust, and the elapsed sampling time. GRA

N77-12472*# Ohio Dept. of Economic and Community Development, Columbus.
THE OHIO LAND ALLOCATION MODEL, PHASE 2
Oscar Fisch, Principal Investigator and Steven I. Gordon Jul. 1976 81 p refs ERTS
(Contract NAS5-22399)
(E77-10042; NASA-CR-149171) Avail: NTIS HC A05/MF A01 CSCL 08B

N77-12474*# Brevard County Planning Dept., Titusville, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 12 May - 11 Aug. 1976
John W. Hannah, Garland L. Thomas, Fernando Esparza, Principal Investigators, and James J. Millard (NASA. Kennedy Space Center) 11 Aug. 1976 35 p ref ERTS
(Contract NAS5-20907)
(E77-10044; NASA-CR-149180; BCPD-L2-6) Avail: NTIS HC A03/MF A01 CSCL 08B

N77-12475*# Ohio Dept. of Economic and Community Development, Columbus.
DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO Quarterly Progress Report
Paul E. Baldridge, Principal Investigator 10 Sep. 1976 5 p ref ERTS
(Contract NAS5-22399)
(E77-10045; NASA-CR-149181; QPR-5) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. A preliminary comparison of the land use maps derived from high altitude photography and imagery generated from land use CCT's shows considerable correlation of data. Most land use features are best identified on LANDSAT data taken over a full year, showing the effects of the four seasons. It appears that the most cost effective and timely way of providing land use data is to use LANDSAT data for identifying 75 to 90 percent of land use categories, using temporal data. For surface mining, close examination of LANDSAT, Skylab, and aircraft data covering the same area where linears were found seems to indicate that the type of resolution characteristic of LANDSAT data results in a better definition of linears of one or more miles. Long line linears were found in the vicinity of known gas production areas in Ohio.

N77-12483*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUMIS: LAND USE MANAGEMENT AND INFORMATION SYSTEMS; COORDINATE ORIENTED PROGRAM DOCUMENTATION
1 Nov. 1976 161 p ref
(NASA-CR-149165; JPL-SP-43-33) Avail: NTIS HC A08/MF A01 CSCL 08B

An integrated geographic information system to assist program managers and planning groups in metropolitan regions is presented. The series of computer software programs and procedures involved in data base construction uses the census DIME file and point-in-polygon architectures. The system is described in two parts: (1) instructions to operators with regard to digitizing and editing procedures, and (2) application of data base construction algorithms to achieve map registration, assure the topological integrity of polygon files, and tabulate land use acreages within administrative districts. Author

N77-12615# European Space Agency, Paris (France).
MEASUREMENT OF GASEOUS MINOR CONSTITUENTS IN THE NATURAL STRATOSPHERE
Marie-Lise Chanin, Raymond Chevalerias, Andre Girard, Olga Lado-Bordowski, Nicole Louisnard, Andre Marten, and Christian Muller Oct. 1976 105 p refs Transl. into ENGLISH of "La Mesure des Constituants Gazeux Minoritaires dans la Stratosphere Naturelle", ONERA, Paris Report ONERA-P-1976-1, 1976 Original report in FRENCH previously announced as N77-10739
(ESA-TT-337; ONERA-P-1976-1; COVOS-1) Avail: NTIS HC A06/MF A01

To determine whether stratospheric aircraft risk dangerously modifying the present condition of the atmosphere, it is necessary to ascertain this condition with a precision comparable to the changes anticipated. The most recent results for each of the so-called gaseous minor constituents are described, after first reviewing the various techniques of measurement which can be used from the ground, from aircraft, and from balloons. It is shown that investigators are already remarkably well-equipped for detecting natural variations and, possibly, variations not arising from natural sources which might affect the principal gases being surveyed. Nonetheless, significant gaps still exist in the present knowledge of stratospheric dynamics and chemistry. The progress

needed to fill these gaps, either by improvement of present techniques or development of new ones, is defined.
Author (ESA)

N77-13138*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONTAMINATION FROM SKYLAB AS DETERMINED FROM THE SOLAR CORONAGRAPH DATA
James P. McGuire Dec. 1976 33 p refs
(NASA-TM-X-73353) Avail: NTIS HC A03/MF A01 CSCL 14B

The white light solar coronagraph was one of the scientific telescopes flown on Skylab to study the sun. It studied the sun's atmosphere located from 0.5 to 5.0 solar radii above the sun's limb. Such a telescope is so sensitive to contamination around the spacecraft that it caused a major contamination abatement program to be initiated at the conception of Skylab. The coronagraph's data is analyzed showing the successfulness of that abatement program. Author

N77-13384 Princeton Univ., N.J.
MULTIPLEXED FABRY PEROT INTERFEROMETERS Ph.D. Thesis
Robert A. King 1976 150 p
Avail: Univ. Microfilms Order No. 76-23832

The feasibility of using rotational Raman backscattering in the remote detection of atmospheric pollutants in the concentration range 300-400 ppm is discussed, with the signature and concentration of the pollutant determined by the multiplexing of its spectrum through a Fabry-Perot interferometer. Background rotational Raman and Rayleigh scattering is removed using a Fabry-Perot in reflection as a narrow band periodic notch filter. The variation of resonance width with B value, choice of optimum resonance for complex systems such as nitric oxide, and stringent criteria for free spectral range, Fabry-Perot etalon quality, and reflectivity are discussed for both the pollutant summing Fabry-Perot and for the background rejection Fabry-Perot. A combination of the increased scattering cross section of rotational over vibrational Raman, the multiplexing effect of the Fabry-Perot, and the increased light gathering power of a Fabry-Perot gives an estimated improvement in signal strength. Dissert. Abstr.

N77-13399# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
DEVELOPMENT OF AN INFRARED GAS SPECTROMETER BASED ON THE BIFREQUENCY PRINCIPLE, FOR AUTOMATIC AND CONTINUOUS ANALYSIS OF GASEOUS EMISSIONS Final Report
Joachim Marckmann Bonn Bundesmin. fuer Forsch. u. Technol. Jun. 1976 70 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-76-22; BMFT-NTO-36) Avail: NTIS HC A04/MF A01; ZLDI, Munich, DM 14,30

The dispersive infrared-analyzer developed quantitatively scans the concentration of a sample gas component by measuring the absorption as a characteristic infrared band of the sample relative to the background absorption at a reference frequency. The instrument sequentially scans the concentration of up to four components within the spectral range from 4150/cm to 1000/cm. The spectral range may be modified by the exchange of different gratings and detectors. The optical layout allows the use of different infrared liquid cells and special accessories as well as of longpath gas cells. The system is completed by the gas probe with heated coarse and fine gas filters, heated gas tubings, and a gas pump. Author (ESA)

N77-13497*# Tennessee Univ., Tullahoma. Remote Sensing Div.
REMOTE SENSING APPLICATION TO REGIONAL ACTIVITIES Semiannual Report, 15 Apr. - 15 Oct. 1976
F. Shahrokhi, N. L. Jones, and L. A. Sharber 15 Oct. 1976 24 p
(Contract NAS8-31980)
(NASA-CR-150123) Avail: NTIS HC A02/MF A01 CSCL 08F

Two agencies within the State of Tennessee were identified whereby the transfer of aerospace technology, namely remote sensing, could be applied to their stated problem areas. Their stated problem areas are wetland and land classification and strip mining studies. In both studies, LANDSAT data was analyzed with the UTSI video-input analog/digital automatic analysis and classification facility. In the West Tennessee area three land-use classifications could be distinguished; cropland, wetland, and forest. In the East Tennessee study area, measurements were submitted to statistical tests which verified the significant differences due to natural terrain, stripped areas, various stages of reclamation, water, etc. Classifications for both studies were output in the form of maps of symbols and varying shades of gray. Author

N77-13572# Naval Research Lab., Washington, D.C.
AMBIENT AIR QUALITY DATA MANAGEMENT AT NRL Final Report
A. Stamulis, R. L. Fluornoy, and Lynn K. Jones Apr. 1976 36 p refs
(AD-A025024; NRL-MR-3261) Avail: NTIS HC A03/MF A01 CSCL 13/2

The instruments housed in the NRL air monitoring station are described. A description of the computer program to handle the data generated by the air pollution analyzers is presented including the program routine and subroutines. The presentation outlined in this report should be useful to those facilities interested in maintaining an air monitoring station and arranging the air quality data in a useful and meaningful format. GRA

N77-14545*# Department of Industry, London (England).
THE USE OF ERTS/LANDSAT IMAGERY IN RELATION TO AIRBORNE REMOTE SENSING FOR TERRAIN ANALYSIS IN WESTERN QUEENSLAND, AUSTRALIA Quarterly Report
Monica M. Cole, Principal Investigator and Stewart Owen-Jones 15 Nov. 1976 9 p refs Sponsored by NASA ERTS
(E77-10046; NASA-CR-149252) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Distinctive spectral signatures were found associated with areas of near surface bedrock with covered ground east of Dugald River and along the Thorntonia River valley west of Lady Annie. Linears identified in the Dugald River area on LANDSAT 2 imagery taken in March and July 1975 over the Cloncurry-Dobbyn area, displayed preferred orientation. A linear group with NE-SW orientation was identified in the Lady Annie area. In this area, the copper mineralization in the Mt. Kelly area occurs along a well marked linear with NNW/SSE direction apparent on images for March, September, and November 1975. Geobotanical anomalies provided surface expression of the copper deposits in Mt. Kelley.

N77-14549*# West Virginia Dept. of Natural Resources, Charleston.
CONTRIBUTION OF ERTS-B TO NATURAL RESOURCE PROTECTION AND RECREATIONAL DEVELOPMENT IN WEST VIRGINIA Progress Report, 19 Jun. - 19 Sep. 1976
Ira S. Latimer, Jr., Principal Investigator 16 Nov. 1976 12 p refs ERTS
(E77-10050; NASA-CR-149257; PR-4) Avail: NTIS HC A02/MF A01 CSCL 08B

N77-14550*# Stanford Univ., Calif. School of Earth Sciences.
EVALUATION OF ERTS MULTISPECTRAL SIGNATURES IN RELATION TO GROUND CONTROL SIGNATURES USING A NESTED-SAMPLING APPROACH Final Report
Ronald J. P. Lyon, Principal Investigator Apr. 1975 275 p refs Revised Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21884)

(E77-10051; NASA-CR-149258) Avail: NTIS HC A12/MF A01 CSCL 08F

The author has identified the following significant results. Ground measured spectral signatures of wavelength bands matching ERTS MSS were collected using a radiometer at several Californian and Nevadan sites, and directly compared with similar data from ERTS CCTs. The comparison was tested at the highest possible spatial resolution for ERTS, using deconvoluted MSS data, and contrasted with that of ground measured spectra, originally from 1 meter squares. In the mobile traverses of the grassland sites, these one meter fields of view were integrated into eighty meter transects along the five km track across four major rock/soil types. Suitable software was developed to read the MSS CCT tapes, to shadeprint individual bands with user-determined greyscale stretching. Four new algorithms for unsupervised and supervised, normalized and unnormalized clustering were developed, into a program termed STANSORT. Parallel software allowed the field data to be calibrated, and by using concurrently continuously collected, upward- and downward-viewing, 4 band radiometers, bidirectional reflectances could be calculated.

N77-14566*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

FIRST CONCEPT FOR A TROPICAL AREA MONITORING PROJECT

Jul. 1976. 26 p refs

(NASA-TM-X-74306; JSC-11464) Avail: NTIS HC A03/MF A01 CSCL 05B

The first concept of a tropical area monitoring project is presented. The project would develop an operational system capable of monitoring land areas by machine processing of satellite data. LANDSAT images would be processed within a controlled isolable unit to detect changes in forest cover, rangeland, soil integrity, and other factors important to conservation of tropical ecology. An introductory developmental effort is described to demonstrate the use of LANDSAT data in this application. The independent unit, which functions as a user organization within the development project, assures that the technology will be transferable to a user organization through well defined, easily monitored interfaces with the rest of the world. Author

N77-15475# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

APPLICATION OF REMOTE SENSING TO ENVIRONMENTAL MANAGEMENT AT MILITARY FACILITIES

Lewis E. Link, Jr. and Daniel H. Cress 1976 15 p refs

(AD-A026063) Avail: NTIS HC A02/MF A01 CSCL 14/5

The systematic application of remote sensing techniques at Fort Carson has provided critical information for the environmental management of vehicle-maneuver training areas. The remote sensing simulation model provided a quantitative means for selecting the best film-filter combination for the job. Only one type of information was extracted from remotely sensed data for the purposes of this example; the techniques and systematic procedures followed herein could easily be applied to more complex studies requiring other types of information. It must be emphasized that the application of remote sensing to a specific problem must be closely allied with the specific data requirements necessary for the solution of the problem. Accuracy, scale, and threshold values considered critical for detection must be identified prior to the conduct of the remote sensing mission to allow adequate planning of the data acquisition program, both on the ground and with remote sensor systems. Author (GRA)

N77-15532*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Physics and Geophysical Sciences.

A THEORETICAL/EXPERIMENTAL PROGRAM TO DEVELOP ACTIVE OPTICAL POLLUTION SENSORS

Frank S. Mills, Roger N. Blais, and Earl C. Kindle 1977 53 p refs

(Grant NsG-1060)

(NASA-CR-149394; PGSTR-AP77-47) Avail: NTIS HC A04/MF A01 CSCL 14B

Light detection and ranging (LIDAR) technology was applied to the assessment of air quality, and its usefulness was evaluated by actual field tests. Necessary hardware was successfully constructed and operated in the field. Measurements of necessary physical parameters, such as SO2 absorption coefficients were successfully completed and theoretical predictions of differential absorption performance were reported. Plume modeling improvements were proposed. A full scale field test of equipment, data analysis and auxiliary data support was conducted in Maryland during September 1976. Author

N77-15533# California Univ., Livermore. Lawrence Livermore Lab. Biomedical and Environmental Research Div.

OVERVIEW OF THE IMPERIAL VALLEY ENVIRONMENTAL PROJECT

L. R. Anspaugh, ed. and P. L. Phelps, ed. 8 Apr. 1976 14 p Presented to the Natl. Geothermal Conf., Palm Springs, Calif., 19-22 Apr. 1976

(Contract W-7405-eng-48)

(UCID-17067; Conf-760450-1) Avail: NTIS HC A02/MF A01

A long-term project to acquire complete understanding of the environmental quality in the Imperial Valley of California was initiated to ensure that the development of geothermal resources proceeds on an environmentally sound basis. Consequently, the Imperial Valley Environmental Project (IVP) is committed to an intensive and comprehensive study designed to establish an environmental baseline for the Imperial Valley as well as to develop an understanding of the environmental and other effects associated with development of geothermal resources. The IVP is organized into seven main study sections, which when taken together cover all the significant issues and concerns. The sections are: Air Quality; Water Quality; Ecosystem Quality, (Soil, Plants, Animals, etc.); Subsidence and Induced Seismicity; Health Effects; Socio-Economics; and an Integrated Assessment. Author (ERA)

N77-15564*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ATMOSPHERIC AEROSOLS: THEIR OPTICAL PROPERTIES AND EFFECTS (SUPPLEMENT)

1976 46 p refs Conf. proc. held at Williamsburg, Va., 13-15 Dec. 1976; sponsored by NASA Langley Research Center and the Optical Soc. of Am.

(NASA-CP-2004-Suppl) Avail: NTIS HC A03/MF A01 CSCL 04A

A digest of technical papers is presented. Topics include aerosol size distribution from spectral attenuation with scattering measurements; comparison of extinction and backscattering coefficients for measured and analytic stratospheric aerosol size distributions; using hybrid methods to solve problems in radiative transfer and in multiple scattering; blue moon phenomena; absorption refractive index of aerosols in the Denver pollution cloud; a two dimensional stratospheric model of the dispersion of aerosols from the Fuego volcanic eruption; the variation of the aerosol volume to light scattering coefficient; spectrophone in situ measurements of the absorption of visible light by aerosols; a reassessment of the Krakatoa volcanic turbidity, and multiple scattering in the sky radiance. A.H.

03
GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A77-10121 * Thermographic mosaic of Yellowstone National Park. R. S. Williams, Jr. (U.S. Geological Survey, Reston, Va.), P. G. Hasell, Jr. (Michigan, Environmental Research Institute, Ann Arbor, Mich.), A. N. Sellman (NASA, Goddard Space Flight Center, Greenbelt, Md.; Michigan, Environmental Research Institute, Ann Arbor, Mich.), and H. W. Smedes (U.S. Geological Survey, Denver, Colo.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Oct. 1976, p. 1315-1324. 28 refs.

An uncontrolled aerial thermographic mosaic of Yellowstone National Park was assembled from the videotape record of 13 individual thermographs obtained with linescan radiometers. Post mission processing of the videotape record rectified the nadir line to a topographic map base, corrected for v/h variations in adjacent flight lanes, corrected for yaw and pitch distortions, and distortions produced by nonlinearity of the side-wise scan. One of the purposes of the thermographic study was to delineate the areas of thermal emission (hot springs, geysers, etc.) throughout the Park, a study which could have great value in reconnaissance surveys of geothermal areas in remote regions or regions of high relief. B.J.

A77-10897 * # The Lageos satellite. C. W. Johnson, C. A. Lundquist, and J. L. Zurasky (NASA, Marshall Space Flight Center, Huntsville, Ala.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-065.* 7 p. 11 refs.

The fundamental concept of Lageos is a long-lived, dense, electrically and mechanically inert spherical satellite with its surface speckled with retroreflecting cube corners, designed such that range measurements between duly equipped laser ground stations and the satellite are possible with an ultimate accuracy of 2 cm when data from a single satellite pass are appropriately averaged. The Lageos concept requires that the satellite be placed in an orbit for which an ephemeris can be determined ultimately to 5 cm rms uncertainty for a 24-hour arc. These required satellite characteristics should allow the several geodynamic motions experienced by ground stations to be determined typically with 2 cm accuracy. (Author)

A77-11219 * Ogo 5 observations of Pc 5 waves - Ground-magnetosphere correlations. S. Kokubun, R. L. McPherron, and C. T. Russell (California, University, Los Angeles, Calif.). *Journal of Geophysical Research,* vol. 81, Oct. 1, 1976, p. 5141-5149. 37 refs. NSF Grants No. GA-341484; No. DES-74-23464; Contract No. N000-69-A-200-4016; Grant No. NGR-05-007-004.

A77-11235 * Detailed gravimetric geoid confirmation of sea surface topography detected by the Skylab S-193 altimeter in the Atlantic Ocean. J. G. Marsh (NASA, Goddard Space Flight Center, Earth Survey Applications Div., Greenbelt, Md.) and E. S. Chang (EG & G/Washington Analytical Services Center, Inc., Riverdale, Md.). *Bulletin Géodésique,* vol. 50, no. 3, 1976, p. 291-299. 13 refs.

A77-11591 A surface thermal anomaly in the region of Chaudes-Aigues /France/ detected on aerial thermographs. S. Paul (Paris VIII, Université, Paris, France), J. P. Gibert (Paris XI, Université, Orsay, Essonne, France), L. Pontier, C. Dechambenoy, and L. Menenger (CNRS, Laboratoire de Météorologie Dynamique, Palaiseau, Essonne, France). *Remote Sensing of Environment,* vol. 5, no. 3, 1976, p. 177-190. 10 refs. Délégation Générale à la Recherche Scientifique Contracts No. 73-7-1322; No. 74-7-1375.

In the course of an aerial survey mission with an infrared scanning radiometer (10.5-12.5 microns) performed in 1974 over an area of eruptive volcanic rocks, a surface thermal anomaly has been detected in the vicinity of Chaudes-Aigues, France. Its amplitude, 2-3 C, is close to the one produced by hyperthermal springs at Chaudes-Aigues. The existence of this anomaly has been confirmed by in-situ surface temperature measurements performed in 1975. This paper reports on the method by which a surface temperature anomaly was confirmed by ground measurements, using contact thermometers and a hand-held Barnes PRT-6 radiometer. An isopleth map of surface thermal anomalies has been produced which is based on airborne thermal infrared imagery (aerial thermography).

(Author)

A77-12077 # Multipole representation of the basic features of the geoid figure (Mul'tipol'noe istolkovanie osnovnykh osobennostei figury geoida). G. A. Meshcheriakov and A. N. Marchenko. *Geodeziia i Kartografiia,* June 1976, p. 14-24. 14 refs. In Russian.

A multipole representation of planetary geopotential is used to examine the geoid figure of the earth. In this approach, using a Maxwell representation of the spherical functions of geopotential, the quadrupole and octapole are used as auxiliary constructions to describe the geoid figure on a global scale. The quadrupole defines an earth figure which is close to a three-axis ellipsoid, while the octapole describes the eight major undulations of the surface of this ellipsoid. These undulations correspond to the eight charges of the octapole - the main global inhomogeneities of planetary mass (mascons) in their generalized form. B.J.

A77-12440 Surface feature reconnaissance of Death Valley, California using Skylab S192 multispectral scanner thermal data. A. V. Mazade (Lockheed Electronics Co., Inc., Houston, Tex.). In: *Conference on Decision and Control, 6th, and Symposium on* Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 417-421. 7 refs.

Thermal channel data collected with the Skylab S192 multispectral scanner was evaluated for a scene collected over the Death Valley, California area during January 1974. The data collection features of the scanner and the preprocessing of computer compatible precision data products are described. The thermal scene is evaluated for surface feature discrimination using three techniques: (1) false color image construction based on data statistics, (2) image density slicing based on a frequency historgram, and (3) quantitative and qualitative single-channel classification of predominant features in the scene. Procedures and results are discussed and sample test materials are presented. The results indicate that relative temperature values in small adjacent areas have potential importance in feature discrimination. The temperatures of non-adjacent features over a large scene have less immediate value due to the adiabatic effects of altitude and the effects of differential solar heating. (Author)

A77-12886 Automatic cartography and photogrammetry (La cartographie automatique et la photogrammétrie). B. Dubuisson (*Ecole des Travaux Publics; Ecole Supérieure des Géomètres et* Topographes, Paris, France). *ITC Journal,* no. 3, 1975, p. 360-373. In French.

The paper describes a system of computer-aided mapmaking (automatic photogrammetry) based on stereorestitution of aerial photographs. Automatic cartography as it is described here is a three-fold process: (1) the analytical or analog realization of a numerical chain of images, (2) necessary computer processing, particularly the conversion of terrain profiles to photogrammetric couples (this processing can also be used to subclassify terrain elements of the same type - roads, factories, railroads, waterways, etc.) in terms of a thematic map, and (3) computerized design after production of the magnetic tape of the design to scale. B.J.

A77-12904 **Interpolation accuracy for topographic and geological surfaces.** K. Kubik (Ministry of Transport and Public Works, The Hague, Netherlands) and A. G. Botman (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal*, no. 2, 1976, p. 236-274. 6 refs.

The paper examines the theoretical accuracy of point interpolation for topographic and geological surfaces. The type and roughness of the surface is described by a covariance function, and various models (exponential and Gaussian) for this covariance function and various interpolation methods are studied. It is found that interpolation accuracy depends primarily on the properties of the surface and on the spacing of the control points, and, to a lesser extent, on the interpolation method used. B.J.

A77-12942 * **Sensitivity analysis of short-arc station coordinate determinations from range data.** B. E. Schutz and B. D. Tapley (Texas, University, Austin, Tex.). *Journal of the Astronautical Sciences*, vol. 24, Apr.-June 1976, p. 111-136. 21 refs. Grant No. NGR-44-012-283.

The accurate determination of the geocentric coordinates of a tracking station is essential for most geodetic and geophysical satellite applications. Since most of these satellites are close to the earth, the geopotential model is a dominant source of error which significantly influences station coordinate determinations. Other sources, such as GM error and drag, also influence the accuracy of the station coordinate determination. One technique for reducing the effect of these errors is to use short-arcs consisting of a few passes of the satellite over the tracking station. This paper analyzes the sensitivity of short-arc station coordinate estimates to various errors in the physical model, to the number of observations, and to the station-satellite geometry using simulated as well as real data.

(Author)

A77-17900 * **Imaging radar applications to mapping and charting.** F. Leberl (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *(International Society for Photogrammetry, Congress, 13th, Helsinki, Finland, July 11-23, 1976.) Photogrammetria*, vol. 32, Nov. 1976, p. 75-100. 118 refs.

The paper outlines the major actual and potential radar mapping applications, gives an account of the present state of satellite radar imaging, and reviews the radargrammetric work achieved since 1972. Attention is focused on the mapping methods and accuracy regarding single-image radar mapping, stereo radargrammetry, and mapping from blocks of overlapping imagery. It is recommended that more radargrammetric expertise be applied in radar mapping projects so that full advantage may be taken of the metric information potential of imaging radar. S.D.

A77-18974 * **Digital registration of topographic data and satellite MSS data for augmented spectral analysis.** P. E. Anuta (Purdue University, West Lafayette, Ind.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 180-187. Contract No. NAS9-13380.

Results are presented for a project directed to assess the type and extent of long-term natural and man-made changes in floodplain features of a definite area in the Mississipi River Valley. 1:6000 scale maps were prepared from remotely sensed film/filter photographic coverage of the area at different times to compare changes in such features as channels, backwaters, vegetation as well as changes in the amount, location, and conditions of dredge spoil. Changes observed by this sequential photo comparison include abandonment of agricultural land followed by orderly secondary plant succession, the filling-in of shallows by sediment and the orderly succession of plants from a hydric to a more mesic environment and changes in deltas of small tributary streams in response to agricultural practices occurring at their headwaters. Plant colonization is observed on some spoil, and secondary movement of spoil is revealed in other areas. S.D.

A77-18989 * **Interpolation of a surface from sets of discrete height data of different statistical characteristics.** F. Leberl (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div., Pasadena, Calif.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 517-528. 7 refs.

This paper presents and analyzes a method for the interpolation of a unique surface from two sets of independent digital height data of differing statistical characteristics. This method is based on linear prediction and thus relies on the concepts of auto- and cross-covariance functions. The linear prediction algorithm for two sets of digital height measurements is first derived and then evaluated using the method of moving averages and bilinear interpolation for comparison. It is found that the overall root mean square interpolation errors of linear prediction are similar to those from moving averages and bilinear interpolation. This accuracy performance, together with the well known potential for controlled filtering of measuring errors and good-behavior in areas of poor control, makes linear prediction a versatile and general method for interpolating a unique surface from two sets of digital height data, with applications in photogrammetric mapping, remote sensing, and other fields.

(Author)

A77-18990 **Coherent optics in mapping at USAETL.** R. D. Leighty (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, Va.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 529-542. 51 refs.

The paper presents a review of basic and applied research at USAETL on coherent optical techniques having potential applicability to the mapping systems of the future. Particular attention is given to application of holography to topographic information processing, photogrammetric data reduction, holographic terrain displays, and cartographic data extraction. Other topics include the use of mass optical memories, map data storage and retrieval, optical recording materials, and image processing. The research program is maturing rapidly to the point where a few selected coherent optical systems will move from the research to the development stage. S.D.

A77-19188 # **Determination of the optimal observational design in local positional networks with the aid of the method of dynamic optimization (Bestimmung der günstigsten Beobachtungsanordnung in lokalen Lagenetzen mit Hilfe der Methode der dynamischen Optimierung).** H. Heister. München, Technische Universität, Fachbereich für Bauingenieur- und Vermessungswesen, Dr.-Ing. Dissertation, 1975. 91 p. 64 refs. In German.

The aid provided by the geodesist in connection with the conduction of surveys related to engineering projects is considered, taking into account the planning of the basic network design and tasks related to the supervision of the completed object and its vicinity. Questions concerning the economics and accuracy in the case of the required geodetic elements are investigated. Attention is given to the development of approaches which will provide optimum accuracy under given conditions of surveying effort. The determination of the minimum amount of surveying work needed to obtain a specified accuracy level for the geodetic elements is also discussed.

G.R.

N77-10584* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

OPTICAL PROCESS FOR PRODUCING CLASSIFICATION MAPS FROM MULTISPECTRAL DATA Patent

Richard E. Haskell, inventor (to NASA) (Oakland Univ.) Issued 5 Oct. 1976 12 p Filed 30 Aug. 1974 Supersedes N74-32780 (12 - 22, p 2680) Sponsored by NASA

(NASA-Case-MSC-14472-1; US-Patent-3,984,671; US-Patent-Appl-SN-502138; US-Patent-Class-235-181; US-Patent-Class-340-146.3P; US-Patent-Class-340-146.3Q) Avail: US Patent Office CSCL 08B

A method of producing single-class and multi-class composite classification maps from multispectral data is provided. The multispectral data is transformed into a binary matrix format which is then encoded on an optical medium such as photographic

film. The encoded data is holographically correlated with coded patterns representing selected spectral signatures to produce signal-class classification maps. Several single-class maps are optically superimposed to produce multi-class composite classification maps. *Official Gazette of the U.S. Patent Office*

N77-11524# Bendix Research Labs., Southfield, Mich.
AS-11B-X AUTOMATED STEREOMAPPER Final Technical Report, Sep. 1971 - Dec. 1975
Gerald A. Brumm, Arliss E. Whiteside, George M. Bedross, Leonard A. Forrest, and Allan J. Hutchenreuther Apr. 1976 113 p
(Contract F30602-72-C-0042; AF Proj. 3202)
(AD-A025428; BRL-8031; RADC-TR-76-100) Avail: NTIS HC A06/MF A01 CSCL 08/2

Most stereoplotter systems currently in use were designed primarily for producing contour and profile outputs on a coordinatograph. Recently, however, there has been an increasing need for topographic information in the form of digital gridpoint elevation data. While some existing systems can be used to extract this type of data, they cannot do it rapidly or efficiently. The AS-11B-X system is an experimental model of a new type of system intended particularly for the rapid collection of digital elevation data. The system achieves an increase in data collection rates of from 10-50 times that presently being obtained with conventional systems, at equivalent accuracy. The AS-11B-X system obtains its high data-collection rates by processing multiple lines of elevation points in parallel using digital processing. A combination of special techniques is used to simplify the digital processing and to reduce the amount of data storage required. While the AS-11B-X was built for evaluation as an experimental system, it has undergone extensive testing that has proven its performance capabilities and demonstrated that it can be used as a production system. GRA

N77-13500*# Kanner (Leo) Associates, Redwood City, Calif.
CORRELATION OF GEOPHYSICAL FIELDS AND SPACE IMAGES IN THE SOUTHERN PART OF THE SIBERIAN PLATFORM
T. V. Florenskaya Washington NASA Mar. 1976 17 p refs Transl. into ENGLISH of "Sootnosheniye Geofizicheskikh Poley i Kosmicheskikh Izobrazheniy v Yuzhnoy Chasti Sibirskoy Platform" Moscow, 1975 8 p
(Contract NASw-2790)
(NASA-TT-F-16946) Avail: NTIS HC A02/MF A01 CSCL 08G

The geological structure, geophysical fields and the substructure of the Irkutsk amphitheater are discussed. The geophysical fields over different radii are averaged for determination of the subsurface structure. The averaged fields are interpreted by means of space photographs of various scales. A definite convergence is observed between the patterns of the averaged geophysical fields. Color differentiation of the space photographs, and correspondence of different space photograph scales to the various subsurface structures are investigated. Author

N77-13503*# Scientific Translation Service, Santa Barbara, Calif.
THE ROLE OF SATELLITE PHOTOGRAPHY IN STUDYING THE MOVEMENTS OF BLOCKS OF THE EARTH'S CRUST
Yu. B. Bogdanov, A. V. Dolivo-Dobrovol'skiy, and E. V. Lemanov Washington NASA Apr. 1976 22 p refs Transl. into ENGLISH of the report "Rol' kosmicheskikh snimkov pri izucheniy dvizheniy blokov zemnoy kory" Moscow, Acad. of Sciences USSR, 1975 p 1-19
(Contract NASw-2791)
(NASA-TT-F-16949) Avail: NTIS HC A02/MF A01 CSCL 08G

The use of satellite photographs in studying large scale horizontal displacements of the earth's crust is discussed. Based on a study of television photographs from Soviet and American weather satellites, a diagram of the fault tectonics of the Baltic shield was constructed. Author

N77-13504*# Kanner (Leo) Associates, Redwood City, Calif.
APPLICATION OF THE METHOD OF MULTISTAGE GENERALIZATION DURING THE STUDY OF GEOLOGIC STRUCTURES OF VARIOUS SCALES (FOR EXAMPLE, NORTHERN CAUCASUS)
V. D. Skaryatin Washington NASA Mar. 1976 25 p refs Transl. into ENGLISH of "Primeneniye Metoda Mnogostrupenchatoy Generalizatsii Pri Izuchenii Geologicheskikh Struktur Raznogo Masshtaba (na Primere Sev. Kavkaza)," Moscow, USSR Acad. of Sci., 1975 15 p
(Contract NASw-2790)
(NASA-TT-F-16950) Avail: NTIS HC A02/MF A01 CSCL 08G

Images of the earth's surface were obtained from the Soyuz 9 and Soyuz 12 manned spacecraft. Aerial photographs were taken on various scale and reduced. Uncontrolled photomosaics covering the northern Caucasus were interpreted and corroborated by visual air and field observations of individual regions, for the purpose of finding tectonic lineaments and determining their interrelations among themselves. The fold structure of the region and circular formation were studied. Identification of numerous specific tectonic lineaments, synclines, anticlines and circular formations is discussed in detail. Several requirements for interpretation of images of the earth's surface various scales are stated, and the set of general levels of the images to be used is recommended. Author

N77-13505*# Scientific Translation Service, Santa Barbara, Calif.
RULES FOR GENERALIZATION OF IMAGES OF CERTAIN INDICATORS OF GEOLOGICAL STRUCTURE ON SPACE PHOTOGRAPHS
G. B. Gonin and N. A. Yakovlev Washington NASA Mar. 1976 22 p refs Transl. into ENGLISH of the report "Zakonomernosti generalizatsii na kosmicheskikh fotosnimkakh izobrazheniy nekotorykh indikatorov geologicheskogo stroyeniya" Moscow, USSR Acad. of Sciences, 1975 p 1-15
(Contract NASw-2791)
(NASA-TT-F-16951) Avail: NTIS HC A02/MF A01 CSCL 08G

A study is made of the interrelationship between geological structure and components of the landscape. Use was made of material from satellite experiments in 1969 and 1970 with the Soyuz spacecraft. Author

N77-13506*# Scientific Translation Service, Santa Barbara, Calif.
THE ROLE OF SPACE PHOTOGRAPHS IN THE STUDY OF THE LINEAR AND ANNULAR STRUCTURES OF THE EARTH'S CRUST
A. V. Dolivo-Dobrovol'skiy and S. I. Strel'nikov Washington NASA Apr. 1976 37 p refs Transl. into ENGLISH of the report "Rol' kosmicheskikh snimkov v izuchenii lineynykh i kol'tsevykh struktur zemnoy kory" Moscow, USSR Acad. of Sciences, 1975 p 1-25
(Contract NASw-2791)
(NASA-TT-F-16952) Avail: NTIS HC A03/MF A01 CSCL 08G

A structural interpretation of data from space photography was performed to study the structure of folded regions of various ages. For comparison, a preliminary interpretation is also made of a mosaic map of the USA consisting of photographs from ERTS A. Author

N77-13507*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
A COMBINATION OF REMOTE AND GROUND-BASED METHODS FOR STUDYING YOUNG FOLDED DEFORMATIONS IN THE WESTERN KOPETDAG DEPRESSION
T. P. Ivanova and V. G. Trifonov Washington NASA Apr. 1976 19 p refs Transl. into ENGLISH of "Sochetaniye Distantsionnykh i Nazemnykh Metodov Issledovaniya Molodykh Skladchatykh Deformatsii Zapadnogo Pogruzheniya Kopetdaga", Moscow, USSR Acad. of Sci., 1975 10 p
(Contract NASw-2789)
(NASA-TT-F-16953) Avail: NTIS HC A02/MF A01 CSCL 08G

Topographic information obtained from high altitude photographs is combined with ground based measurements in an analysis of young folded deformations in the Western Kopetdag Depression. Sedimentation patterns obtained from pictures and maps of the area were supplemented by ground based measure-

ments of cuts in the mountain plain rises and river embankments to determine the history and present development of folded structures. Author

N77-13508*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
THE PLACE OF SPACE IMAGERY IN THE COMPLEX PROCESSING OF GEOLOGICAL AND GEOPHYSICAL INFORMATION FOR THE STUDY OF THE PLUTONIC FORMATION OF THE LOWER VOLGA REGION
P. V. Florenskiy, A. S. Petrenko, L. A. Vedeshin, and B. P. Shorin-Konstantinov Washington NASA Apr. 1976 37 p refs Transl. into ENGLISH of the book "Mesto kosmicheskogo izobrazheniya pri kompleksnoy obrabotke geologo-geofizicheskoy informatsii dlya izucheniya glubinnogo stroyeniya nizhnego povolzhya" Moscow, Acad. Sci. USSR, 1975 30 p
(Contract NASw-2789)
(NASA-TT-F-16954) Avail: NTIS HC A03/MF A01 CSCL 08G

Analysis of space photographs for clarification of geological peculiarities of certain regions is one of the integral branches of regional geological investigations. The interpreted properties of photos must be artificially improved during space photo operations. Density conversion of the photo consists of emphasizing the boundaries between the stages with various imagery densities. Other types of photo conversion are also possible. Various regions were analyzed for their geological and geophysical characteristics, including gravitational and magnetic fields. As a result of a complex comparison of the existing geological and geophysical material with the data of the visual interpretation, a correlation analysis was established which made it possible to use all existing information for investigating the plutonic structure of the foundation of the lower Volga region, and to supplement existing diagrams. Author

N77-13583 Utah State Univ., Logan.
ALBEDO OF THE EARTH'S SURFACE: A COMPARISON OF MEASUREMENTS TAKEN ON THE GROUND AND FROM FLYING PLATFORMS Ph.D. Thesis
Frank Delafield Eaton 1976 184 p
Avail: Univ. Microfilms Order No. 76-25603

The main objectives of the study were to develop the indicatrices of reflected solar radiation from different natural surfaces and to show comparisons between values sensed in space of emergent radiation to ground values obtained from accounting for anisotropic reflection and estimating the effect of the intervening atmosphere. Anisotropy of reflected radiation was found for all surfaces examined and increased with decreasing solar angle. Different surfaces showed different degrees and patterns of forward and backscatter. Comparisons were made between estimated emergent radiation from the top of the earth's atmosphere accounting for anisotropy of the ground reflection pattern and estimates of atmospheric attenuation to values of reflected radiation obtained from the MSS subsystem of the ERTS program for the lava beds region and White Sands area in New Mexico. Also, comparisons were shown between the estimated emergent radiation from the earth's surface for the same features and spectral bands to the values sensed in space. Dissert. Abstr.

N77-13585*# Ohio State Univ. Research Foundation, Columbus.
MONITORING OF CRUSTAL MOVEMENTS IN THE SAN ANDREAS FAULT ZONE BY A SATELLITE-BORNE RANGING SYSTEM Ph.D. Thesis
Muneendra Kumar Aug. 1976 157 p refs
(Grant NGR-36-008-204; OSURF Proj. 3820-A1)
(NASA-CR-149246; DGS-243) Avail: NTIS HC A08/MF A01 CSCL 08G

The Close Grid Geodynamic Measurement System is conceived as an orbiting ranging device with a ground base grid of reflectors or transponders (spacing 1.0 to 30 km), which are projected to be of low cost (maintenance free and unattended), and which will permit the saturation of a local area to obtain data useful to monitor crustal movements in the San Andreas fault zone. The system includes a station network of 75 stations covering an area between 36 deg N and 38 deg N latitudes, and 237 deg E and 239 deg E longitudes, with roughly half of the stations on either side of the faults. In addition, the simulation of crustal movements through the introduction of changes in the relative positions between grid stations, weather effect for intervisibility between satellite and station and loss of observations thereof, and comparative evaluation of various observational scheme-patterns have been critically studied. Author

N77-13587*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC ANOMALY MAP OF NORTH AMERICA SOUTH OF 50 DEGREES NORTH FROM POGO DATA
M. A. Mayhew Aug. 1976 22 p refs Presented at 2d Intern. Conf. on the New Basement Tectonics, Univ. of Delaware, Jul. 1976
(NASA-TM-X-71229; X-922-76-201) Avail: NTIS HC A02/MF A01 CSCL 08E

A magnetic anomaly map produced from Pogo data for North America and adjacent ocean areas is presented. At satellite elevations anomalies have wavelengths measured in hundreds of kilometers, and reflect regional structures on a large scale. Prominent features of the map are: (1) a large east-west high through the mid-continent, breached at the Mississippi Embayment; (2) a broad low over the Gulf of Mexico; (3) a strong gradient separating these features, which follows the Southern Appalachian-Ouachita curvature; and (4) a high over the Antilles-Bahamas Platform which extends to northern Florida. A possible relationship between the high of the mid-continent and the 38th parallel lineament is noted. Author

N77-13589*# Transemantics, Inc., Washington, D.C.
RELATIONSHIP OF INTERPRETIVE CRITERIA OF PLUTONIC FRACTURES TO THE CHARACTER OF THE NEWEST MOVEMENTS (KAZAKHSTAN AND CENTRAL ASIA AS EXAMPLES)
N. V. Skublova NASA Mar. 1976 16 p refs Transl. into ENGLISH of "O Zavisimosti Deshifrovochnykh Priznakov Glubinnykh Razlomov ot Kharaktera Noveyshikh Dvizheniy (na Primere Kazakhstana i Sredney Azii)" Moscow, 1975 12 p
(Contract NASw-2792)
(NASA-TT-F-16937) Avail: NTIS HC A02/MF A01 CSCL 08G

Analysis of the recent tectonics of individual regions on the basis of satellite photographs makes it possible to establish the role of discontinuous fractures in the formation of very large recent structures, and to classify the lineaments which were identified into discontinuous fractures of four types. The boundary orogenic planetary faults may be viewed as the antipodes of the deep faults of the rift valleys of the oceans. The differences consist in the fact that the deep faults of the rift valleys determine the separation zones, and the boundary orogenic faults determine the compression and thrust zones. Author

N77-13590*# Scientific Translation Service, Santa Barbara, Calif.
CROSS STRUCTURAL PLAN OF THE EARTH'S CRUST AND THE PROBLEM OF THE MANIFESTATION OF ITS PLUTONIC ELEMENTS ON THE SURFACE (TYAN-SHAN AND TURAN PLATE AS EXAMPLES)
V. I. Makarov and L. I. Solovyeva Washington NASA Apr. 1976 44 p refs Transl. into ENGLISH of the book "Perekrestnyy strukturnyy plan zemnoy kory i problema proyavleniya ego glubinnykh elementov no poverkhnosti (na primere Tyan-Shanya i turanskoy plity)" Moscow, Acad. Sci. USSR, 1975 p 1-50
(Contract NASw-2791)
(NASA-TT-F-16938) Avail: NTIS HC A03/MF A01 CSCL 08G

The plutonic structures of the earth's crust based on an analysis of its surface with the aid of orbital photographs are studied. It is found that space photography is very valuable in studying the substructure of the earth's crust. The possibility of distinguishing genetically diverse components of the geochemical spectrum of the earth's surface may have far-reaching consequences in fossil fuel exploration. Author

N77-13633# Texas A&M Univ., College Station. Dept. of Physics.
THE SUNLIGHT GLITTER PATTERN

Gilbert N. Plass, George W. Kattawar, and John A. Guinn, Jr. 2 Jun. 1976 43 p refs
(Contract N00014-75-C-0537; NR Proj. 083-036)
(AD-A026225; TR-10) Avail: NTIS HC A03/MF A01 CSCL 08/3

Time-averaged intensities are computed for the glitter pattern of sunlight on a wind-ruffled sea. Isopleths are drawn from these on graphs which simulate glitter-pattern photographs through projections of sea-surface grid points on an inclined plane assumed to be in front of the observer. The intensity computed for each grid point is based on a calculation of the wave-surface orientation required for direct reflection from source to observer at that point; the probability of occurrence of this orientation, determined from the Cox-Munk distribution, is the principal factor in the computed intensity. The curvature of the earth is taken into account, and calculations are made for various cases of source elevation angle, observer altitude, and wind speed (the controlling parameter for the distribution of wave inclinations). Percent polarization is computed for the glitter patterns, and projected isopleths of this quantity are plotted. The effects of variations in wind speed, source elevation angle, and observer height on the morphology of the glitter pattern are shown, and such phenomena as the shifting of a reflected image toward the horizon are clearly demonstrated. It is suggested that the technique developed here could be useful in evaluating models of ocean wave structure and in making remote determinations of the sea state in the region of the glitter pattern. Author (GRA)

N77-14562*# Geological Survey, Reston, Va.
AN EXPERIMENT IN CULTURAL INTERPRETATION AND MAP REVISION FROM SKYLAB DATA Final Report
William J. Kosco, Principal Investigator 17 Mar. 1976 25 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4108-B)
(E77-10063; NASA-CR-151105) Avail: NTIS HC A02/MF A01 CSCL 08B

N77-14576# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
MICROCOPYING WILDLAND MAPS FOR DISTRIBUTION AND SCANNER DIGITIZING Final Report
Elliot L. Amidon and E. Joyce Dye 1976 18 p refs Sponsored by the Dept. of Agriculture
(PB-257030/7; FSRP-PSW-114) Avail: NTIS HC A02/MF A01 CSCL 08B

Images in graphic or printed form can be reduced in size by microcopying. Microform is a collective term for stored microimages. Conventional microform films include silver halide, nonsilver diazo, vesicular, and color. Criteria for selecting the proper format include map quadrangle size and reduction ratio. Among several competing types of microforms, only microfilm and microfiche were judged acceptable for application to wildland maps. Microimages can be digitized by automatic techniques. With careful planning, it is possible to digitize automatically forest map microimages for input to computerized mapping systems. Other benefits of microcopying include a reduction in the cost of handling and shipping the original documents, savings in space, and making archival copies more lasting. GRA

N77-15376# National Environmental Satellite Center, Washington, D.C.
ALGORITHM FOR CORRECTING THE VHRR IMAGERY FOR GEOMETRIC DISTORTIONS DUE TO THE EARTH CURVATURE, EARTH ROTATION, AND SPACECRAFT ROLL ATTITUDE ERRORS
Richard Legeckis and John Pritchard Apr. 1976 37 p refs
(PB-258027/2; NOAA-TM-NESS-77; NOAA-76062211) Avail: NTIS HC A03/MF A01 CSCL 14E

An algorithm is reported for approximately correcting the Very High Resolution Radiometer (VHRR) digital data from NOAA's polar orbiting operational environmental satellites for geometric distortions that arise primarily because of the Earth's curvature and rotation and satellite roll attitude errors. The corrections are made along each scan line independently. The algorithm is verified by an intercomparison of VHRR imagery. Several images of the Gulf Stream are included for illustration. GRA

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04
GEOLOGY AND MINERAL RESOURCES

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

A77-11050 **Remote sensing of an underground coal-burn cavity with a wide-band induction system.** E. A. Quincy (Wyoming, University, Laramie, Wyo.) and D. F. Moore (ERDA Laramie Energy Research Center, Laramie, Wyo.). *IEEE Transactions on Geoscience Electronics*, vol. GE-14, Oct. 1976, p. 236-243. 21 refs.

A conducting cavity in an underground coal burn was remotely probed from the surface with a wide-band electromagnetic induction system. The cavity, located near Hanna, WY., was produced by underground gasification of a 30-ft-thick subbituminous-coal seam ranging in depth from 300 to 400 ft. The cavity filled with saline ground water after the burn. The wide-band loop-loop system employed pseudonoise and cross-correlation techniques to produce a transient-time response in the field. Additional computer processing produced normalized 3-dimensional signature maps in both the time and frequency domains. These horizontal profiling maps, corresponding to a .100-Hz-50 kHz passband, demonstrate that a significant anomaly is produced by the cavity as the system is moved across the site. Time-domain maps show nearly a 7-1 change in relative peak-to-peak values, whereas the frequency-domain magnitude response changes as much as 36-1. Results were corroborated using another single-frequency system. These anomalies demonstrate the feasibility of employing induction systems to remotely characterize underground coal-burn cavities filled with conducting fluid. (Author)

A77-11321 * **The Sagatu Ridge dike swarm, Ethiopian rift margin.** P. A. Mohr (Harvard College Observatory and Smithsonian Astrophysical Observatory, Cambridge, Mass.) and E. C. Potter (Marathon Oil Co., Casper, Wyo.). *Journal of Volcanology and Geothermal Research*, vol. 1, June 1976, p. 55-71. 52 refs. Contract No. NAS5-21748.

A swarm of dikes forms the core of the Sagatu Ridge, a 70-km-long topographic feature elevated to more than 4000 m above sea level and 1500 m above the level of the Eastern (Somalian) plateau. The ridge trends NNE and lies about 50 km east of the northeasterly trending rift-valley margin. Intrusion of the dikes and buildup of the flood-lava pile, largely hawaiitic but with trachyte preponderant in the final stages, occurred during the late Pliocene-early Pleistocene and may have been contemporaneous with downwarping of the protorift trough to the west. The ensuing faulting that formed the present rift margin, however, bypassed the ridge. The peculiar situation and orientation of the Sagatu Ridge, and its temporary existence as a line of crustal extension and voluminous magmatism, are considered related to a powerful structural control by a major line of Precambrian crustal weakness, well exposed further south. Transverse rift structures of unknown type appear to have limited the development of the ridge to the north and south. (Author)

A77-11336 **A word on worldwide petroleum resources (A propos des ressources mondiales de pétrole).** M. Grenon. *Revue de l'Energie*, vol. 27, Feb. 1976, p. 113-116. In French.

Techniques for elaborating estimates or well-educated guesses on occurrences and reserves of petroleum, and other hydrocarbons, on large-area scales are compared and evaluated briefly. Some recent estimates of resources and reserves are tabulated. The methods are grouped under four headings: (1) extrapolation of past trends; (2) methods based on geological analogy, including offshore extensions of proven petroliferous provinces; (3) methods utilizing experience and know-how (or hunches) of geologists; (4) statistical techniques or qualitative models. Cautious optimism is ventured on the reliability of techniques being developed further and novel approaches. R.D.V.

A77-11339 **Concerning world oil resources. II - Statistical logistic models /King Hubbert's models/ (A propos des ressources mondiales de pétrole. II - Modèles statistiques logistiques /modèles de King Hubbert/).** M. Grenon. *Revue de l'Energie*, vol. 27, Mar. 1976, p. 165-174. In French.

A promising but highly controversial approach to mathematical modeling of the resource problem (in particular, for ultimate oil resources), proposed by King Hubbert by the end of the 1950s, is discussed. One of the Hubbert's methods is based on the analysis of the production curves for fossil fuels, assuming that this production has already reached the advanced phase, and using independent data (evaluations) concerning ultimate production values. Some numerical predictions obtained by means of the Hubbert's model show a surprisingly good agreement with the observed values. Another method developed by King Hubbert in 1967 uses statistical data and curves of discovered oil resources per linear unity of exploration boring. The values of the ultimate oil resources for the 48 continental states of the U.S., obtained by the two methods are nearly coinciding (170 and 172 billions of barrels) and coincide with the value predicted recently by the U.S. Geological Survey experts with the aid of a completely different method. S.N.

A77-11341 **World oil resources. III - The geological analogy method (A propos des ressources mondiales de pétrole. III - La méthode d'analogie géologique).** M. Grenon. *Revue de l'Energie*, vol. 27, Apr. 1976, p. 226-231. In French.

The paper describes developments of the geological analogy method for estimating total oil reserves in a large region. The method began with Zapp in 1962, who arrived at a figure of 590 billion barrels for total U.S. reserves by assuming constant drilling yields in time and space for operating wells, probable economical discoveries, and non-economical discoveries. Hendricks modified the method in 1965 by considering the total oil in the earth rather than just recoverable oil, and assuming that the probability of oil existing in the regions considered will vary between 0 and 1, and arrived at the figure of 400 billion barrels. A recent refinement of the method divides a large explored region such as the U.S. into zones of similar geological features, and assumes that the ratio of oil yield to reserves in that region can be applied to other less explored regions of the world. Finally, another modification calculates undiscovered recoverable resources by assuming that the ratio of their amount to the volume of favorable, unexplored rocks is proportional to the ratio of the amount of known hydrocarbons to the volume of drilled terrain. P.T.H.

A77-11342 **World petroleum resources. IV - Probabilistic methods (A propos des ressources mondiales de pétrole. IV - Les méthodes probabilistes).** M. Grenon. *Revue de l'Energie*, vol. 27, June 1976, p. 316-325. In French.

The paper gives a general description of the method of petroleum zones or 'play' for estimating the probability of oil deposits attaining certain levels in unexplored petroleum zones in a given basin. Basically the method consists in surveying experts regarding their opinions on the probability of parameters attaining given values in the zone. Such parameters might be, for example, the surface area of traps to be tested, the mean thickness of deposits or thickness of rocks with porosity above a certain minimum, gas/oil ratio, recovery rate for oil, and recovery rate for gas. The procedure used by Odell and Rosing (1975) to estimate the productivity of the North Sea basin over twenty years of drilling is examined. P.T.H.

A77-11343 **The world's oil resources. V - Recovery rates (A propos des ressources mondiales de pétrole. V - Les taux de récupération).** M. Grenon. *Revue de l'Energie*, vol. 27, July-Aug. 1976, p. 372-377. In French.

The rate of recovery of oil resources is estimated to be about 30 percent, i.e., for each ton of oil produced, at least two tons are left in the earth. The paper describes a number of methods of tertiary (improved assisted) recovery of oil reserves which can augment the recovery rate. The methods discussed are classified into three categories: (1) methods based on the injection of soluble gaseous compositions, (2) methods based on the injection of water modified with polymers, microemulsions, caustics, etc., and (3) thermal methods such as in situ combustion with or without water, drainage using water vapor, and cyclic stimulation using vapor ('huff and puff'). B.J.

A77-11968 Optical filtering of airborne and ground magnetic data. M. K. Seguin and H. H. Arsenault (Université Laval, Quebec, Canada). *Pure and Applied Geophysics,* vol. 114, no. 4, 1976, p. 663-683. 43 refs. Research supported by the Geological Survey and National Research Council of Canada.

An optical filtering technique has been developed which can be applied to ground-based or aeromagnetic (or gravimetric) contour maps to extract some of the geological information they contain. The method consists of transforming magnetic (or gravimetric) data into the spatial frequency domain, filtering the amplitude or intensity spectrum obtained, and using an inverse Fourier transform to obtain another map in the spatial domain which yields new and partly hidden geological information. A comparison of this method with digital filtering methods shows that optical filtering is a cheaper and quicker process. B.J.

A77-12236 Synthetic fuels - Prices, prospects, and prior art. O. H. Hammond and R. E. Baron (MIT, Cambridge, Mass.). *American Scientist,* vol. 64, July-Aug. 1976, p. 407-417. 29 refs.

An overview of the development of synthetic fuel technologies is followed by a comparative description of the naturally occurring carbonaceous raw materials (lignite, coals, oil shales, and tar sands), their chemical composition and relative abundance. Basic methods available for conversion of natural raw materials into fuel are discussed, including hydrogenation by pyrolysis and by direct reaction with hydrogen, and indirect hydrogenation using water as a source of hydrogen. Application of these methods to coal gasification, coal liquefaction, and processing of tar sands is examined. Attention is also given to the in-situ processing of raw materials. Economic problems related to synthetic fuel industrial development are analyzed and prospects of synthetic fuels are tentatively assessed. S.N.

A77-12256 # Use of radar in geology. H. C. MacDonald (Arkansas, University, Fayetteville, Ark.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 3, July 1976, p. 93-104.

In some areas of the world where the collection of photogeological data is constrained by adverse weather conditions, side-looking airborne radar (SLAR) imaging systems are a primary tool for geological reconnaissance. A number of applications of SLAR imagery to geological surveying are discussed including general geological interpretation, mineral, petroleum, and groundwater exploration, and geological mapping. B.J.

A77-12433 Commercial applications of geological remote sensing. R. K. Vincent (Geospectra Corp., Ann Arbor, Mich.). In: Conference on Decision and Control, 6th, and Symposium on Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 258-263. 7 refs.

Six types of computer-processed remote sensing products are discussed which are intended to highlight differences in chemical or mineral composition of exposed rocks, minerals and soils. Examples of three of these (iron-oxide ratio image, calibrated color composite of three ratios, and automatic recognition maps) are given in this presentation for a Landsat frame of the Wind River Basin, Wyoming. Mineral exploration can be improved by including iron oxide mapping as a reconnaissance tool for mapping hydrothermally altered areas in igneous terrain and exposed portions of geochemical cells in porous sandstones. Both metal and hydrocarbon exploration can be aided by stratigraphic mapping with automatic recognition maps, which can sometimes disclose 'hidden' structures and can map some compositional differences among members and facies with in a single formation. (Author)

A77-12439 A search for sulfide-bearing areas using Landsat-1 data and digital image-processing techniques. R. G. Schmidt (U.S. Geological Survey, Reston, Va.), B. B. Clark, and R. Bernstein (IBM Corp., Federal Systems Div., Gaithersburg, Md.). In: Conference on Decision and Control, 6th, and Symposium on Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 415, 416.

A77-12883 Means of one-dimensional arrays - A study relating to some aspects of mine evaluation. A. G. Botman, S. Dijkstra (International Institute for Aerial Survey and Earth Sciences, The Hague, Netherlands), K. Kubik (Ministry of Transport and Public Works, The Hague, Netherlands), and T. R. P. Singh (National Mineral Development Corp., India). *ITC Journal,* no. 3, 1975, p. 319-330.

The paper is concerned with the properties and accuracies of mean metal values estimated from one-dimensional arrays of sampling points, with reference to the accuracy of estimated mean metal values for sections of boreholes or sections along underground mine openings. A theoretical investigation of the statistical properties of true mean values is carried out, considering both discrete and continuous random functions. B.J.

A77-12895 Geochemical investigation of some latosols. S. Dijkstra, H. J. van den Hul (International Institute for Aerial Survey and Earth Sciences, Delft, Netherlands), R. Kühnel (Delft, Technische Hogeschool, Delft, Netherlands), and E. N. Shei. *ITC Journal,* no. 4, 1975, p. 521-534. 6 refs.

Latosols are freely drained tropical soils characterized by intense chemical weathering and leaching processes and generally show low cation exchange capacity values and low base saturation. The geochemical exploration of latosols aims at the delineation of anomalous trace metal patterns which are related to the presence of mineralization. This paper reports on the geochemical delineation of trace metals (Li, Pb, Zn, Cu, Ni, Co, Mn and Cr) in latosols of different ages from Thailand and Nigeria. B.J.

A77-13217 * Landsat-1 imagery for geologic evaluation. C. W. Welby (North Carolina State University, Raleigh, N.C.). *(American Society of Photogrammetry, Annual Convention, Washington, D.C., Mar. 9-14, 1975.) Photogrammetric Engineering and Remote Sensing,* vol. 42, Nov. 1976, p. 1411-1419. 8 refs. Contract No. NAS5-21732.

The paper reviews the geologic evaluation of the North Carolina coastal plain using Landsat-1 imagery as related to a general study of the geomorphology to assess the imagery as a tool for upgrading the understanding of the coastal plain, along with recognition of subsurface structures. Among the more prominent features displayed on the Landsat imagery are the scarps and beach ridges associated with former positions of the shoreline. Compilations of various types of lineaments reveal two dominant trends, one northwest-southeast and the other northeast-southwest, which are significant in the tectonic development of the Atlantic Coastal Plain. The synoptic view recorded by the satellite allows a perspective that aids geologic studies of the Atlantic Coastal Plain. S.D.

A77-13648 * # Geothermal flux through palagonitized tephra, Surtsey, Iceland - The Surtsey temperature-data-relay experiment via Landsat-1. J. D. Friedman, D. M. Preble, and S. Jakobsson. *U.S. Geological Survey, Journal of Research,* vol. 4, Nov.-Dec. 1976, p. 645-659. 22 refs. Research sponsored by the Icelandic Museum of Natural History, U.S. Geological Survey, and NASA.

The net geothermal flux through palagonitized basaltic tephra rims of the Surtur I and Surtur II craters at Surtsey, Iceland, in 1972,

is estimated at 780 plus or minus 325 microcal/sq cm/s, indicating a decline since 1969 when a flux of 1500 microcal/sq cm/s was estimated. Heat flux in this range characterizes the postvolcanic environment on Surtsey in which the subaerial polagonitization of basaltic tephra is associated with mass transfer of hydrothermal vapor, either of meteoric or sea-water origin, only a few years after cessation of eruptive activity. The flux estimation is the result of the Surtsey data-relay experiment via Landsat-1 which was carried out in several phases. Temperature data were transmitted for a 38-day period in November and December 1972. A near-surface vertical gradient of 69.4 C/m was obtained, suggesting a mixed mechanism of heat transfer, partitioned between conduction and convection. (Author)

A77-13649 # **A comparison of Landsat images and Nimbus thermal-inertia mapping of Oman.** H. A. Pohn. *U.S. Geological Survey, Journal of Research,* vol. 4, Nov.-Dec. 1976, p. 661-665.

A comparison of Landsat images and Nimbus thermal-inertia mapping of Oman has shown that the use of high-resolution thermal-inertia data makes possible the definition of major lithological boundaries. In particular, the use of Landsat imagery cleared up a significant discrepancy between the thermal-inertia map and the reconnaissance geological map concerning the ophiolite belt which defines the axis of the Oman mountains. B.J.

A77-14819 * **Thermal inertia imaging - A new geologic mapping tool.** A. B. Kahle, A. R. Gillespie, and A. F. H. Goetz (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Geophysical Research Letters,* vol. 3, Jan. 1976, p. 26-28. 9 refs. Contract No. NAS7-100.

A thermal model of the earth's surface has been developed and used to determine the thermal inertia of a test site in the Mojave Desert, California. The model, which includes meteorological heating terms as well as radiation and conduction heating terms, is used with remotely sensed surface temperature and reflectance data to determine the thermal inertia of the surface materials at the test site. The thermal inertia is displayed in image form, and can aid in the differentiation of the various lithologic materials in the test site. Since this thermal property is representative of the upper several cm of the surface, it complements visible and reflected near-IR image data. (Author)

A77-14820 * **Petrology, structure and origin of the Manicouagan melt sheet, Quebec, Canada - A preliminary report.** R. J. Floran, W. C. Phinney, J. L. Warner (NASA, Johnson Space Center, Houston, Tex.), C. H. Simonds, B. M. Jahn (Lunar Science Institute, Houston, Tex.), R. A. F. Grieve, M. R. Dence (Department of Energy, Mines and Resources, Gravity Div., Ottawa, Canada), and M. J. Rhodes (Lockheed Electronics Co., Houston, Tex.). *Geophysical Research Letters,* vol. 3, Feb. 1976, p. 49-52. 19 refs. Contract No. NSR-09-051-001.

A77-17562 * **On the age of Rhodesian greenstone belts.** B.-M. Jahn and K. C. Condie (New Mexico Institute of Mining and Technology, Socorro, N. Mex.). *Contributions to Mineralogy and Petrology,* vol. 57, 1976, p. 317-330. 34 refs. Contract No. NSR-09-051-001.

Isochron ages and initial Sr-87/Sr-86 ratios are derived from Rb-Sr isotopic analyses on metavolcanic rocks from some greenstone belts of the Rhodesian Archean craton. Three mineral isochron ages (about 2.4 billion years) are tentatively suggested to represent the time of an important low-grade metamorphic event. V.P.

A77-17563 * **An experimental investigation of olivine morphology.** C. H. Donaldson. *Contributions to Mineralogy and Petrology,* vol. 57, 1976, p. 187-213. 43 refs. Research supported by the Natural Environment Research Council of England; Contract No. NSR-09-051-001.

Results are reported for a morphological study of olivine and an experimental investigation performed to determine the degrees of supercooling and the cooling rates necessary to crystallize particular morphologies. Ten arbitrary categories of three-dimensional olivine crystal shape are identified: polyhedral, granular, hopper, chain, lattice, plate, branching, radiate, feather, and swallow-tail. The morphological study establishes that equant and tabular crystals are the common shapes of olivine, nonequant crystals are elongate parallel to the a or c axis, and skeletal crystals result when a particular form is missing or only partially developed. In the experiment, olivine crystals were grown by melting rock samples above their liquidus temperatures before initiating crystallization. The results show that olivine morphology changes systematically as a function of the degree of melt supercooling, the melt cooling rate, and the normative olivine and water contents of the melt. It is also found that each shape has a specific range of temperature stability which is essentially independent of melt composition. F.G.M.

A77-17564 * **New evidence for impact origin of the Bushveld Complex, South Africa.** R. C. Rhodes. *Geology,* Oct. 1975, p. 549-554. 33 refs. Grants No. NGL-32-004-011; No. NGL-32-004-001.

The importance of hypervelocity impacts as a geologic process is demonstrated by the example of the Bushveld Complex and the (nearby) Vredefort Ring. Each is interpreted as the result of four simultaneous impacts modified by large-scale endogenic processes triggered by the impact event. The layered mafic sequence and the voluminous red granite associated with the complex are endogenic magmas, probably generated by pressure release accompanying crater excavation. Shock melting of older sedimentary rocks must have produced a layer of impact melt (the Rooiberg Felsite), the upper part of which was extruded over its originally chilled crust as a series of thick lava flows. Field evidence and radiometric age determinations indicate that the Bushveld Complex formed approximately 2000 billion years ago. V.P.

A77-18991 **Preliminary geologic analysis of southwest Jordan from computer enhanced Landsat I image data.** G. L. Berlin, P. S. Chavez, Jr., T. E. Grow, and L. A. Soderblom (U.S. Geological Survey, Flagstaff, Ariz.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, *Proceedings.* Falls Church, Va., American Society of Photogrammetry, 1976, p. 545-563. 13 refs.

Landsat I Multispectral Scanner (MSS) digital data representing an area in southwest Jordan were subjected to computer image processing techniques to extract the maximum geologic content possible. Two types of processing were performed: pre-processing ('clean-up') and image enhancement. Pre-processing techniques eliminated the undesirable effects of sun elevation variations, atmospheric haze, unwanted artifacts ('noise'), and geometric distortions. Various enhancements were then applied to the pre-processed data, producing three different image products: (1) simulated true color, (2) hybrid ratio false color, and (3) sinusoidal stretch false color. A geologic-interpretative map, incorporating 23 lithologic categories was prepared. Three linear feature maps were also compiled from the enhanced true color image. (Author)

N77-10588*# Minnesota State Planning Agency, St. Paul.
ERTS-B APPLICATIONS TO MINNESOTA RESOURCE MANAGEMENT Progress Report, 26 Jun. - 25 Sep. 1976
Joseph E. Sizer, Principal Investigator 15 Oct. 1976 81 p refs ERTS
(Contract NAS5-20985)
(E77-10004; NASA-CR-148975) Avail: NTIS HC A05/MF A01 CSCL 08B

The author has identified the following significant results. Well over half of the land cover change for 1969 - 1975 is directly related to mining activity in the Mesabi Range. Although land cover changes amount to only a few percent of the 28 quadrangeles, over 18 percent of the Kinney quadrangle land cover changed in six years. Recent land cover change has three major foci: (1) Kinney-Virginia area, (2)Silica-Kewatin-Pengilly--Hibbing-Dewey Lake area, and (3)Isaac Lake-Babbitt-Aurora area. These are listed in order of importance based upon quadrangle analysis and acreage of cover change.

N77-10590*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT Progress Report, 19 Jun. - 19 Sep. 1976
Orville R. Russell, Principal Investigator 19 Sep. 1976 5 p ERTS
(Contract NAS5-21998)
(E77-10007; NASA-CR-148978; C-1037-2-6) Avail: NTIS HC A02/MF A01 CSCL 08I

N77-10606*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
MULTISPECTRAL COLOR PHOTOGRAPHY FOR MINERAL EXPLORATION BY THE REMOTE SENSING OF BIOGEOCHEMICAL ANOMALIES
Edward Yost Aug. 1975 147 p refs
(Grant NGR-33-151-007)
(NASA-CR-144811) Avail: NTIS HC A07/MF A01 CSCL 14E

Selected band multispectral photography was evaluated as a mineral exploration tool by detecting stress on trees caused by underground mineralization. Ground truth consisted of two test sites in the Prescott National Forest within which the mineralization had been established by a drilling program. Species of trees were categorized as background, intermediate, and anomalous based upon where they grew with respect to this underlying mineralization. Soil geochemistry and the metal content of ashed samples of the trees were studied in relation to the inferred locus of mineralization. Computer analysis of the reflectance spectra of mineralized trees confirmed that the relative percent reflectance differences of trees growing in anomalous areas was less than that of the same tree species growing in background areas. Author

N77-10610*# Perceptronics, Inc., Woodland Hills, Calif.
DEVELOPMENT OF SIGNAL PROCESSING ALGORITHMS FOR ULTRASONIC DETECTION OF COAL SEAM INTERFACES Final Report
Dennis D. Purcell and Moshe Ben-Bassat Aug. 1976 43 p refs
(Contract NAS8-31782)
(NASA-CR-150024; PFTR-1030-76-8) Avail: NTIS HC A03/MF A01 CSCL 08I

A pattern recognition system is presented for determining the thickness of coal remaining on the roof and floor of a coal seam. The system was developed to recognize reflected pulse echo signals that are generated by an acoustical transducer and reflected from the coal seam interface. The flexibility of the system, however, should enable it to identify pulse-echo signals generated by radar or other techniques. The main difference being the specific features extracted from the recorded data as a basis for pattern recognition. Author

N77-10616*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOLOGICAL APPLICATIONS OF NIMBUS RADIATION DATA IN MIDDLE EAST
Lewis J. Allison Oct. 1976 106 p refs Submitted for publication
(NASA-TM-X-71207; X-901-76-164) Avail: NTIS HC A06/MF A01 CSCL 08G

Plateaus of Eocene limestone and exposed limestones escarpments, in Egypt and Saudi Arabia respectively, were indicated by cool brightness temperatures T sub B (less than 240 to 265 K) by the Nimbus 5 electrically scanning microwave radiometer (ESMR) over a 2-year period. Nubian sandstone, desert eolian sand and igneous metamorphic rocks were differentiated from these limestone areas by warm T sub B values (more than 265 to 300 K). Cool T sub B values in the form of a V were found over broad areas of the Nile Valley and in the western desert of central Egypt. Similar cool T sub B values were shown over limestone-dolomitic hills of the interior Homocline and the Hadramawt plateau of Saudi Arabia. Nimbus 5 and 6 ESMR T sub B values selectively identified intermediate dense rock types (limestone versus sandstone/granite) in the Lake Nasser region whose thermal inertia ranged from 0.035 to 0.06 cal cm to minus 2 C sec 1/2 to minus one half. Author

N77-10617# Instituto Geografico Militar, La Paz (Bolivia). Departamento Geofisico.
GRAVITY MEASUREMENTS IN BOLIVIA [MEDICIONES GRAVIMETRICAS EN BOLIVIA]
1974 190 p In SPANISH
Avail: NTIS HC A09/MF A01

Gravimetric work initiated by the IGM and IGB of Bolivia is reported. A brief historical sketch is given, along with numerous summaries in tabulated form of gravimetric data and calculations from various gravimetric stations in Bolivia. Work in the area of oil prospects and international relations is discussed. Gravimetric instruments used in the National Network are listed, and scale maps of Bouguer ree-air anomalies in Bolivia are included.
Transl. by B.B.

N77-10624# Bureau of Mines, Washington, D.C.
MINERALS IN THE US ECONOMY: TEN-YEAR SUPPLY-DEMAND PROFILES FOR MINERAL AND FUEL COMMODITIES
Jul. 1975 102 p refs
(PB-252994/9; BM-SP-2-75) Avail: NTIS HC A06/MF A01 CSCL 08I

The Bureau of Mines has prepared supply-demand diagrams and tables to highlight the flow of minerals through the U.S. economy. The selected mineral supply-demand tables and flow diagrams comprise one output from the information and data collected and compiled by the Bureau of Mines on a continuing basis covering mineral production, consumption, prices, shipments, imports, exports, and stocks, as well as industry activities in all States and abroad. The 10-year data base terminates with 1973 figures because adequate world information was not available beyond that date. Moreover, 1974 was an anomalous year with respect to prices, supply, and demand for many commodities.
GRA

N77-10626# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
THE SUPPLY OF COAL IN THE LONG RUN: THE CASE OF EASTERN DEEP COAL
Martin B. Zimmerman Sep. 1975 87 p refs
(Grant NSF SIA-73-07871-A02)
(PB-252642/4; MIT-EL-75-021) Avail: NTIS HC A05/MF A01 CSCL 08I

A methodology is developed for estimating long-run supply curves for coal. The method relies on engineering information and geological data and is applied to deep mining in the Eastern United States. Cost functions are estimated combining engineering and econometric procedures. Information on the geology of coal deposits is used in conjunction with the cost functions to estimate how costs will behave over time as output cumulates. The procedure is applied separately to low sulfur and high sulfur coal. GRA

N77-10633# Lewin and Associates, Inc., Washington, D.C.
THE POTENTIAL AND ECONOMICS OF ENHANCED OIL RECOVERY Final Report
Apr. 1976 274 p refs
(Contract FEA-CO-03-50222-000)
(PB-254991/3; FEA/B-76/221) Avail: NTIS HC A12/MF A01 CSCL 21D

The amount of oil that can be made available through enhanced recovery methods and the time and cost involved in its production are discussed. Potential oil reserves in California, Louisiana, and Texas are emphasized. GRA

N77-10749# Nevada Univ., Reno.
NEAR FIELD SMALL EARTHQUAKE LONG PERIOD SPECTRUM Final Report, 1 Apr. 1973 - 30 Nov. 1975
William A. Peppin and Alan Ryall Apr. 1976 58 p refs
(Contract F44620-72-C-0069; ARPA Order 2134)
(AD-A024359; AFOSR-76-0502TR) Avail: NTIS HC A04/MF A01 CSCL 08/11

The authors compute displacement spectra of explosion and earthquake seismograms in an attempt to study source parameters. The explosion data are at odds with several recent source theories for explosions (e.g. flat P-wave spectra from .025 to 1.5 Hz). These data are consistent with a study of trans-Sierra earthquakes in that the spectral corner frequency appears to be controlled by the source time duration. These data should stimulate the investigation of source models for which the corner frequency measures the source time duration and not the source dimension. GRA

N77-10750# Cornell Univ., Ithaca, N.Y. Dept. of Geological Sciences.
INTEGRATED GEOPHYSICAL AND GEOLOGICAL STUDY OF EARTHQUAKES IN NORMALLY ASEISMIC AREAS Final Report
Jack E. Oliver, Bryan L. Isacks, and James York, comp. 1976 262 p refs
(Grant AF-AFOSR-2494-73; ARPA Order 1827)
(AD-A024344; AFOSR-76-0513TR) Avail: NTIS HC A12/MF A01 CSCL 08/11

Information from precise leveling, sea level observations, geomorphology, photogeology, the sedimentary record, igneous activity, faulting, and theoretical geomechanics are brought to bear on understanding intraplate tectonics, especially in the eastern United States and China. Releveling data indicate vertical movements much faster than average geologic rates and possible movements on concealed faults. Intraplate faulting in the eastern U.S. and China extend the seismic record through Quaternary and earlier times. Author (GRA)

N77-11490*# Helsinki Univ. (Finland). Dept. of Geology.
USE OF SATELLITE PICTURES FOR DETERMINING MAJOR SHIELD FRACTURES RELEVANT FOR ORE PROSPECTING, NORTHERN FINLAND
Heikki V. Tuominen and Jussi Aarnisalo, Principal Investigators Sep. 1976 101 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10027; NASA-CR-149130) Avail: NTIS HC A06/MF A01 CSCL 08G

The author has identified the following significant results. A combined analysis of LANDSAT 1 imagery, aeromagnetic and other maps, and aerial photos has revealed a dense network of bedrock fractures in northern Finland. They form several fracturing zones, which obviously represent surficial manifestations of major fractures. The fractures follow, in general, the eight main trends of crustal shear characteristics of the Baltic Shield, but show distinct deviations from them in detail. The major fracture zones divide the bedrock into a mosaic of polygonal blocks, which in many cases coincide with the main rock units of the area and are characterized by different patterns of internal fracturing. Known mineralizations show a tendency to concentrate along the fracture zones. Optical filtering of original LANDSAT images might provide a rapid tool for the analysis of major structural trends in extensive areas such as shields or entire continents.

N77-11491*# Servicio Geologico de Bolivia, La Paz.
THE 29950 EARTH RESOURCE TECHNOLOGY SATELLITE (ERTS-A) SENSOR DATA FOR MINERAL RESOURCE SECTOR DEVELOPMENT AND REGIONAL LAND USE SURVEY, MARCH - AUGUST 1976
Carlos E. Brockmann, Principal Investigator Aug. 1976 31 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10028; NASA-CR-149131) Avail: NTIS HC A03/MF A01 CSCL 08F

N77-11493*# Milan Univ. (Italy).
LANDSAT 2 IMAGE STUDIES AS APPLIED TO A TEST AREA IN NORTHERN APPENNINE RANGE Progress Report
C. M. Marino, Principal Investigator and E. Zilioli [1976] 7 p Sponsored by NASA ERTS
(E77-10030; NASA-CR-149133) Avail: NTIS HC A02/MF A01 CSCL 08B

N77-11495*# Instituto Geografico y Catastral, Madrid (Spain).
THEMATIC MAPPING, LAND USE, GEOLOGICAL STRUCTURE AND WATER RESOURCES IN CENTRAL SPAIN Quarterly Report
Nunez DeLasCuevas, Principal Investigator 6 Sep. 1976 51 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10034; NASA-CR-149135; QR-3) Avail: NTIS HC A04/MF A01 CSCL 08F

The author has identified the following significant results. A method for a rapid updating of cartography at scale 1:200,000 was established. An annular tectonic structure was detected north of Madrid which was named Structural Halo of Guadalix, since its center is situated in the locality of Guadalix de la Sierra. This circular complex has from 30 to 40 km of radius and its influences at its most extreme edges reach Madrid.

N77-11511# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
BASIC STUDIES OF COAL PYROLYSIS AND HYDROGASIFICATION Quarterly Progress Report, 21 Feb. - 20 May 1976
T. W. Bush, J. B. Howard, W. A. Peters, and E. M. Suuberg 1976 25 p refs
(Grant NSF AER-75-13673)
(PB-254878/2; NSF/RA-760156; QPR-4) Avail: NTIS HC A02/MF A01 CSCL 07A

The low pressure batch sample reactor apparatus underwent the final modifications necessary to accomplish total product analyses. Concurrently with the development of the low pressure system, the successful modifications were incorporated into a design of the high pressure hydrogenation reactor. The analysis scheme for either reactor involves capturing products in four classes: (1) char; (2) gas; (3) condensible liquid; and (4) tar. The designs for many components of the laminar flow reactor were finalized. These components include the gas preheater, the coal particle feeder, the gas pressure and flow rate control system, and the process temperature control system. GRA

N77-11518# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
APPLYING COMPUTER-DRAWN MAPS OF GEOLOGIC DATA TO ANALYSIS OF MINING PROBLEMS
Charles M. McCulloch Jun. 1976 32 p refs
(PB-255497/0; BM-RI-8151) Avail: NTIS HC A03/MF A01 CSCL 08I

The principles of using computers to draw maps and plot geologic data of mining areas are discussed. The types of maps that can be drawn by a computer are discussed using as examples two separate areas where poor roof and gas emissions caused mining problems. Such maps can be used not only to help identify problem areas, but also to predict areas where problems could occur, thus giving mine operators time to work out solutions prior to mining. The average cost of a computer-drawn map for a mine property is less than $100, including computer time and man-hours for data preparation. GRA

N77-11572# California Univ., Livermore. Lawrence Livermore Lab.
DRAFT ENVIRONMENTAL ASSESSMENT OF APPLICATION BY ERDA FOR A SPECIAL LAND USE PERMIT FOR USE OF PUBLIC LANDS IN WYOMING FOR IN SITU COAL GASIFICATION EXPERIMENTS
W. Mead 22 Jan. 1976 42 p
(Contract W-7405-eng-48)
(UCID-17011) Avail: NTIS HC A03/MF A01

The proposed experiment represents a major element in an LLL program to explore and develop a unique method of in situ coal gasification. The new method promises to provide economic access to the enormous western coal resource, while avoiding some of the principal environmental drawbacks of conventional coal-recovery methods. The LLL approach involves the creation of a zone of permeable coal--an underground packed-bed reactor--through the use of chemical high explosives emplaced in an array of drilled holes. Oxygen and steam are supplied to the in situ reactor through an injection well, and the combustible mixture of product gases is withdrawn through suitable exhaust wells. The injected oxygen allows some of the coal to burn so as to provide process heat for the desired reactions. The withdrawn product gases would be cleaned and upgraded in a surface facility to provide high-Btu pipeline-quality gas. The proposed Hoe Creek experiment will consist of explosively fracturing and dewatering a suitable zone of Felix No. 2 coal, followed by an underground gasification procedure lasting about 2 months and involving roughly 3,000 tons of coal. The environmental effects of the proposed experiment are expected to be very small.
Author (ERA)

N77-12486*# National Field Investigations Center, Denver, Colo.
AN APPLICATION OF ERTS TECHNOLOGY TO THE EVALUATION OF COAL STRIP MINING AND RECLAMATION IN THE NORTHERN GREAT PLAINS Final Report
Feb. 1975 120 p Sponsored by NASA and EPA
(NASA-CR-149208; PB-255590/2; EPA-330/3-75-001) Avail: NTIS HC A06/MF A01 CSCL 08G

The coal mines in Wyoming, Montana, North and South Dakota were studied using remote sensing data from Earth Resources Technology Satellite (ERTS). The study documented the size, shape and location of the actively mined area, untouched spoils piles, reclaimed or recontoured areas, newly vegetated areas and abandoned spoils piles within each of the 30 active, inactive or proposed coal mine sites. Land use, or classification, at each mine evaluated was defined by computer processing of ERTS data from digital magnetic tapes. (GRA)

N77-12499# Denver Research Inst., Colo. Metallurgical and Materials Science Div.
CHARACTERIZATION STUDY OF DOMESTIC NICKELIFEROUS LATERITES BY ELECTRON OPTICAL AND X-RAY TECHNIQUES
Dhanesh Chandra and Clayton O. Ruud Apr. 1976 64 p refs
(Contract DI-BM-GO-254028)
(PB-256699/0; BM-OFR-75-76) Avail: NTIS HC A04/MF A01 CSCL 08I

X-ray diffraction, scanning electron microscopy, and conventional mineralogical investigations to determine elemental distribution, particle shape and size, and mineral identity of the Eight Dollar Mountain and Pine Flats ores are described. The nickel was found to be mainly associated with a cryptocrystalline geothite, while the cobalt and minor amounts of nickel are distributed in the manganese minerals. Low concentrates of hematite and trace amounts of magnetite and chromite are present in the ores. Major silicate minerals present are antigonite serpentine, chlorite, talc, and quartz. Nickel, aluminum, and chromium are incorporated in the geothite lattice. GRA

N77-12500# Federal Energy Administration, Washington, D.C.
A SURVEY OF SALT DEPOSITS AND SALT CAVERNS: THEIR RELEVANCE TO THE STRATEGIC PETROLEUM RESERVE
Charles J. Jirik and Louis K. Weaver Jul. 1976 72 p refs
(PB-255948/2; FEA/S-76/310) Avail: NTIS HC A04/MF A01 CSCL 08I

Rock salt has been mined in the United States by underground mining since 1867 and by large scale water-leaching methods since shortly after World War II. Since the 1940's, underground caverns have become very useful for storing liquefied petroleum gases and natural gas. Of all underground storage capacity in reservoirs of all types in the United States, about 93 percent is in salt. To evaluate the potential of any salt deposit as a storage site, information regarding all major activities, past and present, on each deposit was determined. Those activities are summarized as they pertain to LPG storage, salt production, and sulfur production operations on each appropriate site. GRA

N77-12501# Battelle Columbus Labs., Ohio.
METALS MINING AND MILLING PROCESS PROFILES WITH ENVIRONMENTAL ASPECTS Final Report, Aug. 1975 - May 1976
R. J. Nerkervis and J. B. Hallowell Jun. 1976 318 p refs
(Contract EPA-68-02-1323)
(PB-256394/8; EPA-600/2-76-167) Avail: NTIS HC A14/MF A01 CSCL 08/1

The environmental aspects of metals mining and milling (concentration) operations in the U.S. are discussed. The metals include Al, Sb, Be, Cu, Au, Fe, Pb, Zn, Hg, Mo, Ni, Pt, the rare earth metals, Ag, Ti, W, U, and V. The types of environmental impacts associated with operations from mining through production of concentrate are described. The number and locations of plants, the names of producing companies, production levels, and other characteristics of the industry are presented. Each unit process is described in terms of function, input materials, operating conditions, utilities and energy use, and waste streams. GRA

N77-13484 Illinois Univ., Urbana-Champaign.
ISOTOPIC CHARACTERIZATION OF ILLINOIS NATURAL GAS Ph.D. Thesis
Dennis Dale Coleman 1976 185 p
Avail: Univ. Microfilms Order No. 76-24060

To characterize natural gas from various sources in Illinois, over 100 samples were collected and analyzed. Of these, 19 samples from gas wells in Paleozoic bedrock were studied. This gas appears to have been formed by thermal decomposition of organic material. In addition, 22 samples from gas wells in glacial drift were analyzed. The origin of this gas from bacterial decomposition of organic material within the glacial drift was confirmed by radiocarbon dating of methane. Evidence suggests that the primary mode of methane migration in glacial drift is in solution with ground water. Analyses of 52 samples of gas from freshwater wells indicate that all but two of these samples are of bacterial origin. Several samples of methane from artificial sources including water wells and sanitary landfills, were also analyzed. Finally, a model of kinetic isotope effects during bacterial production of methane was developed and compared to both experimental and natural systems. Dissert. Abstr.

N77-13498*# Transemantics, Inc., Washington, D.C.
FURTHER DEVELOPMENT OF PHOTOGRAPHIC FILTRATION OF IMAGES FOR PURPOSES OF GEOLOGICAL INTERPRETATION
V. B. Komarov, V. F. Nomokonova, and Yu. V. Uglev NASA Mar. 1976 17 p Transl. into ENGLISH of "Dal'Neysheye Razvitiye Fotograficheskoy Fil Tratsii Izobrazhen iy v Tselyakh Geologicheskogo Deshifrirovaniya" Moscow, USSR Acad. of Sci., 1975 10 p
(Contract NASw-2792)
(NASA-TT-F-16940) Avail: NTIS HC A02/MF A01 CSCL 08G

Photographic image filtration and its development for purpose of geological interpretation. Generally speaking, image filtration is treated as its optical photographic conversion on the basis of certain rules on algorithms, corresponding to the problem of representing the result in the form of a new image, transmitting a photograph of the object being investigated. The data obtained as a result of these conversions make it possible to investigate in greater detail and to obtain analytical results in an objective and more representative form. Author

N77-13501*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
EVIDENCE OF THE INNER GEOLOGIC STRUCTURE OF KAMCHATKA ON SPACE PHOTOGRAPHS OF VARIOUS SCALES
I. V. Florenskiy and P. V. Florenskiy Washington NASA Apr. 1976 17 p refs Transl. into ENGLISH of "Proyavleniye Vnutrenney Geologicheskoy Struktury Kamchatki na Kosmicheskikh Izobrazheniyakh Raznogo Masshtaba", Moscow, USSR Acad. of Sci., 1975 p 12
(Contract NASw-2789)
(NASA-TT-F-16947) Avail: NTIS HC A02/MF A01 CSCL 08G

The inner geologic structure of the Kamchatka peninsula and adjacent area is revealed by high altitude photographs. Useful information on present day and historical topography, including the location of geologically active areas, e.g. faults and volcanos, are obtained from large scale photographs of the area. Author

N77-13502*# Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF REGIONS OF MODERN VOLCANISM AND ITS CONNECTION WITH PLUTONIC GEOLOGY FROM SPACE PHOTOGRAPHS
N. A. Gusev Washington NASA Mar. 1976 25 p refs Transl. into ENGLISH of the report "Izucheniye rayonov sovremennogo vulkanizma i yego svyazi s Glubinnoy geologiyev po snimkam iz kosmosa", Acad. of Sciences, USSR, Moscow, 1975 19 p
(Contract NASw-2790)
(NASA-TT-F-16948) Avail: NTIS HC A02/MF A01 CSCL 08G

Photographs and television images from numerous American and Soviet manned and unmanned spacecraft are interpreted in terms of major plutonic structures in areas of modern volcanism. The general outlines and numerous structural details of four areas of modern volcanism are discussed: north Africa (central Libya southeast to the Sudan), northern Iran (from the western part of the Little Caucasus to the Dast-i-Kavir), the Caucasus, and the Kamchatka peninsula. Author

N77-13509*# Kanner (Leo) Associates, Redwood City, Calif.
AEROSPACE AND GROUND METHODS OF STUDYING OF LATE QUATERNARY FISSURES (BASED ON THE ZONE OF THE CHIEF KOPETDAG FRACTURE)
V. G. Trifonov Washington NASA Mar. 1976 22 p refs Transl. into ENGLISH of "Aerokosmicheskiye i Nazemnyye Metody Izucheniya Pozdnechetvertichnykh Razryvov (Na Primere Zony Glavnogo Kopetdagskogo Razloma)," Moscow, Acad. of Sci. USSR, 1975 14 p
(Contract NASw-2790)
(NASA-TT-F-16955) Avail: NTIS HC A02/MF A01 CSCL 08G

A method of identification of late quaternary fissures in the Chief Kopetdag fracture zone is discussed in detail. Aerial photographs, space photographs from Meteor series satellites and LANDSAT series satellites, and ground observations are used to identify and characterize numerous fissures. The late quaternary disturbances, intersecting relief forms of the end of the middle Pleistocene or younger ages are distinguished from ancient fissures subjected to late Quaternary erosion and linear anthropogenic elements of the landscape (primarily lines of near horizontal underground water collecting galleries) are used to distinguish the fissures in the ground examination. Author

N77-13515# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
USE OF EARTH RESOURCES TECHNOLOGY SATELLITES (ERTS) TO DETERMINE TECTONIC CHARACTERISTICS NEAR LOW M SUB s - M SUB b EARTHQUAKES IN TIBET
R. R. Blandford and J. Gurski 2 Dec. 1975 28 p refs
(Contract F08606-76-C-0004; ARPA Order 2551; ARPA Order 1620)
(AD-A025177; SDAC-TR-75-13) Avail: NTIS HC A03/MF A01 CSCL 08/11

Examination of Earth Resources Technology Satellite (ERTS) photographs suggests intersecting faults within 10-20 kilometers of the NEIS epicenters of a cluster of low M sub s - m sub b events in Tibet. This suggests that the low Ms values may be due to some tectoni.. cause, for example dip slip thrust faults having high stress drop and small fault plane areas dipping about 45 deg which have been shown by Douglas to have low M sub s - m sub b. Therefore, unless the faults are steeply dipping, the low M sub s values cannot be traced to attenuation of the Rayleigh waves due to great depths of the hypocenters.
Author (GRA)

N77-13516# Resource Planning Associates, Inc., Cambridge, Mass.
THE EXPLORATION, DEVELOPMENT AND PRODUCTION OF NAVAL PETROLEUM RESERVE NUMBER 4 Final Report
19 Jul. 1976 386 p refs
(Contract FEA-CR-05-60579-00)
(PB-256714/7; FEA/S-76/368) Avail: NTIS HC A17/MF A01 CSCL 10A

The history of exploration in and the resource potential of NPR-4 are discussed. Likely levels of investment, manpower, and resources necessary to explore and develop NPR-4 are outlined. Alternative management programs for NPR-4 exploration and development are analyzed and the likely social and environmental impacts of NPR-4 exploration and development are addressed. GRA

N77-14541 Pennsylvania State Univ., University Park.
INORGANIC AND ISOTOPIC GEOCHEMISTRY OF THE UNSATURATED ZONE IN A CARBONATE TERRANE Ph.D. Thesis
Stephen OReilly Sears 1976 244 p
Avail: Univ. Microfilms Order No. 76-24799

The influence of processes in the unsaturated zone (zone of aeration) on the quality of ground water recharge, and resultant ground water is studied. Soil moisture samples were collected from depths of 1-9 m in the unsaturated zone with suction lysimeters. The three sites studied were in a carbonate rock terrane in central Pennsylvania. General results of the study indicate that: (1) weathering of carbonate rocks in the unsaturated zone not only involves their attack by carbonic acid derived from soil CO2, but that other sources of acidity such as H(+) desorbed from clays and oxidation of pyrite can be important; (2) in mineralogically and texturally homogeneous soils, Donnan equilibrium effects and selective adsorption are capable of maintaining constant major cation ratios in the soil solution over extended periods of time; (3) solubilities of ideal clay minerals used in conjunction with analyses of water chemistry and soil clay mineralogy can be used to determine the direction of clay diagenesis in soils; (4) a small fraction of the soil water moves downward rapidly, in contrast to the major portion of the total soil moisture which is practically stationary. Dissert. Abstr.

N77-14543*# Geological Survey, Malaysia.
GEOLOGICAL AND HYDROGEOLOGICAL INVESTIGATIONS IN WEST MALAYSIA Quarterly Report
Jaafar Bin Ahmad, Principal Investigator Aug. 1976 5 p Sponsored by NASA ERTS
(E77-10033; NASA-CR-149134; QR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

N77-14546*# Geological Survey, Reston, Va.
DETECTION AND MAPPING OF MINERALIZED AREAS IN THE CORTEZ-UINTA BELT, UTAH-NEVADA USING COMPUTER-ENHANCED ERTS IMAGERY Progress Report
Lawrence C. Rowan, Principal Investigator, Alexander F. H. Goetz (JPL), and Roger P. Ashley [1976] 2 p Sponsored by NASA ERTS
(E77-10047; NASA-CR-149253) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. The reflectance spectra of most hydrothermally altered rocks were characterized by broad ferric iron absorption bands short of 1.1 microns and a sharper hydroxyl band near 2.2 microns; maximum reflectance occurred near 1.6 microns. Their features became more prominent as albedo increased. The MSS color ratio composite images were the most effective and practical

means for detecting and mapping limonitic rocks in areas having less than about 50 percent desert brush cover and less than 25-35 percent coniferous tree cover. Limonitic altered and unaltered rocks could not be distinguished in MSS color ratio composite images.

N77-14547*# New England Univ., Armidale (Australia).
STRUCTURES IN GRANITIC BATHYLITHS AND ASSOCIATED FOLDBELTS IN RELATION TO MINERAL RESOURCES Quarterly Report
Hilary J. Harrington, Principal Investigator and Kerry L. Burns (Commonwealth Scientific and Industrial Res. Organization, North Ryde, Australia) 28 Oct. 1976 5 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10048; NASA-CR-149255; QR-1) Avail: NTIS HC A02/MF A01 CSCL 05B

N77-14551*# Montana Univ., Missoula. Dept. of Geology.
APPLICABILITY OF ERTS-1 TO MONTANA GEOLOGY Final Report
R. M. Weidman, Principal Investigator, D. D. Alt, R. Berg, W. Johns, R. Flood, K. Hawley, and L. Wackwitz 8 Dec. 1976 92 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21826)
(E77-10052; NASA-CR-149259) Avail: NTIS HC A05/MF A01 CSCL 08G

The author has identified the following significant results. Late autumn imagery provides the advantages of topographic shadow enhancement and low cloud cover. Mapping of rock units was done locally with good results for alluvium, basin fill, volcanics, inclined Paleozoic and Mesozoic beds, and host strata of bentonite beds. Folds, intrusive domes, and even dip directions were mapped where differential erosion was significant. However, mapping was not possible for belt strata, was difficult for granite, and was hindered by conifers compared to grass cover. Expansion of local mapping required geologic control and encountered significant areas unmappable from ERTS imagery. Annotation of lineaments provided much new geologic data. By extrapolating test site comparisons, it is inferred that 27 percent of some 1200 lineaments mapped from western Montana represent unknown faults. The remainder appear to be localized mainly by undiscovered faults and sets of minor faults or joints.

N77-14554*# Helsinki Univ. (Finland). Dept. of Geology.
INVESTIGATION OF LANDSAT IMAGERY ON CORRELATIONS BETWEEN ORE DEPOSITS AND MAJOR SHIELD STRUCTURES IN FINLAND Quarterly Progress Report, Apr. - Jun. 1976
Heikki V. Tuominen, Principal Investigator and Viljo Kuosmanen [1976] 14 p ref Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10055; NASA-CR-149273; QPR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Based on tests, it is obvious that practically all major LANDSAT winter linears found are geologically significant features. Most of them are chains of bogs, lakes, rivers, and cultivated areas covered by ice and/or snow, i.e., unforested linear topographic lows. They need no explanation other than that they are extensive fracture zones of the basement.

N77-14555*# Nevada Univ., Reno. Mackay School of Mines.
GEOLOGIC INVESTIGATIONS IN THE BASIN AND RANGE OF NEVADA USING SKYLAB/EREP DATA Final Report
Jack G. Quade, Principal Investigator and Dennis T. Trexler Jun. 1975 169 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13274)
(E77-10056; NASA-CR-144497) Avail: NTIS HC A08/MF A01 CSCL 08B

The author has identified the following significant results. Working from the S190A photography at a scale of 1:702,000 and comparing the results with existing geologic maps has suggested that the larger scale structural features can be mapped and related to regional trends which provide an overall view not available at lower altitudes. All S190B in-house coverage was in stereo. The stereo capability was helpful in resolving problems relating to elevations and attitude of bedding, etc., but the greatest single contribution was the resolution capability.

N77-14564*# Kanner (Leo) Associates, Redwood City, Calif.
APPLICATION OF A SET OF MULTIZONAL SCANNING SPACE IMAGES OF THE EARTH FOR THE STUDY OF GEOLOGICAL STRUCTURE (EASTERN REGIONS OF THE FERGAN AND THE TADZHIK DEPRESSION AS EXAMPLES)
V. M. Panin and S. F. Skobelev Washington NASA Mar. 1976 16 p refs Transl. into ENGLISH of the report "Primeneniye komplekta mnogozonal nykh skanernykh kosmicheskikh izobrazheniy zemli dlya izucheniya geologicheskoy struktury (na primere vostochnykh rayonov fergana i tadzhikskoy depressii)", Moscow, Acad. of Scis. USSR, 1975 8 p
(Contract NASw-2790)
(NASA-TT-F-16939) Avail: NTIS HC A02/MF A01 CSCL 08G

ERTS-1 multizonal scanning photographs of the eastern Fergan, northeastern Tadzhik Depression and the Pamir-Tien-Shan connecting zone are discussed. The youngest Quaternary formations are best distinguished in the yellow-green spectrum, which also reveals horizons of more ancient rocks with increased groundwater filtration and can be used in hydrogeological exploration. The yellow-red spectrum produces more information on plutonic structure, and the red and infrared bands have much information on both the surface structure and the plutonic structure. Author

N77-14568*# *National Aeronautics and Space Administration.* Ames Research Center, Moffett Field, Calif.
GEOLOGIC GUIDE TO THE ISLAND OF HAWAII: A FIELD GUIDE FOR COMPARATIVE PLANETARY GEOLOGY
Ronald Greeley, ed. Aug. 1974 258 p refs Prepared in cooperation with Santa Clara Univ., Calif.
(NASA-TM-X-74272) Avail: NTIS HC A12/MF A01 CSCL 08B

With geological data available for all inner planets except Venus, we are entering an era of true comparative planetary geology, when knowledge of the differences and similarities for classes of structures (e.g., shield volcanoes) will lead to a better understanding of general geological processes, regardless of planet. Thus, it is imperative that planetologists, particularly those involved in geological mapping and surface feature analysis for terrestrial planets, be familiar with volcanic terrain in terms of its origin, structure, and morphology. One means of gaining this experience is through field trips in volcanic terrains - hence, the Planetology Conference in Hawaii. In addition, discussions with volcanologists at the conference provide an important basis for establishing communications between the two fields that will facilitate comparative studies as more data become available. Author

N77-14573# NUS Corp., Rockville, Md.
AVAILABILITY OF POTENTIAL COAL SUPPLY THROUGH 1985 BY QUALITY CHARACTERISTICS
Landy A. Stinnett, George W. Toth, Shirley C. Barber, Jeffrey B. Goodman, and Jasper Maltese Aug. 1976 121 p refs
(Contract FEA-CO-05-60574-00)
(PB-256680/0; NUS-1725; FEA/G-76/367) Avail: NTIS HC A06/MF A01 CSCL 21D

The availability of uncommitted low-sulfur coal was analyzed in terms of quantity, quality, and timeliness of production and uncommitted recoverable coal which is potentially available for production. The effects on coal availability of manpower,

equipment, availability, economics, ownership, and regulations were considered implicitly by virtue of the responses received in the market survey. GRA

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05

OCEANOGRAPHY AND MARINE RESOURCES

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

A77-10112 Gulf Stream kinematics inferred from a satellite-tracked drifter. A. D. Kirwan, Jr. (Texas A & M University, College Station, Tex.), G. McNally, and J. Coehlo (California, University, La Jolla, Calif.). *Journal of Physical Oceanography*, vol. 6, Sept. 1976, p. 750-755. 11 refs. Contract No. N00014-75-C-0537.

A drifter was deployed in the Gulf Stream and tracked for five months by the Nimbus 6 satellite. From this experiment, assessments are made of the technical capability of the satellite fixing system for measuring ocean currents, the drifter trajectory as it relates to the Gulf Stream position as determined by other independent means, and the kinematics and accelerations following the Stream axis. It is shown that the trajectory agrees quite well with the other data on the location of the Gulf Stream. The velocities, accelerations, and kinetic energies derived from the trajectory are compared with previous studies. The kinetic energy of the Gulf Stream as inferred from the drifter is compared with some recent calculations made from ship drift. (Author)

A77-10717 A technique for estimating tropical open-ocean rainfall from satellite observations. B. J. Kilonsky and C. S. Ramage (Hawaii, University, Honolulu, Hawaii). *Journal of Applied Meteorology*, vol. 15, Sept. 1976, p. 972-975. 13 refs. NSF Grant No. DES-74-22685.

A procedure has been devised for extracting the frequency of highly reflective clouds from visual satellite picture mosaics of the tropical Pacific Ocean. Over the period May 1971 through April 1973, monthly frequencies of highly reflective clouds were statistically tested for a regression relationship with 820 station-months of coral island rainfall. The correlation coefficient was +0.75 while the line of regression passed near the origin and was equidistant from the abscissa and ordinate. The F calculated from an analysis of variance table was highly significant at the 1% level. The rainfall estimated from highly reflective cloud frequencies was then compared to other tropical Pacific Ocean climatological rainfall estimates. (Author)

A77-10895 * # Seasat-A oceanographic data system and users. S. W. McCandless, Jr. (NASA, Washington, D.C.) and V. J. Cardone (New York, City University, Bronx, N.Y.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-061*. 12 p. 7 refs.

The Seasat-A system is reviewed with emphasis on data retrieval, processing and dissemination plans. Attention is paid to the sensors of the Seasat satellite including the compressed pulse radar altimeter, the coherent synthetic aperture imaging radar, the microwave wind scatterometer, and the scanning visible/infrared radiometer. Particular emphasis is placed on a particular set of experiments: the Navy's Fleet Numerical Weather Control will receive Seasat data in real time and process the data into products that will be used in weather and sea condition forecasts. B.J.

A77-10896 # The rules of classification of water surface conditions in remote sounding from space. Iu. E. Sidorov and S. V. Solonin (Leningradskii Gidrometeorologicheskii Institut, Leningrad, USSR). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-062*. 9 p.

The paper deals with the problem of statistical synthesis of the rules for classifying ocean surface conditions in the case of incomplete a priori information on the parameter distributions in remote sounding measurements, at different frequencies, of the outgoing microwave radiation of the ocean/atmosphere system. A solution is obtained by formulating the classification problem as a problem of estimating the parameters of a linear equation that relates the radio brightness temperatures at various wavelengths for various conditions at the ocean surface. V.P.

A77-11322 Submarine geothermal resources. D. L. Williams (U.S. Geological Survey, Denver, Colo.). *Journal of Volcanology and Geothermal Research*, vol. 1, June 1976, p. 85-100. 49 refs.

The paper considers submarine geothermal resources, which are indicated by hydrothermal discharge from young rocks adjacent to active seafloor-spreading centers and submarine volcanic areas. Evidence for the existence and importance of submarine hydrothermal heat loss is discussed, and the magnitude of such heat loss is estimated to be roughly equivalent to humanity's present gross energy-consumption rate. Probable characteristics of submarine geothermal reservoirs are examined, emphasizing hot-water volume, factors affecting reservoir temperatures, geochemical temperatures, geothermal temperature gradients, the location and dimensions of reservoirs, and their permeability and porosity. It is shown that the distribution of permeability and porosity is of primary importance in determining the magnitude of submarine geothermal resources. The possible geothermal potential of the northern Gulf of California is evaluated, and it is suggested that the electrical generating potential would be approximately 180,000 MW for 30 years. F.G.M.

A77-11565 # Interpretation of 8-13-micron measurements of sea-surface temperature. J. L. Cogan. *Royal Meteorological Society, Quarterly Journal*, vol. 102, Oct. 1976, p. 771-774. 8 refs. Contract No. N77856-4120-5502.

The difference between the true sea-surface temperature and that inferred from satellite measurements of infrared radiances when viewing vertically through a cloud-free atmosphere may be estimated to a useful accuracy for satellite-borne radiometers operating in the wavelength range from 8 to 13 microns. A simple parametric formula is developed that gives the difference to within + or -0.6 K of that computed by a numerical method for solving the equation of radiative transfer. A comparison with data suggests that accuracies not exceeding 1.3 K may be achieved relative to the actual value. Further work is necessary to confirm this accuracy because of an apparent discrepancy in the satellite data. (Author)

A77-11590 * Imaging radar observations of frozen Arctic lakes. C. Elachi, M. L. Bryan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and W. F. Weeks (Cold Regions Research and Engineering Laboratory, Hanover, N.H.). *Remote Sensing of Environment*, vol. 5, no. 3, 1976, p. 169-175. 14 refs. Navy-supported research; Contract No. NAS7-100.

A synthetic aperture imaging L-band radar flown aboard the NASA CV-990 remotely sensed a number of ice-covered lakes about 48 km northwest of Bethel, Alaska. The image obtained is a high resolution, two-dimensional representation of the surface backscatter cross section, and large differences in backscatter returns are observed: homogeneous low returns, homogeneous high returns and/or low returns near lake borders, and high returns from central areas. It is suggested that a low return indicates that the lake is frozen completely to the bottom, while a high return indicates the presence of fresh water between the ice cover and the lake bed. B.J.

A77-11592 Detection of oceanic thermal fronts off Korea with the Defense Meteorological Satellites. O. K. Huh (Louisiana State University, Baton Rouge, La.). *Remote Sensing of Environment*, vol. 5, no. 3, 1976, p. 191-213. 18 refs. Navy-supported research.

Satellites of the Defense Meteorological Satellite Program used scanning infrared radiometers (8-13 microns) to provide serial images

four times daily of sea-surface temperature gradients over the Sea of Japan, the Yellow Sea, and adjacent portions of the East China Sea. The electro-optically contoured infrared radiation temperatures faithfully reproduced the mesoscale structure of the surface temperature field. The radiometry provided near real-time, synoptic thermal charts of the surface waters for oceanographic observations, and for deployment of ship and aircraft sampling missions. The principal advantages of the satellite system are the high repetition rate of satellite overpasses, the flexible near real time display capabilities, the electro-optical data contouring capabilities, the geographic gridding system, and the high resolution and quality of the digital data stream. B.J.

A77-11633 # **Characteristics of microwave radiation scattering by breaking sea waves (Osobennosti rasseianiia SVCh izlucheniia na obrushivaiushchikhsia morskikh volnakh).** A. I. Kalmykov, A. S. Kuretin, Iu. A. Lementa, I. E. Ostrovskii, and V. V. Pustovoitenko (Akademiia Nauk Ukrainskoi SSR, Institut Radiofiziki i Elektroniki, Kharkov, Ukrainian SSR). *Radiofizika*, vol. 19, no. 9, 1976, p. 1315-1321. 9 refs. In Russian.

Data on the backscattering of eight-millimeter and three-centimeter radio waves by the sharp crests of breakers prior to breakdown are analyzed. It is shown that maximum scattering is produced by spray from the breaking waves, and that scattering, with respect to frequency dependence, is similar to Rayleigh scattering in intense rains; that scattering by surface foam is weaker than the reflection from spray; and that scattering by spray is characterized by weak depolarization, and is almost independent of the polarization of radiation. Scattering by spray may exceed substantially the reflection from the sea surface. V.P.

A77-14519 **The radiation budget of the ocean-atmosphere system and its components according to calculations and satellite measurements.** N. A. Timofeev (Akademiia Nauk Ukrainskoi SSR, Morskoi Gidrofizicheskii Institut, Moscow, USSR). *(Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana*, vol. 11, Dec. 1975, p. 1330-1333.) *Academy of Sciences, USSR, Izvestiya, Atmospheric and Oceanic Physics*, vol. 11, July 1976, p. 830-832. 7 refs. Translation.

A77-14710 **A model for non-Rayleigh sea echo.** E. Jakeman and P. N. Pusey (Royal Radar Establishment, Malvern, Worcs., England). *IEEE Transactions on Antennas and Propagation*, vol. AP-24, Nov. 1976, p. 806-814. 34 refs.

A mathematical model for non-Rayleigh microwave sea echo is developed which describes explicitly the dependence of statistical properties of the radar cross section on the area of sea surface illuminated by the radar. In addition to the first probability distribution of the scattered radiation, its temporal and spatial correlation functions are also considered. It is shown that, in general, these correlation functions decay on at least two scales, the second, non-Rayleigh, contributions being strongly dependent on the properties of a 'single scatterer'. Predictions of the model are found to be in qualitative agreement with existing experimental data. A new class of probability distributions, the 'K-distributions', is introduced, which may prove useful for fitting such data. (Author)

A77-14732 # **Some results of a study of sea-surface state using a highly sensitive radiometer (Nekotorye rezul'taty issledovaniia sostoianiia morskoi poverkhnosti pri pomoshchi vysokochuvstvitel'nogo radiometra).** V. I. Andrianov, A. A. Glotov, S. V. Dotsenko, S. O. Lomadze, D. T. Matveev, V. G. Mirovskii, V. V. Nikitin, N. Ia. Nikolaev, M. D. Raev, and I. A. Troitskii (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovanii and Institut Fiziki Atmosfery; Akademiia Nauk Ukrainskoi SSR, Morskoi Gidrofizicheskii Institut, Moscow, USSR). *Akademiia Nauk. SSSR, Izvestiia, Fizika Atmosfery i Okeana*, vol. 12, Aug. 1976, p. 868-874. 7 refs. In Russian.

Results are reported for a study of statistical sea-surface properties which employed a radiometer operating at a wavelength of 2.08 cm with a fluctuation sensitivity of 0.03 deg and a response time of one second. The radiometer was installed on a cliff about 50 m from the shore line at a height of about 8 m above mean sea level; its parabolic reflector was directed toward the open sea. Spectral methods of studying fluctuations in thermal radio emission are evaluated as a means of determining the statistical properties of a choppy sea surface. The results presented show that a radiometer of such high sensitivity may be used as a remote-sensing device for measuring temporal statistical sea-surface properties from distances of several tens or hundreds of meters. F.G.M.

A77-14750 **Unusual tropical development from a mid-Pacific cold low.** D. R. Cochran (NOAA, National Environmental Satellite Service, Honolulu, Hawaii). *Monthly Weather Review*, vol. 104, June 1976, p. 804-808. 11 refs.

A brief case history of a mid-Pacific upper tropospheric low which developed into a surface system that rapidly attained tropical character is presented. Satellite and conventional data suggest that hurricane-force winds were probably attained, marking, perhaps, the first such documented case north of 30 deg latitude in the central Pacific. (Author)

A77-14772 # **Methods of experimental design and optimum allocations of oceanographic measurements (Metodi planuvannia i optimal'noe rozmishchennia okeanografichnikh vimiriuvan').** V. I. Beliaev and G. A. Moiseev. *Akademiia Nauk Ukrains'koi RSR, Visnik*, vol. 40, Sept. 1976, p. 82-92. 15 refs. In Ukrainian.

Methods of numerical experimentation and analytical techniques for optimizing oceanographic measurements and design of oceanographic measuring experiments, with computerized updating of data fields and discrete measurements in space-time are discussed. Estimate of the effect of errors in allocating measurement points on the updating accuracy, algorithms for updating, planning of oceanographic observations implemented with instruments towed by the oceanographic research vessel, and observations using stationary automatic buoy station networks are treated, with discussion of optimum meshes, statistical properties of variability in space, Kalman and Wiener filters, isotropic finite spectral density, and towed-instrument monitoring of ocean salinity, electrical conductivity, sea water transparency, temperature, and mapping of ocean bottom topography. R.D.V.

A77-15777 * **Internal wave observations made with an airborne synthetic aperture imaging radar.** C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.) and J. R. Apel (NOAA, Pacific Marine Environmental Laboratory, Seattle, Wash.). *Geophysical Research Letters*, vol. 3, Nov. 1976, p. 647-650. 10 refs. NOAA-DARPA-supported research; Contract No. NAS7-100.

Synthetic aperture L-band radar flown aboard the NASA CV-990 has observed periodic striations on the ocean surface off the coast of Alaska which have been interpreted as tidally excited oceanic internal waves of less than 500 m length. These radar images are compared to photographic imagery of similar waves taken from Landsat 1. Both the radar and Landsat images reveal variations in reflectivity across each wave in a packet that range from low to high to normal. The variations point to the simultaneous existence of two mechanisms for the surface signatures of internal waves: roughening due to wave-current interactions, and smoothing due to slick formation. B.J.

A77-16225 **Use of enhanced infrared satellite imagery for sea ice and oceanographic studies.** K. O. L. F. Jayaweera (Alaska, University, Fairbanks, Alaska). *(International Conference on Port and Ocean Engineering Under Arctic Conditions, 3rd, University of Alaska, Fairbanks, Alaska, Aug. 1975.) Ocean Engineering*, vol. 3, Oct. 1976, p. 293-298. Grants No. NOAA-5-35190; No. NOAA-04-6-158-44039.

Infrared (IR) imagery from the NOAA 2, 3 and 4 satellites could be used to measure accurately the absolute temperature of the sea

surface and sea water. Comparison with measured temperatures indicate that the satellite observed values are within 2 C of those measured. Contouring temperatures and observing temperature fluctuations within 0.5 C is also possible by enhancing the infrared image. This is done by confining the 16 steps of gray of the image to a desired small temperature scale. The existence of open water areas within the pack ice and the positions of the ice edges could be readily distinguishable by generating special imagery in such a way that the gray scale covers two temperature ranges with a gray tone jump at the freezing point of sea water. In this way ice-water boundary appears as a line of demarcation between two different gray tones. Because the IR imagery is available all year round these techniques are readily applicable at all times especially during the winter months when the low sun angles make visible imagery not useful. (Author)

A77-16361 **Island wind shadows observed by satellite and radar.** J. W. Deardorff (National Center for Atmospheric Research, Boulder, Colo.). *American Meteorological Society, Bulletin,* vol. 57, Oct. 1976, p. 1241, 1242. 13 refs.

It is proposed that the mechanism responsible for maintaining an island wind shadow is the stable thermal stratification induced when the air first passes over the heated island and then over the sea. The enhanced atmospheric stability to the lee of the island is associated mainly with anomalously warm air rather than with an anomalously cool ocean surface. The air is heated when traversing the land or island in the daytime, and it emerges downstream of the island generally warmer than neighboring air that did not traverse land. After the warm air passes out over the cooler water surface, stable atmospheric stratification gradually develops from the surface upward (a stable internal boundary layer). B.J.

A77-18994 * **Study of Arctic sea ice drift from L-band synthetic aperture radar.** F. Leberl, T. Farr, L. Bryan, and C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div., Pasadena, Calif.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 597-611. 8 refs. Contract No. NAS7-100.

As part of the Arctic Ice Dynamics Joint Experiment (AIDJEX) several repetitive coverages of L-band (25 cm wavelength) side-looking airborne radar images have been flown over coastal areas of Alaska and a test area in the Arctic. These images allow the analysis of sea ice and its drift. Radar is particularly suited for the mapping and interpretation of Arctic sea ice due to independence from sunlight and the capability to penetrate clouds. Ice floes and leads can be readily identified on the radar images. Measurement of ice floe drift is based on the transformation of radar image coordinates into a geocentric coordinate system using inertial guidance data from the survey aircraft. The paper will demonstrate an example of Arctic ice drift measurements from L-band synthetic aperture radar imagery with an absolute accuracy of about 5%. The conclusions are of particular value in view of planned spaceborne side-looking radar missions in polar orbits. (Author)

A77-19199 # **Radio emission spectra of Antarctic glaciers (Spektry radioizlucheniia lednikov Antarktidy).** A. S. Gurvich, D. T. Matveev, and T. G. Krasil'nikova (Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Moscow, USSR). *Meteorologiia i Gidrologiia,* Nov. 1976, p. 94-96. In Russian.

Spatial variation in the radio brightness spectra of the Antarctic ice mass obtained during passes of the Kosmos 243 satellites over that continent's glaciers, and from Nimbus-5 data, at different wavelengths, is reported and analyzed. The results underline the need to take spectral properties of glaciers into account when sounding the atmosphere from satellites. Any calculations ignoring that factor are only rough approximations. Measurements of radio brightness spectra in polar regions yield information on the structure of density variations of polar-cap glaciers. R.D.V.

N77-10611*# Ohio State Univ., Columbus. ElectroScience Lab.

PASSIVE MICROWAVE MAPPING OF ICE THICKNESS Final Report. Ph.D. Thesis

John J. Apinis and William H. Peake Aug. 1976 156 p refs (Grant NsG-3005)

(NASA-CR-149104; FR-3892-2) Avail: NTIS HC A08/MF A01 CSCL 08B

Basic calculations are presented for evaluating the feasibility of a scanning microwave radiometer system for mapping the thickness of lake ice. An analytical model for the apparent brightness temperature as a function of ice thickness has been developed, and elaborated to include such variables as galactic and atmospheric noise, aspect angle, polarization, temperature gradient in the ice, the presence of transition layers such as snow, slush, and water, increased loss due to air inclusions in the ice layer, and the presence of multiple ice thicknesses within the antenna footprint. It was found that brightness temperature measurements at six or seven frequencies in the range of 0.4 to 0.7 GHz were required to obtain unambiquous thickness estimates. A number of data processing methods were examined. The effects of antenna beamwidth, scanning rate, receiver bandwidth, noise figure, and integration time were studied.

Author

N77-10768*# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

BASELINE DATA ON THE OCEANOGRAPHY OF COOK INLET, ALASKA Final Report, Apr. 1972 - Feb. 1975

Lawrence W. Gatto Feb. 1975 146 p refs

(NASA Order W-13452)

(NASA-CR-149141) Avail: NTIS HC A07/MF A01 CSCL 08C

Regional relationships between river hydrology, sediment transport, circulation and coastal processes were analyzed utilizing aircraft, ERTS-1 and N.O.A.A. -2 and -3 imagery and corroborative ground truth data. The use of satellite and aircraft imagery provides a means of acquiring synoptic information for analyzing the dynamic processes of Cook Inlet in a fashion not previously possible. Author

N77-10770# Naval Oceanographic Office, Washington, D.C.

COASTAL OCEANOGRAPHIC USE OF THE DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP) Final Report

Oscar K. Huh Sep. 1975 43 p refs Revised

(NR Proj. 387-062)

(AD-A024269; NOO-TR-241) Avail: NTIS HC A03/MF A01 CSCL 08/3

The spaceborne infrared sensors (8-13 micrometers) of the Defense Meteorological Satellite Program (DMSP) have provided remarkable images of mesoscale sea surface thermal patterns outlining currents, thermally distinct watermasses, and oceanic fronts. During 1971-72 the thermal outlines of the South Korean Coastal Oceanic Front, the Tsushima Current, the Yellow Sea Warm Current, the China Coastal Current and the Liman Current were detected and monitored with the 2-nmi resolution infrared DMSP imagery. The data are displayed in a series of 16 gray shades on photographlike images covering an area of 1560x3000 nmi of the earth's surface. The images are oblique Mercator projections at scales of 1:15,000,000 or enlarged to 1:7,500,000 with a thermal resolution of 1.6C. The outstanding characteristics of this system are: (1) The high repetition rate of coverage (minimum) of four times daily), (2) near real-time data availability, (3) high-resolution (1/3 and 2 nmi) visual and infrared images, and (4) global coverage. As in other infrared systems, cloud cover prevents sea surface observations. GRA

N77-11497*# National Marine Fisheries Service, Bay Saint Louis, Miss.

LANDSAT MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION, GULF OF MEXICO Progress Report, 1 Aug. - 31 Oct. 1976

Kenneth Savastano, Principal Investigator, Andrew J. Kemmerer, Thomas Leming, Hillman Holley, and Kenneth Faller (NASA. Johnson Space Center) Nov. 1976 37 p refs Original contains

imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order S-54114)
(E77-10036; NASA-CR-149137; SEFC-Contrib-464; MARMAP-Contrib-132; Rept-6) Avail: NTIS HC A03/MF A01 CSCL 08A

The author has identified the following significant results. The most significant achievements thus far include the successful charting of high probability fishing areas from LANDSAT MSS data and the successful simulation of an operational satellite system to provide tactical information for the commercial harvest of menhaden.

N77-12473*# Geological Survey, Menlo Park, Calif.
STUDIES OF THE INNER SHELF AND COASTAL SEDIMENTATION ENVIRONMENT OF THE BEAUFORT SEA FROM ERTS-A Final Report, 15 Jun. 1972 - 15 Oct. 1973
Erk Reimnitz, Principal Investigator, Peter W. Barnes, Larry J. Toimil, and Deborah Harden 15 Aug. 1976 104 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E77-10043; NASA-CR-149172) Avail: NTIS HC A06/MF A01 CSCL 08L

The author has identified the following significant results. Shearing periodically occurs between the westward moving pack ice (3 to 10 km/d) within the Pacific Gyre and the fast ice along the coast, forming major grounded shear and pressure ridges between the 10 to 40 m isobaths. Ridges occur in patterns conforming to known shoals. The zone of grounded ridges, called stamukhi zone, protects the inner shelf and coast from marine energy and pack ice forces. Relatively undeformed fast ice grows inshore of the stamukhi zone. The boundary is explained in terms of pack ice drift and major promontories and shoals. Intense ice gaging, highly disrupted sediments, and landward migration of shoals suggest that much of the available marine energy is expended on the sea floor within the stamukhi zone. Naleds (products of river icings) on the North Slope are more abundant east than west of the Colville River. Their location, growth, and decay were studied from LANDSAT imagery.

N77-12484# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.
REMOTE SENSING OF VARIATIONS OF SEA-ICE-SURFACES IN THE BARENTS-SEA FROM 1966 - 1975 BY MEANS OF SATELLITE DATA, AMONG OTHERS NOAA-VHRR
Heinz Kaminski 1976 32 p refs In GERMAN Presented at the 10th Intern. Polar Meeting, Zurich, 6-8 Apr. 1976
Avail: NTIS HC A03/MF A01

The sea ice dynamics were investigated from ESSA 2, 4, 6, 8, ITOS 1, NOAA 1, 3, 4 satellite infrared sensor measurements in April of the years 1966 to 1975. The free water surface was established and correlated with the average air and water temperature measured at the Vardoe, Kanin, Bjoernoya, Spitzbergen, and Ostrov Heisja weather stations. The free water surface is shown to have increased in the reference period, and the annual variations of the free water surface show a good correlation with the average water temperature of the Gulf North Cape stream and with the average April air temperature. ESA

N77-12560# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
PHYSICAL AND BIOLOGICAL ASPECTS OF THERMAL POLLUTION IN SEA WATER
L. Maiani 7 Nov. 1975 41 p refs In ITALIAN; ENGLISH summary Presented at the Seminar on Principi della Lotta contro gli Inquinamenti delle Acque Marine, Rome, 14-23 Apr. 1975
(ISS-L-75/14) Avail: NTIS HC A03/MF A01

The main physical and biological phenomena related to the discharge of refrigeration waters in marine environment are illustrated. In particular, the size of the coastal areas potentially involved in thermal pollution phenomena in connection with the present forecasts of electric energy production in Italy is discussed, based on the energy budget of an electric power plant making use of either nuclear or natural fuels. Author (ESA)

N77-12664# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET MATERIAL ON INTERNAL WAVES, NO. 6, NOVEMBER 1975 - APRIL 1976
Stuart G. Hibben, L. H. Boylan, and M. Ness 7 May 1976 42 p
(Contract MDA903-76-C-0099; DARPA Order 3097)
(AD-A025813) Avail: NTIS HC A03/MF A01 CSCL 08/3

This is the sixth bibliography of Soviet open-source publications relating to internal wave studies. It covers material received from November 1975 through April 1976. Main selection criteria are studies of small-scale variation in ocean parameters and of airborne techniques for deducing internal wave conditions. An index of serial source abbreviations is appended. Author (GRA)

N77-13311# Polar Research Lab., Inc., Santa Barbara, Calif.
ARCTIC RESEARCH IN ENVIRONMENTAL ACOUSTICS (AREA) TECHNICAL REPORT NO. 2: PRELIMINARY RADIO PERFORMANCE PREDICTIONS FOR THE ARCTIC ENVIRONMENTAL BUOY (AEB) Interim Report
Beaumont M. Buck 7 Jun. 1976 36 p
(Contract N00014-74-C-0065; NR Proj. 307-355)
(AD-A026552; PRL-TR-5) HC A03/MF A01 CSCL 08/10

Consideration is being given to adapting the high-frequency Arctic Environmental Buoy (AEB) originally developed for the Arctic Ice Dynamics Joint Experiment (AIDJEX), to a new concept for long-term, wide-area environmental data collection in the Arctic Ocean. The AEB was originally applied to a small area; under this new concept a number of small, widely dispersed drifting stations will be established on pack ice. The concept is called 'Manned-UnManned Multipurpose Environmental Research Station' (MUMMERS). Each station is equipped for short manned experiments and, when unmanned, automatically collects and relays synoptic oceanographic, meteorological, and geophysical environmental data to shore stations via the AEB's HF telemetry. A preliminary study was made of the expected performance of the AEB's HF link to determine its overall feasibility and to identify those AEB modifications and shore receiving sites needed to optimize performance. It was concluded that the addition of 8 MHz to the original 4 MHz would be a feasible AEB modification which would probably offer satisfactory performance during all seasons over most of the Arctic Ocean if two receiving sites located at Barrow, Alaska and Alert, Canada were used. GRA

N77-13408*# Miami Univ., Coral Gables, Fla. Lab. for Optics and Astrophysics.
LASER APPLICATION TO MEASURE VERTICAL SEA TEMPERATURE AND TURBIDITY, DESIGN PHASE
Joseph G. Hirschberg, A. W. Wouters, K. M. Simon, J. D. Byrne, and C. E. Deverdun Jan. 1976 123 p refs
(Contract NAS10-8795)
(NASA-CR-144854) Avail: NTIS HC A06/MF A01 CSCL 20E

An experiment to test a new method was designed, using backscattered radiation from a laser beam to measure oceanographic parameters in a fraction of a second. Tyndall, Rayleigh, Brillouin, and Raman scattering all are utilized to evaluate the parameters. A beam from a continuous argon ion laser is used together with an interferometer and interference filters to gather the information. The results are checked by direct measurements. Future shipboard and airborne experiments are described. Author

N77-13511# Centre National d'Etudes Spatiales, Toulouse (France).
LOCALIZATION AND DATA COLLECTION OF MARINE TRACERS BY SATELLITE PASSES [LOCALISATION ET COLLECTE DES DONNEES DE TRACEURS MARINS PAR SATELLITE A DEFILEMENT]
Andre Detape Jun. 1976 54 p refs In FRENCH; ENGLISH summary
(CNES-NT-39) Avail: NTIS HC A04/MF A01

The Eole satellite's localization and data collection systems were used to carry out a variety of experiments in which drifting buoys and icebergs acted as ocean current tracers. Results of

these experiments (mainly concerning data transmission and localization) are presented, and conclusions are drawn which are applicable to similar experiments performed with Nimbus 6 or with Argos localization and data collection systems, to be flown on the Tiros N satellite. ESA

N77-13512# Texas A&M Univ., College Station. Remote Sensing Center.
RADAR STUDIES OF ARCTIC ICE AND DEVELOPMENT OF A REAL-TIME ARCTIC ICE TYPE IDENTIFICATION SYSTEM Final Report
B. R. Jean 31 Jan. 1976 34 p
(Contract N60921-74-C-0008)
(AD-A025739; RSC-3005-6) Avail: NTIS HC A03/MF A01 CSCL 08/12

The Remote Sensing Center at Texas A and M University has conducted studies for the Naval Surface Weapons Center to develop a real-time, special purpose radar data processor. The purpose of this processing system is to provide ice type identification using radar scatterometer measurements. This final report documents the construction of the Real-Time Ice Classification System (RTICS) processor. Author (GRA)

N77-13513# Texas A&M Univ., College Station. Remote Sensing Center.
RADAR STUDIES OF ARCTIC ICE AND DEVELOPMENT OF A REAL-TIME ARCTIC ICE TYPE IDENTIFICATION SYSTEM Progress Report, Sep. 1974 - Jan. 1975
B. R. Jean, G. J. Reisor, M. T. Shay, and J. A. Permenter 31 Jan. 1975 110 p refs
(Contract N60921-74-C-0008)
(AD-A025862; RSC-3005-5) Avail: NTIS HC A06/MF A01 CSCL 08/12

The Remote Sensing Center at Texas A and M University is conducting studies for the Naval Surface Weapons Center to develop a real-time, special purpose radar data processor. The purpose of this processing system is to provide ice type identification using radar scatterometer measurements. This document reports on the activities of the Remote Sensing Center during the months of September 1, 1974 through January 31, 1975 directed toward that effort. Author (GRA)

N77-13514# Naval Postgraduate School, Monterey, Calif.
OCEANOGRAPHIC INVESTIGATION OF THE MARGINAL SEA-ICE ZONE OF THE CHUKCHI SEA: MIZPAC 1974 Final Report, 10 Jun. 1974 - 30 Jun. 1975
Robert G. Paquette and Robert H. Bourke May 1976 129 p refs
(ZF5255501)
(AD-A025854; NPS-58PA76051) Avail: NTIS HC A07/MF A01 CSCL 08/12

Continuous profiles of temperature and salinity (STD observations) were made in the shallow (approximately 45 m) Bering and Chukchi Seas in July 1974 as part of the MIZPAC program. In addition to measurements in ice-free waters, seven closely spaced crossings of the sea-ice margin were made along with two crossings of the Alaskan coastal zone. In all, 111 STD stations and approximately 100 XBT drops were made for which graphs and tabulations were produced of temperature, salinity, density and sound speed. South of the ice the water is sharply layered with a warm fresh layer (8-10 C and approximately 10 m thick) above a cold dense layer. At or near the sea-ice margin the layering gradually disappears with modification of isopycnals and isotherms extending to the bottom. Large scale temperature fluctuations of 0.5 to 2 C, termed mesostructure, were observed at 12-15 m depth in the first three crossings, but were weak or absent in the other crossings. Mesostructure appears to be correlated with a relatively rapid melting of the ice, and hence, probably with a strong northward flow, or a diffuse ice margin. Mesostructure formation is believed to result from non-uniform lateral mixing of waters of different temperatures but the same density, possibly modified or controlled by a complex lateral pressure field near the ice. Author (GRA)

N77-13519# Environmental Research Inst. of Michigan, Ann Arbor.
BASIC INVESTIGATIONS FOR REMOTE SENSING OF COASTAL AREAS Quarterly Report, 1 Apr. - 15 Jul. 1976
R. A. Shuchman, F. J. Thomson, and D. R. Lyzenga 15 Jul. 1976 25 p refs
(Contract N00014-74-C-0273; NR Proj. 389-166)
(AD-A027468; ERIM-108900-7-L) Avail: NTIS HC A02/MF A01 CSCL 08/6

During the recording period four activities took place. The second year interim report was extensively revised using comments from the sponsor and ERIM personnel and currently is in printing. A detailed program plan for 1974 ONR activities was written and distributed internally to key ERIM personnel for review. Work has commenced on obtaining critical optical properties of beach minerals needed as inputs into the Beach Environment model. And in the water modeling area, work is progressing along two fronts: (1) a computer program has been written to implement a combined water-atmosphere model, and (2) further theoretical work has indicated a small correction to be made to the existing QSS model. GRA

N77-14552*# Norsk Polarinstitutt, Oslo.
SEA ICE STUDIES IN THE SPITSBERGEN-GREENLAND AREA Quarterly Report
Torgny E. Vinje, Principal Investigator Nov. 1976 16 p ref
Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10053; NASA-CR-149261; QR-5) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Detailed information on the outflow through the Fram Strait of ice from the Polar Ocean over shorter periods was obtained. It is found that the speed of the outflow may vary about 100% over periods of a few days. The core of the East Greenland Current is found between 2 deg E and 4 deg W. The speed of the surface water at 81 deg N is for a calm period estimated to be about 10 cm/s. A new surging glacier was discovered and new fronts of several glaciers were determined. The variation of the snow line with respect to distance from the coast was for the first time determined for the southern part of Spitsbergen. Great variations were observed, from 200 m in east to 550 m in the central area of the island.

N77-14724*# Ocean Data Systems, Inc., Rockville, Md.
DEVELOPMENT OF SPECIFICATIONS FOR SURFACE AND SUBSURFACE OCEANIC ENVIRONMENTAL DATA Final Technical Report
Paul M. Wolff Jun. 1976 113 p
(Contract NASw-2558)
(NASA-CR-149211) Avail: NTIS HC A06/MF A01 CSCL 08J

The existing need for synoptic subsurface observations was demonstrated giving special attention to the requirements of meteorology. The current state of synoptic oceanographic observations was assessed; a preliminary design for the Basic Observational Network needed to fulfill the minimum needs of synoptic meteorology and oceanography was presented. There is an existing critical need for such a network in the support of atmospheric modeling and operational meteorological prediction, and through utilization of the regional water mass concept an adequate observational system can be designed which is realistic in terms of cost and effort. Author

N77-14727# Scripps Institution of Oceanography, La Jolla, Calif.
MEAN TS CURVES IN THE PACIFIC AND THEIR APPLICATION TO DYNAMIC HEIGHT COMPUTATIONS
Richard T. Wert and William J. Emery 22 Apr. 1976 127 p refs
(Contract N00014-75-C-0152; Grant NSF OCE-74-24583)
(AD-A027216; SIO-Ref-76-6) Avail: NTIS HC A07/MF A01 CSCL 08/10

Smoothed mean curves of temperature versus salinity are computed from all available hydrographic data for 10 deg squares in the Pacific between 20 deg S and 40 deg N. Together these curves provide information on the distribution of water masses. Graphs of the individual curves are presented which

include the scatter of TS pairs and the standard deviation in salinity along each curve. Salinity at a temperature interval of 1 C is also given in tabular form for each curve. Author (GRA)

N77-15602*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPARISON OF REMOTELY SENSED CONTINENTAL-SHELF WAVE SPECTRA WITH SPECTRA COMPUTED BY USING A WAVE REFRACTION COMPUTER MODEL

Lamont R. Poole Washington Dec. 1976 45 p refs (NASA-TN-D-8353; L-11072) Avail: NTIS HC A03/MF A01 CSCL 08C

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

N77-15604# National Environmental Satellite Service, Washington, D.C.

SATELLITE DERIVED SEA SURFACE TEMPERATURES FROM NOAA SPACECRAFT

Robert L. Brower, Hilda S. Gohrband, William G. Pichel, T. L. Signore, and Charles C. Walton Jun. 1976 84 p refs (PB-258026/4; NOAA-TM-NESS-78; NOAA-76062401) Avail: NTIS HC A05/MF A01 CSCL 08J

Sea surface temperature values were derived from scanning radiometer infrared data from the NOAA series of polar orbiting satellites. The technique used to obtain these temperatures was the fully automated computer procedure, GOSSTCOMP (Global Operational Sea Surface Temperature Computation). Surface temperature retrievals were derived by statistical analysis and quality control techniques applied to instrument measurements covering roughly 100-km square areas. Retrieval temperatures were corrected for the effects of atmospheric attenuation by using time-coincident measurements derived from a vertical temperature profile radiometer. The basic product obtained was a daily set of 5,000 to 7,000 observations of sea surface temperature over the oceans of both hemispheres. GRA

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.

A77-10989 **Remote sensing of hydrological and atmospheric stresses in the European agglomeration area by means of environmental research satellites (Fernerkundung hydrologischer und atmosphärischer Belastungen im europäischen Ballungsgebiet mittels Umweltforschungssatelliten).** H. Kaminski (Bochum, Sternwarte, Bochum; Duisburg, Universität, Duisburg, West Germany). *Naturwissenschaftliche Rundschau,* vol. 29, May 1976, p. 158-166. 5 refs. In German.

A study of the effects of the processes of human civilization and technology on the conditions of the hydrosphere and the atmosphere requires also an employment of satellite survey methods. The recognition of such effects with the aid of NOAA-VHRR satellites is illustrated with the aid of European examples. The data of satellite technology can provide a basis for decisions concerning the actions which are needed to protect the environment. Attention is given to effects on the European hydrosphere, a European satellite environmental-surveillance system, details regarding the orbits and the equipment of the satellites, examples of data interpretation, the effects of air traffic on the atmosphere, and a proposal for a European environmental research program utilizing space technology. G.R.

A77-12257 # **Use of radar in hydrology and geomorphology.** R. M. McCoy (Utah, University, Salt Lake City, Utah) and A. J. Lewis (Louisiana State University Baton Rouge, La.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 3, July 1976, p. 105-122.

The potential for mapping flooded land with radar imagery is illustrated by a radar image of the 1973 Missouri River flood near St. Louis. It has been found (McCoy, 1969) that although different radar systems yield different amounts of drainage network detail, the consistency of information content in any given radar system allows extrapolation of data to the level of detail that would be available on a 1:24,000 topographic map. As for geomorphology, radar imagery is a valuable tool in terrain analysis based on topographic relief, slope or texture. The identification of individual geomorphic features on radar imagery is accomplished by the interpretation of tone, texture, pattern, topographic position, and size. B.J.

A77-12879 **The Westplaat /sw-Netherlands/ - A study of coastal dynamics from sequential aerial photography.** M. R. Schmitt-Taverna. *ITC Journal,* no. 2, 1975, p. 173-185. 17 refs.

A77-12881 **Land scape development in the valley of the Guadiana River, Spain.** D. Goosen (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 2, 1975, p. 236-244. 8 refs.

A77-12882 **Will the road to the green hell be paved with SLAR - A case study of tropical rain forest type mapping in Colombia.** G. Sicco Smit (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 2, 1975, p. 245-266. 8 refs.

In this article an evaluation is given of the system of tropical rain forest type mapping on SLAR images in Colombia. A SLAR image is included to show the importance of the pragmatic differentiation into forest types according to the physiographic conditions of the terrain. In addition, two stereograms of conventional aerial photographs demonstrate that tonal changes on SLAR are not always related to significant vegetation differences. The restraint inherent in checking the accuracy of SLAR forest type delineation is discussed. The impossibility of obtaining data about species composition and its volume with SLAR involves a time-consuming inventory survey for the classification of the forest types delineated. Recommendations are made for the planning of forest and vegetation type mapping in the PRORADAM project in the Colombian Amazon and for the forest inventory survey that is required. (Author)

A77-12884 **Applied geomorphological mapping for erosion surveys - The example of the Oliva basin, Calabria.** D. P. Rao (Indian Photo-Interpretation Institute, Dehra Dun, India). *ITC Journal,* no. 3, 1975, p. 341-351.

Geomorphological mapping methods were applied to a study of erosion and conservation in a small drainage basin of 60 sq km in southern Italy. The method of approach was based on a study of the landforms, as well as on the active and passive processes and their interrelationship with slope, vegetation and lithology. Data were gathered on geomorphological units and features, or erosion classes, and on slope and vegetal cover. The results of the study indicate that geological factors such as structure, and the nature and competence of rocks, render the area very susceptible to severe erosion, which in this case has ultimately been triggered off by human interference. The utility of the maps produced for combating erosion and planning conservation measures is emphasized. (Author)

A77-12894 **Landforms and inundations of the lowlands of South-Central Java - An example of applied geomorphology, using aerial photographs.** H. T. Verstappen (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 4, 1975, p. 511-520.

Parts of the alluvial plain bordering the south coast of Central Java, between the Nusakambangan Peninsula in the west and the Karangbolang Hills in the east, are subject to flooding every year during the rainy season. A set of 1:20,000 black and white infrared aerial photographs of this region were taken on December 22, 1972 and were used for mapping the various geomorphological features and also the flood-stricken areas. A generalized geomorphological map with the main flood classification zones is presented. B.J.

A77-15052 **Applicability of Landsat data to water management and control needs.** J. W. Jarman (U.S. Army, Washington, D.C.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. PA-1 to PA-6. 6 refs.

A77-15058 **Resource inventory using Landsat data for areawide water quality planning.** R. N. Schecter (Triangle J Council of Governments, Research Triangle Park, N.C.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. (A77-15051 04-43) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 1B-1 to 1B-10. 8 refs.

The Triangle J Council of Governments (Triangle J is located in the eastern portion of the North Carolina Piedmont) used Landsat imagery to provide an essential data base for water quality inventory in the area as well as for input data for modeling water quality and future development patterns. Water quality inventory was obtained for the 1,750 sq mile study area through the computer processing of Landsat computer compatible tapes. Ten land cover categories were interpreted at a detail of 0.44 hectares and included three developed categories, four forest types, agricultural managed lands, bare soil and water. The resulting products included color-coded overlays for each category at a ratio scale of 1:96,000, a color composite map of all categories at the same scale, and a computer tape containing land

cover data for each 54 USGS 7-1/2 minute quadrangles by 50 m grid cells. B.J.

A77-16794 **Remote sensing of suspended sediments in surface waters.** J. C. Ritchie, F. R. Schiebe, and J. R. McHenry (U.S. Department of Agriculture, Oxford, Miss.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Dec. 1976, p. 1539-1545. 17 refs.

Reflected and incident solar radiation 20 to 50 cm above the water surface were measured on six northern Mississippi reservoirs between August 1973 and December 1974. Linear regression analyses showed the best fit for the relationship between reflected solar radiation, or reflectance, and suspended sediment concentration of surface water was between 700 and 800 nm. Further analyses, using sun angle grouping, showed that sun angle had a definite effect on these relationships. These studies showed that quantitative estimates of suspended sediment concentration of surface water could be made using reflected solar radiation. (Author)

A77-18973 **Assessment of upper Mississippi River floodplain changes with sequential aerial photography.** K. N. Olson and M. P. Meyer (Minnesota, University, St. Paul, Minn.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 167-177. 5 refs. Army-sponsored research.

A77-18984 **Utilization of remote sensing techniques to detect land use effects on wildland water quality.** G. B. Coltharp, D. H. Graves, and M. C. Hammetter (Kentucky, University, Lexington, Ky.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 368-372. 5 refs.

Multistage sampling techniques are being utilized to determine and monitor land use changes and the effects of such changes on water quality in the Cumberland Plateau region in eastern Kentucky. Land use practices being monitored include forest fertilization, logging, and surface mining. Vegetation inventory and physical, chemical and bacteriological water quality data provide the ground truth for correlation efforts. Manually-operated spot densitometers are being used to identify vegetation signatures on Landsat multispectral and seasonal 1:24,000 color infrared and multispectral transparencies. Densitometry data will be correlated with ground truth information in the attempt to develop a water quality prediction model. Color additive viewing of satellite and aircraft multispectral imagery is being evaluated for land use monitoring and change detection potential. (Author)

A77-18992 * **Remote sensing as a tool for watershed-wide estimation of net solar radiation and water loss to the atmosphere.** S. Khorram and R. W. Thomas (California, University, Berkeley, Calif.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 564-583. 26 refs. Grant No. NGL-05-003-404.

Results are presented for a study intended to develop a general remote sensing-aided cost-effective procedure to estimate watershed-wide water loss to the atmosphere via evapotranspiration and to estimate net solar radiation over the watershed. Evapotranspiration estimation employs a basic two-stage two-phase sample of three information resolution levels. Net solar radiation is taken as one of the variables at each level of evapotranspiration modeling. The input information for models requiring spatial information will be provided by Landsat digital data, environmental satellite data, ground meteorological data, ground sample unit information, and topographic data. The outputs of the sampling-estimation/data bank system will be in-place maps of evapotranspiration on a data resolution element basis, watershed-wide evapotranspiration isopleths, and estimates of watershed and subbasin total evapotranspiration with associated statistical confidence bounds. The methodology developed is being tested primarily on the Spanish Creek Watershed Plumas County, California. S.D.

A77-19197 # **Feasibility of cloud recognition against a snow background (O vozmozhnosti raspoznavaniia oblakov na fone snega).** L. I. Chapurskii. *Meteorologiia i Gidrologiia,* Nov. 1976, p. 32-39. In Russian.

Results of airborne measurements of the brightness of clouds and of a snow-covered landscape over the 0.35-0.85 micron and 1.2-3 micron range of the spectrum are reported. Detection of clouds against a background of snow cover and forest stands with the two spectral intervals used separately and jointly is backed up by statistical treatment of the experimental data. Computerized handling of satellite TV imagery and airborne data on fields of clouds, snow, and ice over various spectral intervals, and algorithms for that purpose, are discussed. R.D.V.

N77-10587*# Bureau of Reclamation, Denver, Colo.
USE OF THE LANDSAT-2 DATA COLLECTION SYSTEM IN THE COLORADO RIVER BASIN WEATHER MODIFICATION PROGRAM Final Report
Archie M. Kahan, Principal Investigator Feb. 1976 107 p refs ERTS
(NASA Order S-53881-A)
(E77-10003; NASA-CR-148974) Avail: NTIS HC A06/MF A01 CSCL 05B

The author has identified the following significant results. Many types of environmental sensors can be interfaced to the LANDSAT DCP. The LANDSAT field installations proved to be remarkably reliable, weather resistant, and cost effective units able to relay high quality data in near real time. The wind averaging system demonstrated the feasibility of transmitting averaged wind data, stored over a period of several hours, from a remote site.

N77-10591*# Texas A&M Univ., College Station. Remote Sensing Center.
SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS Progress Report, 1 Jun. - 31 Aug. 1976
Bruce J. Blanchard, Principal Investigator Sep. 1976 27 p refs ERTS
(Contract NAS5-22534)
(E77-10008; NASA-CR-148979; RSC-3273-4) Avail: NTIS HC A03/MF A01 CSCL 20F

N77-10627# National Weather Service, Silver Spring, Md. Office of Hydrology.
A POINT ENERGY AND MASS BALANCE MODEL OF A SNOW COVER
Eric A. Anderson Feb. 1976 173 p refs
(PB-254653/9; NOAA-TR-NWS-19; NOAA-76040701) Avail: NTIS HC A08/MF A01 CSCL 08L

The model is based on two equations. These are the snow cover energy balance equation and the equation for energy transfer within a snow cover. The snow cover is divided into finite layers. Implicit finite difference expression, based on the two equations, are written for each layer. This set of nonlinear finite difference equations is solved by use of the Newton-Raphson iteration technique. The model also includes mathematical representations of the densification of the snow and the retention and transmission of liquid-water. The results obtained with this energy balance model are compared to results obtained with a temperature index snow cover compared to nonlinearity. Author (GRA)

N77-10628# Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
A REVIEW AND ANALYSIS OF SELECTED HYDROLOGIC MODELING CONCEPTS
J. L. Nieber, M. F. Walter, and R. D. Black Jun. 1976 72 p refs
(Contract DI-14-31-0001-5032)
(PB-254489/8; W76-09718; OWRT-A-061-NY(1)) Avail: NTIS HC A04/MF A01 CSCL 08H

Several selected hydrologic watershed runoff models commonly used for forecasting floods and water supply were analyzed. The three approaches to hydrologic modeling, deterministic, parametric, and stochastic, are compared to emphasize the advantages and disadvantages of each. A review of the literature gives the general development of rainfall excess routing techniques, infiltration and evaporation determination techniques and techniques for estimating groundwater flow. Approaches of integrating these process submodels into a total watershed runoff model are considered. Several selected watershed modeling packages are discussed relative to origin, concept, and usefulness. GRA

N77-10629# Geological Survey, Tallahassee, Fla. Water Resources Div.
THE SHALLOW AQUIFER: A PRIME FRESHWATER RESOURCE IN EASTERN PALM BEACH COUNTY, FLORIDA Final Report
H. G. Rodis and L. F. Land Feb. 1976 17 p refs Sponsored by Palm Beach County Board of Commissioners, Fla., Central Fla. Flood Control District, and Southern Fla., Flood Control District
(PB-254393/2; USGS-WRD-WRP-76-038; USGS-WRI-76-21) Avail: NTIS HC A02/MF A01 CSCL 08H

The shallow aquifer underlies all of Palm Beach County and is the source of almost all freshwater supplies in the eastern part of the county. It consists of mixtures of sand, shell sandstone, and limestone. In this area the concentration of dissolved solids in the ground water usually does not exceed 500 milligrams per litre. A section of cavity-riddled limestone and other permeable rocks is located several miles inland and extends north to south almost the entire length of the county. This section yields up to 2,000 gallons per minute (130 lites per second) of water to large wells and offers an excellent potential for the development of future groundwater supplies. Sea-water intrusion into the shallow aquifer is a potential threat to several coastal well fields. The wells nearest the coast were found to be most vulerable. GRA

N77-10632# General Electric Co., Santa Barbara, Calif.
MONITORING GROUNDWATER QUALITY: DATA MANAGEMENT
Norman F. Hampton Apr. 1976 72 p refs
(Contract EPA-68-01-0759)
(PB-255492/1; GE75TMP-70; EPA-600/4-76-019) Avail: NTIS HC A04/MF A01 CSCL 08H

Management of a data base which assures that pertinent information is available when and where it is needed is discussed. The requirements of groundwater data management are described, and available capabilities which may serve to satisfy these requirements are examined. The means by which these capabilities can be used to accomplish the management of groundwater data are identified. GRA

N77-11484 Massachusetts Univ., Amherst.
SOURCES OF ORGANIC COLOR IN NATURAL WATERS Ph.D. Thesis
Bill Otto Wilen 1976 358 p
Avail: Univ. Microfilms Order No. 76-22311

The organic matter research was conducted in Western Massachusetts on a 3,000 acre watershed containing a complex of three interconnected reservoirs with a combined capacity of 46,000,000 gallons and a safe yield of 1.1 million gallons a day. Initial research efforts pinpointed the sources of organic-coloring-matter production as the wetlands in the headwaters of the watershed. Although water color production depends on climate, vegetation, land-surface form, and soils, research indicates that climate and the land-surface form of the local setting are the most important variables in water color production. A water color prediction model was developed which presented a functional tool to watershed managers for predicting water color levels at the source of production. The model's success was due to the fact that the level of water color produced is very similar for different wetland types at the source of production. Dissert. Abstr.

N77-11489*# Corps of Engineers, Waltham, Mass.
THE LANDSAT SATELLITE AND FLOOD CONTROL IN NEW ENGLAND, JUNE 1976
Saul Cooper, Principal Investigator [1976] 10 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10026; NASA-CR-149129) Avail: NTIS HC A02/MF A01 CSCL 08H

N77-11492*# Atomic Energy Commission, Dacca (Bangladesh).
INVESTIGATIONS USING DATA FROM LANDSAT-2 Quarterly Report, Jul. - Sep. 1976
Anwar Hossain, Principal Investigator Oct. 1976 3 p refs Sponsored by NASA ERTS
(E77-10029; NASA-CR-149132) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. *Preliminary land use maps of Sunamgonj, Baniachong, and* Srimongal areas in the Sylhet districts were prepared. Indication of new land in the southern Patuakhali district and Hatiya Island were found, and erosion in northern Hatiya Island is also indicated.

N77-11494*# College for Civil Engineering, Bucharest (Romania). Lab. for Remote Sensing.
USE OF LANDSAT DATA FOR NATURAL RESOURCES INVESTIGATION IN THE LOWER BASIN OF DANUBE AND DANUBE DELTA Progress Report, Apr. - Jun. 1976
Nicolaie Oprescu, Principal Investigator Jul. 1976 20 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10032; NASA-CR-149097; DaDelta-1/1) Avail: NTIS HC A02/MF A01 CSCL 08H

N77-11501*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Jul. - Sep. 1976
R. A. Halliday, Principal Investigator and I. A. Reid Oct. 1976 11 p Sponsored by NASA ERTS
(E77-10041; NASA-CR-149153) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. Results have demonstrated the suitability of satellite retransmission as a means of obtaining near real time data from remote areas in Canada. Capital costs of the equipment installed at a gaging station are reasonable, and indications are that the DCPs do not require much maintenance. The potential impact on water resources data gathering activities is considerable.

N77-11503*# Army Engineer District, Tulsa, Okla. Geology Section.
RED RIVER CHLORIDE REMOTE SENSING STUDY Final Report
31 Dec. 1975 44 p Original contains color illustrations
(NASA Order W-13557)
(NASA-CR-149189) Avail: NTIS HC A03/MF A01 CSCL 08H

Side looking radar, infrared thermal imagery and color photography, together with a few examples of black and white panoramic photos, are used to supplement information on the natural saline pollution problem that is hydrologically and geologically oriented. The study area was explored concurrently by ground methods and a reasonably good understanding of hydrogeological conditions has been achieved. Examples of the products acquired, their interpretation, and use techniques are included. Author

N77-11510# Michigan State Univ., East Lansing. Dept. of Geology.

GRAVITY GEOPHYSICS FOR GROUNDWATER EXPLORATION IN GLACIATED AREAS
Robert Carmichael Jul. 1976 45 p refs
(Contract DI-14-31-0001-5022)
(PB-254542/4; W76-09758; OWRT-A-076-MICH(1)) Avail: NTIS HC A03/MF A01 CSCL 08H

The applicability of the gravity geophysics method in groundwater prospecting is assessed. By mapping variations in the gravity field over the ground surface, subsurface geologic structures such as buried stream valleys on the bedrock surface under glacial deposits are defined. Subsurface conditions and measurement errors that make the gravity method practical and innovative data analysis techniques are defined such as: (1) using theoretical diurnal-tide gravity variation as part of the drift correction, and (2) fitting a high degree polynomial surface to data to compensate for elevation errors reconnaissance surveys. GRA

N77-12489# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EFFECTS OF RADIATION PENETRATION ON SNOWMELT RUNOFF HYDROGRAPHS
Samuel C. Colbeck Apr. 1976 17 p refs
(DA Proj. 4A1-61102-AT-24)
(AD-A025763; CRREL-76-11) Avail: NTIS HC A02/MF A01 CSCL 08/8

Water flow through the unsaturated portion of a snowpack is calculated using various assumptions about radiation penetration into the snow. The results show that for the purposes of hydrologic forecasting, it is sufficiently accurate to assume that all of the radiation absorption occurs at the surface. The error in the calculation of flow is largest for very shallow snowpacks, but this error is reduced by radiation absorption at the base of the snow and by the routing of meltwater through the saturated basal layer. GRA

N77-12494# Geological Survey, Little Rock, Ark. Water Resources Div.
WATER RESOURCES DATA FOR ARKANSAS, WATER YEAR 1975 Water Data Report, 1 Oct. 1974 - 30 Sep. 1975
Jul. 1976 696 p refs Prepared in cooperation with Ark. Geol. Comm., Little Rock, Ark. State Highway Dept.,Little Rock, Ark. Div. of Soil and Water Resources, Little Rock
(PB-256671/9; USGS/WRD/HD-76/022;
USGS/WDR/AR-75/1) Avail: NTIS HC A99/MF A01 CSCL 13B

Water resources data for the 1975 water year for Arkansas consist of records of stage, discharge, and water quality of streams; stage; contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. The report contains discharge records for 72 gaging stations; stage only records for 1 gaging station; stage and contents for 1 gaging station; stage and contents for 13 lakes and reservoirs; water quality for 123 gaging stations, 62 partial-record flow stations, 8 lakes, and 21 wells; and water levels for 75 observation wells. Also included are 116 crest-stage partial-record stations. GRA

N77-12495# Geological Survey, Rolla, Mo. Water Resources Div.
WATER RESOURCES DATA FOR MISSOURI, WATER YEAR 1975 Water Data Report, 1 Oct. 1974 - 30 Sep. 1975
Aug. 1976 378 p refs Prepared in cooperation with Mo. Dept. of Nat. Resources, Jefferson City and Mo. State Highway Dept., Jefferson City Sponsored in part by EPA
(PB-256765/9; USGS/WRD/HD-76/031;
USGS/WDR/MO-75/1) Avail: NTIS HC A17/MF A01 CSCL 13B

Water Resources data for the 1975 water year for Missouri consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs. This report contains discharge records for 138 gaging stations; stage and contents for 6 lakes and reservoirs, and water quality for 53 gaging stations. Also included are data for 103 crest stage partial record stations, 30 partial record water quality stations and 25 miscellaneous sampling sites. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating state and Federal agencies in Missouri. GRA

N77-12496# Geological Survey, Trenton, N.J. Water Resources Div.
WATER RESOURCES DATA FOR NEW JERSEY, WATER YEAR, 1975 Annual Report, 1 Oct. 1974 - 30 Sep. 1975
Jun. 1976 494 p refs Sponsored in part by N. J. Dept. of Environ. Protection, Trenton and Corps of Engr., Washington, D. C.
(PB-256802/0; USGS/WRD/HD-76/020;
USGS/WDR/NJ-75/1; Rept-1) Avail: NTIS HC A21/MF A01 CSCL 13B

Water resources data for the 1975 water year for New Jersey consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water quality in wells and springs. Included are discharge records for 85 gaging stations; tide summaries for 11 stations; stage and contents for 31 lakes and reservoirs; water quality for 25 gaging stations, 87 partial- record flow stations, and 164 wells. Also included are 75 crest stage partial record stations and 58 low flow partial record stations. Additional water data collected at various sites, not part of the systematic data collection program are published as miscellaneous measurements. GRA

N77-12497# Geological Survey, Honolulu, Hawaii. Water Resources Div.
WATER RESOURCES DATA FOR HAWAII AND OTHER PACIFIC AREAS, WATER YEAR 1975 Water Data Report, 1 Oct. 1974 - 30 Sep. 1975
Mar. 1976 414 p Sponsored by Hawaii State Dept. of Land and Natural Resources and State Dept. of Transportation, Honolulu, Hawaii, Corps of Engr., Washington, D. C. and Trust Territory of the Pacific Islands, Saipan, Mariana Islands
(PB-256668/5; USGS/WRD/HD-76/021;
USGS/WDR/HI-75/1) Avail: NTIS HC A18/MF A01 CSCL 13B

Water resources data for Hawaii and other Pacific Areas consist of records of stage, discharge, and water quality of streams; stage of a reservoir; and water levels and water quality in wells and springs. This report contains discharge records for 164 gaging stations; stage only record for 1 gaging station; water quality for 10 gaging stations, 56 partial-record flow stations and 113 wells; and water levels for 8 observation wells. Also included are 107 crest stage partial record stations and 103 low flow partial record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. GRA

N77-12947# North Central Texas Council of Governments, Arlington.
OUR NATURAL RESOURCES: WHAT IS OUR WATER WORTH. 1975 - 1978 WATER QUALITY MANAGEMENT PLANNING PROGRAM, NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS
Jun. 1976 118 p Sponsored by EPA
(PB-256976/2; NCTCOG/WR-76/01) Avail: NTIS HC A06/MF A01 CSCL 13B

The continuing planning process to date, the anticipated content of the annual plans, detailed NCTCOG staff work activities, each anticipated consultant contract, and the resources being devoted to the program are described. Integration of functional planning efforts at NCTCOG is being addressed primarily through the formulation and adoption of a preferred regional development policy. GRA

N77-13517# Arizona Univ., Tucson. Lab. of Tree-Ring Research.
RIPARIAN DENDROCHRONOLOGY: A METHOD FOR DETERMINING FLOOD HISTORIES OF UNGAGED WATERSHEDS Completion Report, Jun. 1974 - Jul. 1976
David Laing and Charles Wayne Stockton Aug. 1976 23 p refs
(Contract DI-14-34-0001-6003)

(PB-256967/1; W76-11523; OWRT-A-058-ARIZ(1)) Avail: NTIS HC A02/MF A01 CSCL 08H

Examination of 106 crossdated tree ring cores from the riparian zone of Pine Creek near Escalante, Utah, 10 cores from Bright Angel Creek, Grand Canyon, Arizona, 8 cores from South Taylor Creek, Zion National Park, Utah, and 5 cores from the Animas River near Silverton, Colorado, has yielded the following information: (1) various riparian gymnosperm and angiosperm species crossdate with semi-arid site gymnosperms; (2) tree growth is best correlated with snowpack water equivalent; (3) flood damage to trees is manifested in growth suppression on root exposure or burial, in reaction wood on tilting, and in scarring; and (4), flood damage is very infrequent at Pine Creek from 1700 to 1880, more so from 1880 to 1909, and very frequent from 1909 to the present. GRA

N77-13518# Utah Center for Water Resources Research, Logan.
A SURVEY OF THE PHYSICAL LIMNOLOGY OF GREAT SALT LAKE Completion Report
Anching Lin Salt Lake City Utah Div. of Water Resources. 1976 88 p refs Prepared in cooperation with Utah Geological and Mineralogical Survey
(Contract DI-14-31-0001-5045; OWRT Proj. A-029-UTAH(1)) (PB-256210/6; W76-11107) Avail: NTIS HC A05/MF A01 CSCL 08H

Physical processes on the Great Salt Lake are summarized. Of some interest to limnologists is the meromixis (sustained two-layer stratification) in the south basin. The conspicuous two-layer was made possible by the presence of the railroad causeway. The stable stratification is demonstrated in the records of the last 15 years. The rate of entrainment of the chemocline obeys the general rules applicable to other large two-layer basins. The large-scale motion takes place more than 50 percent of the time. In the winter, the lake is calmer and most violent in late spring and early summer. GRA

N77-14539*# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
SEDIMENT MEASUREMENT IN ESTUARINE AND COASTAL AREAS
Philip E. Shelley Washington NASA Dec. 1976 102 p refs (Contract NAS6-2325)
(NASA-CR-2769; TR-7115-001) Avail: NTIS HC A06/MF A01 CSCL 08J

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

N77-14544*# Pakistan Water and Power Development Authority, Lahore.
WATER RESOURCES INVESTIGATION IN WEST PAKISTAN WITH THE HELP OF ERTS IMAGERY: SNOW SURVEYS
Ch. Mohammad Umar, Principal Investigator Aug. 1976 48 p Sponsored by NASA ERTS
(E77-10038; NASA-CR-149139; Rept-29810) Avail: NTIS HC A03/MF A01 CSCL 08H

N77-14548*# Corps of Engineers, Waltham, Mass.
THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, period ending 1 Sep. 1976
Saul Cooper, Principal Investigator 1 Sep. 1976 13 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10049; NASA-CR-149256) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. A graph that shows the snow water equivalent data during the 1975-76 winter season for the Ninemile and Michaud Farms snow pillows located in northern Maine is shown. The Bournes transducers used in the snow pillow interface were tested after field use under controlled laboratory conditions of temperature and pressure. It was found that the temperature calibration curve for the Bournes transducers became erratic below 0 C. On 8-10 August 1976, the remainder of hurricane, Belle, travelled through Vermont, New Hampshire, northern Maine, and on into Canada's Maritime Provinces dumping three inches of rain in many areas. In Canada and Maine, local storms dropped up to two inches during the following week. The Saint John River reached near flood stages at Fort Kent, Maine. During this storm, DCP data were received from Fort Kent, Ninemile Bridge, and Saint Francis River in New Brunswick. Resulting high runoff after these storms was studied in connection with the proposed Dickey-Lincoln School dams to be built in that area, and significantly, it was found that creditable flood hydrographs could be generated from LANDSAT DCP data in spite of the voids caused by the satellite being below the horizon.

N77-14565*# Environmental Research Inst. of Michigan, Ann Arbor.
[REMOTE SENSING OF WETLANDS, MARSHES, AND SHORELINES IN MICHIGAN INCLUDING ST. JOHN'S MARSH] Semiannual Status Report, 1 Jun. - 1 Dec. 1976
Donald S. Lowe 1 Dec. 1976 26 p
(Grant NGR-23-005-552)
(NASA-CR-149348; ERIM-193400-15-L) Avail: NTIS HC A03/MF A01 CSCL 08B

Remote sensing data are used to show the strategic relationship of the endangered marsh to population centers of SE Michigan. The potential ecological consequences and the impact of past development and changing lake levels are discussed. Applications of remote sensing are presented showing its usefulness for preparing statewide infrared wetland and forest mapping. M.C.F.

N77-14567*# Earth Satellite Corp., Washington, D.C.
AOIPS WATER RESOURCES DATA MANAGEMENT SYSTEM Final Report, Dec. 1975 - Aug. 1976
Earl S. Merritt, Robert L. Shotwell, Michael C. Place, and Nathaniel J. Belknap Sep. 1976 535 p refs
(Contract NAS5-22894)
(NASA-CR-144823) Avail: NTIS HC A15/MF A01 CSCL 08H

A geocoded data management system applicable for hydrological applications was designed to demonstrate the utility of the Atmospheric and Oceanographic Information Processing System (AOIPS) for hydrological applications. Within that context, the geocoded hydrology data management system was designed to take advantage of the interactive capability of the AOIPS hardware. Portions of the Water Resource Data Management System which best demonstrate the interactive nature of the hydrology data management system were implemented on the AOIPS. A hydrological case study was prepared using all data supplied for the Bear River watershed located in northwest Utah, southeast Idaho, and western Wyoming. Author

N77-14569*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TROPHIC CLASSIFICATION OF LAKES USING LANDSAT-1 (ERTS-1) MULTISPECTRAL SCANNER DATA Final Report, 1972-1973
D. H. P. Boland Apr. 1976 263 p refs Prepared in cooperation with Pacific Northwest Environmental Research Lab., Corvallis, Ore.
(Contracts NAS7-100; JPL-EZ-608770)

(NASA-CR-149349; PB-255292/5; EPA-600/3-76-037) Avail: NTIS HC A12/MF A01 CSCL 08H

The LANDSAT-1 multispectral scanner (MSS) is evaluated as a means of estimating lacustrine trophic state. Numerical classificatory methods are employed to ascertain the trophic character of 100 lakes in Minnesota, Wisconsin, Michigan, and New York. Principal components analysis is used to derive a multivariate trophic state index (PCI) using the trophic indicators chlorophyll A, conductivity, inverse of Secchi depth, total phosphorus, an algal assay yield, and total organic nitrogen. A binary masking technique is used to extract lake related MSS data from digital tapes (CCTs). MSS color ratio models are developed which give good estimates of Secchi depth and fair estimates of chlorophyll A levels. Trophic state, as defined by lake position on the first principal component axis (PCI), is predicted using MSS color ratio regression models. GRA

N77-14571# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.

DEMONSTRATION OF A NEW TECHNIQUE FOR RAPIDLY SURVEYING ROOF MOISTURE Final Report, Apr. 1975 - Mar. 1976

Lewis E. Link, Jr. Jun. 1976 52 p ref

(AD-A026722; WES-MP-M-76-14) Avail: NTIS HC A04/MF A01 CSCL 13/13

The results of this study demonstrate the potential of the combined thermal IR-nuclear moisture meter roof survey technique described herein. Application of the technique at Dyess AFB, Texas, resulted in the detection of roof areas with entrapped moisture on 5 of the 128 buildings surveyed. Airborne thermal IR imagery proved to be a very effective means of identifying roof areas with potential entrapped moisture. Some false alarms were created by air vents on smaller buildings; however, prior knowledge of the position of the vents (i.e. during the examination of the imagery) would probably reduce this problem considerably. Not all the questions were answered. Information is needed to define the usefulness of the technique as a function of climatic conditions and roof types. In addition, more data are needed to help define the optimum time for acquiring thermal IR imagery for roof moisture surveys. Author (GRA)

N77-14572# California Univ., Davis. Water Resources Center.

PROCEEDINGS 10TH BIENNIAL CONFERENCE ON GROUND WATER, TOTAL WATER MANAGEMENT FOR CALIFORNIA'S LONG-RANGE NEEDS

Dec. 1975 274 p refs Conf. held at Ventura, Calif., 11-12 Sep. 1975 Sponsored by Calif. State Dept. of Water Resources, Sacramento

(PB-256808/7; W76-11491) Avail: NTIS HC A12/MF A01 CSCL 13B

The conference, co-sponsored by the California Dept. of Water Resources and the California Water Resources Center, included papers under the following session topics: Innovation in Conjunctive Use of Ground and Surface Water; Ground Water Conservation, Protection and Use--Some Technical and Institutional Considerations; Energy and Economic Considerations in the Use and Development of Ground Water; and Legal and Regulatory Aspects. GRA

N77-14574# Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.

INTERDISCIPLINARY / INTERINSTITUTIONAL REQUIREMENTS FOR WATER RESOURCE PLANNING: PROCESSES TO ENHANCE COOPERATION

George W. Reid and James O. Dritt Jan. 1976 132 p refs Sponsored by the Dept. of Interior

(PB-255632/2; W76-10609; OWRT-X-122(3749)(1)) Avail: NTIS HC A07/MF A01 CSCL 13B

Difficulties and opportunities for effective cooperation within an interdisciplinary research group are explored. While emphasizing such research within an academic environment and on water resources related cases, this study is directed toward a broad spectrum of research project leaders and team participants. The analytical framework was designed to point out differences that exist between single, multidisciplinary and interdisciplinary team research. An opportunity to respond and share future results is provided. Several steps were suggested for the optimal use of interdisciplinary personnel in water resources research. The salient organizational and situational conditions include the establishment of favorable internal relationships and coalitions as a basis for administrative support and cooperation. GRA

N77-14575# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

USE OF AUTOMATED REMOTE SENSING TECHNIQUES TO DEFINE THE MOVEMENT OF TOW-GENERATED SUSPENDED MATERIAL ON THE ILLINOIS AND UPPER MISSISSIPPI RIVERS Final Report

Lewis E. Link, Jr. and Albert N. Williamson, Jr. Jun. 1976 73 p refs

(AD-A025733; WES-TR-M-76-6) Avail: NTIS HC A04/MF A01 CSCL 14/5

Sequential color-infrared aerial photos and corresponding surface water samples were obtained at selected sites on the Illinois and Upper Mississippi Rivers to examine the movement of tow-generated suspended material plumes. The aerial photos were digitized with a scanning microdensitometer, and optical density values were extracted for correlation with suspended material concentration data obtained by laboratory analysis of the water samples. Correlation of the optical density and concentration values for each site and for sample positions at each site did not produce a statistically significant relation between the variables. The poor correlation between optical density and concentration values prevented quantitative definition from the imagery of the distribution of suspended material concentrations at the sites as a function of time. Digital data handling procedures were used to enhance the visibility on the imagery of the tow-generated plumes. The procedures applied were successful in delineating the movement and dissipation of the tow-generated plumes under favorable sun and water conditions. GRA

N77-15468 California Univ., Davis.

PREDICTION OF NATURAL TEMPERATURES IN RIVERS Ph.D. Thesis

Richard Daniel Noble 1976 239 p

Avail: Univ. Microfilms Order No. 76-28987

Synoptic meteorological, flow, and water temperature data were collected over a three month period in the Mattole River basin in northern California. The meteorological variables monitored were total incoming radiation, incoming short wave radiation, wet bulb air temperature, dry-bulb air temperature, and wind velocity. Flow data included volumetric flow rate, time of travel, and axial dispersion coefficients. A mathematical model was developed for predicting the water temperature of a river at any point in the basin. The model includes convective and dispersive effects as well as a source term. Results indicate that calculated water temperatures can be obtained which have a daily root-mean-square deviation of less than 3 C, a daily amplitude ratio of plus or minus 0.20 of 1.0, and a daily mean within 2 C of observed data. Dissert. Abstr.

N77-15469 Minnesota Univ., Minneapolis.

A STOCHASTIC APPROACH TO SNOWMELT RUNOFF FORECASTING Ph.D. Thesis

Kwonshik Kim 1976 153 p

Avail: Univ. Microfilms Order No. 76-27863

Models were developed by which air temperature and precipitation data can be generated for spring periods so that the data can be used in mathamatical runoff models to determine the range and probability of snowmelt floods. Historical data on temperature and precipitation in the Minnesota River Basin were studied to develop stochastic simulation models. The streamflow synthesis and reservoir regulation (SSARR) model was chosen as a transformation function. Temperature at one station could be modeled by a series of steps. Temperature was first transformed to obtain constant variance. Then the transformed temperature was divided into deterministic and stochastic components. The deterministic component was represented by a second degree

regression line and the stochastic component was described by a first order autoregressive-first order moving average model.
Dissert. Abstr.

N77-15472*# Mississippi Air and Water Pollution Control Commission, Jackson.
INVESTIGATION OF PEARL RIVER DATA COLLECTION SYSTEM Final Report
Nov. 1976 38 p
(Contract NAS8-31351)
(NASA-CR-150138) Avail: NTIS HC A03/MF A01 CSCL 08H

The reliability of employing NASA developed remote sensing for in situ near real time monitoring of water quality in the Pearl River is evaluated. The placement, operation and maintenance of a number of NASA developed data collection platforms (DCP's) on the Pearl River are described. The reception, processing, and retransmission of water quality data from an ERTS satellite to the Mississippi Air and Water Pollution Control Commission (MAWPCC) via computer linkup are assessed. Author

N77-15473*# Alabama Univ., University. Dept. of Chemical and Metallurgical Engineering.
WATER RESOURCES PLANNING FOR RIVERS DRAINING INTO MOBILE BAY Final Report
Gary C. April Dec. 1976 132 p refs
(Contract NAS8-29100)
(NASA-CR-150149; BER-209-112) Avail: NTIS HC A07/MF A01 CSCL 08H

The application of remote sensing, automatic data processing, modeling and other aerospace related technologies to hydrological engineering and water resource management are discussed for the entire river drainage system which feeds the Mobile Bay estuary. The adaptation and implementation of existing mathematical modeling methods are investigated for the purpose of describing the behavior of Mobile Bay. Of particular importance are the interactions that system variables such as river flow rate, wind direction and speed, and tidal state have on the water movement and quality within the bay system. Author

N77-15479# California Univ., Los Angeles. Dept. of Engineering Systems.
OPTIMIZATION OF REAL TIME DAILY OPERATION OF A MULTIPLE RESERVOIR SYSTEM
Willima W.-G. Yeh, Leonard Becker, D. Fults, D. Sparks, and G. Logan Apr. 1976 176 p refs
(Contract DI-14-31-0001-4208)
(PB-257515/7; UCLA-ENG-7628; W76-12155; OWRT-C-5184(4208)(4)) Avail: NTIS HC A09/MF A01 CSCL 13B

System optimizing procedures are developed for on-line use in the operation of the Central Valley Project (CVP) in California. The CVP is a complex multiple objective water resource system. The operation of the project is subject to requirements and interagency agreements which typify the usual water resource environment and which constrain optimal operating policy. The method developed for the CVP provides the necessary decomposition and involves the project manager, assisted by an integrated group of multiple policies based on inter-related monthly and daily models. GRA

N77-15480# West Virginia Univ., Morgantown. Plant Sciences Div.
EXTENSIVE OVERBURDEN POTENTIALS FOR SOIL AND WATER QUALITY Final Report, 1 Nov. 1973 - 1 Apr. 1975
Richard M. Smith, Andrew A. Sobek, Thomas Arkle, Jr., John C. Sencindiver, and John R. Freeman Aug. 197 329 p refs
Prepared in cooperation with Geol. and Econ. Surv., Morgantown, West Va.
(Grant EPA-R-802603-01)
(PB-257739/3; EPA-600/2-76-184) Avail: NTIS HC A15/MF A01 CSCL 08I

Chemical, physical and mineralogical measurements and interpretations developed were improved and applied to coal overburden columns in 12 widely spaced neighborhoods and 2 adjunct locations in 10 states, from Pennsylvania on the Northeast to Alabama on the southeast and Oklahoma on the west. Field studies in each neighborhood and adjunct location involved logging and sampling soil and rock horizons from surface to coal, testing and improving field clues, determining properties of mine soils and water resulting from mining operations, and checking reclamation. GRA

N77-15481# Cincinnati Univ., Ohio. Water Resources Div.
URBAN RUNOFF CHARACTERISTICS. VOLUME 1: ANALYTICAL STUDIES Final Report
Herbert C. Preul and C. N. Papadakis Sep. 1976 353 p refs Sponsored by EPA 2 Vol.
(PB-258033/0; EPA-600/2-76-217-a-Vol-1) Avail: NTIS HC A16/MF A01; also available in set of 2 reports as PB-258032-SET, PC $28.25/MF $5.00

Analytical studies and field investigations made for the characterization of urban runoff and combined sewer overflows. The analysis and development of stormwater management models was considered. The results of studies are given on the development of storm hyetographs and the determination of infiltration capacity curves for use in hydrologic runoff models. An hydrologic model known as the University of Cincinnati urban runoff model was developed and a general description was given of the EPA storm water management model. GRA

N77-15482# Cincinnati Univ., Ohio. Water Resources Div.
URBAN RUNOFF CHARACTERISTICS. VOLUME 2: FIELD INVESTIGATIONS Final Report
Herbert C. Preul and C. N. Papadakis Sep. 1976 781 p Sponsored by EPA 2 Vol.
(PB-258034/8; EPA-600/2-76-217-b-Vol-2) Avail: NTIS HC A99/MF A01; also available in set of 2 reports as PB-258032-SET, PC $28.25/MF $5.00 CSCL 08H

Analytical studies and field investigations for the characterization of urban runoff and combined sewer overflows are presented. A compilation is given of hydrologic and water quality data collected over a three year period from a typical combined sewer watershed of 2380 acres area in Cincinnati, Ohio. GRA

N77-15497*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF INFORMATION SYSTEMS FOR HYDROPOWER OPERATIONS
Robert L. Sohn, Leonard Becker, John Estes, David Simonett, and William W.-G. Yeh Sep. 1976 336 p refs
(Contract NAS7-100)
(NASA-CR-149373; JPL-5040-44; RTOP-777-30-01) Avail: NTIS HC A15/MF A01 CSCL 10C

The operations of hydropower systems were analyzed with emphasis on water resource management, to determine how aerospace derived information system technologies can increase energy output. Better utilization of water resources was sought through improved reservoir inflow forecasting based on use of hydrometeorologic information systems with new or improved sensors, satellite data relay systems, and use of advanced scheduling techniques for water release. Specific mechanisms for increased energy output were determined, principally the use of more timely and accurate short term (0-7 days) inflow information to reduce spillage caused by unanticipated dynamic high inflow events. The hydrometeorologic models used in predicting inflows were examined to determine the sensitivity of inflow prediction accuracy to the many variables employed in the models, and the results used to establish information system requirements. Sensor and data handling system capabilities were reviewed and compared to the requirements, and an improved information system concept outlined. Author

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07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A77-10117 Comparison of color, color infrared, and panchromatic aerial photography. P. R. Stephens (Ministry of Works and Development, Palmerston North, New Zealand). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Oct. 1976, p. 1273-1277. 7 refs.

This paper compares color, color infrared, and panchromatic vertical 35 mm aerial photographs taken in the southern Ruahine Mountains, New Zealand. The capability of the three film types is assessed in order to gauge their effectiveness in distinguishing the following features: alignments, fault pug zones and seepage areas, eroded surfaces, erosion types and processes, vegetation types and condition, and drainage pattern. Of the three film types, color infrared was the most effective in distinguishing the features. (Author)

A77-10118 Synthetic stereo and Landsat pictures. R. M. Batson, K. Edwards, and E. M. Eliason (U.S. Geological Survey, Flagstaff, Ariz.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Oct. 1976, p. 1279-1281, 1283, 1284. 7 refs. Research sponsored by the U.S. Department of the Interior.

A strong stereoscopic parallax can be introduced into Landsat images by displacing image details by varying amounts as a function of their known relative elevations. This effect can be introduced in identical amounts into each band, so that stereoscopic color composities can be made. The introduction of stereoscopic parallax into a monoscopic image requires a digital array of brightness values, and a digital array of terrain elevations. Data sets utilized for this enhancement are Landsat images with 128 brightness levels in each of 4 spectral bands and terrain data sets produced by the Defense Mapping Agency with elevation values in one-foot increments and 200-foot spacing on the Universal Transverse Mercator projection. B.J.

A77-10120 Land-use classification utilizing infrared scanning imagery. R. E. Brown and R. K. Holz (Texas, University, Austin, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Oct. 1976, p. 1303-1314. 19 refs.

An exercise was performed to examine two main concepts: the utility of aerial infrared linescan imagery for empirical, thematic land use analysis, and the utility of the U.S. Geological Survey Circular 671 (Anderson, et. al., 1972) land use classification system for infrared imagery analysis. The study area consisted of the land immediately surrounding an artificial water impoundment (Oak Creek Lake) in west-central Texas. Land classification categories evaluated were residential, commercial and services, extractive, transportation, communications, and utilities, cropland and pasture, grass rangeland, savanna rangeland, deciduous forests, and water bodies. B.J.

A77-10122 Fourier texture features - Suppression of aperture effects. C. R. Dyer and A. Rosenfeld (Maryland, University, College Park, Md.). *IEEE Transactions on Systems, Man, and Cybernetics,* vol. SMC-6, Oct. 1976, p. 703-705. NSF Grant No. ENG-74-22006.

It was reported by Weszka et al. (1976) that a texture feature set derived from the discrete Fourier power spectra of Landsat images of geological terrain types did not perform as well as a set of space-domain features in classifying the samples. It was suggested that since the Fourier transform treats its input as though it were periodic, abrupt edges would appear to be present in the input, influencing the spectra from which the features are computed. Schaming's (1974) method of computing features from a 2n-by-2n reflected image rather than the n-by-n original image was tried and found to improve the performance of the discrete Fourier power spectra, but still not to raise it to the level of that of the space-domain features. P.T.H.

A77-10636 A hologram matrix radar. K. Iizuka, J. L. Yen (Toronto, University, Toronto, Canada), H. Ogura (Kyoto Institute of Technology, Matsugasaki, Japan), V.-K. Nguyen (Telesat Canada, Ottawa, Canada), and J. R. Weedmark (Bell Northern Laboratories, Ottawa, Canada). *IEEE, Proceedings,* vol. 64, Oct. 1976, p. 1493-1504. 11 refs. Research sponsored by the Department of Energy, Mines, and Resources.

The concept of hologram matrix is proposed. This concept was incorporated into the design of a novel radar which, unlike conventional radars, determines the distance by the spatial distribution of the scattered wave rather than by the lapse of time. The radar based upon this principle was developed and built for the purpose of mapping ice thickness in the range of 0.5 to 5 m, but it has potential applications in other fields. Such a radar has real-time processing capability, resulting from an amalgamation of the antenna and computer subsystems. The programability of the radiation pattern by software of the processing simplifies the construction of the radar. Capability of dual focussing of the transmitter and receiver eliminates the necessity of either pulsing, or frequency modulation of the transmitting signal. (Author)

A77-10653 Computer recognition of roads from satellite pictures. R. Bajcsy (Pennsylvania, University, Philadelphia, Pa.) and M. Tavakoli (Pahlavi University, Shiraz, Iran). *IEEE Transactions on Systems, Man, and Cybernetics,* vol. SMC-6, Sept. 1976, p. 623-637. 21 refs. NSF Grant No. GJ-43440.

A program which recognizes real roads, their intersections, and objects which are road-like is presented. Although the work has been strongly motivated by the real roads as they are seen from the ERTS satellite, the visual model of a road can be used for recognition of any road-like objects. This model is structured in such a way that it can handle real roads as well as rivers and streams as they are seen on satellite pictures, tracks in bubble chambers, and veins under the appropriate magnification. (Author)

A77-10890 # Future orbital active imaging microwave experiments. J. W. Rouse, Jr. (Texas A & M University, College Station, Tex.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-050.* 4 p.

Current applications and potential of active microwave imaging sensors by orbital monitoring of the earth's ocean and atmosphere are reviewed. In discussing the NASA active microwave program plans intended to achieve all-weather, day or night sensing capability, particular attention is given to the Seasat system, scheduled for launch in 1978. Operational characteristics of the Seasat precision altimeter, surface windfield scatterometer, and high-resolution synthetic aperture imaging radar (SAR) are considered together with the features limiting the use of these devices. Information is presented on the Shuttle Orbital Flight Test No. 2 (OFT-2) Geology Mission planned for 1979 or 1980, which will employ a modified Seasat L-band SAR, Shuttle Technology Demonstration Satellite (TDS) Soil Moisture System with an L- or C-band SAR (1980 or 1981), as well as on the Shuttle Multichannel Spaceborne Imaging Radar (1982), and the Shuttle Meteorological Radar (1985). It is shown that multichannel active microwave image sensors rival multispectral scanner devices in several application areas. S.N.

A77-10893 # High ground resolution in passive microwave earth observations from space by multiple-wavelength aperture synthesis. E. Schanda (Bern, Universität, Berne, Switzerland). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-057.* 4 p.

A method for spaceborne passive microwave earth observation is proposed, which permits to achieve an improved ground resolution along one direction e.g., along the flight trace. Two widely spaced antennas constitute a two-element interferometer which produces a series of narrow beams with sufficiently separated frequencies yielding an equal number of spatial Fourier components of the observed ground landscape. The technique of multiple-wavelength aperture synthesis, equivalent to the conventional variable-spacing synthesis techniques, is then used to synthesize a single narrow (down to 0.001 radian) beam. The width of this beam is determined by the ratio of the shortest wavelength used to the distance between the two antennas. An arrangement of two single antennas e.g., at a 10-meter distance and of an aperture size of 4 m times 1 m each used at wavelength of 1 cm to 6 cm can yield a ground resolution element of about 0.25 times 3.0 sq km by nadir viewing from an altitude of 250 km. Limitations of the method due to the frequency dependence of the beamwidth and of the brightness temperature of the ground are analyzed, and ways of future improvement of the method are traced. The interferometer is recommended for use in the Space Shuttle. S.N.

A77-10894 # **Multiband space imagery - A contribution to the study of oceanic dynamics.** V. I. Kravtsova (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-060.* 15 p. 7 refs.

Effective application of multiband photography to the study of water areas is based on the use of the differences in the spectral brightness of various coasts, surfaces, and submerged objects and on the use of differences in the depth of penetration (into water) of light rays of various spectral bands. The use of a 'special signature' is essential in the interpretation of submerged objects, such as the contours of water vegetation. The effectiveness of multiband photography is demonstrated by images obtained in the visible and near infrared bands. Some difficulties involved in the interpretation of photographs of shallows are discussed. V.P.

A77-10934 # **The Landsat earth resources ground receiving and processing station at Fucino, Italy.** G. Bressanin (Telespazio S.p.A., Rome, Italy). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-182.* 9 p.

A description is presented of the ground station for the acquisition and processing of earth resources survey data at Fucino, near Rome, Italy. The ground station was completed and tested in March 1975. Data from the Landsat spacecraft are received on a regular basis since April 1975. The facility obtains also data from weather satellites. A 10-m parabolic antenna is used to receive the data from the earth observation satellites. G.R.

A77-10935 # **Change detection of land cover in Tokyo Districts using multitemporal Landsat digital data.** S. Murai (Tokyo, University, Tokyo, Japan). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-183.* 6 p.

The objective of the study is to detect the change of land cover in Tokyo Districts and to evaluate the urban environment using Landsat MSS digital data. The paper deals with the following studies which have been carried out in Murai Laboratory, Institute of Industrial Science, University of Tokyo. (1) Geometric and geographic correction for high resolution Landsat digital data base. (2) Establishment of the indicator for evaluation of land cover and its color representation. (3) Change detection of land cover in Tokyo Districts using multitemporal Landsat digital data. The performance of the software developed was tested for the test area selected in Tokyo Districts. Geographic accuracy for digital correction will be high enough for change detection between two different dates. Land cover can been evaluated by the indicator which corresponds to the ratio of the mixture of three primary components, water, vegetation and non-organic matter. (Author)

A77-11085 * # **A Seasat-A Synthetic Aperture Imaging Radar System.** R. L. Jordan and D. H. Rodgers (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *American Institute of Aeronautics and Astronautics, Systems Design Driven by Sensors, Pasadena, Calif., Oct. 18-20, 1976, Paper 76-966.* 10 p.

The Seasat-A Synthetic Aperture Imaging Radar System is the first radar system of its kind designed for the study of ocean wave patterns from orbit. The basic requirement of this system is to generate continuous radar imagery with a 100-km swath with 25 m resolution from an orbital altitude of 800 km. These requirements impose unique system design problems and their solutions will be stated. The end to end data system will be described including interactions of the spacecraft, antenna, sensor, telemetry link, and data processor. The synthetic aperture radar system generates a large quantity of data (110 megabits per second) requiring the use of a dedicated data link. The data link selected for use with the synthetic aperture radar is an analog link with stable local oscillator encoding. The problems associated in telemetering the radar information with sufficient fidelity to synthesize an image on the ground will be described as well as the selected solutions to the problems. (Author)

A77-11530 **Analysis of satellite-observed tropical cloud clusters. I - Wind and dynamic fields. II - Thermal, moisture and precipitation.** E. Ruprecht and W. M. Gray (Colorado State University, Fort Collins, Colo.). *Tellus,* vol. 28, no. 5, 1976, p. 391-426. 51 refs. Grant No. NOAA-04-3-158-51.

Available data from routine rawinsonde observations, surface observations, and satellite photographs are gathered, combined, and integrated for tropical cloud clusters, the cloud-cluster environments, and associated clear areas. Emphasizing regional differences between Western Pacific and West Indian systems, a detailed study is made of wind fields, dynamic fields, temperature, relative humidity, and rainfall characteristics of the clusters. A calculation of the mean cloud-cluster vorticity budget reveals that the horizontal divergence of vorticity transport is the predominant term in the budget for both regions. Based on this result, a large eddy transport of vorticity from the lower to the upper troposphere is postulated. It is found that the systems in each region differ mainly in zonal-wind properties; that practically no temperature differences exist among cloud clusters, their environments, and the clear areas; and that middle-level moisture contents are the primary differences among these divisions. It is shown that the rainfall within a tropical cloud cluster is highly concentrated and that large diurnal variations in rainfall and convergence are exhibited by Western Pacific clusters. F.G.M.

A77-11593 **Computer generated gridding of digital satellite imagery.** R. G. Kirkham and M. R. Stevenson (California, University, La Jolla, Calif.). *Remote Sensing of Environment,* vol. 5, no. 3, 1976, p. 215-224. Grants No. NOAA-04-5-158-56; No. NOAA-04-6-158-44043.

A method is discussed whereby geographical grid benchmarks, corresponding to the elements of a given grid-coordinate matrix, may be entered into a digital-image field by a computer line-printer. A listing is presented of the required Fortran subroutine, along with samples of the output products and some estimates of plotted grid coordinate accuracy. (Author)

A77-12239 * **Precision processing of earth image data.** R. Bernstein (IBM Corp., Advanced Image Processing Analysis and Development Dept., Gaithersburg, Md.) and G. C. Stierhoff (IBM Corp., Research Div., Armonk, N.Y.; Briarcliff College, Briarcliff Manor, N.Y.). *American Scientist,* vol. 64, Sept.-Oct. 1976, p. 500-508. 16 refs. NASA-supported research.

Precise corrections of Landsat data are useful for generating land-use maps, detecting various crops and determining their acreage, and detecting changes. The paper discusses computer processing and visualization techniques for Landsat data so that users can get more information from the imagery. The elementary unit of data in each band of each scene is the integrated value of intensity of reflected light detected in the field of view by each sensor. To develop the basic mathematical approach for precision correction of the data,

differences between positions of ground control points on the reference map and the observed control points in the scene are used to evaluate the coefficients of cubic time functions of roll, pitch, and yaw, and a linear time function of altitude deviation from normal height above local earth's surface. The resultant equation, termed a mapping function, corrects the warped data image into one that approximates the reference map. Applications are discussed relative to shade prints, extraction of road features, and atlas of cities. S.D.

A77-12252 # Operation and characteristics of imaging radar systems. H. C. MacDonald (Arkansas, University, Fayetteville, Ark.) and A. J. Lewis (Louisiana State University, Baton Rouge, La.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 3, July 1976, p. 23-45.

After a brief discussion of ground-to-air radar, the operation of air-to-ground imaging radar is discussed examined in detail with emphasis on plan position indicators, and side looking airborne radar. Attention is given to terrain-signal interaction (surface roughness, angle of incidence, polarization, complex dielectric constant, and frequency), penetration, stereoradar, and imagery format. Radar imagery characteristics (radar foreshortening and layover) are considered along with imagery interpretation (tone, texture, shape, pattern, size, and shadow). B.J.

A77-12430 * A brief review of digital image processing. F. C. Billingsley (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Conference on Decision and Control, 6th, and Symposium on Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 238-243. 8 refs. Contract No. NAS7-100.

The review is presented with particular reference to Skylab S-192 and Landsat MSS imagery. Attention is given to rectification (calibration) processing with emphasis on geometric correction of image distortions. Image enhancement techniques (e.g., the use of high pass digital filters to eliminate gross shading to allow emphasis of the fine detail) are described along with data analysis and system considerations (software philosophy). B.J.

A77-12431 A comparison of observed and model-predicted atmospheric perturbations on target radiances measured by ERTS. I - Observed data and analysis. R. J. P. Lyon, F. R. Honey, and G. I. Ballew (Stanford University, Stanford, Calif.). In: Conference on Decision and Control, 6th, and Symposium on Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 244-249.

Two targets of measured, constant reflectivity in the area of San Francisco, California are studied. The first standard, a waste (carbon black) treatment pond at an oil refinery near Suisan Bay, having an area of approximately 0.3 square miles, (or 215 pixels), and bandpass reflectances of about 0.5% in all four bands, is assumed to have a zero contribution to the radiance recorded by ERTS. The radiance observed then arises entirely from atmospheric scattering. The variation in these radiance values as a function of solar zenith angle has been analyzed. A second target, a concrete parking area for aircraft of Moffett Field, California, assuming that it remains dry during the period of study has constant reflectances of 27.8, 31.0, 30.0, and 32.3 per cent bandpass reflectances in four MSS equivalent channels. Using these values, the radiance observed by ERTS may be corrected for the atmospheric contribution, and thus values for the radiance from the target may be calculated. These values were studied as a function of solar zenith angle. (Author)

A77-12432 Interactive analysis of digital images - A systems design overview. H. G. Moik (Computer Sciences Corp., Silver Spring, Md.). In: Conference on Decision and Control, 6th, and Symposium on Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 251-257. 10 refs.

A review of the design of an interactive digital image processing system is presented. Reasons for interactive image analysis are given and the functional requirements of a system are determined from image processing problems and by considering the techniques applied by a human photointerpreter. Design considerations and the implementation of an interactive image processing system on a general purpose computer are described. Several examples demonstrating the application of interactive digital image processing are given. (Author)

A77-12875 Infrared thermography at the ITC. I - The radiation laws. S. A. Hempenius (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 1, 1975, p. 1-52. 10 refs.

The radiation laws of Planck, Wien, Rayleigh-Jeans, and Stefan-Boltzmann are presented in various forms and graphs, and are discussed from the standpoint of their significance in remote sensing in the middle and far infrared through the earth's atmosphere. The accuracy with which the temperatures of objects can be determined theoretically at various wavelengths is indicated as a function of the uncertainty in the measured radiant energy of those objects. Wien's approximation of Planck's law proves sufficiently accurate for earth science applications of infrared thermography; for passive microwave radiometry, Rayleigh-Jeans' law is required. The relative increase in spectral radiance, due to a small relative increase in absolute temperature, is expressed as a simple function of the wavelength. Modified Stefan-Boltzmann laws are developed for medical and oceanographic remote sensing thermography. (Author)

A77-12876 A discussion of the cost, the efficiency, and the choice of imagery - Some observations based mainly on experience in soil survey. E. Nieuwenhuis (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 1, 1975, p. 53-69. 16 refs.

In this paper phases in development projects are discussed and scales appropriate to the effectuation of surveys indicated. Types of aerial photography and other remote sensing media (collectively referred to as 'imagery') are compared, and an evaluation made of their usefulness. Some information is given on the cost of imagery in relation to scale (of photography) and to the size of the area involved (satellite, radar). The efficiency of the use of photographs is illustrated in diagrams. Finally a checklist is presented of the factors which should be considered, in a given situation, when imagery has to be decided upon. (Author)

A77-12878 Why publish a grey-scale printout of Landsat. N. J. Mulder (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 1, 1975, p. 129-133.

Three computer printouts of Landsat images of Enschede, Netherlands, produced as a byproduct of the work on the Tape-to-Film Project of ITC set up for the conversion of digital data into gray scale data on film are presented. The primary digital data has been compressed into nine gray-level classes. The method of histogram equalization which takes together levels with low frequency-of-appearance in order to obtain a more equal histogram of the requantized levels has been applied to the examples shown here. B.J.

A77-12897 A digital terrain model system. B. Makarovic (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 1, 1976, p. 57-83. 13 refs.

An attempt is made to integrate the different components of the digital terrain model (DTM) into a uniform system comprising all the functions and their interactions involved in the acquisition and handling of DTM data. Acquisition (terrain classification, sampling modes, point grids, progressive sampling, and composite sampling) and processing (preprocessing, classification of output data, and conversion approaches, and procedures) are both examined in detail. The performance of DTM is considered with attention given to experimental and analytical approaches for determining accuracy. B.J.

A77-13213 **Energy balance maps from remotely sensed imagery.** R. W. Pease and D. A. Nichols (California, University, Riverside, Calif.). *Photogrammetric Engineering and Remote Sensing,* vol. 42; Nov. 1976, p. 1367-1374. 8 refs.

Results are presented for an experiment in which a calibrated multispectral scanner is used during an imaging overflight and the data acquired are translated by automated means into maps showing urban heat islands, surface albedos, energy absorbed by the surface, and net radiation. Without automation, construction of the maps would not be feasible except in small experimental instances. Methods for acquiring calibrated data from a scanner and the construction of maps from image transparencies are described and evaluated. Calibration is achieved through the use of calibration targets, areas of homogeneous surface large enough to yield image elements that can be measured densitometrically. Several targets are chosen to give a range in both temperature and reflectance values. A contouring program with a pre-processor linear interpolation routine is used which has the dual purpose of scaling the matrix size and smoothing the surface. S.D.

A77-13218 **Photographic data extraction from Landsat images.** A. D. Jones (New England, University, Armidale, New South Wales, Australia). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Nov. 1976, p. 1423-1425. Research supported by the *University of New England.*

The paper describes the use of photographic methods to produce land-use maps from Landsat imagery, based on the concept of tonal signatures. The equipment required for the process is a contact frame, normal darkroom facilities for developing and, for proofing and enlargement by overhead projector, a diazo printer with ammonia developer. Kodak lithographic film is used and developed in Kodalith developer. Lithographic negatives of the original transparencies are made for Bands 4, 5, and 7, and positives are obtained from these lithographic negatives. The use of specific colors enabled seven distinct categories of land use to be mapped. The tonal signatures related to each grouping are shown diagrammatically. The use of lithographic film makes screening the images unnecessary though it would produce a lighter toned copy. Major problems of the method are those present in any photographic enhancement system. A land-use multicolor map is included. S.D.

A77-14738 # **Aircraft studies of the transfer characteristic of the atmosphere in the spectral regions of 0.61, 0.744, and 1.036 microns (Samoletnye issledovaniia peredatochnoi kharakteristiki atmosfery v uchastkakh spektra 0,61; 0,744 i 1,036 mkm).** E. M. Kozlov and V. V. Badaev (Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Moscow, USSR). *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,* vol. 12, Sept. 1976, p. 938-946. 15 refs. In Russian.

The dependence of the transfer function of the atmosphere on the optical characteristics of the atmosphere and the underlying surface in the visible and near-infrared is studied on the basis of measurements obtained from aircraft. A formula is proposed which permits transfer from reflected solar radiation intensities measured from satellites and aircraft to terrestrial brightnesses. V.P.

A77-15056 **The Earth Resources Interactive Processing System /ERIPS/ Image Data Access Method /IDAM/.** A. E. Pape and D. L. Truitt (IBM Corp., Federal Systems Div., Houston, Tex.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 1A-18 to 1A-22.

IDAM (Image Data Access Method) was developed as the access method for the Earth Resources Interactive Processing System. The method allows a user program to quickly and easily retrieve any desired subset of an image in terms of selected channels, lines, and pixels within lines. IDAM philosophy and technique are discussed in detail, and image creation and image utilization examples are given. A set of eight user macros has been provided which satisfies the utilization requirement. B.J.

A77-15062 **Three system approach for Landsat data interpretation.** R. Y. Li and K. S. Fu (Purdue University, West Lafayette, Ind.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 2A-10 to 2A-17. 7 refs. NSF Grant No. ENG-74-17586; Contract No. F30602-75-C-0150.

This paper describes a tree system approach which interpretates highways and rivers from Landsat pictures. The basic definitions of tree grammars and tree automaton and a grammatical inference procedure are first introduced. The interpretation process is conceived as a process of continuous verification of the hypothesized descriptions of objects in the picture. The Landsat imagery map of Lafayette, Indiana is used as a training data set and tree grammar is inferred from the interpretation process. The versatility of this set of syntactic rules is tested on a different data set and the initial results are reported. (Author)

A77-15063 * **The use of spatial characteristics for the improvement of multispectral classification of remotely sensed data.** *D. J. Wiersma and D. Landgrebe (Purdue University, West Lafayette,* Ind.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical *and Electronics Engineers, Inc., 1976, p. 2A-18 to 2A-25. 9 refs.* Contract No. NAS9-14016.

Two techniques for the classification of multispectral remotely sensed data - the image processing technique of texture features, which is modeled after the human visual system, and the ECHO (Extraction and Classification of Homogeneous Objects) numerical technique - are examined. These two spatial analysis techniques are compared using Landsat imagery of an area of Indiana as an example, and it is found that the numerical approach is superior in classification accuracy and more efficient computationally. B.J.

A77-15064 * **Stratification of Landsat data by clustering.** M. E. Bauer and B. J. Davis (Purdue University, West Lafayette, Ind.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 2A-26 to 2A-35. 10 refs. Contract No. NAS9-14016.

Full realization of the potential advantages of the synoptic coverage provided by Landsat will require the development and use of data analysis techniques which take into account the large variation and diversity of patterns found over many Landsat scenes. Stratification of the scene into units which are internally homogeneous is recommended as a first step in the analysis of data for whole or multiple frames of Landsat data. The use of clustering as an objective and efficient method of dividing scenes into areas which are spectrally similar (strata) is discussed and initial results, including classification performances and comparisons of spectral strata with major physical factors, are presented. (Author)

A77-15066 **Use of Landsat technology by statistical reporting service.** W. H. Wigton (U.S. Department of Agriculture, Statistical Reporting Service, Washington, D.C.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. PB-6 to PB-10.

This paper describes an area sampling frame and defines the sampling error and bias of an estimate. Landsat data is explained in the Statistical Reporting Service framework and the essential components of computer classification are delineated. A procedure is presented that utilizes satellite data to improve an estimator with 3 per cent sampling error. (Author)

A77-15076 * **Experimental examination of similarity measures and preprocessing methods used for image registration.** M. Svedlow, C. D. McGillem, and P. E. Anuta (Purdue University, West

Lafayette, Ind.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4A-9 to 4A-17. 7 refs. Contract No. NAS9-14016.

The criterion used to measure the similarity between images and thus find the position where the images are registered is examined. The three similarity measures considered are the correlation coefficient, the sum of the absolute differences, and the correlation function. Three basic types of preprocessing are then discussed: taking the magnitude of the gradient of the images, thresholding the images at their medians, and thresholding the magnitude of the gradient of the images at an arbitrary level to be determined experimentally. These multitemporal registration techniques are applied to remote imagery of agricultural areas. B.J.

A77-15077 * A Landsat Digital Image Rectification System. P. Van Wie and M. Stein (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4A-18 to 4A-26. 12 refs.

DIRS is a Digital Image Rectification System for the geometric correction of Landsat Multispectral Scanner digital image data. DIRS removes spatial distortions from the data and brings it into conformance with the Universal Transverse Mercator (UTM) map projection. Scene data in the form of landmarks or Ground Control Points (GCPs) are used to drive the geometric correction algorithms. The system offers extensive capabilities for 'shade printing' to aid in the determination of GCPs. Affine, two dimensional least squares polynominal and spacecraft attitude modeling techniques for geometric mapping are provided. Entire scenes or selected quadralaterals may be rectified. Resampling through nearest neighbor or cubic convolution at user designated intervals is available. The output products are in the form of digital tape in band interleaved, single band or CCT format in a rotated UTM projection. The system was designed and implemented on large scale IBM 360 computers with at least 300-500K bytes of memory for user application programs and five nine track tapes plus direct access storage. (Author)

A77-15078 Filtering to remove cloud cover in satellite imagery. O. R. Mitchell and P. L. Chen (Purdue University, West Lafayette, Ind.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4A-27 to 4A-31. 5 refs. Contract No. F30602-75-C-0150.

The possibility of filtering light cloud cover in satellite imagery to expose objects beneath the clouds is discussed. A model of the cloud distortion process is developed and a transformation is introduced which makes the signal and noise additive so that optimum linear filtering techniques can be applied. This homomorphic filtering can be done in the two dimensional image plane, or it can be extended to include the spectral dimension on multispectral data. This three dimensional filter is especially promising because clouds tend to follow a common spectral response. The noise statistics can either be estimated from a general cloud model or they can be derived from a multispectral classification program. Results from a computer simulation and from Landsat data are shown. (Author)

A77-15079 Experiments in iterative enhancement of linear features. G. J. VanderBrug (Maryland, University, College Park, Md.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4A-32 to 4A-44.

Lines and curves in an image are detected locally by a template-matching process which determines the 'line-ness' value of the image at each point, in a set of orientations. The output of the detection process is the strongest of these values at each point, and the orientation that gave rise to this value. The results of this approach tend to be noisy, but their noisiness can be reduced by examining, for each point, the values at nearby points, in the direction defined by the preferred orientation, and increasing the point's value if the nearby points have high values and similar orientations. Iteration of this reinforcement process leads to further noise reduction. Several variations on this scheme are presented. The preferred orientations can also be 'sharpened' by examining the orientation at nearby points (in the preferred direction) and biasing it toward their average. Experimental results using these methods are obtained for Landsat and Skylab images containing many linear features. (Author)

A77-15080 * Signature extension through the application of cluster matching algorithms to determine appropriate signature transformations. P. F. Lambeck and D. P. Rice (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 4A-45 to 4A-51. Contract No. NAS9-14123.

Signature extension is intended to increase the space-time range over which a set of training statistics can be used to classify data without significant loss of recognition accuracy. A first cluster matching algorithm MASC (Multiplicative and Additive Signature Correction) was developed at the Environmental Research Institute of Michigan to test the concept of using associations between training and recognition area cluster statistics to define an average signature transformation. A more recent signature extension module CROP-A (Cluster Regression Ordered on Principal Axis) has shown evidence of making significant associations between training and recognition area cluster statistics, with the clusters to be matched being selected automatically by the algorithm. B.J.

A77-15180 * The evolution of the SEASAT imaging radar. W. E. Brown, Jr. (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div., Pasadena, Calif.). In: National Telecommunications Conference, New Orleans, La., December 1-3, 1975, Conference Record. Volume 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 37-4, 37-5. Contract No. NAS7-100.

The paper describes the design parameters and development of a synthetic aperture radar for use on the SEASAT spacecraft. This imaging radar is designed to operate at altitudes of 800 km with an orbital inclination of 108 deg, a nominal resolution of 25 m, and a swath width of 100 km. The design evolved from planetary imaging radar studies conducted over many years where an L-band imaging radar was developed and tested on aircraft flights as a prototype system to map the surface of Venus. A solid-state transmitter is used where the pulse repetition frequency is a function of altitude and will be about 2kHz for a 12-m long antenna. The receiver consists of the receiver protector, input filters, the gain control, and the RF amplifier. The ground station uses the standard NASA receiver with a 10-m antenna. The correlator, either optical or digital, must be able to compensate for the pitch and yaw variations of the spacecraft as well as the inherent effective yaw caused by the rotation of the earth, and extract the range curvature and range walk effects. S.D.

A77-15183 * The Shuttle imaging microwave system experiment. J. W. Waters, F. T. Barath, E. Y. Chow, A. F. H. Goetz, E. J. Johnston, J. M. Stacey (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), D. H. Staelin, J. A. Kong, E. G. Njoku (MIT, Cambridge, Mass.), and J. J. Gustincic. In: National Telecommunications Conference, New Orleans, La., December 1-3, 1975, Conference Record. Volume 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 37-21 to 37-26. 29 refs.

The purpose of the Shuttle microwave system experiment (SIMS) is to utilize the capabilities of the Space Shuttle to perform

passive microwave measurements of thermal emission from the earth's atmosphere and surface, which can be interpreted in terms of meaningful atmospheric and geophysical parameters. The paper is a status report of an ongoing definition phase study of SIMS. The wavelengths and observable parameters for the SIMS channels are identified. The SIMS instrument is discussed with particular reference to the antenna system. A system consisting of a parabolic torus reflector offset fed by a number of feeds and radiometers on a rotating wheel is determined to be the best antenna configuration for SIMS. A tentative data flow diagram for SIMS is also provided. S.D.

A77-15860 Evaluation of satellite imagery of the Bodensee (Auswertung von Satellitenaufnahmen vom Bodensee). K. A. Ulbricht (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt Institut für Nachrichtentechnik, Oberpfaffenhofen, West Germany). *DFVLR-Nachrichten,* Nov. 1976, p. 790-792. In German.

A gray scale of black/white imagery (1 to 256, in 9 bits) of the Bodensee (Lake of Constance) and environs is used to recover color contrasts and spectral distribution from imagery taken by satellite via four channels from green to IR (0.6 to 1.1 micron). Controls for presence of clouds or pollution are derived from the contrasts of the several channels. The DIBIAS digital image processing technique is applied, using I/O devices to recover B/W and color images from prints, negatives, slides, or magnetic tape records (gray scale values as electric pulse patterns). Inflow from tributaries to the lake, outlets of cooling ponds or towers, industrial wastes, blooming of algae from the lake bottom, stream mixing patterns, and water quality are tentatively identified and evaluated from the multispectral imagery, but the need for correlation with ground truth is emphasized. R.D.V.

A77-15918 * North polar region of Mars - Imaging results from Viking 2. J. A. Cutts, K. R. Blasius (Science Applications, Inc., Pasadena, Calif.), G. A. Briggs (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), M. H. Carr, H. Masursky (U.S. Geological Survey, Branch of Astrogeology, Flagstaff, Ariz.), and R. Greeley (NASA, Ames Research Center, Moffett Field; Santa Clara, University, Santa Clara, Calif.). *Science,* vol. 194, Dec. 17, 1976, p. 1329-1337. 19 refs. NASA-supported research.

During October 1976, the Viking 2 orbiter acquired approximately 700 high-resolution images of the north polar region of Mars. These images confirm the existence at the north pole of extensive layered deposits largely covered over with deposits of perennial ice. An unconformity within the layered deposits suggests a complex history of climate change during their time of deposition. A pole-girdling accumulation of dunes composed of very dark materials is revealed by the Viking cameras. The entire region is devoid of fresh impact craters. Rapid rates of erosion or deposition are implied. A scenario for polar geological evolution, involving two types of climate change, is proposed. (Author)

A77-16313 # Some aspects of the problem of allowing for the local vertical refraction constant in trigonometric levelling (O nekotorykh aspektakh problemy ucheta mestnogo koeffitsienta vertikal'noi refraktsii pri trigonometricheskom nivelirovanii). D. G. Vil'ner. *Geodeziia, Kartografiia i Aerofotos'emka,* no. 24, 1976, p. 8-18. 7 refs. In Russian.

A77-17507 # Study on the relationship between parameters of the vertical water vapour profile up to 500 mb and the pattern of satellite cloud pictures. U. Schubert, K. Berhnhardt (Berlin Humboldt-Universität, Berlin, East Germany), and W. Böhme (Meteorologischer Dienst, Potsdam, East Germany). *COSPAR, Plenary Meeting; 19th, Philadelphia, Pa., June 8-19, 1976, Paper.* 7 p.

An attempt is made to find a statistical relationship between the vertical distribution of dew point differences below 500 mb, determined from radiosonde measurements, and the cloud types identified from satellite photographs. The height and thickness of the clouds were assessed from IR pictures. The profile of the dew-point differences did not exhibit any noteworthy vertical gradient. The atmospheric humidity at cloud levels above 900 mb was found to be higher than for cirrus conditions. In the presence of stratiform clouds, the dew-point difference below 800 mb decreases rapidly from 14 C to 2.2 C down to the 1000 mb surface, remaining at 2.0 C down to the earth's surface. The vertical profile of stratocumulus clouds between 500 and 900 mb corresponds approximately to the dew-point difference profile for cumulus clouds. V.P.

A77-17570 * Application of real-time mass spectrometric techniques to environmental organic geochemistry. I - Computerized high resolution mass spectrometry and gas chromatography-low resolution mass spectrometry. B. R. Simoneit (California, University, Berkeley, Calif.), D. H. Smith (Stanford University, Stanford, Calif.), and G. Eglinton (Bristol, University, Bristol, England). *Archives of Environmental Contamination and Toxicology,* vol. 3, 1975-1976, p. 385-409. 41 refs. Grant No. NGL-05-003-003.

A77-17829 The AFOS program and future forecast applications. W. H. Klein (NOAA, National Weather Service, Silver Spring, Md.). *(American Meteorological Society, Conference on Weather Forecasting and Analysis, 6th, Albany, N.Y., May 10-13, 1976.) Monthly Weather Review,* vol. 104, Dec. 1976, p. 1494-1504. 32 refs.

The Automation of Field Operations and Services (AFOS) program of the National Weather Service will provide a new dimension to local weather analysis and forecasting. By providing minicomputers, video displays and high-speed communications to over 200 weather stations around the country, AFOS will greatly increase the forecaster's ability to assess, process, display and disseminate meteorological information. New prediction techniques will become feasible such as automatically monitoring and updating aviation terminal forecasts, providing computer-worded objective public forecasts, and using digitized radar data to update and improve precipitation, hydrologic and thunderstorm forecasts. The progress of research projects to develop these new analysis and forecast methods for local application in the AFOS system is described, and the latest status of the AFOS program is discussed. (Author)

A77-18832 Metric principles for constructing an aeromagnetic control network in the USSR. M. A. Vasil'eva and R. T. Vasil'ev (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Geofizicheskikh Metodov Razvedki, Leningrad, USSR). *(Geomagnetizm i Aeronomiia,* vol. 16, Jan.-Feb. 1976, p. 175-180.) *Geomagnetism and Aeronomy,* vol. 16, Aug. 1976, p. 102-105. 7 refs. Translation.

A77-18966 A method for determining the operational imaging performance of orbital earth resources sensors. R. Schowengerdt (Arizona, University, Tucson, Ariz.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. (A77-18963 06-43) Falls Church, Va., American Society of Photogrammetry, 1976, p. 25-62. 43 refs. Contracts No. F04695-67-C-0197; No. F4701-75-C-0248.

Knowledge of the operational imaging performance of optical systems is desirable in order to compare with design predictions, to study time-varying effects, and to establish criteria for future systems. For aerial and orbital optical systems, special ground targets or naturally occurring edge-type features are normally used to measure optical performance. A new technique, called Scale Matching Analysis (SMA), is proposed. Small scale imagery taken from an aircraft flying under the orbiting sensor to be studied, is used to calibrate any ground scene for the spacecraft imagery. The Fourier theory of image formation is then used to find the optical transfer function for the spacecraft sensor. The theory of this approach is outlined and results from a laboratory simulation comparing SMA to Edge Gradient Analysis (EGA) are presented. (Author)

A77-18968 Digital sensor simulation. M. B. Faintich (U.S. Defense Mapping Agency, Aerospace Center, St. Louis, Mo.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1976, p. 76-102.

Project SENSE (Sensor Simulation Experiment) is designed to analyze the effectiveness of digital culture and terrain data bases generated at the Defense Mapping Agency Aerospace Center for the simulation of various types of sensor systems. Although most of the initial effort dealt with digital radar simulation, other sensors such as microwave radiation, forward looking infrared (FLIR), and low light level television (LLLTV) are being investigated. The simulation software to support this analysis consists of three general sections. The first segment searches the data bases to construct a perspective view of the area for removal of hidden objects. Studies are underway to determine optimal sampling steps. The next segment mathematically models the emission and interaction of the radiation with the data bases, the sensor receiving unit, and the sensor display response. This section is modular to accommodate any type of sensor. The third segment of the software improves the simulated display via image processing techniques and buffers the output image to the appropriate unit for display. Parameters affecting radar simulations and comparisons of actual and simulated scenes are presented. (Author)

A77-18969 * **Selection of remote sensing techniques - Surface roughness information from 3 cm wavelength SLAR images.** G. G. Schaber (U.S. Geological Survey, Flagstaff, Ariz.), G. L. Berlin (Northern Arizona University, Flagstaff, Ariz.), and D. J. Pitrone (California, University, Los Angeles, Calif.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 103-117. 6 refs. NASA-supported research.

The value of SLAR (Side-Looking Airborne Radar) image data for detecting and measuring small-scale surface roughness is examined, using as an example the Cottonball Basin in Death Valley National Monument, California. The SLAR image was obtained by an X-band (3 cm wavelength) synthetic aperture radar system operated at an altitude of 10,732 m above sea level. The polarization of the transmitted and received signals was horizontal. Film density values were used to produce color hypsometric maps of small-scale surface irregularities. It is shown that semi-quantitative surface roughness information, from uniquely flat surfaces such as the Cottonball Basin, can be obtained by analysis of 3 cm wavelength SLAR images calibrated by limited field measurements. Quantitative roughness data could be obtained with proper consideration of modifying surface and radar system parameters. S.D.

A77-18970 **Horizontal control extension with Skylab/EREP imagery.** E. E. Derenyi (New Brunswick, University, Fredericton, Canada). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 118-128. Research sponsored by the Department of Energy, Mines, and Resources of Canada.

Aerial triangulation was performed on three strips of photography taken with the Skylab/EREP S190A system and on one strip taken with the S190B camera. Ground control was obtained from 1:50,000 and 1:25,000 scale topographic maps and a Zeiss PSK comparator was used for the mensuration. Analytical model formation and the independent models ajustment technique was employed during the course of the triangulation. The standard error of unit weight ranged from 7 microns to 16 microns and the root mean square error of the discrepancies at the redundant control points ranged from 12 microns to 31 microns at image scale. These results compare favorably to the accuracies attainable with conventional aerial photography. (Author)

A77-18978 **Precision equidensity slicing with conventional photographic materials.** D. S. Ross. In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 239-249. 10 refs.

Equidensity contouring, or density slicing, converts the continuous tone image grey scale to discrete steps, which are in effect, digital. Density slicing is particularly useful for aiding the analysis of remotely-sensed earth resources imagery, taken from satellites and aircraft. While density slicing can be performed by video image digitizers and computers, simpler photographic processes can offer results which in some cases are superior. A method of density slicing using conventional photographic materials and techniques is described. The precision of the process is controllable, and if the sensitometry of the input image is known, the density slices may be related quantitatively to the scene, as viewed from the sensor position. (Author)

A77-18993 **Computer mapping of water quality in Saginaw Bay with Landsat digital data.** R. H. Rogers, N. J. Shah, J. B. McKeon (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.), and V. E. Smith (Cranbrook Institute of Science, Bloomfield Hills, Mich.). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 584-596. 7 refs.

Computer techniques have been developed for mapping water quality parameters from Landsat data, using surface samples collected in an ongoing survey of water quality in Saginaw Bay (Lake Huron), Michigan, sponsored by the U.S. Environmental Protection Agency. Chemical and biological parameters were measured on July 31, 1975 at 16 bay stations in concert with the Landsat overflight. Application of stepwise linear regression to seven of these parameters and corresponding Landsat measurements resulted in regression correlation coefficients that varied from 0.94 for temperature to 0.71 for Secchi depth. Chloride, conductivity, total Kjeldahl nitrogen, total phosphorus, and chlorophyll a were best correlated with the ratio of Landsat Band 4 to Band 5. Temperature and Secchi depth were best correlated to Band 5. (Author)

N77-10399*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SEASAT-A SYNTHETIC APERTURE IMAGING RADAR SYSTEM
Rolando L. Jordan and David H. Rodgers [1975] 10 p
(NASA-CR-148838) Avail: NTIS HC A02/MF A01 CSCL 17I

The SEASAT, a synthetic aperture imaging radar system is the first radar system of its kind designed for the study of ocean wave patterns from orbit. The basic requirement of this system is to generate continuous radar imagery with a 100 km swath with 25m resolution from an orbital altitude of 800 km. These requirements impose unique system design problems. The end to end data system described including interactions of the spacecraft, antenna, sensor, telemetry link, and data processor. The synthetic aperture radar system generates a large quantity of data requiring the use of an analog link with stable local oscillator encoding. The problems associated in telemetering the radar information with sufficient fidelity to synthesize an image on the ground is described as well as the selected solutions to the problems. Author

N77-10608*# *National Aeronautics and Space Administration.* Marshall Space Flight Center., Huntsville, Ala.
EVALUATION CRITERIA FOR SOFTWARE CLASSIFICATION INVENTORIES, ACCURACIES, AND MAPS
Robert R. JaYroe, Jr. Sep. 1976 27 p
(NASA-TM-X-73347) *Avail:* NTIS HC A03/MF A01 CSCL 05B

Statistical criteria are presented for modifying the contingency table used to evaluate tabular classification results obtained from remote sensing and ground truth maps. This classification technique contains information on the spatial complexity of the test site, on the relative location of classification errors, on agreement of the classification maps with ground truth maps, and reduces back to the original information normally found in a contingency table. Author

N77-10609*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NEAREST NEIGHBOR, BILINEAR INTERPOLATION AND BICUBIC INTERPOLATION GEOGRAPHIC CORRECTION EFFECTS ON LANDSAT IMAGERY
Robert R. JaYroe, Jr. Sep. 1976 28 p ref
(NASA-TM-X-73348) Avail: NTIS HC A03/MF A01 CSCL 05B

Geographical correction effects on LANDSAT image data are identified, using the nearest neighbor, bilinear interpolation and bicubic interpolation techniques. Potential impacts of registration on image compression and classification are explored. Author

N77-10613# Corps of Engineers, Waltham, Mass. New England Div.
OPERATION OF THE LANDSAT AUTOMATIC TRACKING SYSTEM
Timothy D. Buckelew May 1976 72 p refs
Avail: NTIS HC A04/MF A01

The procedure and operation of the LANDSAT tracking system are discussed. Instructions for the normal day-to-day operation are presented showing information needed for program modification, file maintenance and trouble shooting. M.C.F.

N77-10614*# Computer Sciences Corp., Huntsville, Ala.
A STUDY AND EVALUATION OF IMAGE ANALYSIS TECHNIQUES APPLIED TO REMOTELY SENSED DATA Final Report
R. J. Atkinson, B. V. Dasarathy, M. Lybanon, and H. K. Ramapriyan Oct. 1976 205 p refs
(Contract NAS8-32107)
(NASA-CR-150041) Avail: NTIS HC A10/ A01 CSCL 05B

An analysis of phenomena causing nonlinearities in the transformation from Landsat multispectral scanner coordinates to ground coordinates is presented. Experimental results comparing rms errors at ground control points indicated a slight improvement when a nonlinear (8-parameter) transformation was used instead of an affine (6-parameter) transformation. Using a preliminary ground truth map of a test site in Alabama covering the Mobile Bay area and six Landsat images of the same scene, several classification methods were assessed. A methodology was developed for automatic change detection using classification/cluster maps. A coding scheme was employed for generation of change depiction maps indicating specific types of changes. Inter- and intraseasonal data of the Mobile Bay test area were compared to illustrate the method. A beginning was made in the study of data compression by applying a Karhunen-Loeve transform technique to a small section of the test data set. The second part of the report provides a formal documentation of the several programs developed for the analysis and assessments presented. Author

N77-10615*# Auburn Univ., Ala. Dept. of Electrical Engineering.
OPTICAL DATA PROCESSING STUDY Final Technical Report, 3 Feb. 1975 - 4 Oct. 1976
L. J. Pinson 12 Oct. 1976 73 p
(Contract NAS8-31223)
(NASA-CR-150042) Avail: NTIS HC A04/MF A01 CSCL 20F

An onboard coherent optical data processing system was designed to handle large information content of imagery at high speeds, reduce redundancy in picture transmission, and detect specific image features. Theoretically derived Fourier transform characteristics for simple but representative two dimensional images served as a basis for predicting expected features of actual target images. Fourier transformation and spatial filtering of coherent optical images was accomplished theoretically and in the laboratory. The effect of various parameters such as optical aperature, incidence angles, the transparency assumption, the thin lens approximation on resolution, and performance of the system are predicted and tested. Author

N77-10618# Comision Nacional del Espacio Exterior, Mexico City (Mexico).
DATA PROCESSING OF INFORMATION FROM REMOTE SENSORS IN MEXICO [PROCESSAMIENTO AUTOMATICO DE INFORMACION DE PERCEPCION REMOTA EN LA COMISION NACIONAL DEL ESPACIO EXTERIOR]
Munoz Alfonso E. Zarco 1974 43 p refs In SPANISH
Avail: NTIS HC A03/MF A01

A brief summary of various experiments and projects that show the potential of remote sensors applied to specific problems. Areas of application are: (1) agriculture, (2) geothermal resources, and (3) detection of salt content in soil and bodies of water. Transl. by B.B.

N77-10630# Inter-American Tropical Tuna Commission, La Jolla, Calif.
COMPUTER PROCESSING OF LANDSAT-1 MSS DIGITAL IMAGERY FOR MARINE STUDIES
Robert G. Kirkham, Merritt R. Stevenson, and Forrest R. Miller Feb. 1976 77 p refs
(Grant NOAA-04-6-158-44043)
(PB-254655/4; NOAA-76042901) Avail: NTIS HC A05/MF A01 CSCL 08J

A procedure in which a series of 15 computer programs was developed to process data from the 4 spectral bands of multispectral scanner systems aboard LANDSAT-1 for the central part of the Gulf of California are described. Methods to specifically produce digital auxiliary tapes of full scenes from the EROS Computer Compatible Tapes (CCT's) and from these tapes to construct digital images using a high speed line printer are discussed. Comparison of prominent surface features in the gulf with computer generated benchmarks showed the gridding program to be quite accurate in generating geographical benchmarks for the full scene imagery. GRA

N77-10631# Pattern Analysis and Recognition Corp., Rome, N.Y.
SPECTRAL ANALYSIS Final Technical Report, Jun. 1973 - Jan. 1975
Alex Zanon, Michael Gillotte, and Michael Zoracki Griffiss AFB, N. Y. RADC Mar. 1976 299 p refs
(Contract F30602-73-C-0383)
(AD-A024209; PAR-75-9; RADC-TR-75-302) Avail: NTIS HC A13/MF A01 CSCL 08/7

This report investigates the application of digital image processing techniques to a selected set of multispectral images. Various processes for performing automatic classification on selected terrain classes on 9-lens multispectral imagery were tested. GRA

N77-10696# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
AIRBORNE SYSTEM FOR MAPPING AND TRACKING EXTENDED GAMMA RAY SOURCES
T. P. Stuart, T. J. Hendricks, G. G. Wallace, and J. R. Cleland 1976 16 p refs Presented at the Symp. on the Development of Nucl. Based Techniques, Vienna, 15 Mar. 1976
(EGG-1183-1685; Conf-760311-3; SM-206/24) Avail: NTIS HC A03/MF A01

An airborne system was developed for mapping and tracking extended sources of airborne or terrestrially distributed gamma ray emitters. The system records 300 channel gamma ray spectral data every three seconds on magnetic tape. Computer programs were written to isolate the contribution from the particular radionuclide of interest. Aircraft position as sensed by a microwave ranging system is recorded every second on magnetic tape. Measurements of airborne stack releases of A-41 concentrations versus time or aircraft position agree well with computer code predictions. Author (ERA)

N77-11481*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2: CUMULATIVE NON-US STANDARD CATALOG, 1975 - 1976
1976 1412 p
(NASA-TM-X-74212; GSFC/LNI/2-76/1) Avail: NTIS HC A99 CSCL 05B

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

N77-11482*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT 2: CUMULATIVE US STANDARD CATALOG, 1975 - 1976
1976 880 p
(NASA-TM-X-74217; GSFC/LUI/2-76/1) Avail: NTIS HC A99 CSCL 05B
For abstract, see N77-11481.

N77-11483 Pennsylvania Univ., Philadelphia.
A SYSTEMATIC APPROACH TO OPERATIONAL SCHEDULING FOR INFORMATION COLLECTION SYSTEMS Ph.D. Thesis
David Sims 1976 357 p
Avail: Univ. Microfilms Order No. 76-22783
A systematic methodology is presented which enables one to construct and solve a large scale linear zero-one mathematical programming model of an information collection system. The parameters of this model define the system's operational capability, its resources, its management's operational philosophy, and its users' desires. The solution to this model specifies the system's optimum operational schedule. The presented methodology is employed to formulate a computerized scheduling process for the Earth Resources Technology Satellite system. This process is termed a control mechanism. It utilized state variables to define the system element's operational modes and the system's environment. A utility space is established to quantify the management philosophy and the users' desires. The solution process utilizes heuristic programming, the principle of tearing, dynamic programming, and constrained continuous optimization. A methodology for solving the large-scale zero-one model is presented Dissert. Abstr.

N77-11496*# Zurich Univ. (Switzerland).
DIGITAL IMAGE PROCESSING [DIGITALE BILDVERARBEITUNG]
Klaus Seidel, Principal Investigator 1976 59 p refs In GERMAN; partly in ENGLISH Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10035; NASA-CR-149136) Avail: NTIS HC A04/MF A01 CSCL 05B

N77-11504*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG, 1 - 30 JUNE 1976
30 Jun. 1976 137 p
(GSFC/LN-76/006; NASA-TM-X-74218) Avail: NTIS HC A07/MF A01 CSCL 05B
Information regarding the availability of LANDSAT imagery processed and imput to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog included imagery covering the continental United States, Alaska, and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT -1 and LANDSAT-2 coverage, respectively. Author

N77-11506*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG, 1 - 30 JUNE 1976
30 Jun. 1976 131 p
(NASA-TM-X-74219; GSFC/LU-76/006) Avail: NTIS HC A07/MF A01 CSCL 05B
The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N77-11507*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG, 1 - 31 JULY 1976
30 Jul. 1976 113 p
(NASA-TM-X-74213; GSFC/LU-76/007) Avail: NTIS HC A06/MF A01 CSCL 05B
Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N77-11517# Hawaii Inst. of Geophysics, Honolulu.
COMPUTER PROGRAM PROJECTING FICTITIOUS LONGITUDE AND LATITUDE SYSTEMS ONTO STANDARD MERCATOR GRIDS
Peter P. K. Wong, Christopher Gregory, and David W. Handschumacher Dec. 1975 39 p ref
(Contract N00014-75-C-0209; NR Proj. 083-603)
(AD-A025076; HIG-75-19; HIG-Data-30) Avail: NTIS HC A03/MF A01 CSCL 08/2
A computer program has been written in FORTRAN language that plots fictitious latitudes and longitudes about an arbitary polar system onto standard Mercator projections. The mathematical development of this program is presented along with a complete program description and program listing. Several example plots generated by the program are included to demonstrate its option characteristics. Author (GRA)

N77-11521*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG Monthly Report, 1-31 Jul. 1976
31 Jul. 1976 126 p
(NASA-TM-X-74214; GSFC/LN-76/007) Avail: NTIS HC A07/MF A01 CSCL 05B
Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. The section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Author

N77-11522*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG Monthly Report, 1-31 Aug. 1976
31 Aug. 1976 116 p
(NASA-TM-X-74215; GSFC/LN-76/008) Avail: NTIS HC A06/MF A01 CSCL 05B
For abstract, see N77-11521.

N77-11523*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG Monthly Report, 1-31 Aug. 1976
31 Aug. 1976 130 p
(NASA-TM-X-74216; GSFC/LU-76/008;

NTISUB/B/138-76/008) Avail: NTIS HC A07/MF A01 CSCL 05B

For abstract, see N77-11521.

N77-12243*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

AGRICULTURAL AND HYDROLOGICAL APPLICATIONS OF RADAR Final Report

Fawwaz T. Ulaby 31 Jul. 1976 90 p refs
(Contract NAS9-10261)
(NASA-CR-151107; RSL-TR-177-62) Avail: NTIS HC A05/MF A01 CSCL 08H

Program objectives, covering a wide range of disciplines and activities in radar remote sensing, include radar systems development and analysis, data processing and display, and data interpretation in geology, geography and oceanography. Research was focused on the evaluation of radar remote sensing applications in hydrology and agriculture based on data acquired with the Microwave Active Spectrometer (MAS) system. The title, author(s) and abstract of each of the 62 technical reports generated under this contract are appended. Author

N77-12468*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT 1 US CUMULATIVE CATALOG, 1975 - 1976

31 Jul. 1976 442 p
(NASA-TM-X-74298; GSFC/LU-76/013;
NTISUB/B/138-76/013) Avail: NTIS HC A19 CSCL 05B

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

N77-12469*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT 1 NON-US CUMULATIVE CATALOG, 1975 - 1976

31 Jul. 1976 209 p
(NASA-TM-X-74297; GSFC/LN-76/013;
NTISUB/B/139-76/013) Avail: NTIS HC A10 CSCL 05B

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

N77-12470*+ New Mexico Univ., Albuquerque.

QUARTERLY LITERATURE REVIEW OF THE REMOTE SENSING OF NATURAL RESOURCES, THIRD QUARTER 1976

Oct. 1976 221 p
(NASA-CR-149163) Avail: NTIS For foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC $15.00 CSCL 08F

Abstracts related to remote sensing instrumentation and techniques, and to the remote sensing of natural resources are presented by the Technology Application Center at the University of New Mexico. Areas of interest included theory, general surveys, and miscellaneous studies; geology and hydrology; agriculture and forestry; marine sciences; and urban and land use. An alphabetically arranged Author/Key Word index is provided. Author

N77-12485# Bochum Observatory (West Germany). Inst. fuer Weltraumforschung.

REMOTE SENSING OF GEOTHERMIC ACTIVITIES OF THE VOLCANOES AETNA, STROMBOLI AND VESUV BY MEANS OF INFRA-RED NOAA-VHRR-SATELLITE DATA

Heinz Kaminski 1976 17 p refs In GERMAN; ENGLISH summary Presented at the 16th Intern. Tech. Sci. Meeting on Space, Rome, 18-20 Mar. 1976
Avail: NTIS HC A02/MF A01

Geothermal investigations of volcanoes in southern Italy were made using high resolution (900 m ground resolution) NOAA 2, 3, and 4 remote sensing data. The thermal activity of the volcanoes is represented as delta F sub D, i.e., film density difference compared to the sea water film density in the period May to September 1974. The intensity variations of the three volcanoes are similar, which might mean that the volcanoes have the same magma source. ESA

N77-12487# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

AN ALGORITHM FOR THE ANALYSIS OF RECONNAISSANCE IMAGERY Final Report, Jun. 1972 - May 1975

Roger A. Gagnon Mar. 1976 26 p refs
(AF Proj. 7233)
(AD-A025964; AMRL-TR-75-60) Avail: NTIS HC A03/MF A01 CSCL 15/4

The algorithm is modular in design. The user only need substitute either his own subroutines or parameter values in order to test his hypotheses on the solution of the reconnaissance problems. As written, the algorithm uses the author's hypotheses on the human visual system approach to a reconnaissance problem. The resulting algorithm consists of a main program that defines the options chosen by the investigator and the search procedure to be used. Individual subroutines are used to perform each of several tasks that are dependent upon the reconnaissance problem at hand. The investigator need only specify the options desired. If he desires to investigate alternate approaches to those already programmed, he can substitute alternate subroutines. The algorithm is intended for use as a research vehicle that can be adapted to the specific needs of the researcher. Fruitful subroutines can then be incorporated for use by other users. Author (GRA)

N77-12488# Stanford Research Inst., Menlo Park, Calif.

EFFECT OF SUN ANGLE, ATMOSPHERIC ATTENUATION, AND TURBULENCE ON MIRROR BEACONS FOR LANDSAT IMAGE CONTROL

William E. Evans Mar. 1976 72 p refs
(Contract DI-14-08-001-14897; SRI Proj. 4175-2)
(PB-255404/6; USGS-LI-76/001) Avail: NTIS HC A04/MF A01 CSCL 17H

Numerous experiments were conducted using mirrors for reflecting solar rays to mark LANDSAT images. After reviewing the results and calculating the theoretical and practical factors affecting the success of the operation, it was concluded that plane mirrors of from 1- to 4-sq ft of reflecting area can provide adequate marks on the image. Even though LANDSAT passes occur at a time when atmospheric thermal turbulence is relatively high, the strength of the return is adequate for spatial marking and possibly for spectral calibration purposes. Mirror pointing is the most critical factor affecting the results. An improved inexpensive mount was developed for use where it is desirable to excite an array of several pixels arranged in an identifiable pattern. GRA

N77-12490*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT US STANDARD CATALOG Monthly Progress Report, 1-31 Jul. 1976

31 Jul. 1976 112 p
(NASA-TM-X-74261; GSFC/LU-76/007) Avail: NTIS HC A06/MF A01 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N77-12493*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG Monthly Progress Report, 1-31 Aug. 1976
31 Aug. 1976 117 p
(NASA-TM-X-74258; GSFC/LN-76/008) Avail: NTIS HC A06/MF A01 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N77-12498# Control Data Corp., Minneapolis, Minn. Digital Image Systems Div.
DIGITAL-ORTHOPHOTO STUDY ADD-ON Final Technical Report, Jan. - Feb. 1976
D. J. Panton Griffiss AFB, N. Y. RADC May 1976 37 p
(Contract F30602-76-C-0108; AF Proj. 5569)
(AD-A025690; RADC-TR-76-121) Avail: NTIS HC A03/MF A01 CSCL 14/5

Digital image processing techniques for orthophoto generation were developed and investigated in a previous study entitled Digital Orthophoto Study. The primary concern of this Add-On is the application of these techniques to a large image area. Two frames of aerial photography were digitized using different devices. The slower device did produce an image whose orthophoto was more accurate. It was found that the process referred to as interior orientation is a crucial factor affecting the accuracy of the final orthophoto as well as the precision with which separate orthophoto segments can be mosaicked together. Author (GRA)

N77-12767*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LOW-COST DATA ANALYSIS SYSTEMS FOR PROCESSING MULTISPECTRAL SCANNER DATA
Sidney L. Whitely Washington Oct. 1976 41 p refs Original contains color illustrations
(NASA-TR-R-467; JSC-S-460; JSC-10949) Avail: NTIS HC A03/MF A01 CSCL 08B

The basic hardware and software requirements are described for four low cost analysis systems for computer generated land use maps. The data analysis systems consist of an image display system, a small digital computer, and an output recording device. Software is described together with some of the display and recording devices, and typical costs are cited. Computer requirements are given, and two approaches are described for converting black-white film and electrostatic printer output to inexpensive color output products. Examples of output products are shown. Author

N77-13139# Telespazio, S.p.A., Rome (Italy).
ON-BOARD AND GROUND DATA PROCESSING IN THE SPACELAB FOR EARTH RESOURCES
G. Bressanin [1975] 34 p refs
Avail: NTIS HC A03/MF A01

Requirements and characteristics were assessed. The ground data processing system will probably be non-dedicated. As a consequence many of the aspects related to data processing on the ground are much better defined than the corresponding data management problems for the spaceborne systems proper. The on-board data system is considered. The most promising methods for solving the system requirements are discussed with emphasis on new technologies such as optical and holography memories. The ground data processing system is examined. The main data processing techniques for earth resources applications are illustrated. Specific attention is paid to dedicated special purpose processors, which will extract useful information from the data in an efficient and cost-effective way. ESA

N77-13486*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
APOLLO-SOYUZ DOPPLER-TRACKING EXPERIMENT MA-089 Final Report
G. C. Weiffenbach, M. D. Grossi, and P. W. Shores Oct. 1976 153 p refs
(Contract NAS9-13837)
(NASA-CR-151122) Avail: NTIS HC A08/MF A01 CSCL 08B

The Doppler tracking experiment was designed to test the feasibility of improved mapping of the earth's gravity field by the low-low satellite-to-satellite tracking method and to observe variations in the electron density of the ionosphere between the two spacecraft. Data were taken between 1:01 and 14:37 GMT on July 24, 1975. Baseline data taken earlier, while the docking module was still attached to the command and service module, indicated that the equipment operated satisfactorily. The ionospheric data contained in the difference between the Doppler signals at the two frequencies are of excellent quality, resulting in valuable satellite-to-satellite observations, never made before, of wave phenomena in the ionosphere. The gravity data were corrupted by an unexpectedly high noise level of as-yet-undetermined origin, with periods greater than 150 seconds, that prevented unambiguous identification of gravity-anomaly signatures. Author

N77-13487*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG, 1-30 SEPTEMBER 1976
30 Sep. 1976 109 p
(NASA-TM-X-74302; GSFC/LU-76/009;
NTISUB/B/138-76/009) Avail: NTIS HC A06/MF A01 CSCL 05B

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

N77-13488*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG, 1-31 OCTOBER 1976
31 Oct. 1976 102 p
(NASA-Tm-X-74303; GSFC/LU-76/010) Avail: NTIS HC A06/MF A01 CSCL 05B

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

N77-13489*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG Monthly Report, 1-30 Sep. 1976
30 Sep. 1976 122 p
(NASA-TM-X-74304; GSFC/LN-76/009;
NTISUB/B/139-76/009) Avail: NTIS HC A06/MF A01 CSCL 05B

The Non-U.S. Standard Catalog lists imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such

as data acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N77-13490*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG *Monthly Report*, 1-31 Oct. 1976
31 Oct. 1976 84 p
(NASA-TM-X-74305; GSFC/LN-76/010;
NTISUB/B/139-76/010) Avail: NTIS HC A05/MF A01 CSCL 05B

N77-13493*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT D USER DATA PROCESSING STUDY *Final* Report
22 Nov. 1976 57 p
(Contract NAS5-23412)
(NASA-CR-144826; GE-76SDS4277) Avail: NTIS HC A04/MF A01 CSCL 05B

The major expected users of the LANDSAT D system and a preliminary system design of their required facilities are investigated. This system design will then be costed in order to provide an estimate of the incremental user costs necessitated by LANDSAT D. One major use of these cost estimates is as part of an overall economic cost/benefit argument being developed for the LANDSAT D system. The implication of this motive is key; the system design (and corresponding cost estimates) must be a credible one, but not necessarily an optimum one. Author

N77-13494*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT D DATA TRANSMISSION AND DISSEMINATION STUDY Final Report
22 Nov. 1976 80 p
(Contract NAS5-23412)
(NASA-CR-144827; GE-76SDS4277) Avail: NTIS HC A05/MF A01 CSCL 17B

An assessment of the quantity of data processed by the system is discussed investigating the various methods for transmission within the system. Various methods of data storage are considered. It is concluded that the entire processing system should be located in White Sands, New Mexico. M.C.F

N77-13495*# *General Electric Co., Philadelphia, Pa.* Space Div.
LANDSAT D DATA PROCESSING FACILITY STUDY Final Report
22 Nov. 1976 69 p
(Contract NAS5-23412)
(NASA-CR-144828; GE-76SDS4277) Avail: NTIS HC A04/MF A01 CSCL 05B

Mission planning of the LANDSAT D is discussed which will present several major advances in the spacecraft, sensor (Thematic Mapper), ground systems and overall system design. The system provides for two data links-direct satellite to ground, and via the Tracking and Data Relay Satellite. M.C.F.

N77-13496*# General Electric Co., Philadelphia, Pa. Space Div.
LANDSAT D POSITION DETERMINATION AND CORRECTION STUDY Final Report
22 Nov. 1976 30 p refs
(Contract NAS5-23412)
(NASA-CR-144829; GE-76SDS4277) Avail: NTIS HC A03/MF A01 CSCL 08B

An assessment of accuracy of the knowledge of LANDSAT D spacecraft ephemeris data, an evaluation of the impact of expected attitude and alignment accuracies and analysis of the various options for the combining of precision ephemeris and attitude data with scene image data are provided. The potential geometric correction system in order to determine overall system costs and impact on other system elements is characterized. Author

N77-13520# Naval Environmental Prediction Research Facility, Monterey, Calif.
CALIBRATION, EARTH LOCATION AND MAPPING PROGRAMS FOR THE NIMBUS-5 ELECTRONICALLY SCANNING MICROWAVE RADIOMETER (ESMR)
Roland Nagle Jan. 1976 131 p
(wf52551716)
(AD-A027226; NEPRF-cp/Note-24) Avail: NTIS HC A07/MF A01 CSCL 08/2

Programs to calibrate, earth-locate, and map to polar stereographic projection the Electronically Scanning Microwave Radiometer (ESMR) data from the NIMBUS-5 satellite are presented. The NASA calibration and earth location programs are converted to the CDC-6500 computer. Full descriptions of the input data tape formats are given. Documentations of all subroutines are provided. Run instructions, control card structure and program options are also presented. Grey shade images of output on three different display devices for brightness temperature ranges selected to enhance ice/sea differences are shown. Complete program listings are provided. Author (GRA)

N77-13522# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
EXTENDED STUDIES OF A QUADRILATERALIZED SPHERICAL CUBE EARTH DATA BASE Final Report, Jul. 1975 - Mar. 1976
E. M. ONeill and R. E. Laubscher 27 May 1976 114 p refs
(Contract N00228-75-C-2329)
(AD-A026294; CSC/TR-76/6008; NEPRF-TR-3-76(CSC)) Avail: NTIS HC A06/MF A01 CSCL 08/2

This report describes the results of research into a number of aspects of a proposed global meteorological data base. Subjects covered include: improvement of formulation of map transformations; a rapid method of obtaining data base coordinates from satellite elements and scanner angles; comparison of two fast-filling algorithms, the maintenance of multiple-and variable resolution data bases; and the operation of maps in the data base coordinate system. Author (GRA)

N77-13523# Army Engineer Topographic Labs., Fort Belvoir, Va.
SEMIAUTOMATIC PASS POINT DETERMINATION USING DIGITAL TECHNIQUES
Michael A. Crombie Dec. 1975 54 p *refs*
(DA Proj. 4A7-62707-A-855)
(AD-A026082; ETL-0051) Avail: NTIS HC A04/MF A01 CSCL 08/2

This research note describes a study performed at CSL (Computer Sciences Laboratory) to evaluate the feasibility of measuring pass points on overlapping imagery using digital correlation methods instead of utilizing conventional stereo viewing procedures. Rather than investigate the entire problem of automatic pass point mensuration including the logistics and electronic aspects, this study was limited to the photogrammetric problem. The photogrammetric problem is simply the numerical problem associated with the determination of corresponding points. The logistics aspect of the problem pertains to the organization of pass point data and density data with regard to computer storage and retrieval. The electronics aspect of the problem pertains to the scanner, to the image display system, and to the electronic marking device. The basic idea behind the proposed method is that pass points can be measured more quickly, and hopefully more accurately by digital methods than by conventional methods. It should be possible to evaluate each match numerically in the computer, thus rejecting poor determinations and reducing to zero the probability of having to remeasure the model in a triangulation exercise. Generally, an operator will display corresponding image subsets of a particular model on a display device and will visually select pass points by marking them with a cursor. Density data around a selected point will be read into computer memory, and the match (estimated with the cursor) will be refined by using correlation techniques. GRA

N77-13834# Vought Corp., Sterling Heights, Mich.
TARGET AND BACKGROUND SIGNATURE TEST PROGRAM Final Report

L. A. Monicatti Apr. 1976 74 p
(Contract DAAH01-75-C-0533)
(AD-A025822; Rept-7-52100/6R-9) Avail: NTIS HC A04/MF A01 CSCL 17/5

The objectives of this program were to: (a) design and fabricate the necessary hardware, and (b) conduct a test program to obtain the infrared signature data characteristics of various targets and backgrounds. The data were obtained through the use of different types of infrared seekers and/or sensors from the overhead aspect employing a U.S. Army UH-1 type helicopter. Subsequent analysis of the data determined the characteristic signatures of the various targets and backgrounds from the vertical hemisphere. The program was a joint effort between the Vought Corporation Michigan Division, the U.S. Army Missile Command (MICOM), and the U.S. Army Tank and Automotive Command (TACOM). Testing was divided into two phases that were arranged to address various environmental aspects pertaining to various ground terrains, geographical locations, and climatic and seasonal characteristics of the target and background signatures. The two phases were: (a) Southern phase - These tests were conducted at Redstone Arsenal, Alabama in the September - October timeframe. (b) Northern phase - These tests were conducted at Grayling, Michigan in January. The southern test series yielded data against a medium temperature, cool grassy field background while the northern test series provided data obtained against a severe winter/snow background. GRA

N77-13957# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 380, PART 2 (COMPREHENSIVE REPORTS). DATA FOR OCTOBER-SEPTEMBER 1975 AND MISCELLANEA. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 378 (SUPPLEMENT) FEBRUARY 1976
Hope I. Leighton Apr. 1976 34 p refs
(PB-247137-380-2; SGD-380-Pt-2; NOAA-76051113-Pt-2) Avail: NTIS MF A01; HC available from National Climatic Center, Attn: Publications, Federal Bldg., Asheville, N. C. 28801. Subscription $34.00/year includes Part 1 (Prompt Reports) and Part 2 (Comprehensive Reports); $18.00/year for either part. Annual Supplement containing explanation is included. $1.50/copy for either part; $1.40 for the extra issue CSCL 03B

Data that gives measurements of solar activity for the months October and September 1975 are reported. These data reports are based on the D2-B satellite results which was launched from French Guyana and which has been collecting spectroheliograms. GRA

N77-14542*# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
[LANDSAT DATA UNDER TYPICAL EUROPEAN ENVIRONMENTAL FRAME CONDITIONS] Progress Report, 9 Sep. 1975 - 9 Sep. 1976
J. Bodechtel, Principal Investigator 9 Sep. 1976 3 p Sponsored by NASA ERTS
(E77-10031; NASA-CR-149096; PR-1) Avail: NTIS HC A02/MF A01 CSCL 05B

N77-14558*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
INVESTIGATION OF SPATIAL MISREGISTRATION EFFECTS IN MULTISPECTRAL SCANNER DATA Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, W. A. Malila, J. M. Gleason, and R. C. Cicone May 1976 79 p refs EREP
(Contract NAS9-14123)
(E77-10059; NASA-CR-150999; ERIM-109600-68-F) Avail: NTIS HC A05/MF A01 CSCL 02F

The author has identified the following significant results. A model for estimating the expected proportion of multiclass pixels in a scene was generalized and extended to include misregistration effects. Another substantial effort was the development of a simulation model to generate signatures to represent the distributions of signals from misregistered multiclass pixels, based on single class signatures. Spatial misregistration causes an increase in the proportion of multiclass pixels in a scene and a decorrelation between signals in misregistered data channels. The multiclass pixel proportion estimation model indicated that this proportion is strongly dependent on the pixel perimeter and on the ratio of the total perimeter of the fields in the scene to the area of the scene. Test results indicated that expected values computed with this model were similar to empirical measurements made of this proportion in four LACIE data segments.

N77-14560*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SIGNATURE EXTENSION USING TRANSFORMED CLUSTER STATISTICS AND RELATED TECHNIQUES Final Report, 15 May 1975 - 14 May 1976
Richard F. Nalepka, Principal Investigator, P. F. Lambeck, and D. P. Rice May 1976 79 p refs EREP
(Contract NAS9-14123)
(E77-10061; NASA-CR-151001; ERIM-109600-70-F) Avail: NTIS HC A05/MF A01 CSCL 05B

N77-14570*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT. NON-US STANDARD CATALOG NO. N-34
30 Jun. 1975 165 p
(NASA-TM-X-74270) Avail: NTIS HC A08/MF A01 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Section 1 and 2 described the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N77-14673# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SELDADS: AN OPERATIONAL REAL-TIME SOLAR-TERRESTRIAL ENVIRONMENT MONITORING SYSTEM
D. J. Williams Mar. 1976 79 p refs
(PB-256131/4; NOAA-TR-ERL-357; SEL-37; NOAA-76051303) Avail: NTIS HC A05/MF A01 CSCL 04A

The real time solar terrestrial environment monitoring system is described. Information provided includes sources of data, computer systems employed, kinds of data now available and soon to be available, methods of accessing data, and names and addresses of key personnel to contact for access. A description of each type of data available is given which includes satellites or observatories reporting, parameters reported, frequency of report, medium of report, retention period for on line availability, list of display formats, and sample displays. GRA

N77-15243# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
RADAR IMAGE SIMULATION PROJECT: DEVELOPMENT OF A GENERAL SIMULATION AND AN INTERACTIVE SIMULATION MODEL, AND SAMPLE RESULTS Contract Report, Dec. 1974 - Feb. 1976
J. C. Holtzman, V. H. Kaup, R. L. Martin, E. E. Komp, and V. S. Frost Feb. 1976 228 p refs
(Contract DAAK02-73-C-0106)
(AD-A027151; RSL-TR-234-13; ETL-0047) Avail: NTIS HC A11/MF A01 CSCL 17/9

This document reports the results of a radar image simulation study performed at the Remote Sensing Laboratory, the University of Kansas, Lawrence, Kansas. The work was sponsored by the U.S. Army Engineering Topographic Laboratories, Fort Belvoir, Virginia. The purpose of this study was to develop radar image simulation and feature extraction techniques. A general model for simulating radar imagery is developed. This model is applicable

to both SLAR (Side-Looking Airborne Radar) and PPI (Plan Position Indicator) radar system image formats. It can produce simulations from both flat and mountainous terrain. The model requires as input a completely specified digital ground truth data base. The radar reflectivity data calculated for each image simulation can be determined from a variety of input data sources. The results presented in this document have all been produced using for input reflectivity data, empirical radar backscatter data from a large agricultural/soil moisture data bank available at the Remote Sensing Laboratory. Also reported is a technique for automating feature extraction, creation of data bases, and interactive radar simulation. A model is developed which incorporates an image analyst (human) in the decision process as the computer simulation program runs. Automatic pattern recognition software is used to pre-process the data base and the interpreter/simulator is given the flexibility to specify or alter previous specifications in real-time in synthesizing the radar image. Author (GRA)

N77-15477# Naval Postgraduate School, Monterey, Calif.
TACTICAL ELECTRONIC RECONNAISSANCE PROCESSING AND EVALUATION SEGMENT, A NEW LOOK M.S. Thesis
Daniel Patrick Kollay and Kenneth Lee Kreutzer Jun. 1976 99 p refs
(AD-A027248) Avail: NTIS HC A05/MF A01 CSCL 15/4

With the proposed procurement of EA-6B aircraft, the U.S. Marine Corps planned the development of TERPES (Tactical Electronic Reconnaissance Processing and Evaluation Segment) to perform post-mission tape analysis. The development phase was initiated on a first generation tactical computer, CP-642B. The thrust of this paper was to identify state-of-the-art replacements for the CP-642B, while identifying areas of concern within the development cycle. Alternative systems were discussed with the emphasis on system flexibility and expandability.
Author (GRA)

N77-15567*# Illinois Univ., Urbana. Aeronomy Lab.
AERONOMY REPORT NO. 74: THE URBANA METEOR-RADAR SYSTEM; DESIGN, DEVELOPMENT, AND FIRST OBSERVATIONS
G. C. Hess and M. A. Geller 1 Oct. 1976 351 p refs
(Grants NGR-14-005-181; NSF ATM-76-01773)
(NASA-CR-149386; UILU-ENG-76-2505; ISSN-0568-0581)
Avail: NTIS HC A16/MF A01 CSCL 04A

The design, development, and first observations of a high power meteor-radar system located near Urbana, Illinois are described. The roughly five-fold increase in usable echo rate compared to other facilities, along with automated digital data processing and interferometry measurement of echo arrival angles, permits unsurpassed observations of tidal structure and shorter period waves. Such observations are discussed. The technique of using echo decay rates to infer density and scale height and the method of inferring wind shear from radial acceleration are examined. An original experiment to test a theory of the Delta-region winter anomaly is presented. Author

N77-15583*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
SYNOPTIC ANALYSES, 5-, 2-, AND 0.4-MILLIBAR SURFACES, JULY 1973 - JUNE 1974
Washington 1976 144 p refs Prepared in cooperation with National Weather Service, Camp Springs, Md.
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Satellite radiance measurements and data from meteorological rocketsondes were employed to analyze a series of high-altitude constant pressure charts. The methods of processing the various types of data and the analysis procedure used are described. Broad-scale analyses for the Northern Hemisphere 5-, 2-, and 0.4-mb surfaces are presented for each week of the period from September through April, and on a once-per-month basis for July, August, May, and June. A brief discussion of the variations of the temperature and height fields throughout the year is also given. Author

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A77-10892 # **Microwave sensing of atmospheric ozone.** L. M. Mitnik (Leningradskii Gidrometeorologicheskii Institut, Leningrad, USSR). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-055.* 8 p. 20 refs.

The possibility of remote sensing of ozone by microwave radiation measurements is examined. The microwave spectrum of ozone is discussed, where the integral absorption of ozone is calculated relative to the strongest lines within the frequency range 140-610 GHz. Absorption coefficients are estimated from standard temperature and pressure profiles and mean ozone vertical distribution. Model calculations are made to determine the frequency dependence of brightness temperature near resonant transitions of ozone. The need for high-sensitivity microwave spectral radiometers for atmospheric ozone sensing is emphasized. S.D.

A77-12109 * **Ultraviolet stellar occultation measurement of the H2 and O2 densities near 100 km in the earth's atmosphere.** S. K. Atreya, B. Wasser (Michigan, University, Ann Arbor, Mich.), T. M. Donahue, W. E. Sharp, J. F. Drake, and G. R. Riegler. *Geophysical Research Letters,* vol. 3, Oct. 1976, p. 607-610. 11 refs. Research supported by the Lockheed Independent Research Program; Grants No. NsG-5097; No. NsG-5117; Contract No. NAS7-100. NASA Task RD-65.

Results are presented for an experimental study designed to measure the density of H2 near 100 km in the earth's atmosphere from occultation of a star, Gamma Vel, by the earth's atmosphere at several wavelengths near the H2 absorption line at 1108.128 A by a spectrometer on an orbiting astronomical observatory. Measurement of the O2 density between 95 and 123 km is also reported. Attention is focused on testing the predictions of a model of the distribution of hydrogen constituents, H, H2, H2O, CH4, OH, and H2O in the upper atmosphere related to a theory of hydrogen escape developed by Hunten and Strobel (1974) and by Liu and Donahue (1974). The measured H2 densities are found to be in good agreement with recent theoretical predictions, whereas the measured O2 density profile generally agrees with the models except for a wavelike structure in the range 104-114 km. S.D.

A77-12329 # **Numerical analysis of geopotential field from atmospheric remote sensing data (Chislennyi analiz polia geopotentsiala po dannym distantsionnogo zondirovaniia atmosfery).** O. M. Pokrovskii and E. E. Ivanykin (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). *Meteorologiia i Gidrologiia,* July 1976, p. 45-55. 9 refs. In Russian.

The technique developed by Pokrovskii and Ivanykin (1976) for exploitation of indirect meteorological data is applied to the analysis of the geopotential field from satellite data on the emerging thermal radiation of the earth-satellite system. A variety of data exploitation schemes are discussed: spatial extrapolation and interpolation, optimal filtration of the set of satellite data, and spatial matching of aerological data and remote sensing data with objective statistical analysis of the geopotential field. Results of computer-based numerical simulation of the schemes are presented. It is shown that the proposed technique allows a better utilization of satellite data than conventional methods of data interpretation. S.D.

A77-12983 # **Data reception in the S-band, 1.7 and 2.3 GHz, of NOAA, VHRR and ERTS /Landsat/-satellites - The Bochum 20-m parabolic universal antenna (Datenempfang im S-Band-1,7 und 2,3 GHz - von NOAA-VHRR und ERTS /Landsat/-Satelliten - Die Bochumer 20 m Parabol-Universalantenne).** H. Kaminski (Bochum, Sternwarte, Bochum, West Germany). *Deutsche Gesellschaft für Luft- und Raumfahrt, Symposium über Telemetrie-Messdatenerfassung, Echtzeitdatenreduzierung und -speicherung, Munich, West Germany, June 23, 24, 1976, Paper.* 64 p. 22 refs. In German.

During the years from 1964 to 1967 a receiving antenna for the communication between ground and earth satellites was built for the Institute of Space Research at the Bochum Observatory in West Germany. The 20-m parabolic antenna can be used also for studies in the area of radio astronomy involving the VHF, the UHF, and the SHF range. Attention is given to aspects of antenna design, the reflector surface, the radome, the parametric amplifier, questions of antenna control, the design of a recently developed control system, and the characteristics of antenna position. G.R.

A77-13214 **Analytic aerotriangulation utilizing Skylab earth terrain camera /S-190B/ photography.** M. Keller (NOAA, National Ocean Survey, Rockville, Md.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Nov. 1976, p. 1375-1383. 15 refs.

Analytic aerotriangulation is a digital solution based on observed coordinates of the images created by pertinent objects on each photograph covering a certain area. The advantages of analytic aerotriangulation accrue from automation, digital accuracy, least-squares adjustment, and freedom from the mechanical discrepancies contributed by stereoscopic analog plotting instruments. Results are presented from a study investigating the feasibility of using Skylab earth terrain camera photography in aerotriangulation procedures to provide low-order, high-density control suitable for small-scale mapping operations. Computer processing is discussed relative to image coordinate refinement and three-photo orientation, secant plane coordinate transformation, strip adjustment to ground control, block adjustment, and accuracy analysis. An RMS error of 15 m in horizontal position is obtained for a 12-photo strip. S.D.

A77-13219 **Digital sensor simulation.** M. B. Faintich (Defense Mapping Agency, Aerospace Center, St. Louis Air Force Station, Mo.). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Nov. 1976, p. 1427-1440.

The paper describes the physical models used and examples simulated with a digital radar simulation computer software. The software is written from the viewpoint of utilizing the sensor required information contained in the data bases. The simulations require two input data bases, with both data bases registered in an array format. Radar scenes were simulated utilizing digital culture and terrain data bases. Parameters affecting radar simulations and comparisons of actual and simulated scenes are presented. The results indicate that digital data bases can be used to effectively simulate radar scenes. The computer program is shown to be a valuable editing and analysis tool for the production of digital data bases. Numerous photographs supplement the text. S.D.

A77-13432 * **Topside optical view of the dayside cleft aurora.** G. G. Shepherd, F. W. Thirkettle (York University, Downsview, Ontario, Canada), and C. D. Anger (Calgary, University, Calgary, Alberta, Canada). *Planetary and Space Science,* vol. 24, Oct. 1976, p. 937-944. 28 refs. Research supported by the National Research Council of Canada, Communications Research Centre of Ottawa, and NASA.

Photometers on the ISIS-II spacecraft provide a view of the atomic oxygen 5577-A and 6300-A emissions and the N2(+) 3914-A emission detected as dayside aurora in the magnetospheric cleft region. The 6300-A emission forms a continuous and permanent band across the noon sector, at about 78 deg invariant latitude, with a defined region of maximum intensity that is never less than 2 kR (uncorrected for albedo) and is centered near magnetic noon. There are significant differences in the intensity patterns on either side of noon and their responses to geomagnetic activity. Discrete 3914-A auroral forms appear within this region at preferred locations that cannot be precisely specified but which tend to the poleward edge of the 6300-A emission in the evening and the equatorward edge in the morning, where the difference between the two emissions is greatest. It is concluded that the discrete auroras observed by all-sky cameras

in the day sector follow the 6300-A emission through the cleft region, though a definite cleft boundary is not defined. (Author)

A77-13512 Installation of a Dobson ozone spectrophotometer in the Seychelles. J. H. Convery. *Meteorological Magazine,* vol. 105, Nov. 1976, p. 350-357.

A new ozone observing station using a Dobson ozone spectrophotometer was opened Nov. 1, 1975 at Mahe, Seychelles (4 deg S, 53 deg E). The Dobson spectrophotometer is a double-beam monochromator operating in the ultraviolet Hartley absorption band of O3 (290-340 nm). The operation and calibration of the spectrophotometer are described, and a diagram illustrating the optics of the instrument is presented. B.J.

A77-13672 *Speckle reduction in synthetic-aperture radars.* L. J. Porcello, N. G. Massey, R. B. Innes, and J. M. Marks (Michigan, Environmental Research Institute, Ann Arbor, Mich.). *Optical Society of America, Journal,* vol. 66, Nov. 1976, p. 1305-1311. 15 refs. USAF-supported research.

Airborne synthetic-aperture radar (SAR) systems employ coherent techniques to generate images of terrain in the microwave region of the spectrum. The high degree of coherence required by radar system considerations results in the presence of radar speckle when diffuse scatterers are imaged. It is possible to introduce frequency and/or angle diversity in such a manner that multiple uncorrelated images of the terrain may be generated and then summed incoherently to reduce the speckle. When system bandwidth and/or viewing angle is severely constrained, then a compromise must be made between image resolution and speckle reduction. Visual examination of controlled samples of radar imagery shows that speckle is reduced noticeably when incoherent summation of uncorrelated images is provided via use of diversity. Some examples of radar images with varying degrees of diversity are presented in the paper and are compared qualitatively. (Author)

A77-14500 Ambiguities in the deduction of rest frame fluctuation spectrums from spectrums computed in moving frames. R. W. Fredricks (TRW Systems, Redondo Beach, Calif.) and F. V. Coroniti (TRW Systems, Redondo Beach; California, University, Los Angeles, Calif.). *Journal of Geophysical Research,* vol. 81, Nov. 1, 1976, p. 5591-5595.

An investigation is conducted of problems related to the measurement of density irregularities or magnetic (or electric) field fluctuations by sensors moving in relation to the plasma rest frame, as for example sensors borne by satellites or rocket payloads. Attention is given to the precision of interpretation of such moving frame spectral measurements in terms of the in situ rest frame frequency of wavelength spectrums. It is demonstrated that, in general, interpretations of the computed satellite frame frequency function spectrum according to the conventional procedure can lead to erroneous physical conclusions. G.R.

A77-14590 Retrieval of atmospheric temperature and composition from remote measurements of thermal radiation. C. D. Rodgers. *Reviews of Geophysics and Space Physics,* vol. 14, Nov. 1976, p. 609-624. 71 refs. Research supported by the National Center for Atmospheric Research.

This paper reviews the methods which may be used to estimate the state of the atmosphere, i.e., the distribution of temperature and composition, from measurements of emitted thermal radiation such as are made by remote sounding instruments on satellites. The principles of estimation theory are applied to a linear version of the problem, and it is shown that many of the apparently different methods to be found in the literature are particular cases of the same general method. As an aid to understanding, the optimum linear solution is described in terms of the geometry of n dimensions, with $n = 3$ for illustration. In generalizing the approach to the nonlinear problem there are two stages: (1) finding any member of the infinite family of possible solutions, which may be done by any convenient iterative method, and (2) finding the optimum solution by satisfying appropriate constraints. (Author)

A77-14917 # Analytical solution of a model radiative equation arising in atmospheric sounding. V. Barcilon (Chicago, University, Chicago, Ill.). *Journal of Quantitative Spectroscopy and Radiative Transfer,* vol. 16, Dec. 1976, p. 1031-1041. 14 refs. Contract No. N00014-76-C-0034.

Kaplan (1974) proposed a simple analytical model for the atmospheric transmission function appropriate for the CO2 bands. This model transmission function is used to infer the thermal structure of the atmosphere from remote sensing measurements. An analytical solution is derived for a large class of outgoing radiances. The model describes the existence of a tropopause and yields a formula for the surface temperature. B.J.

A77-14949 # Consideration of the nonlinear characteristics of slotted shutters (Uchet nelineinoi kharakteristiki shtornykh zatvorov). V. M. Biriukov. *Geodeziia i Aerofotos'emka,* no. 3, 1976, p. 69-74. In Russian.

The paper examines nonlinear image distortions caused by the slotted shutter of an aerial camera. Formulas are presented for the magnitude of corrections for the nonlinearity of the velocity of shutter motion. A method is proposed for increasing the accuracy of the processing of aerial photographs without a single scene center. B.J.

A77-15059 Analysis of geophysical remote sensing data using multivariate pattern recognition techniques. P. E. Anuta, D. W. Levandowski (Purdue University, West Lafayette, Ind.), and H. Hauska. In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 1B-11 to 1B-14. 5 refs.

Multivariate analysis techniques were applied to geophysical remote sensing data which measures phenomena occurring beneath the surface of the earth. Three types of geophysical data: magnetic anomaly, induced pulse transient, and gamma ray data were digitized, registered and analyzed to observe relationships to known geology. In addition, several types of surficial remote sensing data including Landsat multispectral scanner, side looking airborne radar and thermal infrared scanner data were included in the multivariate data set to enable evaluation of all the available remote sensing variables. (Author)

A77-15065 * Landsat Signature Development Program. R. N. Hall, K. G. McGuire (Federal Electric Corp., Kennedy Space Center, Fla.), and R. A. Bland (NASA, Earth Resources Office, Cocoa Beach, Fla.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 2A-36 to 2A-42. 11 refs.

The Landsat Signature Development Program, LSDP, is designed to produce an unsupervised classification of a scene from a Landsat tape. This classification is based on the clustering tendencies of the multispectral scanner data processed from the scene. The program will generate a character map that, by identifying each of the general classes of surface features extracted from the scene data with a specific line printer symbol, indicates the approximate locations and distributions of these general classes within the scene. Also provided with the character map are a number of tables each of which describes either some aspect of the spectral properties of the resultant classes, some inter-class relationship, the incidence of picture elements assigned to the various classes in the character map classification of the scene, or some significant intermediate stage in the development of the final classes. (Author)

A77-15072 * Estimation of the probability of error without ground truth and known a priori probabilities. K. A. Havens, T. C. Minster, and S. G. Thadani (Lockheed Electronics Co., Inc., Aerospace Systems Div., Houston, Tex.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings.

New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 3A-16 to 3A-21. Contract No. NAS9-12200.

The probability of error or, alternatively, the probability of correct classification (PCC) is an important criterion in analyzing the performance of a classifier. Labeled samples (those with ground truth) are usually employed to evaluate the performance of a classifier. Occasionally, the numbers of labeled samples are inadequate, or no labeled samples are available to evaluate a classifier's performance; for example, when crop signatures from one area from which ground truth is available are used to classify another area from which no ground truth is available. This paper reports the results of an experiment to estimate the probability of error using unlabeled test samples (i.e., without the aid of ground truth). (Author)

A77-15074 * Number of signatures necessary for accurate classification. W. Richardson, A. Pentland, R. Crane, and H. Horwitz (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 3A-28 to 3A-34. Contract No. NAS9-14123.

This paper presents a procedure for determining the number of signatures to use in classifying multispectral scanner data. A large initial set of signatures is obtained by clustering the training points within each category (such as 'wheat' or 'other') to be recognized. These clusters are then combined into broader signatures by a program that considers each pair of signatures within a category, combines the best pair in the light of certain criteria, saves the combined signature and repeats the procedure until there is one signature for each category. The result is a collection of sets of signatures, one set for each number between the number of initial clusters and the number of categories. With the aid of statistics such as an estimate of the probability of misclassification between categories, the user can choose the smallest set satisfying his requirements for classification accuracy. (Author)

A77-15182 * An earth and ocean SAR for Space Shuttle - User requirements and data handling implications. E. A. Cohen, J. G. Mehlis, R. L. Jordan, W. E. Brown, Jr. (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div., Pasadena, Calif.), and J. W. Rouse, Jr. (Texas A & M University, College Station, Tex.). In: National Telecommunications Conference, New Orleans, La., December 1-3, 1975, Conference Record. Volume 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 37-18, 37-19. Contract No. NAS7-100.

A brief summary is presented of user requirements for the Shuttle synthetic aperture radar (SAR) to be flown on a sortie mission of 7 to 10 days in duration, based on information collected from survey of the literature and direct user contacts. This information suggests selection of a dual frequency (L and X band) dual polarization SAR capable of meeting most user requirements. Particular attention is given to the SAR system specifications and the data handling capability expected to be available during the 1980s for the tracking and data relay satellite system (TDRSS). The data link requirements of the majority of Shuttle experiments will eventually determine whether the necessary high-capacity Shuttle-TDRSS return link will be part of the intrinsic Shuttle capability or will be part of the SAR payload. S.D.

A77-15645 # Remote sensing of earth resources with the aid of balloons (La télédétection des ressources terrestres à partir des ballons). L. Laidet (Groupement pour le Développement de la Télédétection Aérospatiale, Toulouse, France). In: Symposium on Research Utilizing Balloons, Schliersee, West Germany, October 10, 11, 1974, Proceedings. Garching, West Germany, Max-Planck-Institut für Physik und Astrophysik, 1976, p. 223-229. In French.

An analysis is conducted concerning the possibilities provided by balloons for remote sensing applications, taking into account the use of free, captive, and dirigible balloons. Problems concerning the employment of free balloons are related to difficulties in the prediction of their flight path. The use of free balloons with light and heavier payloads is considered. Captive balloons, in connection with the immobility of their position, are very suitable for the observation of certain points and areas. Constraints regarding their use are related to air traffic safety considerations. Dirigible balloons constitute a new family of air-borne vehicles with a great potential for remote sensing applications. A brief description is given of operations conducted with free stratospheric balloons carrying cameras. G.R.

A77-15782 * In situ measurements of neon in the thermosphere. W. E. Potter and D. C. Kayser (Minnesota, University, Minneapolis, Minn.). *Geophysical Research Letters,* vol. 3, Nov. 1976, p. 665-668. 11 refs. Contract No. NAS5-11438.

The open source neutral mass spectrometer on the Atmosphere Explorer-C satellite has measured neon in the thermosphere. The absolute density of Ne is close to that predicted by using the ground level fraction by volume of Ne along with the assumption of diffusive equilibrium above 100 km. Data is presented for both geomagnetically quiet and disturbed circular orbits. At 290 km, a typical low latitude value of Ne is 3.0 x 10 to the 4th/cu cm. At this altitude Ne appears to be predominantly controlled by temperature except during magnetic disturbances, when offsetting forces due to wind systems may be present. (Author)

A77-16788 Results of the International Orthophoto Experiment 1972-76. T. J. Blachut and M. C. van Wijk (National Research Council, Ottawa, Canada). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Dec. 1976, p. 1483-1498.

The International Orthophoto Experiment 1972-76 has been carried out under the auspices of ISP Working Group II-4. The paper describes the various phases of the experiment and the results of the analysis of the geometrical quality of orthophotos and height data. The orthophoto image quality, offered by direct optical projection, optical image transfer and electronic image transfer is compared. Information on the time which was needed for the various orthophoto production stages is included. (Author)

A77-16790 System errors of differential rectifiers with optical projection. H. Schöler (Jenoptik Jena GmbH, Jena, East Germany). *(International Society for Photogrammetry, Orthophoto Symposium, São Paulo, Brazil, July 1975.) Photogrammetric Engineering and Remote Sensing,* vol. 42, Dec. 1976, p. 1505-1509.

The paper investigates the imaging errors in 'on-line' instrument systems. Errors present themselves as double images, missing image detail, and image point displacements along the strip. A discussion of the errors is followed by pointing out instrumental correction capabilities. Considerations regarding image motion, resolving power, and the flatness of photographic material conclude the paper. (Author)

A77-16791 The stereo-orthophoto technique in cadastral and general mapping. T. J. Blachut (National Research Council, Ottawa, Canada). *(Pan American Conference on the Role of Integrated Land Surveys in the Development of Countries, Bogota, Colombia, Feb. 9-13, 1976.) Photogrammetric Engineering and Remote Sensing,* vol. 42, Dec. 1976, p. 1511-1519. 6 refs.

Single orthophotos not only do not convey the general concept of the vertical configuration of terrain, but also do not permit vertical measurements of the terrain and its man-made or natural details. The stereo-orthophoto technique overcomes these limitations without affecting the essential simplicity of the orthophoto approach. Through the introduction of artificial horizontal parallaxes which are proportional to height differences, the single orthophotos are replaced by stereo-orthophoto pairs in which one picture is a normal orthophoto and the second (stereo-mate) is an orthophoto modified by artificially introduced horizontal parallaxes. The use of this technique for cadastral, topographical ad land inventory mapping is examined. B.J.

A77-16792 Production and accuracy of simultaneously scanned stereo-orthophotos. S. H. Collins (Guelph, University, Guelph, Ontario, Canada) and M. C. van Wijk (National Research Council, Ottawa, Canada). *Photogrammetric Engineering and Remote Sensing,* vol. 42, Dec. 1976, p. 1521-1528. 7 refs.

The creation of an orthophotoscope (the SFOM Orthophotographe) which produces stereo-orthophoto pairs simultaneously from one space model has permitted the test of the theory that errors of heighting in the stereo-orthophotos are very nearly independent of profiling errors, if the parallax introduced into the stereomate is correct. Heighting errors with a mean square value of 0.2-0.3% of the flying height were obtained, using an instrument in which the fundamental errors of heighting in profiling are of the order of 0.6-1% of the flying height. This demonstrates the cancellation of flying errors in the optical and forced parallaxes of the orthophoto and stereomate. B.J.

A77-16892 Radar auroral substorm signatures. I - Expansive and recovery phases. R. T. Tsunoda and E. J. Fremouw (Stanford Research Institute, Menlo Park, Calif.). *Journal of Geophysical Research,* vol. 81, Dec. 1, 1976, p. 6148-6168. 54 refs. NSF Grant No. DES-72-01644A02; Contracts No. DNA001-72-C-0179; No. DNA001-74-C-0167.

Selected radar auroral substorm signatures as seen with the Homer 398-MHz phased array radar are described. The more easily identified radar substorm signatures have been categorized and related to the auroral and magnetic conditions that prevailed during the corresponding phase of a substorm. The selected categories are (1) bifurcation of diffuse auroral echoes, (2) poleward and equatorward movements, and (3) the sudden appearance of discrete auroral echoes. The second part of the paper deals with east-west motions identified in the radar signatures, namely the westward travelling surge in the premidnight sector and eastward motions in the morning sector. An analysis of visual, geomagnetic, and Chatanika radar data has made it clear that a hooklike radar signature is associated with the visual westward travelling surge. B.J.

A77-16907 A rocket measurement of the O2/b 1 Sigma g + -X 3 Sigma g -//0-0/ atmospheric band in aurora. A. J. Deans, G. G. Shepherd (York University, Downsview, Ontario, Canada), and W. F. J. Evans (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada). *Journal of Geophysical Research,* vol. 81, Dec. 1, 1976, p. 6227-6232. 24 refs.

A multichannel stepping filter spectrophotometer aboard a sounding rocket was used to measure the O2(b 1 Sigma g + -X 3 Sigma g -)(0-0) auroral emission at 7619 A. The observed integrated intensities of the O2(b 1 Sigma g +)(0-0), O I 5577 A, and N2(+) 4278 A emissions were 28, 40, and 6 kR, respectively, and the observed I(7619 A)/I(4278 A) ratio of 4.5 is an order of magnitude lower than that obtained in recent theoretical calculations or deduced from ground-based photometric measurements. B.J.

A77-16995 # Estimation of the quality of aerial photographs (Opyt otsenki kachestva aerosnimka). O. I. Anufriev and A. N. Zhivichin. *Geodeziia i Kartografiia,* Oct. 1976, p. 30-36. 10 refs. In Russian.

The relations of the resolving power of an aerial photograph to the accuracy of photogrammetric measurements and to the probability of recognition of terrain objects on the photograph are examined. A statistical analysis is used to study the accuracy of determining the resolving power of aerial photographs in terms of mean-square errors, and differences of longitudinal parallaxes. B.J.

A77-17378 * Airborne bathymetric charting using pulsed blue-green lasers. H. H. Kim (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Applied Optics,* vol. 16, Jan. 1977, p. 46-56. 12 refs. Navy-NASA-supported research.

Laboratory and airborne experiments have proven the feasibility and demonstrated the techniques of an airborne pulsed laser system for rapidly mapping coastal water bathymetry. Water depths of 10 plus or minus 0.25 m were recorded in waters having an effective attenuation coefficient of 0.175 m. A 2-MW peak power Nd:YAG pulsed laser was flown at an altitude of 600 m. An advanced system, incorporating a mirror scanner, a high pulsed rate laser, and a good signal processor, could survey coastal zones at the rate of several square miles per hour. (Author)

A77-18276 Low light level devices for science and technology; Proceedings of the Seminar, Reston, Va., March 22, 23, 1976. Seminar sponsored by the Society of Photo-Optical Instrumentation Engineers. Edited by C. Freeman (U.S. Army, Night Vision Laboratory, Fort Belvoir, Va.). Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 78), 1976. 168 p. $34.

Papers presented at the conference cover the general topics: general applications of low light level (LLL) devices, applications of LLL devices in public services (mining, security systems, firefighting, fisheries management), uses of LLL devices in astronomy, and applications of LLL devices in medicine. Microchannel image inverters, image intensifiers, charge-coupled devices and charge-injection devices and their intensified variants (ICCD, ICID), IR thermography, forward looking IR equipment (FLIR), and video densitometry systems are representative of the hardware discussed. Medical applications concern cancer diagnosis (thermography), LLL monitoring of internal organs and tissues, nuclear medicine (scintigraphy), enhanced X-ray diagnostics, night vision aids for night blindness sufferers, and LLL video techniques in biomedical research. R.D.

A77-18358 * Remote sensing of atmospheric water vapor and liquid water with the Nimbus 5 microwave spectrometer. D. H. Staelin, K. F. Kunzi, R. L. Pettyjohn, R. K. L. Poon, R. W. Wilcox (MIT, Cambridge, Mass.), and J. W. Waters (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Journal of Applied Meteorology,* vol. 15, Nov. 1976, p. 1204-1214. 25 refs. Contracts No. NAS7-100; No. NAS5-21980.

The Nimbus 5 satellite is provided with a passive microwave spectrometer (NEMS) incorporating channels at 22.235 and 31.4 GHz to measure atmospheric water vapor and liquid water over ocean. The discussion covers principles of atmospheric water determination, accuracy of measurements, observations of specific storms and fronts, and observations of water vapor and liquid water on a global scale. The NEMS experiment has demonstrated the ability of a two-channel microwave spectrometer to determine integrated abundances of water vapor and liquid water with estimated rms accuracies of 0.2 and 0.01 g per sq cm, respectively. The data can be used to plot global maps or accumulate global statistics. S.D.

A77-18529 # Classification of flares and flarelike events observed during the Skylab mission. V. E. Scherrer and R. Tousey (U.S. Navy, Naval Research Laboratory, Washington, D.C.). In: Scientific investigations on the Skylab satellite; Conference, Huntsville, Ala., October 30-November 1, 1974, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1976, p. 105-122. 8 refs. (AIAA 74-1236)

Several dozen flares and subflares were observed by the S082A spectroheliograph (171-630 A) and the S082B ultraviolet spectrograph (970-1970 A) during the Skylab missions. Time-lapse sequences of spectroheliograms are shown to illustrate the spatial characteristics of these flares in various emitting wavelengths. Time-lapse sequences of XUV spectra are used to illustrate characteristics of the flare plasma during these events. The observations are correlated with Solrad X-ray data and with H-alpha images that show where S082B was pointed. (Author)

A77-18668 Certain possibilities for determination of underlying-surface temperatures from satellites in the 8-12 microns window. V. M. Ivanov and Iu. A. Savitskii (Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Moscow, USSR). *(Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,* vol. 12, Apr. 1976, p. 433,

434.) *Academy of Sciences, USSR, Izvestiya, Atmospheric and Oceanic Physics*, vol. 12, Nov. 1976, p. 261, 262. 7 refs. Translation.

A77-18765 **Magnetic field measurements on board of altitude rockets (Magnetfeldmessungen an Bord von Höhenforschungsraketen).** B. Theile and H. Lühr (Braunschweig, Technische Universität, Braunschweig, West Germany). *Raumfahrtforschung*, vol. 20, Nov.-Dec. 1976, p. 301-305. In German.

Investigations with three types of payloads including magnetometers of high resolution are conducted in connection with the national altitude rocket program of West Germany. The investigations have the objective to study the dynamics and the effects of magnetospheric substorms. Magnetic field measurements are used in the detection of magnetospheric and ionospheric currents. A technical description of the magnetometer is given, taking into account the parameters to be measured, questions of instrument design, test and calibration problems, and instrument characteristics. G.R.

A77-18965 **High contrast blue and green band multispectral photography for improved scene recording.** D. S. Ross. In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 12-24. 5 refs.

The scene contrast of high-altitude multispectral photography is severely degraded in the blue and green spectral regions by atmospheric light scattering and attenuation. Information of interest in earth sciences such as oceanography is often reduced to such low contrast levels that it fails to record on conventional film emulsions. Aerial flight tests are described where comparison images were taken on a standard aerial emulsion, and on a graphic arts emulsion developed to gamma 6.0. The performance of two color films was also compared with the latter. In all cases the high contrast film succeeded in recording low contrast detail not recorded by the standard films, and in recording subsurface imagery at greater water depths, in both the blue and green spectral bands. (Author)

A77-18976 **Stereo facet plotter and its uses.** H. Yzerman. In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 223-227.

Representation of a terrain in an aerial photograph by a number of small planes or facets involves conformal, perspective, and affine distortions. The paper outlines the major features of a new device referred to as the stereo facet plotter which employs a special-purpose Brewster-Amici prismatic telescope which can independently compensate for the distortions cited. The device permits both a stereoscopic interpretation of details and a stereoscopic delimitation of facets. The required accuracy can be estimated and gross errors can be avoided. S.D.

N77-10329*# Miami Univ., Fla.
CALIBRATION AND VERIFICATION OF ENVIRONMENTAL MODELS
Samuel S. Lee, Subrata Sengupta, Norman Weinberg, and Homer Hiser *In* NASA. Langley Res. Center Advan. in Eng. Sci., Vol. 3 1976 p 1093-1103 refs

Avail: NTIS HC A20/MF A01

The problems of calibration and verification of mesoscale models used for investigating power plant discharges are considered. The value of remote sensors for data acquisition is discussed as well as an investigation of Biscayne Bay in southern Florida. D.M.L.

N77-10495*# Kanner (Leo) Associates, Redwood City, Calif.
AIRCRAFT MICROWAVE RADIOMETRIC EQUIPMENT WITH INCREASED SENSITIVITY FOR REMOTE SOUNDING OF UNDERLYING LAYERS
V. R. Amirkhanyan, Ye. A. Bespalova, M. G. Bulatov, V. M. Veselov, N. N. Vorsin, Yu. A. Militskiy, V. G. Mirovskiy, Yu. A. Nemlikher, V. V. Nikitin, M. D. Rayev *et al* *Washington* NASA Oct. 1976 17 p refs Transl. into ENGLISH of "Kompleks Samoletnoy mikrovolnovoy radiometricheskoy apparatury povyshennoy chuvstvitelnosti dlya distantsionnogo zondirovaniya podsti layushchika poverkhnostey", Rept-Pr-244 USSR Acad. Sci., Inst. of Space Res., Moscow, 1975 p 1-16
(Contract NASw-2790)
(NASA-TT-F-17266) Avail: NTIS HC A02/MF A01 CSCL 14B

Theoretical and experimental studies in recent years have shown the promise of radiophysical methods in remote sounding of underlying surfaces of the earth. The use of passive radiometer receivers for remote sensing is discussed. Brief presentations and technical characteristics are set forth for some radiometer receivers that were installed in an aircraft laboratory. The noise sensitivity of the various radiometers was studied, and is reported. Block diagrams are given which illustrate the radiometer equipment. Author

N77-10594*# Department of Industry, London (England).
MESOSCALE ASSESSMENTS OF CLOUD AND RAINFALL OVER THE BRITISH ISLES
Eric C. Barrett, Principal Investigator, Colin K. Grant, and R. Harris Sep. 1976 53 p refs Sponsored by NASA and Dept. of Industry, London ERTS
(E77-10012; NASA-CR-148982; QR-4) Avail: NTIS HC A04/MF A01 CSCL 04B

N77-10619*# National Conference of State Legislatures, Washington, D.C.
NATIONAL CONFERENCE OF STATE LEGISLATURES' TASK FORCE ON USES OF SATELLITE REMOTE SENSING FOR STATE POLICY FORMULATION Final Report and Recommendations
Sally M. Bay 25 Aug. 1976 142 p , Conf. held at Denver, 25 Aug. 1976
(Contract NASw-2943)
(NASA-CR-149098) Avail: NTIS HC A07/MF A01 CSCL 05A

The applications and limitations of the NASA LANDSAT Follow-on Program were reviewed. State legislators, legislative staff, and state earth resources program managers evaluated the following: (1) the proposed capabilities of the program; (2) existing satellite applications in use by state agencies; (3) existing federal and state legislation mandating natural resources related state programs; (4) inferred data needs of those programs; and (5) an analysis of the feasibility of the Follow-On Program to meet those needs. Author

N77-11487*# Instituto Geofisico del Peru, Lima.
APPLICATION OF REMOTE SENSING TECHNIQUES FOR THE STUDY AND EVALUATION OF NATURAL RESOURCES IN PERU Progress Report
Jose C. Pomalaya, Principal Investigator 1975 3 p Sponsored by NASA ERTS
(E77-10024; NASA-CR-149127) Avail: NTIS HC A02/MF A01 CSCL 08F

N77-11502*# Texas Univ. Health Science Center, Houston. School of Public Health.
POTENTIAL ROLE OF REMOTE SENSING IN DISASTER RELIEF MANAGEMENT
Marjorie Rush, Alfonso Holguin, and Sally Vernon [1976] 97 p refs Original contains color illustrations
(Grant NGL-44-084-003)
(NASA-CR-149102) Avail: NTIS HC A05/MF A01 CSCL 05A

Baseline or predisaster data which would be useful to decision making in the immediate postdisaster period were suggested for the six areas of public health concern along with guidelines for organizing these data. Potential sources of these data are identified. In order to fully assess the impact of a disaster on an area,

information about its predisaster status must be known. Aerial photography is one way of acquiring and recording such data.
Author

N77-11519# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
THE USE OF REMOTE SENSING DEVICES FOR ACQUIRING DATA FOR ENVIRONMENTAL MANAGEMENT PURPOSES. REPORT 2: APPLICATION OF PHOTOGRAPHIC REMOTE SENSORS TO AN ENVIRONMENTAL MANAGEMENT PROBLEM Technical Report, Feb. 1974 - Jan. 1975
Daniel H. Cress and Lewis E. Link, Jr. May 1976 100 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A025616; WES-TR-M-74-8-2) Avail: NTIS HC A05/MF A01 CSCL 14/5

This report demonstrates the application of a procedure developed for the systematic application of photographic remote sensor systems to specific environmental data acquisition problems. Of particular importance to this procedure is a quantitative approach to predicting a proper mission profile (i.e. film-filter combinations, scale, etc.) as a function of properties of the features of interest and the surrounding environment. The application of the procedure to an environmental management problem at a military facility within CONUS, Fort Carson, Colorado, is discussed. The primary emphasis of the work is on the acquisition of data relevant to measurement of the effects of maneuvering vehicles on the environment in two training areas (80 km2) on the post. The parameter selected for measurement is the length of vehicle paths per unit area, referred to as vehicular usage. An obvious application of the map is to support scheduling of training in areas of lowest vehicular usage and to identify areas subject to severe environmental damage. GRA

N77-11622# Meteorology International, Inc., Monterey, Calif.
TESTS AND EVALUATIONS OF CLRX, THE DIAGNOSIS OF CLEAR-COLUMN RADIANCES Final Report, 2 Jun. - 2 Dec. 1975
Manfred M. Holl Dec. 1975 109 p refs
(Contract N00228-75-C-2362)
(AD-A023908; M-215; NEPRF-TR-12-75(MII)) Avail: NTIS HC A06/MF A01 CSCL 04/1

The purpose of the present project is to carry out tests and evaluations of the CLRX capability using measured VTPR (Vertical Temperature Profile Radiometer) radiances, collected by DMSP satellites, and concurrent independent resolution of atmospheric thermal-structure variabilities, from the AMTEX space-time region. GRA

N77-12503# Army Engineer Topographic Labs., Fort Belvoir, Va.
A NEW PHOTOGRAMMETRIC COMPARATOR DESIGN
Andrew J. Bondurant, Jr. 1976 12 p refs
(AD-A025977) Avail: NTIS HC A02/MF A01 CSCL 08/2

This paper describes a comparator believed to be unique in many respects. The laser interferometer permits a lightweight, compact design requiring less operating space and making the instrument very portable. The cost of the instrument is relatively low and the accuracy exceeds that required for most photogrammetric applications. The inclusion of an on-line programmable calculator enables relatively easy calibration of the system and permits near real time computations of the coordinates being measured. With additional programming, the instrument can perform other functions, such as the near real time computation of ground point positions, and any other photogrammetrically related task involving measurements and subsequent computations. The techniques employed in this new instrument represent significant progress in the design of photogrammetric comparators. They also hold great promise for a wide variety of applications in other similar devices. GRA

N77-12564# Naval Weapons Center, China Lake, Calif.
AN ANALYSIS OF DATA INPUT SYSTEMS AND A SURVEY OF OTHER DATA BASES FOR THE NAVAL ENVIRONMENTAL PROTECTION SUPPORT SERVICE (NEPSS) Final Report, Jul. 1974 - Jun. 1975
Peggy A. Davis May 1976 41 p refs
(YF57572002)
(AD-A035085; NWC-TP-5820) Avail: NTIS HC A03/MF A01 CSCL 13/2

This report describes two areas of investigation. First, an analysis effort aimed at defining an improved data acquisition and handling system for the Naval Environmental Protection Support Service (NEPSS). Second, a survey of other environmental data bases complementary to the NEPSS system which can be called upon as additional sources of environmental information.
Author (GRA)

N77-12629# Utah State Univ., Logan. Space Science Lab.
GEOMETRIC ASPECTS OF ROCKET PHOTOMETRY Interim Report
William F. Grieder and Leo A. Whelan (Logicon, Inc., Torrance, Calif.) Feb. 1976 111 p refs
(Contract F19628-74-C-0130; DNA Proj. NWET-K43AAXHX604)
(AD-A024947; HAES-41; AFGL-TR-76-0046; SR-3) Avail: NTIS HC A06/MF A01 CSCL 17/5

This report describes the derivation and application of a technique to transform oblique rocket photometric measurements of emission phenomena to vertical altitude (Zenith) profiles and the subsequent derivation of volume emission rates. The van Rhijn method of aspect correction is analyzed including limitations of the method when applied to D and E region emission measurements. A theoretical study is presented in which the general rocketborne photometer geometry is solved for a set of practical volume emission rate cases. The study definitizes the effects of finite fields of view, system directional responsivity and extinction on interpretation of measured emission data and derived volume emission rates. The results of the theoretical study are applied to an actual photometric measurement accomplished on rocket A17.110-3 flown from Poker Flat Rocket Range in Alaska on 16 March 1972. Zenith profiles are derived from oblique hydroxyl emission measurements in the band 1.67 to 1.90 micrometers band made at 60, 70, and 80 deg zenith angle as the rocket ascended. Volume emission rates deduced from these zenith profiles are consistant with results reported in the literature. Author (GRA)

N77-13483 California Univ., Los Angeles.
APPLICATION OF REMOTE SENSING TO MANAGING THE EARTH'S ENVIRONMENT Ph.D. Thesis
Robert Bruce Gerding 1976 335 p
Avail: Univ. Microfilms Order No. 76-25197

A review of the state of the art of earth observation remote sensing is presented, and the design and development process employed to create a remote sensing space program is described. The history of earth observation remote sensing is discussed with particular emphasis being placed on the last six years. The design and development process is discussed for each of the following major areas within a remote sensing space program: (1) user information needs; (2) remote sensing measurement requirements; (3) remote sensing devices (i.e., sensors); (4) orbit selection; (5) data acquisition platform; and (6) data management system. In discussing data acquisition platforms, consideration is given to both free flying, unmanned spacecraft and spacelab payloads. Dissert. Abstr.

N77-13499*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
DELINEATION AND ANALYSIS OF CONTOURS ON AERIAL AND SPACE PHOTOGRAPHS, USING OPTICAL PROCESSING METHODS IN COHERENT LIGHT
Z. G. Yefimova, V. B. Romarov, B. N. Mozhayev, and D. A. Yanutsh Washington NASA Apr. 1976 19 p Transl. into ENGLISH of "Vydeleniye i Analiz Lineamentov na Aero/i Kosmicheskikh Fotosnimkakh Metodami Opticheskoy Obrabotki v Kogerentnom Svete" Moscow, 1975 9 p
(Contract NASw-2789)
(NASA-TT-F-16944) Avail: NTIS HC A02/MF A01 CSCL 05B

Apparatus for optical delineation of contours contained on aerial and space photographs is described. Resulting rose diagrams are compared with those obtained by visual interpretation

of photographs of several geological formations. It was found that preliminary processing using optical filtering is most effective in delineating poorly defined images on photographs, whereas sharp contours can be studied directly from photos, using coherent spectral analysis. Author

N77-13510# Instituto Geografico y Catastral, Madrid (Spain). Dept. de Teledeteccion.
SPACEBORNE OBSERVATION OF SPAIN WITH REMOTE SENSOR [LA OBSERVACION DE ESPANA CON SENSORES REMOTOS DESDE EL ESPACIO]
German LopezdeLemos 1975 121 p refs In SPANISH Original contains color photographs
(ISBN-84-500-6676-X) Avail: NTIS HC A06/MF A01

A summary is presented of all multispectral information obtained by spacecraft ranging from Gemini to Skylab flights. The quality of data collected and the observation systems used are evaluated. Future space programs, in which the active participation of the country is essential in order to allow rational exploration of its natural resources, are described in brief. ESA

N77-13521# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PIXEL PROBLEMS Final Report
Warren E. Grabay May 1976 89 p
(DA Proj. 4A1-62121-A-896)
(AD-A026598; WES-MP-M-76-9) Avail: NTIS HC A05/MF A01 CSCL 08/2

The exploitation of airborne and satellite-mounted multispectral cameras for the acquisition of terrain information depends upon a detailed understanding of the way in which images are formed by scanner systems, and upon methods of manipulating the radiance values that actually comprise the primary record from which the image is derived. Items discussed include: geometric distortions of the images; relations among pixel size, resolution, and contrast; variations in image geometry caused by mismatches in phase and alignment of pixel arrays; variations in image geometry caused by scanning geometry; and variations in image geometry due to pixel shape. GRA

N77-13524# Army Engineer Topographic Labs., Fort Belvoir, Va.
REMOTE SENSOR IMAGE CAPABILITIES FOR ACQUISITION OF TERRAIN INFORMATION
Theodore C. Vogel Jun. 1976 144 p refs
(DA Proj. 4A7-62707-A-855)
(AD-A026592; ETL-0054; Rept-8) Avail: NTIS HC A07/MF A01 CSCL 17/8

This report utilizes the 1,765 terrain data requirements presented in a USAETL experimental topographic data base system to determine subjectively the overall capability of remote sensor imagery to acquire terrain and environmental information. Remote sensor imagery (RSI) capabilities are evaluated by standard image-interpreter methods and are presented as five levels of capability and two levels of required mensuration. The capability codes are as follows: A - data element can be obtained from RSI; B - data element can not presently be obtained from RSI; C - partial information obtainable; D - other collection methods required; E - data element not compatible with RSI methods; 1 - measurement in X and Y direction required; 2 - measurement in X, Y, and Z direction required. The results of these evaluations indicate that 40 percent of the terrain requirements fall in code A, 5 percent in code B, 38 percent in code C, 17 percent in code D, 13 percent in mensuration category 1, and 10 percent in category 2. Author (GRA)

N77-14678# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.
THE USE OF REMOTE SENSING SYSTEMS FOR ACQUIRING DATA FOR ENVIRONMENTAL MANAGEMENT PURPOSES. REPORT 3: A NOMOGRAM FOR COMPUTING OPTICAL DENSITY CONTRAST Technical Report, 1 Jan. 1974 - 1 Jan. 1975
Lewis E. Link, Jr. and James R. Stabler May 1976 83 p refs
(DA Proj. 4A7-62720-A-986)
(AD-A026718; WES-TR-M-74-8-3) Avail: NTIS HC A05/MF A01 CSCL 17/8

Previous efforts as part of this program resulted in a new capability for predicting photographic-image optical density contrasts. The product of the efforts was a computerized system model that provides a rigorous, quantitative means of objectively selecting a sensor system and mission profile to enhance the success of a remote sensing data acquisition program. The execution of the model requires computer facilities and specialized personnel. A graphical form of the model was developed to provide a simple planning tool that can be applied by users having a wide range of backgrounds and without computer facilities. This report presents a nomogram for predicting optical density contrasts on aerial photographs. The concept and formulation of the nomogram are discussed and an example of its application presented. The accuracy of the nomogram with respect to the computer program from which it was derived is also evaluated. Author (GRA)

N77-14670# Naval Research Lab., Washington, D.C. Airborne Radar Branch.
MICROWAVE RADIOMETRIC DETECTION OF ATMOSPHERIC INTERNAL WAVES Interim Report
Lee U. Martin and Charles I. Beard May 1976 32 p refs
(NRL Proj. B07-37; RR0210141)
(AD-A026523; NRL-MR-3283) Avail: NTIS HC A03/MF A01 CSCL 04/1

Microwave radiometers have, for the first time, detected internal waves in the atmospheric boundary layer and localized their altitude. Varying the intersection height of a narrow (3 deg) antenna beam with that of a wide (22 deg) vertically pointing antenna beam allowed determination of the wave altitudes. The ground-based radiometers were located at San Diego, where, in an experiment in May- June 1975, the Naval Electronics Laboratory Center (NELC) provided 'atmospheric-truth' for comparison to the radiometer data obtained by the Naval Research Laboratory. NELC provided FM-CW radar, acoustic sounder, lidar, microbarograph, radiosonde, and surface meteorological data. Preliminary results showed cases of correspondence between the signals of the passive radiometers and the active FM-CW radar and acoustic sounder systems. Examples included internal wave trains up to an hour in length. Author (GRA)

N77-14708*# National Meteorological Center, Washington, D.C.
A TEST OF THE IMPACT OF NOAA-2 VTPR SOUNDINGS ON OPERATIONAL ANALYSES AND FORECASTS
William D. Bonner, Paul L. Lemar, Robert J. VanHaaren, Armand J. Desmarais, and Hugh M. ONeil Feb. 1976 49 p refs
(NASA Order S-70252-AG)
(NASA-CR-149295; PB-256075/3; NOAA-76032502; NOAA-TM-NWS-NMC-57) Avail: NTIS HC A03/MF A01 CSCL 04B

The impact of vertical temperature profile radiometer (VTPR) data from the NOAA-2 satellite is examined by comparing numerical analyses and forecasts made with and without these data. For 30 days in March and April 1973, parallel analyses were produced using the same analysis and forecast codes but with VTPR soundings excluded from the data base for the parallel mode. Forecasts to 48-hr were made from parallel-mode analyses on 9 of these days. Comparisons between these forecasts and the corresponding operational forecasts show at best a very slight improvement in forecast skill from use of VTPR soundings. GRA

N77-14709# National Meteorological Center, Washington, D.C.
OPERATIONAL-TYPE ANALYSES DERIVED WITHOUT RADIOSONDE DATA FROM NIMBUS 5 AND NOAA 2 TEMPERATURE SOUNDINGS
William D. Bonner, Robert VanHaaren, and Christopher M. Hayden Mar. 1976 23 p refs
(PB-256099/3; NOAA-TM-NWS-NMC-58; NOAA-76051703) Avail: NTIS HC A02/MF A01 CSCL 04B

Test analyses were produced with the National Meteorological Center (NMC) global analysis/forecast system using only surface reports and satellite temperature soundings. Data were assimilated

over a period of 4 days using a 6-hr analysis/forecast cycle. The final test analysis describes the major features shown on the corresponding NMC analysis but underestimates the amplitudes of disturbances and the intensity of thickness gradients. GRA

N77-15471*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

ADVANCED EARTH OBSERVATION SYSTEM INSTRUMENTATION STUDY (AEOSIS) Final Report, 1 Dec. 1974 - 31 Dec. 1975

Robert E. Var Jun. 1976 141 p refs

(Contract NAS5-21917)

(NASA-CR-144839; R-963) Avail: NTIS HC A07/MF A01 CSCL 14B

The feasibility, practicality, and cost are investigated for establishing a national system or grid of artificial landmarks suitable for automated (near real time) recognition in the multispectral scanner imagery data from an earth observation satellite (EOS). The intended use of such landmarks, for orbit determination and improved mapping accuracy is reviewed. The desirability of using xenon searchlight landmarks for this purpose is explored theoretically and by means of experimental results obtained with LANDSAT 1 and LANDSAT 2. These results are used, in conjunction with the demonstrated efficiency of an automated detection scheme, to determine the size and cost of a xenon searchlight that would be suitable for an EOS Searchlight Landmark Station (SLS), and to facilitate the development of a conceptual design for an automated and environmentally protected EOS SLS. Author

N77-15478# Utah Univ., Salt Lake City. Dept. of Meteorology.

REMOTE SENSING OF CIRRUS CLOUD COMPOSITIONS FROM SATELLITES Interim Report

Kuo-Nan Liou and Thomas Stoffel 9 Feb. 1976 83 p refs

(Contract F19628-75-C-0107; AF Proj. 627A)

(AD-A026512; Scientific-1; AFGL-TR-76-0027) Avail: NTIS HC A05/MF A01 CSCL 17/5

Comprehensive description of the discrete-ordinate method for the transfer of infrared radiation in an isothermal cloud layer is presented. Applications of such a method to non-isothermal, inhomogeneous atmospheres containing cirrus clouds are carried out, and a listing of the computational code of the infrared radiation program is given in the Appendix of this report. On the basis of this radiation program which allows non-isothermal as well as non-homogeneous structures of clouds, radiative properties of cirrus clouds are investigated in the 10 micrometers window region. Effects of non-isothermal structure of cirrus are shown to be important when its thickness is greater than about 3 km. In addition, we also find that it seems inappropriate to define an 'emissivity' of a non-isothermal cloud. Utilizing the concept of transmissivity derived from radiative transfer analyses, a retrieval technique is developed for the determination of the surface temperature, the cirrus cloud thickness and its transmissivity at a reference wavenumber and the fraction of cirrus cloudiness. Error analyses employing climatological data reveal that independent random errors in temperature and humidity profiles introduce insignificant errors in the four resulting parameters. Based on the retrieval procedures, we illustrate that the vertical ice content may be estimated assuming that ice particles are randomly oriented in a horizontal plane.

Author (GRA)

N77-15596# Pennsylvania State Univ., University Park. Dept. of Meteorology.

ESTIMATION OF OUTGOING LONGWAVE AND SHORTWAVE RADIATION FROM METEOROLOGICAL VARIABLES ACCESSIBLE FROM NUMERICAL MODELS

H. A. Panofsky, J. J. Cahir, J. Jensenius, and R. Stouffer 1976 52 p refs

(Grant NOAA-04-6-158-44013)

(PB-258424/1; NOAA-76080317) Avail: NTIS HC A04/MF A01 CSCL 04B

Statistical regression techniques were devised and tested for directly estimating infrared and short-wave radiation fluxes at the top of the atmosphere from conventional variables available in numerical forecast models. The relations were developed on the basis of a screening technique which used observed radiation flux from the NOAA 2 and 3 satellites as predictands, and predictors derived from variables available. GRA

09
GENERAL

Includes economic analysis.

A77-10915 # **Perspectives and economic effectiveness of space systems application in studies of natural resources.** S. A. Sarkisian, S. S. Korunov, and A. G. Gurov (Intercosmos Council, Moscow, USSR). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-127.* 23 p.

The past development and future perspectives of satellite remote sensing of earth resources in the frameworks of the U.S. and USSR space programs are reviewed in a general way. A procedure for predicting the cost effectiveness of such remote sensing is outlined and a cost model for an earth resources space program is presented. Attention is also given to the relationship of problems of an investigation and application in the field of remote sensing, the demand for information on earth resources, the management of earth resources, the available technology for remote sensing, and predictions of the cost effectiveness of the commercial uses of remote sensing in such fields as agriculture, forestry, fishing and oceanography, geology, hydrology, and geography. B.J.

A77-10926 # **Mission systems for geoscientific research - Methods, systems, possibilities.** W. v. Kirschbaum (Deutsche Gesellschaft für Luft- und Raumfahrt, Cologne, West Germany). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-156.* 15 p.

Possible uses of modern rigid airships are examined, with particular reference to earth surface exploration, environmental protection, and meteorology. The techniques and economics of hydrogen- and helium-filled airships are discussed. The advantages of an airship are seen in its ability to reach precisely any point of observation, to remain at this point for a relatively long period of time, to perform continuous measurements in three dimensions over large distances, smooth vibration-free motion, and onboard data evaluation. V.P.

A77-10941 # **A survey of U.S. meteorological satellite programs.** A. Schnapf (RCA, Astro-Electronics Div., Princeton, N.J.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-208.* 12 p.

This paper presents an overview of the USA's environmental satellite programs that have been evolving from 1958 to the present and reviews plans for the future meteorological and environmental satellite systems that are scheduled to be placed into service in the late '70s and early '80s. The development of the TIROS family of weather satellites, including TIROS, ESSA, ITOS/NOAA, and the future TIROS-N (the third-generation operational system) is summarized. The contribution of the Nimbus and ATS technology satellites to the development of the operational polar-orbiting and geostationary satellites is discussed. Included are descriptions of both the TIROS and the SMS/GOES future payloads currently under development to assure a continued and orderly growth of these systems into the 1980s. The effectiveness and benefits of the U.S. National Operational Meteorological Satellite System are also reviewed. (Author)

A77-11348 **Remote sensing of the environment - Prospects for the last quarter of the 20th century.** L. W. Bowden (California, University, Riverside, Calif.). *Interciencia,* vol. 1, July-Aug. 1976, p. 85-95. 20 refs.

Remote sensing as a technique for collecting environmental data is discussed. Remote sensing of physical resources and geologic structures is reviewed using Landsat 1 imagery of southern Africa and the western United States as examples. The resolution and scale capabilities of aerial and satellite photography are evaluated, the use of remote sensing in agriculture-related studies is examined, and advances in remote sensing of urban areas are noted. The future of remote sensing in the Americas is considered, emphasizing total land use inventory and survey. F.G.M.

A77-11588 # **Spacelab as an experimental platform for the development of operational earth observation systems.** D. Davidts (Messerschmitt-Bölkow-Blohm GmbH, Ottobrunn, West Germany), E. H. Velten (Dornier System GmbH, Friedrichshafen, West Germany), and J. Bodechtel (Zentralstelle für Geophotogrammetrie und Fernerkundung, Munich, West Germany). *(European Industrial Space Study Group, U.S.-European Conference, 6th, Monte Carlo, Monaco, Oct. 13-16, 1975.) British Interplanetary Society, Journal,* vol. 29, Nov. 1976, p. 743-754. 15 refs.

The experimental platform provided by Spacelab for the development of global spaceborne earth monitoring systems is discussed from the point of view of European scientists and engineers. The operational and experimental requirements on the Spacelab remote sensing systems (which cover all appropriate spectral bands) are outlined. The characteristics of the various remote sensors accommodated by Spacelab are tabulated, along with the European earth observation payload alternatives. Missions and the respective type of payload are defined, including experimental missions for basic scientific research, experimental technological missions for sensor and data system testing and qualification, and missions aimed at testing operational systems. V.P.

A77-12426 **Conference on Decision and Control, 6th, and Symposium on Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings.** Conference sponsored by the Institute of Electrical and Electronics Engineers. New York, Institute of Electrical and Electronics Engineers, Inc., 1975. 895 p. Members, $24.; nonmembers, $32.

Topics discussed include seismic data processing, the role of control and system theories in economics, optimization theory, estimation and identification, and algebraic system theory. Also considered are automatic manipulators and learning prostheses, control theory in environmental problems, stochastic optimal control, linear systems, NASA's F-8 adaptive flight control program, and the application of remote sensed digital imagery to mineral and petroleum exploration. Power systems, biomedical applications of modeling and estimation techniques, large scale system theory, applications of computers in control, and highway traffic systems are also discussed. B.J.

A77-12889 **Multi-disciplinary surveys and the integration necessary to their fulfilment in development planning. I.** J. J. Nossin (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 4, 1975, p. 429-443. 10 refs.

Integrated surveys are a way to promote development planning at whatever level of intensity. They are discussed here in relation to earth resources development on the regional level. The necessity for integration is seen to arise from the complexity of data demands and interdependence and mutual influence of data. Attention is given to scarcity limitation of resources, external integration, an integral approximation in development planning, and a discussion of the following integrating factors: communication of results, cartography, air photo interpretation, and the environment. B.J.

A77-12890 **Nine aspects of remote sensing, a general orientation.** D. Eckhart (International Institute for Aerial Survey and Earth Sciences, Delft, Netherlands). *ITC Journal,* no. 4, 1975, p. 444-451.

A number of aspects of remote sensing are reviewed. These are the following: (1) the purpose of remote sensing, (2) earth resources

satellites, (3) the three atmospheric windows for remote sensing (optical, thermal, and microwave), (4) information flow, (5) organization (NASA and ESA), (6) the European Space Agency, (7) remote sensing and society, (8) social needs and economic values behind remote sensing, and (9) integration of imagery. B.J.

A77-12891 A generalization of standard deviation for distribution groups - The interval of maximum amplitude, a characteristic element, of decision for a distribution of measured values (Une généralisation de l'écart-type pour des familles de distribution - L'intervalle d'amplitude maximum, élément caractéristique, de décision pour une distribution de valeurs mesurées). N. Jalba. *ITC Journal,* no. 4, 1975, p. 452-486. In French.

Calculations of variance and standard deviation are usually necessary in order to indicate the accuracy of geodetic, topographic and photogrammetric measurements. This paper shows that it is possible to make a generalization for variance and for standard deviation using distribution groups characterized by an interval spread A and a volume K. Distribution groups of this kind allow the computation of a maximum and minimum deviation which correspond respectively to a maximum and minimum degree of indetermination. It is shown that the interval spread A, which combined with the volume K can represent a distribution group, can also become a decision element in the course of the measurements. B.J.

A77-12892 Earth resource satellites, a puzzle for the United Nations. G. E. Moore. *(Harvard International Law Journal,* vol. 16, Summer 1975.) *ITC Journal,* no. 4, 1975, p. 487-497. 44 refs.

Some of the political, social, and legal aspects of satellite remote sensing are discussed. Attention is given to questions of sovereignty, control of information gathering, and control of data analysis and dissemination. Reference is made to the Outer Space Treaty and to the work of the United Nations Working Group on Remote Sensing of the Earth by Satellite, established in 1971. B.J.

A77-13311 # Royal Aircraft Establishment, Farnborough Geophysical Studies in Space Department. D. G. King-Hele. *Royal Astronomical Society, Quarterly Journal,* vol. 17, Sept. 1976, p. 335-340. 15 refs.

A description is given of studies related to the analysis of satellite orbits to improve knowledge in geophysics. The orbits are determined from optical and radar observations. The orbital changes are interpreted to determine the earth's gravitational field and upper-atmosphere density and wind speed. Attention is given to orbital theory, the earth's gravitational field, and the characteristics of upper-atmosphere winds. A table of earth satellites maintained since 1958 is also discussed. G.R.

A77-13357 The status of remote sensing (Zur Situation der Fernerkundung). G. Hildebrandt. *Bildmessung und Luftbildwesen,* vol. 44, Nov. 1, 1976, p. 245-248. 10 refs. In German.

It is pointed out that very great technological advances in the area of remote sensing have been made during the last few years. The advances are related to sensors, cameras, films, and nonphotographic systems utilizing the EM range from medium UV to the microwaves in the P-band. Analog and digital image and data processing devices for the manipulation of monospectral and multispectral sensing data were developed. Attention is also given to new areas of application for remote sensing, the Global Environment Monitoring Systems, and new trends regarding the conduction of studies concerned with the evaluation of the remote-sensing data. G.R.

A77-14739 # Selection of thermal and nonthermal radiation in the sounding of the earth from satellites (O selektsii teplovogo i neteplovogo radioizlucheniia pri zondirovanii zemli so sputnikov). L. G. Kachurin and V. I. Poltinnikov (Leningradskii Gidrometeorologicheskii Institut, Leningrad, USSR). *Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,* vol. 12, Sept. 1976, p. 947-952. 11 refs. In Russian.

The transition to the range of wavelengths currently used on ERTS satellites involves determination of the thermal radiation against a background of the nonthermal radiation from clouds. In terrestrial and satellite measurements, there arose a signal selection problem associated with the necessity of identifying the 'thermal portion' of a signal and determining the electrical parameters of the earth's atmosphere. In the present paper, the relationship between thermal and nonthermal radiation within a wide range of wavelengths is studied with a view toward the problem of their mutual selection for the determination of both the radio brightness temperature of thermal radiation and the characteristics of thunderstorm activity. V.P.

A77-15051 * Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. Symposium sponsored by the American Society of Agronomy, IEEE, NASA and Soil Science Society of America. New York, Institute of Electrical and Electronics Engineers, Inc., 1976. 339 p. Members, $18.75; nonmembers, $25.

Papers are presented on the applicability of Landsat data to water management and control needs, IBIS, a geographic information system based on digital image processing and image raster datatype, and the Image Data Access Method (IDAM) for the Earth Resources Interactive Processing System. Attention is also given to the Prototype Classification and Mensuration System (PROCAMS) applied to agricultural data, the use of Landsat for water quality monitoring in North Carolina, and the analysis of geophysical remote sensing data using multivariate pattern recognition. The Illinois crop-acreage estimation experiment, the Pacific Northwest Resources Inventory Demonstration; and the effects of spatial misregistration on multispectral recognition are also considered. B.J.

A77-15053 Remote sensing technology - A look to the future. D. Landgrebe (Purdue University, West Lafayette, Ind.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. PA-7 to PA-18.

The fundamentals and the historical development of remote sensing are reviewed and a generalized systems perspective for remote sensing is outlined in which specific subtechnologies are considered in the context of their place in the entire system. The scene (that part of the system which is in front of the sensor) and its complexities are discussed, along with the sensor, characterizing the scene by the data in terms of spectral, spatial and temporal variations. The adequacy of the data processing procedures is investigated with attention given to processing algorithms, processor implementation, output products, and human participation in processing. B.J.

A77-15069 * Pacific Northwest Resources Inventory Demonstration. J. D. Nichols (ESL, Inc., Sunnyvale, Calif.). In: Symposium on Machine Processing of Remotely Sensed Data, Purdue University, West Lafayette, Ind., June 29-July 1, 1976, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. PC-10 to PC-15. NASA-supported research.

The Pacific Northwest Land Resource Inventory Demonstration project is designed to demonstrate to users from state and local agencies in Washington, Oregon, and Idaho the cost effective role that Landsat derived information can play in natural resource planning and management when properly supported by ground and aircraft data. The project has been organized into five main phases: (1) maps and overlays, (2) early digital image analysis, (3) demonstration of applications using interactive image analysis, (4) Landsat products and land resources information systems, and (5) documentation. The demonstration project has been applied to Washington forestry, water inventory in southern Idaho, and monitoring of tansy ragwort in western Oregon. B.J.

A77-15179 **Microwave remote sensing - Present and future.** J. W. Rouse, Jr. (Texas A & M University, College Station, Tex.). In: National Telecommunications Conference, New Orleans, La., December 1-3, 1975, Conference Record. Volume 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 37-1 to 37-3.

An overview of advances in microwave remote sensing (MRS) is presented, with a discussion of the outlook for development and acceptance of MRS. Potential applications of MRS devices, the status of microwave sensor development and research work for spacecraft remote sensing systems, and characteristics and uses of active and passive MRS devices are discussed. Altimeters, scatterometers, and imagers account for some active MRS applications, while radiometers and imagers exemplify passive MRS. Identification of salt-water and fresh-water ice, determination of sea state, measurements of atmospheric water content, determination of relative soil moisture, prediction of watershed runoff, and measurements of sea-water salinity are considered among MRS applications. A list of applications for active MRS systems is appended. R.D.V.

A77-15510 **Outlook for Space.** I. D. Dooling. *Spaceflight,* vol. 18, Dec. 1976, p. 422-425.

The Outlook for Space study released by NASA in March 1976 is discussed. The study's list of 61 proposed future space objectives includes 28 objectives dealing with environmental or resources problems or the earth itself. Three objectives are concerned with communications, seven with the utilization of the space environment, and 23 with subjects ranging from the fate of the earth to intelligent life in the universe. Attention is given to plans for monitoring the earth's climate, the challenge of solar system reconnaissance, the use of a manned space station, the building of a space colony, a base on the moon, and a space power base. G.R.

A77-15511 **Manned orbital facility.** P. J. Parker. *Spaceflight,* vol. 18, Dec. 1976, p. 426-428, 452. 7 refs.

A description is presented of a manned orbital facility (MOF) that could serve individuals and organizations whose research and applications goals can best be furthered by utilization of the environment of space. The described baseline design for the MOF would initially provide living and working quarters for four people. The MOF configuration is made up of four basic units, including the subsystem module, the habitability module, the logistic module, and the payload module. The modular design makes an extension of the MOF at a later time convenient. The first four person MOF could probably be launched about 1985. MOF baseline study objectives considered are related to IR astronomy, UV astronomy, solar observations, space sciences, magnetospheric and plasma physics in space, space technology, cloud physics/technology, earth science, high energy astronomy and technology, life science/technology, cosmic rays, advanced technology, and space manufacturing. G.R.

A77-16971 **The impact of space science on mankind.** Edited by T. Greve (Norwegian Nobel Institute, Oslo, Norway), F. Lied (Norges Teknisk-Naturvitenskapelige Forskningsrad, Oslo, Norway) and E. Tandberg (Norconsult A/S, Norway). New York, Plenum Press, 1976. 132 p. $19.50.

The benefits that space research and satellite studies in particular can bring to society are discussed. Attention is given to satellite communications, satellite remote sensing of earth resources (especially via Landsat), the use of environmental satellites, and space-assisted meteorology. B.J.

A77-16974 * **The impact of earth resources exploration from space.** W. Nordberg (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: The impact of space science on mankind. New York, Plenum Press, 1976, p. 67-77.

Remote sensing of the earth from satellite systems such as Landsat, Nimbus, and Skylab has demonstrated the potential influence of such observations on a number of major human concerns. These concerns include the management of food, water and fiber resources, the exploration and management of mineral and energy resources, the protection of the environment, the protection of life and property, and improvements in shipping and navigation. B.J.

A77-16975 **The environmental satellite - What it means for man.** R. M. White (NOAA, Rockville, Md.). In: The impact of space science on mankind. New York, Plenum Press, 1976, p. 91-109.

The history of the environmental satellite in the United States is reviewed with emphasis on TIROS, ESSA, NOAA, geostationary satellites, GOES, TIROS-N, and SEASAT. The use of satellites for weather forecasting is examined along with the benefits of international cooperation in the field of environmental satellites. B.J.

A77-17531 **Progress in remote sensing /1972-1976/.** W. A. Fischer, W. R. Hemphill, and A. Kover (U.S. Geological Survey, Reston, Va.). *Photogrammetria,* vol. 32, Oct. 1976, p. 33-72. 189 refs.

Developments in remote sensing during the period from 1972 to 1976 are reviewed. The discussion focuses on the development of algorithms for treating Landsat data, recent applications of Landsat data, precision measurements of intercontinental distances, and global measurements of earth's magnetic field. Solar and thermal IR observations by Landsat are described along with the current status of microwave remote sensing, uses of side-looking radar, technical requirements for the next generation of imaging radars, radar scatterometry and altimetry, and passive microwave imaging. Luminescence observations with the Fraunhofer line discriminator (FLD) and airborne tests of a redesigned FLD are summarized. Several proposed satellite programs are noted, including Lageos, Seasat, Landsat-C, advanced NOAA satellites, NASA's Applications Explorer Mission satellites, and the Geostationary Operational Environmental Satellites (GOES) series. F.G.M.

A77-17804 **Preliminary results from the Air Mass Transformation Experiment /AMTEX/.** D. H. Lenschow (National Center for Atmospheric Research, Boulder, Colo.) and E. M. Agee (Purdue University, West Lafayette, Ind.). *American Meteorological Society, Bulletin,* vol. 57, Nov. 1976, p. 1346-1355. 5 refs.

The Air Mass Transformation Experiment (AMTEX) was organized and implemented as a GARP subprogram on air-surface interaction at a time and place of large energy transfer from the sea to the atmosphere. The field phase was conducted over the East China Sea within a 300-km hexagonal array of observation stations centered at Okinawa, Japan, during the last two weeks of February in both 1974 and 1975. This paper summarizes preliminary results from the 1975 program as well as more detailed results from 1974. The synoptic weather situation during the 1975 field program is described, synoptic and satellite observations are reviewed, and special boundary-layer, cloud, radiation, and oceanographic observations are discussed. The results reported indicate that the total amount of latent and sensible heat transfer exceeds 700 W/sq m during a period of cold air outbreak, large positive-vorticity advection occurs in the upper troposphere during cold air outbreaks, and the net radiative loss by an atmospheric column extending from the surface to 100 mb is larger on warm days than during cold air outbreaks due to the reduced cloud cover. F.G.M.

A77-18526 **Scientific investigations on the Skylab satellite; Conference, Huntsville, Ala., October 30-November 1, 1974, Technical Papers.** Conference sponsored by the American Institute of Aeronautics and Astronautics and American Geophysical Union. Edited by M. I. Kent, E. Stuhlinger (NASA, Marshall Space Flight Center, Huntsville, Ala.), and S.-T. Wu (Alabama, University, Huntsville, Ala.). New York, American Institute of Aeronautics and Astronautics, Inc. (Progress in Astronautics and Aeronautics. Volume 48), 1976. 567 p. Members, $19.; nonmembers, $45.

A Skylab overview is presented and the solar observation programs are examined, taking into account the operational aspects of Skylab, the XUV sun as observed by ATM S082, a classification of flares and flarelike events observed during the Skylab mission, a preliminary analysis of extreme ultraviolet and X-ray observations, and initial results from the EUV spectroheliometer on ATM. Attention is given to ultraviolet stellar spectra obtained with Skylab experiment S019, multicolor photometry of low-light level phe-

nomena from Skylab, Skylab observations of comet Kohoutek, relativistic iron in space and its nuclear progeny, Skylab altimeter applications and scientific results, neutron and proton activation measurements from Skylab, Skylab D024 thermal control coatings and polymeric films experiment, the stability of liquid dispersions in low gravity, observations of the liquid/solid interface in low-gravity melting, and student experiments on Skylab.

G.R.

A77-18963 American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976. 627 p. Members, $2.50; nonmembers, $5.00.

The present collection of papers is concerned primarily with advances in thermal infrared remote sensing and in mapping processes. Featured topics include utilization of remote sensing techniques to detect land use effects on wildland water quality, the Kelsh K-460 stereometric camera as a new tool for close-range applications, some factors affecting the accuracy of aerotriangulation with auxiliary data, and height measurements from satellite images. Application of coherent optical techniques to future mapping systems is also discussed.

S.D.

A77-18987 **Some factors affecting the accuracy of aerotriangulation with auxiliary data.** W. Faig and S. El Hakim (New Brunswick, University, Fredericton, Canada). In: American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D.C., February 22-28, 1976, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 466-481. 16 refs. Research supported by the Department of Energy, Mines and Resources of Canada and Maritime Land Registration and Information Service.

Auxiliary data, particularly statoscope information, have not been adequately utilized in aerotriangulation to reduce the amount of vertical ground control points. The new version of the block adjustment system described by Ackermann et al. (1972) includes the simultaneous treatment of statoscope, airborne profile recorder (APR), and lake information with independent model block triangulation. This system is applied to three blocks located in Canada to assess the effectiveness of auxiliary data as a function of the bridging distance, the interaction between lake distribution and block dimensions, the combined effect of lakes and statoscope, incomplete statoscope coverage, and APR cross flights at low altitude. It is shown that auxiliary vertical control can reduce the ground control requirements for mapping purposes to the perimeter of a block much like horizontal control in simultaneous adjustments. S.D.

N77-10117*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CTS UNITED STATES EXPERIMENTS. A PROGRESS REPORT
W. H. Robbins and P. L. Donoughe 1976 16 p refs Presented at the 27th Intern. Astronautical Congr., Anaheim, Calif., 10-16 Oct. 1976; sponsored by Intern. Astronautical Federation
(NASA-TM-X-73510; E-8918) Avail: NTIS HC A02/MF A01 CSCL 22B

The results are presented of the United States experiments activity to date. Wide segments of the population are involved in the Experiments Program including the scientific community, other government agencies, industry, and the education and health entities. The experiments are associated with both technological objectives and the demonstration of new community and social services via satellite. Author

N77-10622# Materials Associates, Inc., Washington, D. C.
MATERIALS AVAILABILITY IN A CHANGING WORLD
James Boyd 1 Oct. 1975 45 p refs Sponsored by NSF
(PB-252456/9; NSF/RA/N-75-273) Avail: NTIS HC A03/MF A01 CSCL 05C

Materials shortages exist and will continue despite human effort; irrevocable laws of supply and demand reinforce this belief. The government through its agencies has set forth policies to eliminate waste while increasing production of life's essentials such as food and energy supplies. The United States Geological Survey estimates that four quadrillion tons of materials in the earth's crust can be reached by man using conceivable technology, but the translation of a geological discovery into an economic deposit (a reserve) requires expensive development. The burden upon science and technology is heavy; new supply sources must be discovered, new methods of materials extraction must be devised, and more effective use must be made of what then becomes available. GRA

N77-10740# National Center for Atmospheric Research, Boulder, Colo.
THE STRATOSPHERE AND MESOSPHERE: DYNAMICS, PHYSICS AND CHEMISTRY. VOLUME 1: PRINCIPAL LECTURES AND SEMINARS Final Report
John H. E. Clark, James R. Holton, Conway B. Leovy, Michael McElroy, and Clive D. Rodgers 1975 447 p refs
(Contract NSF C-760)
(PB-253373/5; NCAR/CQ-4; Rept-1975-ASP-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 04A

A nine week colloquium was held at the National Center for Atmospheric Research in an attempt to assess the status of research on the stratosphere and mesosphere and foresee future trends. Roughly four categories of stratospheric and mesospheric research were discussed: dynamics, chemistry, radiative transfer, and social impacts. A few highlights were: (1) an exposition of the coupling between the upper atmosphere and the biosphere by the nitrification and denitrification cycles of the biosphere which result in the production of nitrous oxide - an important ingredient in the chemical cycle of ozone; (2) the revelation of new satellite hardware and software developments that will permit observations of the upper atmosphere to a level heretofor considered unachievable; (3) realization of the fact that several possibly severe environmental problems affecting the ozone layer still require the dedication of considerable effort to determine their severity. GRA

N77-11083*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE STATION SYSTEMS ANALYSIS STUDY. PART 1, VOLUME 3: APPENDICES. BOOK 1: OBJECTIVE DATA Final Report
1 Sep. 1976 513 p refs
(Contract NAS9-14958)
(NASA-CR-151104; MDC-G6508-Pt-1-Vol-3-Bk-1) Avail: NTIS HC A22/MF A01 CSCL 22B

The space systems objective evaluation program for determining the requirements for a space station is reported. Forms for this evaluation are included along with objective data packages for the following systems: (1) satellite power system, (2) nuclear energy, (3) earth sciences, (4) space cosmological research and development, (5) space processing, (6) cluster support, (7) depot, (8) multidiscipline science laboratory, (9) sensor development, and (10) living and working space. F.O.S.

N77-11498*# Ministry of Public Works, Mexico City.
INVESTIGATION OF LONG SCOPE FOR HIGHWAY ENGINEERING PURPOSES Final Report, May - Jul. 1976
Javier Toribio Arzate, Principal Investigator Jul. 1976 13 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10037; NASA-CR-149138) Avail: NTIS HC A02/MF A01 CSCL 13B

N77-11500*# Department of Scientific and Industrial Research, Christchurch (New Zealand). Physics and Engineering Lab.
DEVELOPMENT OF REMOTE SENSING TECHNOLOGY IN NEW ZEALAND, PART 1. SEISMOTECTONIC, STRUCTURAL, VOLCANOLOGIC AND GEOMORPHIC STUDY OF

NEW ZEALAND. PART 2. INDIGENOUS FOREST ASSESSMENT, PART 3. MAPPING LAND USE AND ENVIRONMENTAL STUDIES IN NEW ZEALAND, PART 4. NEW ZEALAND FOREST SERVICE LANDSAT PROJECTS, PART 5. GEOGRAPHICAL APPLICATIONS IN LANDSAT MAPPING: LANDUSE MAPPING AND ENVIRONMENTAL STUDIES, PART 6 Quarterly Report

Mervyn C. Probine, Richard P. Suggate, Michael G. McGreevy, and Ian F. Stirling, Principal Investigators Sep. 1976 116 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E77-10040; NASA-CR-149152; Rept-553; QR-3) Avail: NTIS HC A06/MF A01 CSCL 08F

N77-11914*# JWK International Co., Annandale, Va.

BENEFIT ASSESSMENT OF NASA SPACE TECHNOLOGY GOALS Final Report

26 Jul. 1976 128 p refs

(Contract NASw-2911)

(NASA-CR-149192) Avail: NTIS HC A07/MF A01 CSCL 05B

The socio-economic benefits to be derived from system applications of space technology goals developed by NASA were assessed. Specific studies include: electronic mail; personal telephone communications; weather and climate monitoring, prediction, and control; crop production forecasting and water availability; planetary engineering of the planet Venus; and planetary exploration. Author

N77-12476*# ECON, Inc., Princeton, N.J.

SEASAT: A CANDIDATE OCEAN INDUSTRY ECONOMIC VERIFICATION EXPERIMENTS

B. P. Miller 16 Sep. 1976 88 p refs

(Contract NASw-2558)

(NASA-CR-149228; Rept-76-112-1) Avail: NTIS HC A05/MF A01 CSCL 05C

The economic benefits of an operational SEASAT system are discussed in the areas of marine transportation, offshore oil and natural gas exploration and development, ocean fishing, and Arctic operations. A description of the candidate economic verification experiments which could be performed with SEASAT-A is given. With the exception of the area of Arctic operations, experiments have been identified in each of the areas of ocean based activity that are expected to show an economic impact from the use of operational SEASAT data. Experiments have been identified in the areas of the offshore oil and natural gas industry, as well as ice monitoring and coastal zone applications. Emphasis has been placed on the identification and the development of those experiments which meet criteria for: (1) end user participation; (2) SEASAT-A data utility; (3) measurability of operational parameters to demonstrate economic effect; and (4) non-proprietary nature of results. Author

N77-12477*# ECON, Inc., Princeton, N.J.

SEASAT PROGRAMS OPTION ANALYSIS

Larrain Luckl 31 Aug. 1976 16 p

(Contract NASw-2558)

(NASA-CR-149229; Rept-76-112-2) Avail: NTIS HC A02/MF A01 CSCL 05A

A preliminary analysis of the costs of SEASAT follow-on options is presented. All the options assume the existence of SEASAT-A as currently defined in the SEASAT Economic Assessment. It is assumed that each option will continue through the year 2000 and approach operational system status in the 1983-1986 period, depending upon the sensor package selected. The launch vehicle assumed through 1983 is the Atlas Agena. After 1983, it is assumed SEASAT-A will switch to the use of the Space Shuttle. All cost estimates are 1976 dollars for fiscal year cost accounting, with no inflation rate included. Author

N77-12478*# ECON, Inc., Princeton, N.J.

A METHODOLOGY FOR THE EVALUATION OF PROGRAM COST AND SCHEDULE RISK FOR THE SEASAT PROGRAM

Philip Abram and Debra Myers 31 Aug. 1976 63 p

(Contract NASw-2558)

(NASA-CR-149230; Rept-76-113-1) Avail: NTIS HC A04/MF A01 CSCL 05A

An interactive computerized project management software package (RISKNET) is designed to analyze the effect of the risk involved in each specific activity on the results of the total SEASAT-A program. Both the time and the cost of each distinct activity can be modeled with an uncertainty interval so as to provide the project manager with not only the expected time and cost for the completion of the total program, but also with the expected range of costs corresponding to any desired level of significance. The nature of the SEASAT-A program is described. The capabilities of RISKNET and the implementation plan of a RISKNET analysis for the development of SEASAT-A are presented. Author

N77-12479*# Kanner (Leo) Associates, Redwood City, Calif.

USA REPORT PROPOSES: AN END TO FREE SATELLITE PICTURES

Eric Dyring Jul. 1976 16 p Transl. into ENGLISH from Forskaning och Framsted (Norway), v. 5, 1975 p 26-31

(Contract NASw-2790)

(NASA-TT-F-16732) Avail: NTIS HC A02/MF A01 CSCL 05B

A proposed organization of an all-powerful national satellite picture system in the United States of America and its impact on civilian use of satellite pictures are examined. L.S.

N77-12482*# Scientific Translation Service, Santa Barbara, Calif.

REPORT FROM SPACE

K. Lovstuhagen Washington NASA Nov. 1976 21 p Transl. into ENGLISH of "Rapport fra Rommet", a Magasinet, no. 40, 2 Oct. 1976 p 24-28, 30, 32

(Contract NASw-2791)

(NASA-TT-F-17504) Avail: NTIS HC A02/MF A01 CSCL 05B

A discussion is presented on satellite monitoring of Earth resources; the consequences of building a proposed ground support recording station in Norway are studied. L.S.

N77-12635*# ECON, Inc., Princeton, N.J.

A PLAN FOR APPLICATION SYSTEM VERIFICATION TESTS: THE VALUE OF IMPROVED METEOROLOGICAL INFORMATION, VOLUME 2 Final Report

31 Aug. 1976 231 p refs

(Contract NASw-2558)

(NASA-CR-149169) Avail: NTIS HC A11/MF A01 CSCL 04B

For abstract, see N77-12634.

N77-12636*# ECON, Inc., Princeton, N.J.

A PLAN FOR APPLICATION SYSTEM VERIFICATION TESTS: THE VALUE OF IMPROVED METEOROLOGICAL INFORMATION, EXECUTIVE SUMMARY Final Report

31 Aug. 1976 40 p 3 Vol.

(Contract NASw-2558)

(NASA-CR-149168) Avail: NTIS HC A03/MF A01 CSCL 04B

For abstract, see N77-12634.

N77-15057*# Scientific Translation Service, Santa Barbara, Calif.

THE CURRENT TREND OF THE UTILIZATION OF EARTH OBSERVATION SATELLITES, VOLUME 1

Washington NASA Jan. 1977 196 p refs Transl. into ENGLISH from Natl. Space Develop. Agency of Japan (NASDA) Report, v. 1, Mar. 1976 p 1-124

(Contract NASw-2791)

(NASA-TT-F-17500) Avail: NTIS HC A09/MF A01 CSCL 22A

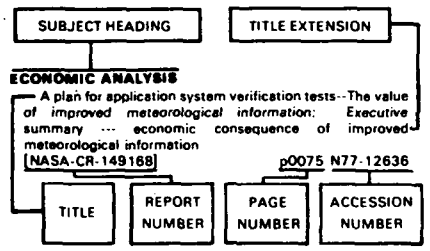
A comprehensive report is presented on the requirements and effectiveness in each case of utilizing the satellite data in such areas as agriculture, forestry, land use, geology, mineral resources, water resources, environment, oceanography, and

disaster prevention. An attempt was made to evaluate the possible applicability of the Space Remote Sensing Technology to each of the above areas. Author

N77-15470*# Transemantics, Inc., Washington, D.C.
LATIN AMERICAN COURSE ON REMOTE SENSORS
NASA Dec. 1976 14 p Transl. into ENGLISH of "Curso Latinoamericano de Sensores Remotos", *Comision Nacl. de Invest. Espaciales*, Buenos Aires, 1976 11 p
(Contract NASw-2792)
(NASA-TT-F-16218) Avail: NTIS HC A02/MF A02 CSCL 14B

Visual interpretation of information obtained by remote sensors for use in studies on natural resources is studied. Particular emphasis is given to fields of agriculture, forestation and geology. Both practical and theoretical classes, class work and field work are included. LANDSAT images selected for interpretation involve the Parana River delta and the Province of San Luis. Author

Typical Subject Index Listing



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A

ABUNDANCE
On the age of Rhodesian greenstone belts p0027 A77-17562

ADAPTIVE CONTROL
Conference on Decision and Control, 6th, and Symposium on Adaptive Processes, 14th, Houston, Tex., December 10-12, 1975, Proceedings p0071 A77-12426

AERIAL PHOTOGRAPHY
Spruce budworm damage evaluations using aerial *photography* p0001 A77-10116
Comparison of color, color infrared, and panchromatic aerial photography --- in southern Ruahine mountains, New Zealand p0049 A77-10117
Thermographic mosaic of Yellowstone National Park p0019 A77-10121
Digital profile to contour converter and display --- earth surface mapping from stereo aerial photographs p0001 A77-10832
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Operation and characteristics of imaging radar systems p0051 A77-12252
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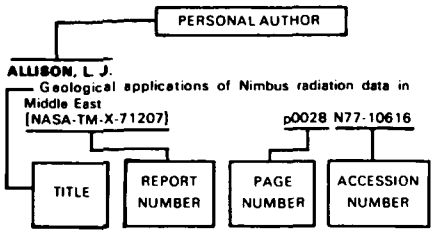

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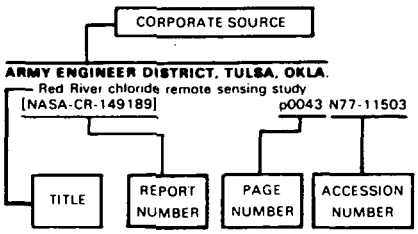

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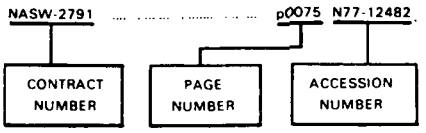

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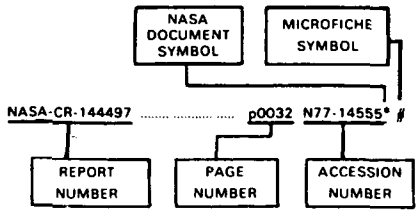

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