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Earth Resources
A Continuing
Bibliography
with Indexes

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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)	N82-16040 - N82-22140
IAA (A-10000 Series)	A82-18840 - A82-28538

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NASA SP-7041(34)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 34

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 April 1 and June 30, 1982 in

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

NASA Scientific and Technical Information Branch 1982
National Aeronautics and Space Administration
Washington, DC

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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 567 reports, articles, and other documents announced between April 1 and June 30, 1982 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA).*

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

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

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

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

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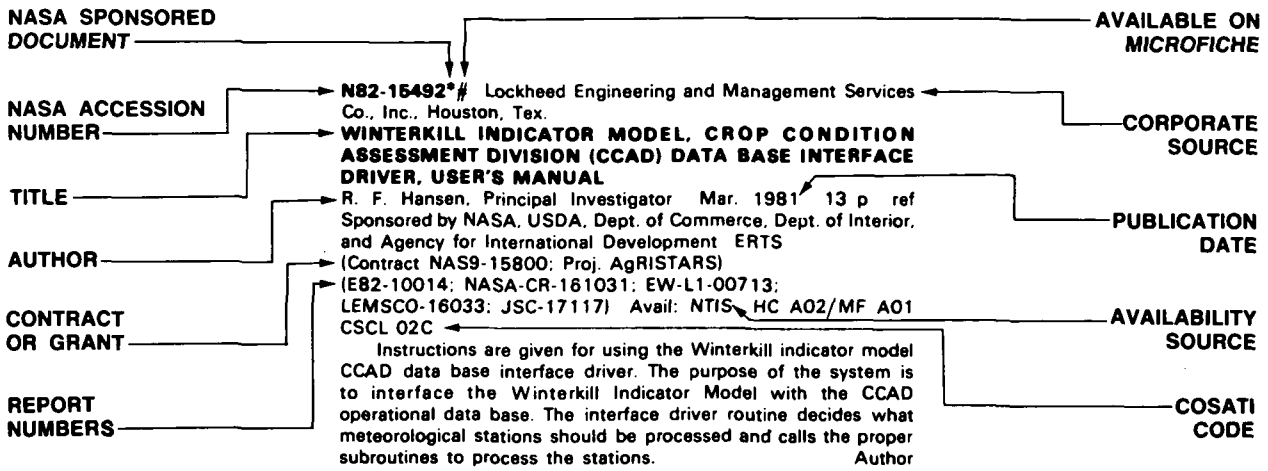

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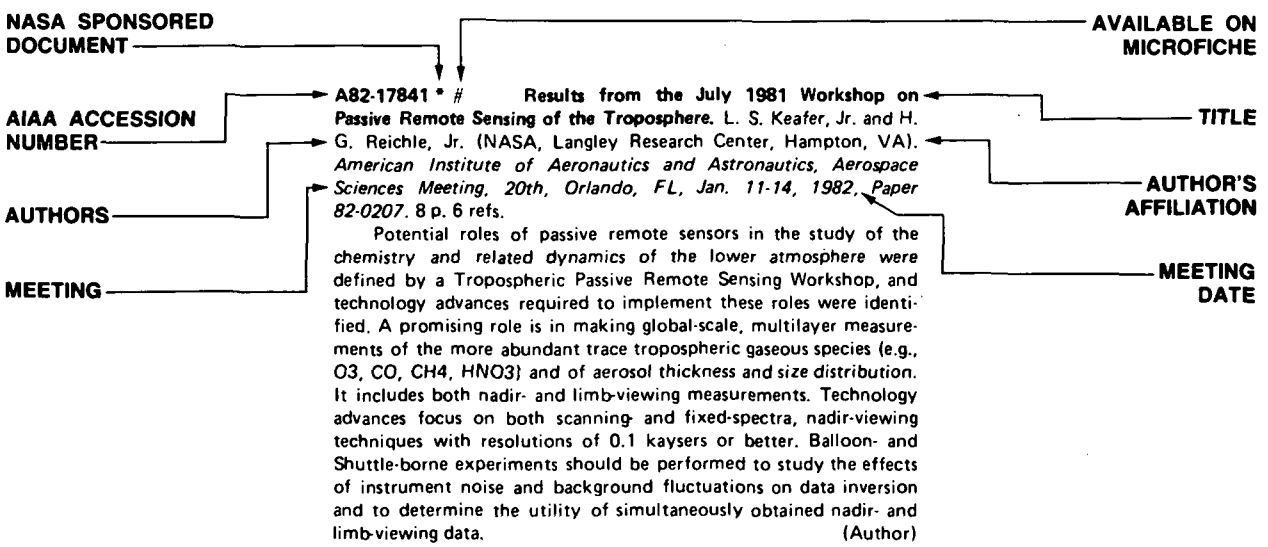

EARTH RESOURCES

A Continuing Bibliography (Issue 34)

JULY 1982

01
AGRICULTURE AND FORESTRY

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

A82-19529 # **Soil moisture determination - Experiments with passive microwave radiometers.** P. Meylan, C. Morzier, R. Caloz (Lausanne, Ecole Polytechnique Fédérale, Lausanne, Switzerland), E. Schanda, and Ch. Matzler (Bern, Universität, Berne, Switzerland). In: European Microwave Conference, 10th, Warsaw, Poland, September 8-12, 1980, Proceedings. Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd., 1981, p. 256-260. 5 refs.

Long term observational programs have been followed in 1977 and 1978 for the determination of the relationship between emissivity and soil moisture on three test sites, representing three soil types. Five radiometers, whose frequencies are centered at 36, 21, 10.5, 4.9 and 1.8 GHz, were used. The interpretation of the measurements follows three ways: (1) analysis of the radiometer response versus scan angle; (2) factorial analysis of correspondences and clustering analysis; and (3) analysis of emissivity variation versus soil moisture content. In this last case a nonlinear function was fitted to the data and could be partially explained. An experiment was also conducted to determine the real penetration depth in a heavy soil. (Author)

A82-20349 † **Experimental evaluation of methods of the automated interpretation of crops from a Fragment MSS image (Eksperimental'naia otsenka metodov avtomatizirovannogo deshifrirovaniia sel'skokhoziaistvennykh kul'tur po snimku s MSS 'Fragment').** I. A. Labutina and I. K. Lur'e (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 89-92. In Russian.

Three methods of automated photointerpretation are examined and compared: the minimum distance method, the maximum likelihood method, and cluster analysis. The comparison involved crop identification from a Fragment MSS image of an area between the Don and Khoper rivers. Recommendations on the organization of automated image processing are given. B.J.

A82-20350 † **Automation of the processing of aerial and space images for forest inventory (Avtomatizatsiia protsessa obrabotki aerokosmicheskikh snimkov v tseliakh inventarizatsii lesov).** A. S. Alekseev, S. V. Vasil'ev, V. G. Mozalevskii, V. P. Piatkin, V. N. Sedykh, and V. S. Sidorova (Akademiia Nauk SSSR, Vychislitel'nyi Tsentr and Institut Lesa i Drevesiny, Novosibirsk, USSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 93-100. 6 refs. In Russian.

Various aspects of the automated processing of remotely sensed images for purposes of forest inventory are considered. Particular attention is given to the use of textural features for image classification. B.J.

A82-20408 **Manual and automatic crop identification with airborne radar imagery.** B. Brisco and R. Protz (Guelph, University, Guelph, Ontario, Canada). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 101-109. 16 refs. Department of Supply and Services Contract No. 08SU-01525-7-0198.

Woods, roughland and corn were identified with accuracies approaching or exceeding 90%, when image tone and texture were employed as the key discriminants, in manual and automatic crop discrimination by means of multi-date radar imagery. Hay-pasture and grain fields were, however, consistently confused, leading to identification accuracies of only about 50%. It is found that, while image enhancement prior to supervised classification was useful, increased class confusion resulted from the lack of textural information in the digital classification and its consequent overlapping of tonal distributions for the five investigated classes. For the more accurate identification of hay-pasture and grain fields, it is suggested that imagery be collected during the growing season. At that time, the two crop types exhibit the greatest difference in geometrical and dielectric properties. O.C.

A82-20422 * # **Simple radiative transfer model for relationships between canopy biomass and reflectance.** J. K. Park (Systems and Applied Sciences Corp., Riverdale, MD) and D. W. Deering (NASA, Goddard Space Flight Center, Earth Survey Applications Div., Greenbelt, MD). *Applied Optics,* vol. 21, Jan. 15, 1982, p. 303-309. 25 refs.

A modified Kubelka-Munk model has been utilized to derive useful equations for the analysis of apparent canopy reflectance. Based on the solution to the model simple working equations were formulated by employing reflectance characteristic parameters. The relationships derived show the asymptotic nature of reflectance data that is typically observed in remote sensing studies of plant biomass. They also establish the range of expected apparent canopy reflectance values for specific plant canopy types. The usefulness of the simplified equations was demonstrated by the exceptionally close fit of the theoretical curves to two separately acquired data sets for alfalfa and shortgrass prairie canopies. (Author)

A82-21026 **The Dutch ROVE program.** G. P. de Loor, P. Hoogeboom (Centrale Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, Physisch Laboratorium TNO, The Hague, Netherlands), and E. P. W. Attema (Delft, Technische Hogeschool, Delft, Netherlands). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 3-11. 22 refs.

The Netherlands Radar Observation of Vegetation (ROVE) team efforts to employ radar as an all-weather, day and night remote sensing technique for observation and control of crops is described. Experiments involving X-band radar from TV towers, an X-band FM/CW system on rails, and an EMI X-band SLAR are reviewed and ground-based and airborne data collection and data are compared. Calibration angles for ground based observations of vegetation are under study, and a grazing angle of 75 deg has been found necessary for measuring soil moisture from the ground. Resolutions in white, black, and grey have been established for sugar beets, wheat, and potatoes, respectively, using airborne radar. Further programs are under way to define the effects on imaging of climate, season, irrigation, soil properties, soil treatment, sowing procedures, and fertilization. M.S.K.

A82-21028 **Microwave radiometry of lands under natural and artificial moistening.** A. M. Shutko (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 18-26. 13 refs.

The dielectric properties of soils and soil conditions are

examined for the applications of microwave radiometry to agriculture, hydrogeology, and land reclamation. Fundamental relations are defined between radiation and soil-moisture content, and characteristics of the microwave emissivity of nonuniform moistened ground with either a flat or rough surface are analyzed. The effects of the uniformity or nonuniformity of the soil, of subsoil water, and of daily temperature variations are examined. Accuracy is found to be diminished by the presence of vegetation, and examples of applications of microwave sensing in agricultural fields, for irrigation quality control, for estimating subsoil water, to find areas with excessive drainage, and to determine the hydrologic regime of dry salt lakes are discussed. M.S.K.

A82-21029 Microwave radiation peculiarities of vegetative covers. A. M. Shutko and A. A. Chukhlantsev (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 27-29.

Theoretical and experimental results for determining the spectral peculiarities of soil-vegetation systems are reported. Vegetation covers were grouped into grain crops, grass and alfalfa, wide-leaf crops such as corn and beets, and bushes and woods. The type of vegetation showed the most influence in the cm band, and the wide-leaf crops were found to display a decrease in emissivity with an increase in wavelength. The total attenuation in vegetative covers was examined, and showed that attenuation is proportional to the water content in vegetation, with a proportionality coefficient which depends on the type of vegetation and its state of growth. A model was developed to take into account the scattering and absorption cross sections, and a formula is presented for the total attenuation in the chosen vegetation model. M.S.K.

A82-21030 Mixture formulas applied in estimation of dielectric and radiative characteristics of soils and grounds at microwave frequencies. A. M. Shutko and E. M. Reutov (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 29-32. 12 refs.

A82-21031 Investigation of the vegetative covers on ploughed areas by SLAR. A. G. Geller, E. N. Zotova, and M. I. Naumov (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 32-35. 7 refs.

Results of SLAR investigations of crop condition and the correlation of dependencies between the mean intensity of reflected signals and the biometrical parameters of the crops are reported. The experiments were made using K-band SLAR with HH polarization at a grazing angle of 12-24 deg, and corn, sugar beets, and winter wheat were examined in the middle of the growth cycle. Microphotometric techniques were used to process the radar data, and the phytomass and crop moisture content parameters were chosen to describe the crop state. The 80% confidence limits for the regression functions are provided, and differences in the scattered signal intensities from wide-leaf crops are accounted for by differences in surface roughness characteristics. The desired antenna pattern was achieved in sensing angles from 68-72 deg, and the use of dual frequency, dual polarization, and a calibrated radar to improve system efficiency is indicated. M.S.K.

A82-21032 Volumetric effects in cross-polarized airborne radar data. A. J. Blanchard, R. W. Newton, L. Tsang, and B. R. Jean (Texas A & M University, College Station, TX). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 36-41. 14 refs.

Experimental results and theoretical models for the sensitivity of radar backscatter return to soil moisture as a function of incident angle and the sensibility of the cross polarized radar return to surface roughness are presented. Additional attention is devoted to establishing the accuracy of cross-polarized radar backscatter measurements by the identification of specific criteria in terms of integrated antenna polarization isolation. NASA scatterometers were used in test runs at 1.6, 4.75, and 13.3 GHz to detect soil moisture. The Kirchhoff scattering theory and the Blanchard and Rouse surface/volume theory were used to test predictions for like-polarized backscatter as a function of moisture and incident angle. Volume dependent measurements were found to be possible independent of surface effects and incident angle. M.S.K.

A82-21033 * Crop classification using airborne radar and Landsat data. F. T. Ulaby, R. Y. Li, and K. S. Shanmugan (University of Kansas Center for Research, Inc., Lawrence, KS). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 42-51. 21 refs. Contract No. NAS9-15421.

NASA 13.3 GHz airborne radar data from a soil moisture measurement analysis is used to investigate the statistical nature of the radar backscattering coefficient for bare ground and three different crop types, and to evaluate the crop classification rates using Landsat data alone or combined with the airborne survey. The scatterometer was a fan-beam Doppler system, VV polarized, and is considered only for 50 deg angles of incidence. A total of 36 fields were covered a week apart by the aircraft and Landsat, and Rayleigh statistics were used in the frequency averaging to eliminate fluctuations due to random fluctuations. Within-field variances were calculated for the Landsat and the radar data and used to design optimum crop classification procedures. The Landsat Band 4 readings were 67% accurate, and an increase in accuracy of 10% was achieved by the addition of the radar data. M.S.K.

A82-21092 Use of Landsat data for automatic classification and area estimation of sugar-cane plantation in Sao Paulo state, Brazil. F. J. Mendonça (Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). *International Journal of Remote Sensing,* vol. 2, Oct.-Dec. 1981, p. 361-368. 11 refs.

A sugar-cane inventory study of plantations in Sao Paulo state, Brazil is presented, in which sugar-cane was automatically classified and its area was estimated using an interactive image analysis system (Image-100) and Landsat digital data. Ten segments, 10 x 20 km, were aerially photographed from May 27-June 12, 1978; two Landsat passes were also made in April and July/August, 1978. Crop density, field size, and spatial distribution were all found to influence the spectral characteristics of the study crop. Classification of sugar-cane was found to be most difficult in the dry season (April) and easiest in July/August. The study area covered four Landsat paths: 235, 236, 237, and 238. The percentages of overall correct classification for the fourth paths ranged from 79.56 percent for path 238 to 95.59 percent for path 237. A difference of only 12.57 percent was encountered between sugar-cane estimates using Landsat data and those which used data from the Institute for Agricultural Economy. J.F.

A82-21093 The estimation of the surface moisture of a vegetated soil using aerial infrared photography. P. J. Curran (Reading, University, Reading, Berks., England). *International Journal of Remote Sensing,* vol. 2, Oct.-Dec. 1981, p. 369-378. 12 refs. Natural Environment Research Council Grant No. GR3/4076.

A remote sensing method for estimating the surface soil moisture of a soil with an incomplete vegetation cover is discussed. It has been shown that when the percentage cover of leaves and nongreen vegetation are known and constant, and the effect of shadow is minimal, the near infrared bidirectional reflectance from the vegetation canopy is negatively related to surface soil moisture. The near infrared bidirectional reflectance, surface soil moisture, and vegetation cover were measured at ten heathland sites on 18 different dates. It was found that the Y axis intercept of a regression between ground-based measurements of near infrared bidirectional reflectance (Y) and the percentage of green vegetation cover (X) was linearly related to surface soil moisture. This relationship between soil moisture and canopy reflectance was used to estimate the surface soil moisture of vegetated heathland in five flights of black and white infrared aerial photography. The resulting estimates had an accuracy of + or - 18.4% at the 95% confidence level. J.F.

A82-22142 An airphoto key for major tropical crops. W. R. Philipson and T. Liang (Cornell University, Ithaca, NY). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 223-233. 15 refs.

A key is presented for identifying selected major crops of the tropics through stereoscopic analysis of medium-scale (1:10,000 to 1:30,000) panchromatic aerial photographs. The development of the

key is based on representative photographs of crops as they occur throughout the tropics. The key recognizes certain field, management, and crop features which are frequently associated with crop occurrence. It is pointed out that positive crop identification normally requires ground verification. Attention has been given to crops of sugar cane, coffee, bananas, pineapple, rice, corn, tobacco, rubber, coconut, and cacao. G.R.

A82-22144 Multispectral photographic remote sensing of green vegetation biomass and productivity. P. J. Curran (Reading, University, Reading, Berks., England). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 243-250. 13 refs. Natural Environment Research Council Grant No. GR/3/1481.

An investigation was conducted with the objective to demonstrate the importance of productivity to the relationship between green biomass and a bidirectional reflectance ratio. Using bidirectional reflectance data derived photographically from 22 sets of near vertical aerial photography and 56 sets of oblique ground photography, it was determined that the amount of bidirectional reflectance ratio variance accounted for by green biomass could be increased by around 6 percent with the addition of productivity. On a pasture site with low green biomass but high productivity, the bidirectional reflectance ratio was higher than for a high green biomass pasture site with lower productivity. G.R.

A82-24961 Influence of illumination and viewing geometry and atmospheric composition on the 'tasseled cap' transformation of Landsat MSS data. J. V. Dave (IBM Scientific Center, Palo Alto, CA). *Remote Sensing of Environment,* vol. 11, Mar. 1981, p. 37-55. 15 refs.

Various characteristics of a simulated tasseled cap (representing the spectral-temporal characteristics of wheat fields, as observed by the Landsat MSS sensors) are investigated as a function of the viewing and illumination geometry parameters, and atmospheric composition. Measured spectral reflectances of ten wheat fields in various growth stages and the satellite-level radiances, computed after taking into account all orders of scattering, are used in this investigation. It is shown that the procedure for normalizing the measured radiances by the cosine of the solar zenith angle is a less accurate approximation, and that the characteristics of the tasseled cap both in the greenness-brightness and yellowness-brightness hyperplanes are significantly affected by the geometric as well as the atmospheric parameters. (Author)

A82-24963 * HCMM detection of high soil moisture areas. J. L. Heilman (South Dakota State University, Brookings, SD; Texas A & M University, College Station, TX) and D. G. Moore (South Dakota State University, Brookings, SD). *Remote Sensing of Environment,* vol. 11, Mar. 1981, p. 73-76. Contract No. NAS5-24206.

It is noted that one objective of NASA's Heat Capacity Mapping Mission (HCMM) is to evaluate the feasibility of using HCMM data to assess soil moisture effects by observing temperatures near the maximum and minimum of the diurnal temperature cycle. The satellite, which carries a two-channel radiometer (0.5-1.1 and 10.5-12.5 microns) gathers data at 1:30 P.M. and 2:30 A.M. local time at midlatitudes, with a repeat cycle of 5 or 16 days depending on latitude. The spatial resolutions are 0.5 x 0.5 km at nadir for the visible channel and 0.6 x 0.6 km at nadir for the thermal infrared channel. An example is presented here of HCMM detection of a region of high soil moisture. C.R.

A82-25457 Assessing mesquite-grass vegetation condition from Landsat. K. C. McDaniel (New Mexico State University, Las Cruces, NM) and R. H. Haas (U.S. Geological Survey, EROS Data Center, Sioux Falls, SD). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Mar. 1982, p. 441-450. 24 refs. Research supported by the E. Paul and Helen Buck Waggoner Foundation.

Regression analyses with Landsat MSS data and vegetation data collected on four dates from six study sites show the two vegetation index models, TVI 6 and GVI, to be highly correlated with such vegetation parameters associated with growing vegetation as green cover, green yield, and plant moisture content. This is seen as an indication of the possibility of vegetation condition quantitative measurement with Landsat MSS data. Because it is shown that land management practices do not seriously affect the relationship of Landsat MSS models with rangeland vegetation parameters obtained from a common vegetation-soil system, the stratifying of relatively uniform vegetation soil systems on Landsat imagery appears to be a useful first step in the vegetation survey use of Landsat MSS data. O.C.

A82-26577 † The spectral reflectance of certain soils (Spektral'naia otrazhatel'naia sposobnost' nekotorykh pochv). P. P. Fedchenko and K. Ia. Kondrat'ev. Leningrad, Gidrometeoizdat, 1981. 232 p. 121 refs. In Russian.

The principal factors affecting the reflectance properties of soils are investigated. Methods are proposed for aircraft and laboratory measurements of the spectral luminance factors of soils. Spectrometers currently in use for studying the reflectance properties of natural topographic features are described. It is shown that the theory of statistical pattern recognition makes possible soil mapping on the basis of reflection spectra. C.R.

A82-26842 * Use of Landsat-derived temporal profiles for corn-soybean feature extraction and classification. G. D. Badhwar (NASA, Johnson Space Center, Houston, TX), J. G. Carnes, and W. W. Austin (Lockheed Engineering and Management Services Co., Inc., Houston, TX). *Remote Sensing of Environment,* vol. 12, Mar. 1982, p. 57-79. 15 refs.

A physical model is presented, which has been derived from multitemporal-multispectral data acquired by Landsat satellites to describe the behavior and new features that are crop specific. A feasibility study over 40 sites was performed to classify the segment pixels into those of corn, soybeans, and others using the new features and a linear classifier. Results agree well with other existing methods, and it is shown the multitemporal-multispectral scanner data can be transformed into two parameters that are closely related to the target of interest and thus can be used in classification. The approach is less time intensive than other techniques and requires labeling of only pure pixels. D.L.G.

A82-27393 † Evaluation of the state of crops from satellite data (Otsenka sostoianiia sel'skokhoziaistvennykh kul'tur po sputnikovym dannym). G. I. Borisoglebskii and V. V. Kozoderov (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, USSR). *Meteorologiia i Gidrologiia,* Mar. 1982, p. 94-101. In Russian.

The paper examines the possibility of evaluating the dynamics of crop development from remote sensing images. Results are presented on the determination of the structure of agricultural lands and the state of winter crops in the Kherson territory of the USSR from medium-resolution satellite images. B.J.

A82-27397 Remote sensing of the structure of taiga landscapes (Distantsionnaia indikatsiia struktury taezhnykh landshaftov). Edited by V. V. Kuzmichev. Novosibirsk, Izdatel'stvo Nauka, 1981. 248 p. In Russian.

Papers are presented on the use of remote sensing to obtain information on the relationships between forests and other elements of the natural environment: soils, relief, the mineralogical composition of rocks, subsurface water, and animal habitats. Particular attention is given to such topics as the mapping of the post-fire stages of the formation of forests, the remote sensing of the dynamics of cedar forests in Siberia, the use of anthropogenic features in landscape studies (with Lake Baikal taken as an example), the use of remote sensing to study bird populations, and the relationship between taiga landscapes and geological structures. B.J.

A82-27586 * # Stochastic models of cover class dynamics. T. H. Barringer (Hunter College, New York, NY; Pennsylvania, University, Philadelphia, PA) and V. B. Robinson (Hunter College, New York, NY). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 125-144. 84 refs. Grant No. NsG-5325.

Investigations related to satellite remote sensing of vegetation have been concerned with questions of signature identification and

extension, cover inventory accuracy, and change detection and monitoring. Attention is given to models of ecological succession, present directions in successional modeling and analysis, nondynamic spatial models, issues in the analysis of spatial data, and aspects of spatial modeling. Issues in time-series analysis are considered along with dynamic spatial models, and problems of model specification and identification. G.R.

A82-27588 # **Data base requirements in support of crop models.** A. B. Park (General Electric Co., Lanham, MD). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 165-174.

Problems regarding the data base design can be approached in at least two ways. For the design of a 'local' model, both the crop and its environment are confined to the research location, and there is no need to consider the spatial distribution complexity problem. However, in the case of the design of a 'global' model, it is necessary to account for the variability of both the crop and the environment in all possible geographic locations. During the development and test of the model, it is normally attempted to simplify this problem by using the 'homologue' approach. Requirements regarding the input of agronomic data are considered, taking into account the crop area, the cropping pattern, the crop calendar, crop varieties, yield, water culture, fertilizer, plant pests, soil, the meteorological station, and the terrain model. Meteorological input data requirements are also discussed. G.R.

A82-27601 # **Multiresource inventory methods pilot test.** R. T. Pelletier (U.S. Department of Agriculture, Forest Service, Washington, DC). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 339-355. 6 refs.

The test is being conducted by the Forest Service as an advanced demonstration of Landsat technology to supplement current methods of conducting recurrent inventories over large areas. It will test, validate, and, if deemed successful by the Forest Service, transfer new remote sensing capability to the inventory and planning process; this will offer new efficiencies benefiting resource managers and planners. The pilot test will be administered over a three-year period and will support major efforts in two geographical areas. C.R.

A82-27617 # **Dew and vapor pressure as complicating factors in the interpretation of spectral radiance from crops.** P. J. Pinter, Jr. and R. D. Jackson (U.S. Water Conservation Laboratory, Phoenix, AZ). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 547-554. 8 refs.

Ground-based radiometers, utilizing relatively wide-band spectral filters similar to those of present and anticipated satellites, are being used extensively to develop fundamental relationships between agricultural targets and their spectral characteristics. In the present investigation some of the unique operational characteristics of a hand-held 4-band radiometer are utilized to examine the effect of dew on the spectral characteristics of wheat and to study the influence of atmospheric vapor pressure on the spectral quality of radiance measured over soil and alfalfa canopy targets. It is found possible to detect and quantify the presence of dew on crops by monitoring the depression in a spectrally-based vegetation index. The timing of spectral data acquisition is a critical factor, because complications regarding the interpretation of data can arise in connection with the presence of dew on crop canopies. G.R.

A82-27621 # **A timely and accurate potato acreage estimate from Landsat - Results of a demonstration.** R. A. Ryerson, R. J. Brown (Canada Centre for Remote Sensing, Ottawa, Canada), J.-L. Tambay, L. A. Murphy (Statistics Canada, Ottawa, Canada), and B. McLaughlin (Statistics Canada, Truro, Nova Scotia, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 587-597. 10 refs.

The current statistical data collection system for obtaining crop area estimates is considered. The area for which an estimate was required is located in the upper St. John Valley in New Brunswick, Canada. The 1980 ground sample and data collection is considered along with the analysis of remotely sensed data, taking into account procedures to improve estimates and the generation of the 1980 estimate based on Landsat data. A highly accurate potato area estimate for the three major potato producing counties of New Brunswick was obtained. G.R.

A82-27622 # **Landsat feature enhancement - Or, can we separate vegetation from soil.** J. E. Colwell (Michigan, Environmental Research Institute, Ann Arbor, MI). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 599-621. 12 refs.

Two separate procedures are presented for enhancing certain features in Landsat data. One procedure is designed to be helpful in assessing soil features in situations where the soil is partially covered by variable amounts of green vegetation. This procedure results in the calculation of a parameter called 'Projected Soil Brightness'. The other procedure is designed to be an aid in interpreting separate soil and vegetation effects in areas with partial cover of nongreen vegetation. This procedure results in the calculation of parameters called 'Normalized Vegetation Shadow Measure' and 'Corrected Soil Brightness Measure'. G.R.

A82-27624 # **Scene analysis for wildland fire-fuel characteristics in a Mediterranean climate.** M. J. Cosentino, C. E. Woodcock, and J. Franklin (California, University, Santa Barbara, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 635-646. 9 refs.

During the dry summer and fall seasons, wildfires are a threat to homes, lives, property, and natural resources in California. A computer program called FIREMOD, which will be used to predict fire spread rate and intensity, is currently being developed. A description is presented of the findings of a research project undertaken to evaluate the potential of using remotely sensed and collateral data in a geographic information system framework to provide maps of chaparral vegetation characteristics for input as a fuels database in the FIREMOD computer model. It is found that Landsat spectral data can be combined with a synthesized texture channel in an unsupervised classification procedure to provide a physiognomic vegetation classification which includes density distinctions. These vegetation classes are useful for fire spread simulation models because they contain meaningful distinctions related to fire behavior. G.R.

A82-27643 # **A vegetation response model applied to range inventory and monitoring using Landsat MSS data.** F. R. Honey and I. J. Tapley (Commonwealth Scientific and Industrial Research Organization, Div. of Land Resources Management, Perth, Australia). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 823-837. 7 refs.

A model describing the response of vegetation to rainfall from the standpoint of corresponding changes in reflectance, as measured by the Landsat MSS system, is presented. The main assumptions of the model are (1) that there is an exponential increase of fresh plant cells from such sources of new growth as seeds or buds, and (2) that the growth rates of the new cells is larger than their decay rate, so that some maximum is reached before the rate of production from the diminishing number of sources is less than the rate of decay. Because the shape of the response function curve will be independent of the means of measuring vegetation density and condition, curves from ground-collected biomass data should match those derived from Landsat vegetation indices. Results from data collected in Western Australia for three vegetation communities and plotted according to the model indicate that data must be collected intensively at the time of the peak. O.C.

A82-27644 # **Forest change detection.** J. E. Colwell (Michigan Environmental Research Institute, Ann Arbor, MI) and F. P. Weber (U.S. Forest Service, Houston, TX). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 839-852.

The U.S. Forest Service has a requirement to make periodic assessments of the renewable resources of the United States. This investigation was designed to examine the utility of Landsat data for assessing changes in renewable resources. Change was analyzed for a partially forested scene in Kershaw County, South Carolina based on Landsat data separated by two years in time. A variety of change detection procedures were investigated, including image analysis and two kinds of digital (automated) procedures. The most fundamental conclusion of this study is that the type of change detection procedure implemented can significantly affect the estimates of amount of change. (Author)

A82-27645 * # **Soybean canopy reflectance as a function of view and illumination geometry.** K. J. Ranson, V. C. Vanderbilt, L. L. Biehl, B. F. Robinson, and M. E. Bauer (Purdue University, West Lafayette, IN). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 853-865. 16 refs. Contract No. NAS9-15466.

Reflectances were calculated from measurements at four wavelength bands through eight view azimuth and seven view zenith directions, for various solar zenith and azimuth angles over portions of three days, in an experimental characterization of a soybean field by means of its reflectances and physical and agronomic attributes. Results indicate that the distribution of reflectance from a soybean field is a function of the solar illumination and viewing geometry, wavelength, and row direction, as well as the state of canopy development. Shadows between rows were found to affect visible wavelength band reflectance to a greater extent than near-IR reflectance. A model describing reflectance variation as a function of projected solar and viewing angles is proposed, which approximates the visible wavelength band reflectance variations of a canopy with a well-defined row structure. O.C.

A82-27646 # **The influence of illumination and viewing geometry on the reflectance factor of agricultural targets.** K. Staenz (Zürich, Universität, Zurich, Switzerland), F. J. Ahern, and R. J. Brown (Canada Centre for Remote Sensing, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 867-882. 25 refs.

The influence of illumination and viewing geometry on the reflectance factor of agricultural targets is investigated. Bare soil, small grains, and broadleaf crops are examined, and the reflectance factor of all three ground cover types shows significant variations with viewing angle. The reflectance factor increases when viewing away from the sun, and decreases when viewing toward the sun, although the effect is not usually symmetric about nadir. Curves showing the typical variation of reflectance factor in the thematic mapper bands as a function of viewing angle about their nadir are presented, and in general, the reflectance is a quasi-linear function of view angle for soil, but shows significant curvature for crops. D.L.G.

A82-27647 # **Digital analysis of spatial and spectral features from airborne MSS of a forested region.** P. M. Teillet, D. G. Goodenough, B. Guindon (Canada Centre for Remote Sensing, Ottawa, Canada), J.-F. Meunier, and K. Dickinson (INTERA Environmental Consultants, Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 883-903. 7 refs.

Forthcoming satellite imaging sensors will have increased spectral resolution and different spectral bandpasses compared to the current Landsat MSS. In order to assess improvements in information extraction anticipated from the use of these sensors, eleven-channel aircraft MSS data were acquired over a rugged forest site, located at Gun Lake near Bralorne, British Columbia. The aircraft MSS data set was rectified to the UTM projection while taking topography into account by means of a digital elevation map. Spatial features were generated using a variety of texture measures. Feature selection and classification were performed to investigate how well forest types can be distinguished and damaged stands can be detected using spatial and/or spectral features. B.J.

A82-27656 # **The potential of remote sensing to monitor soil erosion on cropland.** P. R. Stephens and J. Cihlar (Canada Centre for Remote Sensing, Applications Div., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 985-995. 18 refs.

Multitemporal satellite-borne multispectral scanner and thematic mapper digital data are assessed, following an erosion survey, by relating changes in farm crop rotation to changes in erosion rates according to the Universal Soil Loss Equation (USLE). Of the Landsat 2 and simulated Landsat-D and SPOT-1 data studied, SPOT-1 was evaluated to be the most accurate, with 94% classification accuracy for the case of spring imagery. SPOT-1 and Landsat-D summer imagery achieved the high relationship values of 0.97 and 0.95, respectively, between near-IR reflectance/red reflectance and the USLE C factor. While forest and cropland mapping accuracies were on the order of 90-97% for satellite digital data, pasture mapping accuracies were as low as 59-79%. Visual interpretation of medium-scale aerial photography should therefore be more accurate than satellite MSS data in the classification of spring pastures. O.C.

A82-27662 * # **Evaluation of large area crop estimation techniques.** M. L. Amis, R. K. Lennington, M. V. Martin, W. G. McGuire, and S. S. Shen (Lockheed Engineering and Management Services Co., Inc., Houston, TX). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1047-1056. 9 refs. Contract No. NAS9-15800.

The performance of the USDAs EDITOR system is evaluated. The system processes Landsat imagery and estimates crop hectarage for large areas based on a regression estimator developed on a sample with known ground truth. It is found that use of multitemporal data over unitemporal significantly improves the hectarage estimates, and a 15% reduction in the r-squared of the regression occurs when independent and jackknifed test sets are used to evaluate the performance of the estimator. When an alternative clustering algorithm, CLASSY, is substituted for the current EDITOR method, estimator performance is improved with reduced need for analyst decisions. It is recommended that the CLASSY clustering algorithm and some form of jackknifing be implemented on EDITOR. D.L.G.

A82-27663 # **Potential utility of thematic mapper data in estimating crop areas.** R. Sigman and M. Craig (U.S. Department of Agriculture, Economics and Statistics Service, Washington, DC). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1057-1064. 5 refs.

This paper predicts potential improvements offered by thematic mapper data over multispectral scanner data when utilized in regression estimation of crop areas. A study comparing Landsat data and simulated thematic mapper data is described. Quantitative measures of potential improvements in crop-area estimates of corn, soybeans, and dense woodlands are calculated, and the sensor characteristics causing these improvements are determined. (Author)

A82-27664 # **Automatic and semi-automatic classification of Landsat agricultural crops.** J. D. Tubbs (Arkansas, University, Fayetteville, AR). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1065-1074. 10 refs.

One of the mathematical functions proposed by Crisp and Malila

ERIM-152400-5-T) Avail: NTIS HC A05/MF A01 CSCL 02C

The computer software necessary to perform two research labeling procedures is described and documented. The first labeling technique identifies spring small grain fields based on similarity of growing season and temporal spectral patterns of development in LANDSAT data. The second technique further labels these fields as either wheat, barley or unknown spring grain, based on their spectral position in Tasseled Cap Greenness-Brightness space for a given day around the dough stage of wheat. The subroutines which carry out the steps of the procedure are coded in PREFOR, a preprocessed FORTRAN. The subroutines were designed to fit into the U.S. Corn/Soybeam baseline procedure software developed for use in the AgRISTARS Program. Documentation of the subroutines are provided in an appendix. Author

N82-16455# Colorado State Univ., Fort Collins. Dept. of Forest and Wood Sciences.

THERMAL VEGETATION CANOPY MODEL STUDIES Final Report, 1 Oct. 1978 - 1 Feb. 1980

James A. Smith, K. Jon Ranson, Duong Nguyen, and Lewis E. Link (Army Engineer Waterways Experiment Station, Vicksburg, Miss.) Aug. 1981 221 p refs
(Contract DACW39-77-C-0073; DA Proj. 4A7-62730-AT-42)
(AD-A106422; WES/TR/EL-81-6) Avail: NTIS HC A10/MF A01 CSCL 17/5

This is the final report in a series. Overall objectives of this project are concerned with developing comprehensive optical and thermal signature data bases, the development and evaluation of optical and thermal canopy radiation models, and the interpretation of these measurements. Previous technical reports in this series have described optical and thermal measurements obtained over a coniferous site (Pinus contorta) in Leadville, Colorado. This earlier data set served as a test bed for the development and initial evaluation of first, individual components, that is, needle and leaves, thermal models, and then a composite canopy terrain model. GRA

N82-17746# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE SEVERITY OF THE BRAZILIAN FREEZE OF JULY 1981, AS MONITORED BY SATELLITE

Michael Allan Fortune Sep. 1981 20 p refs
(INPE-2231-RPE/399) Avail: NTIS HC A02/MF A01

The location and intensity of freezing temperature during very cold nights ('geadas') in Brazil is discussed using satellite infrared television image data. The data are needed to lay the groundwork for a short-term freeze forecast model, which is to be developed before winter 1982. A cold snap occurred on 20-22 July 1981, which destroyed a large part of the future coffee, sugar and other harvest is documented. The photographs of enhanced satellite images document the widespread occurrence of subfreezing temperature in the states of Parana, Sao Paulo, Mato Grosso do Sul, and Minas Gerais. These sub-tropical areas are located north of the region which usually experiences frost, and thus damage to agriculture was particularly extensive. The synoptic factor responsible for the cold was a wandering cold-core cut-off low in the upper air, and not a strong cold front. The data contained in the photographs, when combined with the meteorological observations also presented will be valuable in developing a prediction model for the occurrence of 'geadas'. R.J.F.

N82-19607*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

WHEAT STRESS INDICATOR MODEL, CROP CONDITION ASSESSMENT DIVISION (CCAD) DATA BASE INTERFACE DRIVER, USER'S MANUAL

R. F. Hansen, Principal Investigator Feb. 1981 15 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10031; NASA-CR-161032; EW-L1-00711; LEMSCO-16034; JSC-17114) Avail: NTIS HC A02/MF A01 CSCL 02C

The use of the wheat stress indicator model CCAD data base interface driver is described. The purpose of this system is to interface the wheat stress indicator model with the CCAD operational data base. The interface driver routine decides what meteorological stations should be processed and calls the proper subroutines to process the stations. Author

N82-19608*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

AGRISTARS: INTERIM CATALOG GROUND DATA SUMMARY, DATA ACQUISITION YEAR 1979

H. M. Doyle and V. L. Cook, Principal Investigators Feb. 1981 32 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. Agristars)
(E82-10032; NASA-CR-161033; MU-L1-04055; LEMSCO-16207; JSC-17119) Avail: NTIS HC A03/MF A01 CSCL 02C

To honor numerous requests for information about data holdings, and to facilitate the requirements specifications process, a series of interim catalogs are being developed. The 1979 data acquisition year is covered in this volume with subsequent years to follow under different covers. This catalog lists by state those sample segment numbers for which aircraft data has been acquired and/or field inventory products produced. A.R.H.

N82-19610*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

RECOMMENDED DATA SETS, CORN SEGMENTS AND SPRING WHEAT SEGMENTS, FOR USE IN PROGRAM DEVELOPMENT

Willa W. Austin, Principal Investigator Apr. 1981 27 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10034; NASA-CR-161034; SR-L1-0409; LEMSCO-15708; JSC-17137) Avail: NTIS HC A03/MF A01 CSCL 02C

The sets of Large Area Crop Inventory Experiment sites, crop year 1978, which are recommended for use in the development and evaluation of classification techniques based on LANDSAT spectral data are presented. For each site, the following exists: (1) accuracy assessment digitized ground truth; (2) a minimum of 5 percent of the scene ground truth identified as corn or spring wheat; and (3) at least four acquisitions of acceptable data quality during the growing season of the crop of interest. The recommended data sets consist of 41 corn/soybean sites and 17 spring wheat sites. Author

N82-19614*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

AGRISTARS: FOREIGN COMMODITY PRODUCTION FORECASTING. MINUTES OF THE ANNUAL FORMAL PROJECT MANAGER'S REVIEW, INCLUDING PRELIMINARY TECHNICAL REVIEW REPORTS OF FY80 EXPERIMENTS

24 Sep. 1980 191 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development
(Proj. AgRISTARS)
(E82-10039; NASA-TM-84050; FC-J0-00502; JSC-16823) Avail: NTIS HC A09/MF A01 CSCL 02C

The U.S./Canada wheat/barley exploratory experiment is discussed with emphasis on labeling, machine processing using P1A, and the crop calendar. Classification and the simulated aggregation test used in the U.S. corn/soybean exploratory experiment are also considered. Topics covered regarding the foreign commodity production forecasting project include: (1) the acquisition, handling, and processing of both U.S. and foreign agricultural data, as well as meteorological data. The accuracy assessment methodology, multicrop sampling and aggregation technology development, frame development, the yield project interface, and classification for area estimation are also examined. A.R.H.

N82-19615*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.

USE OF THERMAL INERTIA DETERMINED BY HCMM TO PREDICT NOCTURNAL COLD PRONE AREAS IN FLORIDA Quarterly Report, 16 Mar. - 15 Jun. 1981

L. H. Allen, Jr., Principal Investigator, Ellen Chen, J. D. Martsolf, and P. H. Jones 15 Jun. 1981 36 p refs Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (Code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center', non-domestic users send orders to 'Attn: World

Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-26453)
(E82-10040; NASA-CR-164917; QR-1) Avail: NTIS HC A03/MF A01 CSCL 04B

The HCMM transparency scenes for the available winter of 1978-1979 were evaluated; scenes were identified on processed magnetic tapes; other remote sensing information was identified; and a soil heat flux model with variable-depth thermal profile was developed. The Image 100 system was used to compare HCMM and GOES transparent images of surface thermal patterns. Excellent correspondence of patterns was found, with HCMM giving the greater resolution. One image shows details of thermal patterns in Florida that are attributable to difference in near surface water contents. The wide range of surface temperatures attributable to surface thermal inertia that exist in the relatively flat Florida topography is demonstrated. A.R.H.

N82-19628*# Department of Agriculture, Houston, Tex.
AGRISTARS: SOIL MOISTURE/EARLY WARNING AND CROP CONDITION ASSESSMENT. INTERFACE CONTROL DOCUMENT
Nov. 1980 13 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10053; NASA-CR-161028; MU-JO-0101; JSC-16842) Avail: NTIS HC A02/MF A01 CSCL 02C

The interactions and support functions required between the early warning/crop condition assessment (EW/CCA) project and soil moisture (SM) project are defined. The EW Project aims to develop, test and evaluate techniques and procedures for adapting remote sensing technology to provide early warning of events and the timely assessment of those factors which affect the quality and quantity of production of economically important crops. Those techniques to augment and reinforce the current assessment activities are to be developed to improve the definition of the relationship between the plant(s) and its environment. This assessment and evaluation will certainly include the need for soil moisture measurement and estimation. The SM Project aims to develop, test, and evaluate techniques and procedures to measure or predict soil moisture in the root zone using both contact and remote sensors. A.R.H.

N82-19629*# Department of Agriculture, Houston, Tex.
AGRISTARS: YIELD MODEL DEVELOPMENT/SOIL MOISTURE. INTERFACE CONTROL DOCUMENT
Nov. 1980 12 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10054; NASA-CR-161029; MU-JO-0100; JSC-16841) Avail: NTIS HC A02/MF A01 CSCL 02C

The interactions and support functions required between the crop Yield Model Development (YMD) Project and Soil Moisture (SM) Project are defined. The requirements for YMD support of SM and vice-versa are outlined. Specific tasks in support of these interfaces are defined for development of support functions. J.D.H.

N82-19630*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AGRISTARS: EARLY WARNING AND CROP CONDITION ASSESSMENT. PATCH IMAGE PROCESSOR USER'S MANUAL
M. J. Nieves, Principal Investigator Sep. 1980 12 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10055; NASA-CR-161038; EW-LO-00707; LEMSCO-15692; JSC-16833) Avail: NTIS HC A02/MF A01 CSCL 02C

The Patch Image Processor extracts patches in various size (32x32, 64x64, 128x128, and 256x256 pixels) from full-frame Landsat imagery data. With the patches that are extracted, a patch image mosaic is created in the image processing system, IMDACS, format. Author

N82-19631*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AGRISTARS: FOREIGN COMMODITY PRODUCTION FORECASTING. CORN/SOYBEAN DECISION LOGIC DEVELOPMENT AND TESTING
C. L. Dailey and K. M. Abotteen, Principal Investigators Oct. 1980 81 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10056; NASA-CR-161024; FC-LO-00480; LEMSCO-14811; JSC-16380) Avail: NTIS HC A05/MF A01 CSCL 02C

The development and testing of an analysis procedure which was developed to improve the consistency and objectively of crop identification using LANDSAT data is described. The procedure was developed to identify corn and soybean crops in the U.S. corn belt region. The procedure consists of a series of decision points arranged in a tree-like structure, the branches of which lead an analyst to crop labels. The specific decision logic is designed to maximize the objectively of the identification process *and to promote the possibility of future automation. Significant* results are summarized. J.D.H.

N82-19632*# Lockheed Engineering and Management Services *Co., Inc., Houston, Tex.*
AGRICULTURAL SOIL MOISTURE EXPERIMENT, COLBY, KANSAS 1978: MEASURED AND PREDICTED HYDROLOGICAL PROPERTIES OF THE SOIL
L. M. Arya, Principal Investigator Oct. 1980 46 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10057; NASA-CR-161025; SM-LO-00463; LEMSCO-14307; JSC-16366) Avail: NTIS HC A03/MF A01 CSCL 02C

Predictive procedures for developing soil hydrologic properties (i.e., relationships of soil water pressure and hydraulic conductivity to soil water content) are presented. Three models of the soil water pressure-water content relationship and one model of the hydraulic conductivity-water content relationship are discussed. Input requirements for the models are indicated, and computational procedures are outlined. Computed hydrologic properties for Keith silt loam, a soil typer near Colby, Kansas, on which the 1978 Agricultural Soil Moisture Experiment was conducted, are presented. A comparison of computed results with experimental data in the dry range shows that analytical models utilizing a few basic hydrophysical parameters can produce satisfactory data for large-scale applications. Author

N82-19633*# Department of Agriculture, Houston, Tex. Soil Conservation Service.
TAXONOMIC CLASSIFICATION OF WORLD MAP UNITS IN CROP PRODUCING AREAS OF ARGENTINA AND BRAZIL WITH REPRESENTATIVE US SOIL SERIES AND MAJOR LAND RESOURCE AREAS IN WHICH THEY OCCUR
Horace F. Huckle, Principal Investigator Oct. 1980 42 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10058; NASA-CR-161021; SR-UO-00497; JSC-16824) Avail: NTIS HC A03/MF A01 CSCL 02C

The most probable current U.S. taxonomic classification of the soils estimated to dominate world soil map units (WSM)) in selected crop producing states of Argentina and Brazil are presented. Representative U.S. soil series the units are given. The map units occurring in each state are listed with areal extent and major U.S. land resource areas in which similar soils most probably occur. Soil series sampled in LARS Technical Report 111579 and major land resource areas in which they occur with corresponding similar WSM units at the taxonomic subgroup levels are given. Author

N82-19634*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
PRELIMINARY EVALUATION OF SPECTRAL, NORMAL AND METEOROLOGICAL CROP STAGE ESTIMATION APPROACHES
R. B. Cate, J. A. Artley, P. C. Doraiswamy, T. Hodges, M. C. Kinsler, D. E. Phinney, and M. L. Sestak, Principal Investigators Oct. 1980 74 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)

(E82-10059; NASA-CR-161023; SR-LO-04002; LEMSCO-14640; JSC-16830) Avail: NTIS HC A04/MF A01 CSCL 02C

Several of the projects in the AgRISTARS program require crop phenology information, including classification, acreage and yield estimation, and detection of episodal events. This study evaluates several crop calendar estimation techniques for their potential use in the program. The techniques, although generic in approach, were developed and tested on spring wheat data collected in 1978. There are three basic approaches to crop stage estimation: historical averages for an area (normal crop calendars), agrometeorological modeling of known crop-weather relationships agrometeorological (agromet) crop calendars, and interpretation of spectral signatures (spectral crop calendars). In all, 10 combinations of planting and biostage estimation models were evaluated. Dates of stage occurrence are estimated with biases between -4 and +4 days while root mean square errors range from 10 to 15 days. Results are inconclusive as to the superiority of any of the models and further evaluation of the models with the 1979 data set is recommended. Author

N82-19635*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

NOTES FOR BRAZIL SAMPLING FRAME EVALUATION TRIP Technical Report, 1 - 19 Feb. 1981

Robert Horvath, Principal Investigator and David R. Hicks, comp. Aug. 1981 32 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development ERTS

(Contract NAS9-15476; Proj. AgRISTARS)

(E82-10060; NASA-CR-167420; SR-E1-04138; ERIM-152400-7-T) Avail: NTIS HC A03/MF A01 CSCL 02C

Field notes describing a trip conducted in Brazil are presented. This trip was conducted for the purpose of evaluating a sample frame developed using LANDSAT full frame images by the USDA Economic and Statistics Service for the eventual purpose of cropland production estimation with LANDSAT by the Foreign Commodity Production Forecasting Project of the AgRISTARS program. Six areas were analyzed on the basis of land use, crop land in corn and soybean, field size and soil type. The analysis indicated generally successful use of LANDSAT images for purposes of remote large area land use stratification. Author

N82-19636*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

SEGMENT-LEVEL EVALUATION OF THE SIMULATED AGGREGATION TEST: US CORN AND SOYBEAN EXPLORATORY EXPERIMENT

S. A. Davidson, Principal Investigator Oct. 1980 26 p refs Sponsored by NASA, USDA, Dept. of Commerce, of the Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E82-10061; NASA-CR-161022; FC-LO-00493; LEMSCO-15116; JSC-16820) Avail: NTIS HC A03/MF A01 CSCL 02C

An evaluation of the corn and soybean proportion-estimation accuracy and dot labeling accuracy of the Simulated Aggregation Test, U.S. Corn and Soybean Exploratory Experiment, is presented. These results are in turn compared with the corn and soybean proportion-estimation accuracy and dot labeling accuracy of the Classification Procedures Verification Test. Author

N82-19639# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

UTILIZATION OF AEROCHROME 2443 FILM FOR IDENTIFICATION AND ESTIMATING WHEAT GROWING AREAS

Francisco Jose Mendonca, Angela Maria DeLima, Antonio Teraldi Tardin, Armando P. Dossantos, Dall Arthur Cottrell, David C. L. Lee, Fernando C. S. Maia, Liane A. M. Lucht, Mauricio A. Moreira, and Rene Antonio Novaes Aug. 1981 10 p refs In PORTUGUESE; ENGLISH summary Submitted for publication (INPE-2197-PRE/006) Avail: NTIS HC A02/MF A01

To identify and estimate wheat area using remote sensing techniques, aerial photographs were taken using KODAK Aerochrome 2443, at Soledade, Cruz Alta, and Santa Angelo in the state of Rio Grande do Sul, the photographs were interpreted manually and maps indicating areas for wheat, barley, idle land, flowed land, pasture land, nature vegetation, reforestation and others were prepared for each segment. A.R.H.

N82-19640# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

METHOD OF INTERPRETATION OF REMOTE SENSING DATA AND APPLICATIONS TO VEGETATION

Joao Roberto dosSantos, Pedro Hernandez Filho, and Yosio Edemir Shimabukuro Aug. 1981 54 p refs In PORTUGUESE; ENGLISH summary

(INPE-2215-MD/010) Avail: NTIS HC A03/MF A01

The material provided for remote sensing training course on vegetation is presented. Studies using remote sensing products for characterization and mapping, inventory or management problems in forestry were reviewed in the literature. The methodology of visual or automatic interpretation of those most commonly used LANDSAT data products in forestry studies is described. Case studies in natural or reforested vegetation, which were carried out in INPE, are included with the basic information. A.R.H.

N82-19715# Tennessee Valley Authority, Norris. Office of Natural Resources.

REMOTE SENSING OF SULFUR DIOXIDE EFFECTS ON VEGETATION. VOLUME 1: SUMMARY Final Report, 1976 - 1980

C. Daniel Sapp Washington EPA Jul. 1981 33 p 2 Vol. (PB82-115122; TVA/ONR/ARP-81/5-Vol-1; EPA-600/7-81-113) Avail: NTIS HC A03/MF A01 CSCL 06F

Three techniques for detecting and mapping sulfur dioxide (SO2) effects on the foliage of sensitive crops and trees near large, coal fired power plants were tested. These techniques used are spectroradiometry, photometric analysis of aerial photographs, and computer analysis of airborne multispectral scanner data. Airborne multispectral scanner data covering affected soybean fields were analyzed using three computer assisted procedures. GRA

N82-19716# Tennessee Valley Authority, Norris. Office of Natural Resources.

REMOTE SENSING OF SULFUR DIOXIDE EFFECTS ON VEGETATION. VOLUME 2: DATA Final Report, 1976 - 1980

C. Daniel Sapp Washington EPA Jul. 1981 284 p refs 2 Vol.

(PB82-115130; TVA/ONR/ARP-81/6-Vol-2; EPA-600/7-81-114) Avail: NTIS HC A13/MF A01 CSCL 06F

Techniques for detecting and mapping sulfur dioxide (SO2) effects on foliage of sensitive crops and trees near large coal fired power plants were calculated. The techniques are: laboratory spectroradiometry field spectroradiometry; interpretation and analysis of aerial photographs; analysis of multispectral scanner data. GRA

N82-20590*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

EVALUATION OF A SEGMENT-BASED LANDSAT FULL-FRAME APPROACH TO CORP AREA ESTIMATION

M. E. Bauer, Principal Investigator, M. M. Hixson, and S. M. Davis 23 Jun. 1981 22 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(E82-10067; NASA-CR-167400; NAS 1.26:167400; FC-P1-04121; LARS-062381) Avail: NTIS HC A02/MF A01 CSCL 02C

As the registration of LANDSAT full frames enters the realm of current technology, sampling methods should be examined which utilize other than the segment data used for LACIE. The effect of separating the functions of sampling for training and sampling for area estimation. The frame selected for analysis was acquired over north central Iowa on August 9, 1978. A stratification of he full-frame was defined. Training data came from segments within the frame. Two classification and estimation procedures were compared: statistics developed on one segment were used to classify that segment, and pooled statistics from the segments were used to classify a systematic sample of pixels. Comparisons to USDA/ESCS estimates illustrate that the full-frame sampling approach can provide accurate and precise area estimates. A.R.H.

N82-20591*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
EFFECTS OF NITROGEN NUTRITION ON THE GROWTH, YIELD AND REFLECTANCE CHARACTERISTICS OF CORN CANOPIES
M. E. Bauer, Principal Investigator, G. Walburg, and C. S. T. Daughtry May 1981 22 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E82-10068; NASA-CR-165090; NAS 1.26:165090; SR-P1-04044; LARS-030381) Avail: NTIS HC A02/MF A01 CSCL 02C

Spectral and agronomic measurements were collected from corn (Zea mays L.) canopies under four nitrogen treatment levels (0, 67, 134, and 202 kg/ha) on 11 dates during 1978 and 12 dates during 1979. Data were analyzed to determine the relationship between the spectral responses of canopies and their argonomic characteristics as well as the spectral separability of the four treatments. Red reflectance was increased, while the near infrared reflectance was decreased for canopies under nitrogen deprivation. Spectral differences between treatments were seen throughout each growing season. The near infrared/red reflectance ratio increased spectral treatment differences over those shown by single band reflectance measures. Of the spectral variables examined, the near infrared/red reflectance ratio most effectively separated the treatments. Differences in spectral response between treatments were attributed to varying soil cover, leaf area index, and leaf pigmentation values, all of which changed with N treatment. A.R.H.

N82-20594*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SURVEY OF THE CANE-GROWING AREA OF THE STATE OF SAO PAULO USING LANDSAT DATA, SAFRA YEAR 1979/80, VOLUME 2 [LEVANTAMENTO JA AREA CANAVIEIRA DO ESTADO DE SAO PAULO, UTILIZANDO DADOS DO LANDSAT AND SAFRA 1979/80, VOLUME 2]
Nelson deJesusParada, Principal Investigator, Francisco Jose Mendonca, David Chung Liang Lee, Antonio Tebaldi Tardin, Yosio Edemir Shimabukuro, Sherry Chou Chen, Liane Antunes Maciel Lucht, Mauricio Alves Moreira, Angela Maria deLima, and Fernando Celso Soares Maia Mar. 1981 63 p In PORTUGUESE ERTS
(E82-10071; NASA-CR-165093; NAS 1.26:165093; INPE-2021-RPE/288) Avail: NTIS HC A04/MF A01 CSCL 02C

Maps indicating areas of sugar cane cultivation in the state of Sao Paulo, Brazil are presented. J.D.H.

N82-20597*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Final Report, Jan. 1978 - Jan. 1981
J. C. Harlan, Principal Investigator, W. D. Rosenthal, and B. J. Blanchard Apr. 1981 8 p refs Sponsored by NASA HCMM (E82-10074; NASA-CR-165096; NAS 1.26:165096) Avail: NTIS HC A02/MF A01 CSCL 08F

The antecedent precipitation index (API) was related to surface temperatures as measured from the NASA C-130 and HCMM thermal data. Significant results from the aircraft flight in May 1978, include: (1) canopy temperature were measured accurately remotely; (2) pasture surface temperatures were related to pasture and wheat soil moisture conditions; (3) no relationship was developed with that data set between wheat yield and thermal infrared data due to a lack of moisture stress during the measurement period; and (4) lake surface temperatures were useful in normalizing the thermal IR data. Results from HCMM also suggested a relationship between thermal IR data and antecedent precipitation index. While HCMM was adequate in detecting relative soil moisture differences, the overpass timing was infrequent and prevented detailed analysis of the API/thermal relationship. A.R.H.

N82-20600*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ELEVATION OF A CANE-GROWING AREA OF THE STATE OF SAO PAULO USING LANDSAT DATA [LEVANTAMENTO DA AREA CANAVIEIRA DO ESTADO DE SAO PAULO, UTLIZANDO DADOS DO LANDSAT ANO SAFRA: 1979/80]
Nelson deJesusParada, Principal Investigator, Francisco Jose Mendonca, David C. Liang Lee, Antonio Tebaldi Tardin, Yosio Edemir Shimabukuro, Sherry Chou Chen, Liane A. M. Lucht, Mauricio A. Moreira, Angela M. deLima, and Fernando C. S. Maia Aug. 1981 10 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E82-10077; NASA-CR-168398; NAS 1.26:168399; INPE-2199-RPE/007) Avail: NTIS HC A02/MF A01 CSCL 02C

Images at a scale of 1:250.000 were visually interpreted for identification and area estimates of sugar cane plantations in Sao Paulo. The basic criteria for crop identification were the spectral characteristics of channels 5 and 7 and their temporal variations observed from different LANDSAT passes. Using this technique, it was possible to map the sugar cane areas as well as the sugar cane already harvested. An area of 801,950 hectares was estimated within the study area. The confidence interval of correct classification ranged from 87.11% to 94.71%. T.M.

N82-20601*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RELATION OF THE ACTIVITIES OF THE IPDF/INPE PROJECT (REFORESTATION SUBPROJECT) DURING THE YEAR 1979 [REALTORIO DAS ATIVIDADES DO PROJETO IBDF/INPE (SUBPROJETO REFLORESTAMENTO) DURANTE O ANO DE 179]
Nelson deJesusParada, Principal Investigator, Pedro Hernandez Filho, Yosio Edemir Shimabukuro, Jose Simeao deMedeiros, Carlito Chefer deSantana, and Eduardo Carlos Mignone Alves Aug. 1981 10 p In PORTUGUESE; ENGLISH summary Presented at the 11th Congr. Brasileiro de Engenharia Agricola, Brazil, 22-25 Jun. 1981 Sponsored by NASA ERTS
(E82-10078; NASA-CR-168399; NAS 1.26:168399; INPE-2196-RPE/005) Avail: NTIS HC A02/MF A01 CSCL 02F

The state of Mato Grosso do Sul was selected as the study area to define the recognizable classes of Eucalyptus spp. and Pinus spp. by visual and automatic analyses. For visual analysis, a preliminary interpretation key and a legend of 6 groups were derived. Based on these six groups, three final classes were defined for analysis: (1) area prepared for reforestation; (2) area reforested with Eucalyptus spp.; and (3) area reforested with Pinus spp. For automatic interpretation the area along the highway from Ribas do Rio Pardo to Agua Clara was classified into the following classes: eucalytus, bare soil, plowed soil, pine and 'cerrado'. The results of visual analysis show that 67% of the reforested farms have relative differences in area estimate below 5%, 22%, between 5% and 10%; and 11% between 10% and 20%. The reforested eucalyptus area is 17 times greater than the area of reforested pine. Automatic classification of eucalyptus ranged from 73.03% to 92.30% in the training areas. Author

N82-20602*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SYSTEM OF FORECASTING AGRICULTURAL CROPS USING SATELLITE OBSERVATIONS OF EARTH [SISTEMA DE PREVISAO DE SAFRAS AERICOLAS UTILIZANDO SATELITES DE OBSERVACAO DA TERRA]
Nelson deJesusParada, Principal Investigator, Rene Antonio Novaes, Derli M. Silva, Luiz Gylvan Meira Filho, Mucio R. Dias, Oscar P. Dias, Jr., and Fausto C. deAlmeida Jul. 1981 38 p In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E82-10079; NASA-CR-168400; NAS 1.26:168400; INPE-2163-RPE/381) Avail: NTIS HC A03/MF A01 CSCL 02C

A preliminary description of a crop forecasting system is presented. Ground and satellite observation are the main sources of data collection. T.M.

N82-20609*# Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
[FREEZE PREDICTION MODEL] Final Report
C. Terry Morrow *In* Florida Univ. Appl. of Satellite Frost Forecast Technol. to Other Parts of the U.S., Phase 2 Nov. 1981 25 p refs (For primary document see N82-20607 11-43)
Avail: NTIS HC A12/MF A01 CSCL 02C

Measurements of wind speed, net irradiation, and of air, soil, and dew point temperatures in an orchard at the Rock

Springs Agricultural Research Center, as well as topographical and climatological data and a description of the major apple growing regions of Pennsylvania were supplied to the University of Florida for use in running the P-model, freeze prediction program. Results show that the P-model appears to have considerable applicability to conditions in Pennsylvania. Even though modifications may have to be made for use in the fruit growing regions, there are advantages for fruit growers with the model in its present form. A.R.H.

N82-20613*# Michigan State Univ., East Lansing. Dept. of Entomology.
APPLICABILITY OF SATELLITE FREEZE FORECASTING AND COLD CLIMATE MAPPING TO THE OTHER PARTS OF THE UNITED STATES Final Report
In Florida Univ. Appl. of Satellite Frost Forecast Technol. to Other Parts of the U.S., Phase 2 Nov. 1981 59 p refs Original contains color illustrations (For primary document see N82-20607 11-43)
Avail: NTIS HC A12/MF A01 CSCL 04B

Tasks performed to determine the value of using GOES satellite thermal imagery to enhance fruit crop production in Michigan are described. An overview is presented of the system developed for image processing and thermal image and surface environmental data bases prepared to assess the physical models developed in Florida. These data bases were used to identify correlations between satellite apparent temperatures patterns and Earth surface factors. Significant freeze events in 1981 and the physical models used to provide a perspective on how Florida models can be applied in the context of the Michigan environment are discussed. A.R.H.

N82-21635*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
REGISTRATION VERIFICATION OF SEA/AR FIELDS
Willa W. Austin and Lyle Lautenschlager, Principal Investigators Jun. 1981 42 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10083; NASA-CR-161059; JSC-17251; NAS 1.26:161059; EW-L1-04101; LEMSCO-16204) Avail: NTIS HC A03/MF A01 CSCL 02C

A method of field registration verification for 20 SEA/AR sites for the 1979 crop year is evaluated. Field delineations for the sites were entered into the data base, and their registration verified using single channel gray scale computer printout maps of LANDSAT data taken over the site. J.D.H.

N82-21636*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
GROUND REGISTRATION OF DATA FROM AN AIRBORNE SCATTEROMETER
John C. Richter Jun. 1981 27 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10084; NASA-CR-161058; JSC-17296; NAS 1.26:161058; SM-L1-04091; LEMSCO-16340) Avail: NTIS HC A03/MF A01 CSCL 02C

A portion of the data for the agricultural soil moisture experiment, conducted near Colby, Kansas, was collected from four scatterometers mounted on an aircraft. A method is outlined for locating the scatterometer footprints with respect to a ground-based coordinate system. The method requires the airplane's flight parameters along with aerial photography acquired simultaneously with the scatterometer data. Listings of the programs used in the registration process are included. A.R.H.

N82-21639*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AGRISTARS: FOREIGN COMMODITY PRODUCTION FORECASTING. PROJECT TEST REPORTS DOCUMENT, VOLUME 1
J. T. Waggoner and D. E. Phinney, Principal Investigators Jun. 1981 56 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10087; NASA-CR-161063; NAS 1.26:161063; FC-L1-00718-Vol-1; JSC-17155-Vol-1; LEMSCO-16851-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 02C

Foreign Commodity Production Forecasting testing activities through June 1981 are documented. A log of test reports is presented. Standard documentation sets are included for each test. The documentation elements presented in each set are summarized. J.D.H.

N82-21640*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
US CORN AND SOYBEANS EXPLORATORY EXPERIMENT
J. G. Carnes, Principal Investigator Jun. 1981 29 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10088; NASA-CR-161057; NAS 1.26:161057; FC-L1-04073; JSC-17129; LEMSCO-16315) Avail: NTIS HC A03/MF A01 CSCL 02C

The results from the U.S. corn/soybeans exploratory experiment which was completed during FY 1980 are summarized. The experiment consisted of two parts: the classification procedures verification test and the simulated aggregation test. Evaluations of labeling, proportion estimation, and aggregation procedures are presented. J.D.H.

N82-21644*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR THE CLASFYG PROGRAM
C. L. Horton, Principal Investigator Jun. 1981 129 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10092; NASA-CR-161067; NAS 1.26:161067; SR-L1-00304; JSC-17369; LEMSCO-16649) Avail: NTIS HC A07/MF A01 CSCL 02C

This program produces a file with a Universal-formatted header and data records in a nonstandard format. Trajectory coefficients are calculated from 5 to 8 acquisitions of radiance values in the training field corresponding to an agricultural product. These coefficients are then used to calculate a time of emergence and corresponding trajectory coefficients for each pixel in the test field. The time of emergence, two of the coefficients, and the sigma value for each pixel are written to the file. Author

N82-21645*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
PROJECT COMMUNICATIONS/DOCUMENTATION STANDARDS MANUAL
J. T. Waggoner, Principal Investigators and D. E. Phinney Jun. 1981 32 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10093; NASA-CR-161055; NAS 1.26:161055; FC-L1-00714; JSC-17141; LEMSCO-16850) Avail: NTIS HC A03/MF A01 CSCL 02C

The standards apply to the identification and description of remote sensing technical crop estimation analysis procedures. Standard working terminology for technical project and programmatic communications among and between FCPF project technologists and managers as well as with other AgRISTARS projects and program management is established. Basic reference material for FCPF project technologists is provided. The material presented can be used as introductory training material for new technical personnel. T.M.

N82-21647*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
SOYBEAN CANOPY REFLECTANCE AS INFLUENCED BY CULTURAL PRACTICES
M. E. Bauer, Principal Investigator, J. C. Kollenkark, and C. S. T. Daughtry Mar. 1981 46 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E82-10105; NASA-CR-167456; NAS 1.26:167456; SR-P1-04038; LARS-021781) Avail: NTIS HC A03/MF A01 CSCL 02C

Experiments were conducted at West Lafayette, Indiana in 1978 and 1979 to study the reflectance factor of soybean canopies

as affected by differences in row width, population, planting date, cultivar and soil type. Reflectance factor data were acquired throughout the growing season with a LANDSAT-band radiometer. Agronomic data included plant height, leaf area index, development stage, total fresh and dry biomass, percent soil cover, and grain yield. The results indicate that row width, planting date, and cultivar influence the percent soil cover, leaf area index, and biomass present, which are in turn related to the multispectral reflectance. Additionally, the reflectance data were quite sensitive to the onset of senescence. Soil color and moisture were found to be important factors influencing the reflectance in single LANDSAT bands, but the near infrared/red reflectance ratio and the greeness transformation were less sensitive than the single bands to the soil background present. Author

N82-21648*# Nebraska Univ., Lincoln. Dept. of Biology.
A GRADIENT MODEL OF VEGETATION AND CLIMATE UTILIZING NOAA SATELLITE IMAGERY. PHASE 1: TEXAS TRANSECT
David Greegor and Jim Norwine, Principal Investigators (Texas A & M Univ.) Aug. 1981 65 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10107; NASA-CR-167454; NAS 1.26:167454; FC-J1-04176; JSC-17435) Avail: NTIS HC A04/MF A01 CSCL 02C

A climatological model/variable termed the sponge (a measure of moisture availability based on daily temperature maxima and minima, and precipitation) was tested for potential biogeograhic, ecological, and agro-climatological applications. Results, depicted in tabular and graphic form, suggest that, as generalized climatic index, sponge is particularly appropriate for large-area and global vegetation monitoring. The feasibility of utilizing NOAA/AVHRR data for vegetation classification was investigated and a vegetation gradient model that utilizes sponge and AVHRR data was initiated. Along an east-west Texas gradient, vegetation, sponge, and AVHRR pixel data (channels 1 and 2) were obtained for 12 locations. The normalized difference values for the AVHRR data when plotted against vegetation characteristics (biomass, net productivity, leaf area) and sponge values along the Texas gradient suggest that a multivariate gradient model incorporating AVHRR and sponge data may indeed be useful in global vegetation stratification and monitoring. A.R.H.

N82-21649*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
SAN JUAN NATIONAL FOREST LAND MANAGEMENT PLANNING SUPPORT SYSTEM (LMPSS) REQUIREMENTS DEFINITION Final Report
Lee F. Werth, Principal Investigator Sep. 1981 41 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10108; NASA-CR-167448; NAS 1.26:167448; RR-L1-04146; JSC-17422; LEMSCO-17163) Avail: NTIS HC A03/MF A01 CSCL 02F

The role of remote sensing data as it relates to a three-component land management planning system (geographic information, data base management, and planning model) can be understood only when user requirements are known. Personnel at the San Juan National Forest in southwestern Colorado were interviewed to determine data needs for managing and monitoring timber, rangelands, wildlife, fisheries, soils, water, geology and recreation facilities. While all the information required for land management planning cannot be obtained using remote sensing techniques, valuable information can be provided for the geographic information system. A wide range of sensors such as small and large format cameras, synthetic aperture radar, and LANDSAT data should be utilized. Because of the detail and accuracy required, high altitude color infrared photography should serve as the baseline data base and be supplemented and updated with data from the other sensors. A.R.H.

N82-21650*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AN EVALUATION OF ISOCLS AND CLASSY CLUSTERING ALGORITHMS FOR FOREST CLASSIFICATION IN NORTHERN IDAHO
Lee F. Werth, Principal Investigator Sep. 1981 21 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10109; NASA-CR-167447; NAS 1.26:167447; RRI-L1-04143; JSC-17418; LEMSCO-17154) Avail: NTIS HC A02/MF A01 CSCL 02F

Both the iterative self-organizing clustering system (ISOCLS) and the CLASSY algorithms were applied to forest and nonforest classes for one 1:24,000 quadrangle map of northern Idaho and the classification and mapping accuracies were evaluated with 1:30,000 color infrared aerial photography. Confusion matrices for the two clustering algorithms were generated and studied to determine which is most applicable to forest and rangeland inventories in future projects. In an unsupervised mode, ISOCLS requires many trial-and-error runs to find the proper parameters to separate desired information classes. CLASSY tells more in a single run concerning the classes that can be separated, shows more promise for forest stratification than ISOCLS, and shows more promise for consistency. One major drawback to CLASSY is that important forest and range classes that are smaller than a minimum cluster size will be combined with other classes. The algorithm requires so much computer storage that only data sets as small as a quadrangle can be used at one time. A.R.H.

N82-21651*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
TRANSITION YEAR LABELING ERROR CHARACTERIZATION STUDY Final Report
N. James Clinton, Principal Investigators Oct. 1980 81 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10111; NASA-CR-160887; NAS 1.26:160887; RC-LO-00479; LEMSCO-14056) Avail: NTIS HC A05/MF A01 CSCL 05B

Labeling errors made in the large area crop inventory experiment transition year estimates by Earth Observation Division image analysts are identified and quantified. The analysis was made from a subset of blind sites in six U.S. Great Plains states (Oklahoma, Kansas, Montana, Minnesota, North and South Dakota). The image interpretation basically was well done, resulting in a total omission error rate of 24 percent and a comission error rate of 4 percent. The largest amount of error was caused by factors beyond the control of the analysts who were following the interpretation procedures. The odd signatures, the largest error cause group, occurred mostly in areas of moisture abnormality. Multicrop labeling was tabulated showing the distribution of labeling for all crops. Author

N82-21652*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
WHEAT STRESS INDICATOR MODEL, EARLY WARNING (EW) DATA BASE INTERFACE DRIVER, USER'S MANUAL
R. F. Hansen, Principal Investigator Nov. 1981 15 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10115; NASA-CR-167480; NAS 1.26:167480; EW-L1-00732; JSC-17793; LEMSCO-17179) Avail: HC A02/MF A01 CSCL 02C

Detailed instructions on the use of the wheat stress indicator model, early warning (EW) data base interface driver are given. The purpose of this system is to interface the wheat stress indicator model with the EW operational data base. The interface driver routine decides what meteorological stations data should be processed and calls the proper subroutines to process the stations data. M.G.

N82-21653*# Department of Agriculture, Washington, D.C.
AGRISTARS: AGRICULTURE AND RESOURCES INVENTORY SURVEYS THROUGH AEROSPACE REMOTE SENSING. ENUMERATOR'S MANUAL, 1981 GROUND DATA SURVEY
Jan. 1981 88 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10116; NASA-CR-167434; NAS 1.26:167434; FC-J1-04108; JSC-16860) Avail: NTIS HC A05/MF A01 CSCL 05B

General information and administrative instructions are provided for individuals gathering ground truth data to support research and development techniques for estimating crop acreage and production by remote sensing by satellite. Procedures are given for personal safety with regards to organophosphorus insecticides, for conducting interviews for periodic observations, for coding the crops identified and their growth stages, and for selecting sites for placing rain gages. Forms are included for those citizens agreeing to monitor the gages and record the rainfall. Segment selection is also considered. A.R.H.

N82-21654*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

DEVELOPMENT OF ROTATION SAMPLE DESIGNS FOR THE ESTIMATION OF CROP ACREAGES

T. G. Lycthuan-Lee, Principal Investigator Sep. 1981 126 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10117; NASA-CR-167438; NAS 1.26:167438; FC-LI-04153; JSC-17427; LEMSCO-15409) Avail: NTIS HC A07/MF A01 CSCL 02C

The idea behind the use of rotation sample designs is that the variation of the crop acreage of a particular sample unit from year to year is usually less than the variation of crop acreage between units within a particular year. The estimation theory is based on an additive mixed analysis of variance model with years as fixed effects, (a sub t), and sample units as a variable factor. The rotation patterns are decided upon according to: (1) the number of sample units in the design each year; (2) the number of units retained in the following years; and (3) the number of years to complete the rotation pattern. Different analytic formulae for the variance of (a sub t) and the variance comparisons in using a complete survey of the rotation patterns. A.R.H.

N82-21655*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

SAMPLE SELECTION IN FOREIGN SIMILARITY REGIONS FOR MULTICROP EXPERIMENTS

J. T. Malin, Principal Investigator Aug. 1981 44 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10118; NASA-CR-167439; NAS 1.26:167439; FC-L1-04120; JSC-17401; LEMSCO-16663) Avail: NTIS HC A03/MF A01 CSCL 02C

The selection of sample segments in the U.S. foreign similarity regions for development of proportion estimation procedures and error modeling for Argentina, Australia, Brazil, and USSR in AgRISTARS is described. Each sample was chosen to be similar in crop mix to the corresponding indicator region sample. Data sets, methods of selection, and resulting samples are discussed. A.R.H.

N82-21657*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

A LOOK AT THE COMMONLY USED LANDSAT VEGETATION INDICES

G. E. Miller, Principal Investigator Oct. 1981 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10123; NASA-CR-167474; NAS 1.26:167474; EW-L1-04134; JSC-17413; LEMSCO-16844) Avail: NTIS HC A03/MF A01 CSCL 02C

The origins, development, and logic of the indices are discussed. The relationships of the indices to ground-based measurements of vegetation are highlighted. An effort was made to preserve the order in which the various indices appeared in the literature in order to historically trace their underlying concepts. T.M.

N82-21658*# Environmental Research Inst. of Michigan, Ann Arbor.

THE 1981 ARGENTINA GROUND DATA COLLECTION

Robert Horvath, Robert N. Colwell, Principal Investigators, David Hicks, Buzz Sellman, Edwin Sheffner, Gene Thomas, and Byron Wood Oct. 1981 100 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Prepared in cooperation with California Univ., Berkeley Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Contracts NAS9-15476; NAS9-14565; Proj. AgRISTARS)
(E82-10127; NASA-CR-167451; NAS 1.26:167451; SR-E1-04174; ERIM-152400-12-T) Avail: NTIS HC A05/MF A01 CSCL 05B

Over 600 fields in the corn, soybean and wheat growing regions of the Argentine pampa were categorized by crop or cover type and ancillary data including crop calendars, historical crop production statistics and certain cropping practices were also gathered. A summary of the field work undertaken is included along with a country overview, a chronology of field trip planning and field work events, and the field work inventory of selected sample segments. LANDSAT images were annotated and used as the field work base and several hundred ground and aerial photographs were taken. These items along with segment descriptions are presented. Meetings were held with officials of the State Secretariat of Agriculture (SEAG) and the National Commission on Space Investigations (CNIE), and their support to the program are described. A.R.H.

N82-21661*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

SONORA EXPLORATORY STUDY FOR THE DETECTION OF WHEAT-LEAF RUST

R. W. Payne, Principal Investigator Nov. 1980 43 p refs ERTS
(Contract NAS9-15800)
(E82-10133; NASA-CR-161051; JSC-16956; NAS 1.26:161051; LEMSCO-15604) Avail: NTIS HC A03/MF A01 CSCL 02C

The applicability of LANDSAT remote sensing technology to the detection of a wheat-leaf-rust epidemic in Sonora, Mexico, during 1977 was investigated. LANDSAT data acquired during crop years 1975-76 and 1976-77 were clustered, classified, and analyzed in order to detect agricultural changes. Analysis of 1977 data indicates a significant proportion of the identified wheat is stressed (potentially rust-infected). Additional analyses show a significant increase in fallowing during the year, as well as a substantial decrease in reservoir levels in the Sonora agricultural region. Ground observations are required to substantiate these analyses. The possibility exists that heat-rust is not LANDSAT detectable and that the clusters identified as containing stressed signatures represent different varieties of wheat or perhaps nonwheat crops. A.R.H.

N82-21668*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.

DELINEATION OF SOIL TEMPERATURE REGIMES FROM HCMM DATA Quarterly Report

Rick L. Day and Gary W. Petersen, Principal Investigators 31 Dec. 1981 3 p HCMM
(E82-10141; NASA-CR-168526; NAS 1.26:168526) Avail: NTIS HC A02/MF A01 CSCL 08M

Evaluation of LANDSAT and Heat Capacity Mapping Mission (HCMM) data as input into National Cooperative Soil Survey is discussed. Signature classification techniques were applied to 13 May 76 LANDSAT data. LANDSAT data was overlaid with HCMM data, revealing registration problems caused by a shortage of control points in LANDSAT data, and the WARP program developed to improve registration accuracy. Initial images for control point selection were produced using digital terrain elevation data. Statistical procedures for evaluating data classification and to describe spatial distribution of surface temperature and its correlation with soil surface conditions were investigated. J.D.

N82-21670*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

SPECTRAL-AGRONOMIC RELATIONSHIPS OF CORN, SOYBEAN AND WHEAT CANOPIES

M. E. Bauer, Principal Investigator, C. S. T. Daughtry, and V. C. Vanderbilt Oct. 1981 19 p refs Presented at the Intern. Colloq. on Signatures of Remotely Sensed Objects, Avignon, France, 8-11 Sep. 1981 Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)

(E82-10143; NASA-CR-167510; NAS 1.26:167510; SR-PI-04187; LARS-091281) Avail: NTIS HC A02/MF A01 CSCL 20F

During the past six years several thousand reflectance spectra of corn, soybean, and wheat canopies were acquired and analyzed. The relationships of biophysical variables, including leaf area index, percent soil cover, chlorophyll and water content, to the visible and infrared reflectance of canopies are described. The effects on reflectance of cultural, environmental, and stress factors such as planting data, seeding rate, row spacing, cultivar, soil type and nitrogen fertilization are also examined. The conclusions are that several key agronomic variables including leaf area index, development stage and degree of stress are strongly related to spectral reflectance and that it should be possible to estimate these descriptions of crop condition from satellite acquired multispectral data. A.R.H.

N82-21671*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

SIMULATED RESPONSE OF A MULTISPECTRAL SCANNER OVER WHEAT AS A FUNCTION OF WAVELENGTH AND VIEW/ILLUMINATION DIRECTION

M. E. Bauer, Principal Investigator, V. C. Vanderbilt, B. F. Robinson, L. L. Biehl, and A. S. Vanderbilt Nov. 1981 14 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS9-15466; Proj. AgRISTARS)

(E82-10144; NASA-CR-167505; NAS 1.26:167505; SR-P1-04202; LARS-071580) Avail: NTIS HC A02/MF A01 CSCL 02C

The reflectance response with view angle of wheat, was analyzed. The analyses, which assumes there are no atmospheric effects, and otherwise simulates the response of a multispectral scanner, is based upon spectra taken continuously in wavelength from 0.45 to 2.4 micrometers at more than 1200 view/illumination directions using an Exotech model 20C spectra radiometer. Data were acquired six meters above four wheat canopies, each at a different growth stage. The analysis shows that the canopy reflective response is a pronounced function of illumination angle, scanner view angle and wavelength. The variation is greater at low solar elevations compared to high solar elevations. A.R.H.

N82-21672*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

VARIABILITY OF REFLECTANCE MEASUREMENTS WITH SENSOR ALTITUDE AND CANOPY TYPE

C. S. T. Daughtry, V. C. Vanderbilt, and V. J. Pollara Nov. 1981 24 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS9-15466; Proj. AgRISTARS)

(E82-10145; NASA-CR-167509; NAS 1.26:167509; SR-P1-04191; LARS-111481) Avail: NTIS HC A02/MF A01 CSCL 20F

Data were acquired on canopies of mature corn planted in 76 cm rows, mature soybeans planted in 96 cm rows with 71 percent soil cover, and mature soybeans planed in 76 cm rows with 100 percent soil cover. A LANDSAT band radiometer with a 15 degree field of view was used at ten altitudes ranging from 0.2 m to 10 m above the canopy. At each altitude, measurements were taken at 15 cm intervals also a 2.0 m transect perpendicular to the crop row direction. Reflectance data were plotted as a function of altitude and horizontal position to verify that the variance of measurements at low altitudes was attributable to row effects which disappear at higher altitudes where the sensor integrate across several rows. The coefficient of variation of reflectance decreased exponentially as the sensor was elevated. Systematic sampling (at odd multiples of 0.5 times the row spacing interval) required fewer measurements than simple random sampling over row crop canopies. A.R.H.

N82-21673*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

DETERMINATION OF THE OPTIMAL LEVEL FOR COMBINING AREA AND YIELD ESTIMATES

Marvin E. Bauer, Principal Investigator, M. M. Hixson, and C. D. Jobusch 12 Oct. 1981 70 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS9-15466; Proj. AgRISTARS)

(E82-10146; NASA-CR-168531; NAS 1.26:168531; FC-P1-04197; LARS-101281) Avail: NTIS HC A04/MF A01 CSCL 02C

Several levels of obtaining both area and yield estimates of corn and soybeans in Iowa were considered: county, refined strata, refined/split strata, crop reporting district, and state. Using the CCEA model form and smoothed weather data, regression coefficients at each level were derived to compute yield and its variance. Variances were also computed with stratum level. The variance of the yield estimates was largest at the state and smallest at the county level for both crops. The refined strata had somewhat larger variances than those associated with the refined/split strata and CRD. For production estimates, the difference in standard deviations among levels was not large for corn, but for soybeans the standard deviation at the state level was more than 50% greater than for the other levels. The refined strata had the smallest standard deviations. The county level was not considered in evaluation of production estimates due to lack of county area variances. A.R.H.

N82-21676*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

AGRISTARS: SUPPORTING RESEARCH. CLASSIFICATION OF CORN: BADHWAR PROFILE SIMILARITY TECHNIQUE

Willa W. Austin, Principal Investigator Aug. 1981 46 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS)

(E82-10150; NASA-CR-167409;JSC-17113; NAS 1.26:167409; SR-L1-04049; LEMSCO-16035) Avail: NTIS HC A03/MF A01 CSCL 02C

The same software programs used to classify spring wheat are applied to the classification of corn in 26 segments in the corn belt. Numerical results of the acreage estimation are given. Potential problem areas defined in an earlier application are examined. A.R.H.

N82-21681*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.

USE OF THERMAL INERTIA DETERMINED BY HCMM TO PREDICT NOCTURNAL COLD PRONE AREAS IN FLORIDA Quarterly Report, 16 Jun. - 15 Sep. 1981

L. H. Allen, Jr., Principal Investigator, Ellen Chen, J. D. Martsolf, and P. H. Jones 15 Sep. 1981 23 p ref Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM (Contract NAS5-26453)

(E82-10157; NASA-CR-164927; NAS 1.26:164927; QR-2) Avail: NTIS HC A02/MF A01 CSCL 08F

Transparencies, prints, and computer compatible tapes of temperature differential and thermal inertia for the winter of 1978 to 1979 were obtained. Thermal inertial differences in the South Florida depicted include: drained organic soils of the Everglades agricultural area, undrained organic soils of the managed water conservation areas of the South Florida water management district, the urbanized area around Miami, Lake Okeechobee, and the mineral soil west of the Everglades agricultural area. The range of wetlands and uplands conditions within the Suwanee River basin was also identified. It is shown that the combination of wetlands uplands surface features of Florida yield a wide range of surface temperatures related to wetness of the surface features. E.A.K.

N82-21682*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

AGRISTARS: SUPPORTING RESEARCH. US CROP CALENDARS IN SUPPORT OF THE EARLY WARNING PROJECT

T. Hodges, Principal Investigator Jul. 1981 134 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS)

(E82-10158; NASA-CR-167417;JSC-17402; NAS 1.26:167417; SR-L1-04122; LEMSCO-14674) Avail: NTIS HC A07/MF A01 CSCL 05B

The crop calendars produced for the Large Area Crop Inventory

Experiment (LACIE) and crop calendar samples for Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, North Dakota, South Dakota, and Texas are presented. These calendars are based on weekly crop reporting district level observations of the percentage of various crops at several growth stages. A sample of the statistical treatments of the weekly data is provided. Four to five years of 50-percent dates for stages on a crop reporting district level for Arkansas, Iowa, Kentucky, Louisiana, Michigan, Mississippi, Ohio and Wisconsin are also given. M.G.

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.

A82-19177 **Satellite observed cloud patterns associated with excessive precipitation outbreaks.** J. D. Clark, A. J. Lindner, R. Borneman, and R. E. Bell (NOAA, National Environmental Satellite Service, Camp Springs, MD). In: Conference on Weather Forecasting and Analysis, 8th, Denver, CO, June 10-13, 1980, Preprints. Boston, MA, American Meteorological Society, 1980, p. 463-473. 12 refs.

A description is provided of three convective system types in terms of cloud patterns, structure, and life cycle. If these systems move slowly, they are capable of producing excessive precipitation. Other convective occurrences also produce excessive precipitation, but are not as strongly associated with upper level cloud patterns which are easily identifiable in infrared satellite imagery. Each of the three convective types discussed has particular rain producing characteristics which are relevant to the forecasting of excessive precipitation. Synoptic type I systems tend to occur in the summer and early fall. Type II systems are most commonly observed in the spring and fall. Type III systems are generally observed over the eastern two thirds of the nation, but may be found in other areas as well. G.R.

A82-19179 **Modern methods for monitoring and controlling the timeliness, accuracy, and completeness of data for meteorological analysis.** A. R. Thomas (NOAA, National Meteorological Center, Washington, DC) and J. Kerlin (USAF, Offutt AFB, NE). In: Conference on Weather Forecasting and Analysis, 8th, Denver, CO, June 10-13, 1980, Preprints. Boston, MA, American Meteorological Society, 1980, p. 488-495. 6 refs.

The goals and applications of World Weather Watch (WWW) quality control procedures for meteorological data collection and recording are explored. The total systems concept possesses provisions for monitoring and quality control in telecommunication of data and data storage at meteorological centers. Radiosonde, rocketsonde, aircraft, and weather balloon observations are mentioned as part of the exponentially growing sources of mesoscale, synoptic, and asynoptic data where errors can occur in instruments, readings, corrections, signal processing, coding, and transmission. Checking procedures to maintain quality are outlined, and real-time and non-real-time data control are described, noting that the bulletins arrive from international sources. Future applications are indicated to concentrate on ecology, world food production, defense, energy use, and basic comfort and safety, in a climate of growing fiscal constraints. M.S.K.

A82-19826 † **Color characteristics of the earth's surface determined on the basis of spectroscopy results from Salyut 4 (Tsvetovye kharakteristiki pokrovov zemli po rezul'tatam spektrometrirovaniia s orbital'noi nauchnoi stantsii 'Saliut-4').** L. I. Kiselevskii, B. I. Beliaev, A. A. Kovalev, and V. E. Pliuta (Akademiia Nauk Belorusskoi SSR, Institut Fiziki, Minsk, Belorussian SSR). *Akademiia Nauk BSSR, Doklady,* vol. 26, no. 1, 1982, p. 21-24. 11 refs. In Russian.

Salyut-4 spectroscopy data were used to determine color characteristics for various types of underlying surfaces, including desert, vegetation, and water. The quantitative relationship of these color characteristics and Mancell's color-perception system is investigated, and the influence of the porthole on the colors of the underlying surfaces is analyzed. B.J.

A82-20226 **The use of the airborne lidar system 'ALEX F 1' for aerosol tracing in the lower troposphere.** P. Mörl, M. E. Reinhardt, W. Renger, and R. Schellhase (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, West Germany). *Beiträge zur Physik der Atmosphäre,* vol. 54, no. 4, 1981, p. 403-410. 9 refs. Research supported by the Bundesministerium für Forschung und Technologie.

The characteristics and performance of the airborne lidar system ALEX F 1 are described, noting its potential applications on spacecraft. The laser is fixed to a downward looking telescope, which gathers backscattered light for detection by a silicon photodiode, which begins the IR and photomultiplier count. A sample rate of 100 MHz on one channel corresponds to a 1.5 m resolution, with the data recorded on magnetic tape. The strength of the lidar signal is related to a color scale, with different values of the backscatter coefficient yielding different color tones. Examples are provided for the mesoscale measurement of the aerosol in the Po Valley, for the regional scale by imaging the Rhine Valley at a scale of 50 km, and a 5 km small scale aerosol from a point source. The use of multiwavelength laser systems for detecting invisible clouds which mask the results of remote sensing methods is indicated. M.S.K.

A82-20339 † **Landscape mapping and physical-geographical classification of the eastern part of the Chechen-Ingush, ASSR using space imagery (Landshaftnoe kartografirovanie i fiziko-geograficheskoe raionirovanie vostochnoi chasti Checheno-Ingushskoi ASSR po kosmicheskim snimkam).** Iu. I. Kondratova and A. E. Fedina (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 13-18. In Russian.

A82-20999 **Airborne in-situ measurement of particulate sulfur and sulfuric acid with flame photometry and thermal analysis.** W. G. Cobourn, J. Djukic-Husar, R. B. Husar, and S. Kohli (Washington University, St. Louis, MO). *(U.S. Environmental Protection Agency, Electric Power Research Institute, and U.S. National Park Service, Symposium on Plumes and Visibility: Measurements and Model Components, Grand Canyon, AZ, Nov. 10-14, 1980.) Atmospheric Environment,* vol. 15, no. 12, 1981, p. 2565-2571. 17 refs. U.S. Environmental Protection Agency Grant No. R-806606-02.

An airborne in-situ particulate sulfur monitor based on the FPD principle is developed and tested. The lower detection limit for particulate sulfur is 1 ppb (4 micrograms SO4 per cu m), with a time response to 90% of signal at 5 s. FPD zero drift caused by changes in pressure, humidity and other environmental factors is compensated for by including an automatic zeroing cycle so that the zero signal can be monitored with the sulfur signal. An accuracy of + or - 30% is attained, and an examination of field data indicates that plume profiles of particulate sulfur and sulfuric acid can be measured with good detail with vertical profiles of good quality. D.L.G.

A82-21217 **Ionospheric troughs in Antarctica.** J. R. Dudeney, M. J. Jarvis, R. I. Kressman, M. Pinnock, A. S. Rodger, and K. H. Wright (British Antarctic Survey, Cambridge, England). *Nature,* vol. 295, Jan. 28, 1982, p. 307, 308. 22 refs.

The first observations of the dynamics of both the mid-latitude and high-latitude troughs made by the Advanced Ionospheric Sounder (AIS) at Halley Station, Antarctica (76 deg S, 27 deg W; invariant lat. 61 deg) are reported. This experiment is part of a major international project to study the sub-auroral ionosphere and its associations with the magnetosphere. The analysis provides an accurate quantitative description of the latitudinal movements of these features and the first results delineating the orientation of the poleward edge of the mid-latitude trough. These results show that the AIS has a much greater potential for monitoring large scale ionospheric structures and for tracking their motions than more conventional radio wave experiments. (Author)

A82-21386 **Airborne lidar measurements of smoke plume distribution, vertical transmission, and particle size.** E. E. Uthe, B. M. Morley, and N. B. Nielsen (SRI International Atmospheric Science Center, Menlo Park, CA). *Applied Optics,* vol. 21, Feb. 1, 1982, p. 460-463. 12 refs. Research supported by SRI International.

Observations were made of a dense smoke plume downwind from a forest fire using the ALPHA-1 two-wavelength downward-looking airborne lidar system. Facsimile displays were derived which depict plume dimensions, boundary layer height, and underlying

terrain elevations. Results show significantly greater plume attenuation at 0.53-micron wavelengths than at 1.06-micron wavelengths, which indicates about 0.1-micron mean particle diameters, or the presence of gaseous constituents that absorb the visible radiation. D.L.G.

A82-21432 Measurement of atmospheric emission using a balloon-borne cryogenic Fourier spectrometer. H. Sakai, T. C. Li (Massachusetts, University, Amherst, MA), J. Pritchard (Idealab, Inc., Franklin, MA), F. J. Murcray, F. H. Murcray, J. Williams (Denver, University, Denver, CO), and G. Vanasse (USAF, Geophysics Laboratory, Bedford, MA). In: International Conference on Fourier Transform Infrared Spectroscopy, Columbia, SC, June 8-12, 1981, Proceedings. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1981, p. 196-198. AF Project 2310; AF Task 2310G1.

In the lower atmosphere, the tropopause, and the stratosphere, the infrared emission radiance level directly relates to temperature and concentration of the molecules responsible for the emission. An experiment was conducted to obtain high precision data on altitude profiles of various atmospheric parameters by measuring the infrared emission spectrum of the atmosphere from a balloon-borne platform. The balloon flight took place on October 8, 1980. A spectrum was recovered from interferogram data taken at an altitude of approximately 5000 m. The maximum optical path difference was approximately 4 cm, producing a corresponding resolution of 0.12 per cm. The data indicate excellent sensitivity for detecting weak spectral lines. G.R.

A82-22143 A comparison between aerial photography and Landsat for computer land-cover mapping. B. K. Quirk and F. L. Scarpace (Wisconsin, University, Madison, WI). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 235-240. 18 refs. NOAA-sponsored research.

In a number of applications, Landsat imagery resolution was found to be inadequate to meet mapping needs. An analysis of aerial photographs has, therefore, been considered to obtain required land-cover information. The considered investigation attempts to evaluate the potential of such an analysis on the basis of a comparison made between land-cover information provided from several sensors for an urbanizing area around Green Bay, Wisconsin. Land-cover information is important as an input to hydrologic models. Land-cover estimates from the computer analysis of Landsat and digitized aerial photography are compared to manual photointerpretations of black-and-white infrared and color infrared aerial photographs of the area within the watershed. It was found that computer analysis of a color infrared photograph provided more accurate land-cover estimates than Landsat when compared to a manual photointerpretation of an urban watershed. G.R.

A82-24958 A system for quantitative determination of species and vitalities of urban trees on color-infrared photographs. J. Fuhrer, K. H. Erismann, H. J. Keller, and A. Favre (Bern, Universität, Berne, Switzerland). *Remote Sensing of Environment,* vol. 11, Mar. 1981, p. 1-8. 22 refs. Swiss National Science Foundation Grant No. 3,209,77.

Aerial color-infrared photographs of two Swiss cities (Bern and Lausanne) were taken to evaluate the potential use of automatic image analysis for the discrimination of urban tree species and their different vitalities. A TV-based hardware system under full software control measured five different functions at each of the 63 possible intensity levels at red (600 nm), green (550 nm), blue (470 nm), and white illumination. Eighty-three parameters per tree were derived from the corresponding intensity distributions describing tone and texture. Classification by supervised learning was carried out using stepwise discriminant analysis. The overall classification error for the discrimination of four deciduous tree species (horse chestnut, Norway maple, large-leaved lime, and London plane) was 4.9%. A higher error rate (6.2%) was found for the discrimination of five classes, namely healthy trees of the above mentioned four species and damaged horse chestnut trees. The practicability of the proposed system is discussed. (Author)

A82-24962 The Canadian north - Utility of remote sensing for environmental monitoring. B. Dey (Howard University, Washington, DC) and J. H. Richards (Saskatchewan, University, Saskatoon, Canada). *Remote Sensing of Environment,* vol. 11, Mar. 1981, p. 57-72. 31 refs.

Activities related to resource exploration have a great potential for causing environmental change and damage. In connection with a growing interest in northern mineral resources, environmental monitoring of the Canadian north has become important. Monitoring is undertaken so as to distinguish and record dynamic events such as weather, floods, forest fires, and ice break-up, as well as longer-term changes which may affect water quality, vegetation, and wildlife habitat. An investigation concerning the feasibility of remote sensing for environmental monitoring is conducted. It is found that the use of aircraft in remote sensing is becoming increasingly expensive, while the aircraft platform itself may be considered inadequate. In distinction, small-scale satellite imagery is relatively inexpensive, and the regularity and areal extent of satellite coverage is not in doubt. Inherent potentials will be more nearly realized with the aid of new techniques and satellites. G.R.

A82-25140 Building and road extraction from aerial photographs. M. Tavakoli (Shiraz University, Shiraz, Iran) and A. Rosenfeld (Maryland, University, College Park, MD). *IEEE Transactions on Systems, Man, and Cybernetics,* vol. SMC-12, Jan.-Feb. 1982, p. 84-91. 10 refs. Grant No. DAAG53-76-C-0138. DARPA Order 3206.

A method of extracting features such as buildings and roads from high-resolution aerial photographs is described. The approach involves several successive stages of grouping of edge segments. Straight line segments are fitted to sets of edge pixels; compatibilities between pairs of these segments, based on gray level and geometric information, are computed; and the segments are then grouped into building-like and road-like groupings based on these compatibilities. Examples of the results obtained using this approach are given, and some variations on the initial stages of the process are also investigated. (Author)

A82-25149 Mid-latitude summertime measurements of stratospheric NO2. J. B. Kerr, C. T. McElroy, and W. F. J. Evans (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada). *Canadian Journal of Physics,* vol. 60, Feb. 1982, p. 196-200. 11 refs.

Measurements of the vertical distribution of stratospheric nitrogen dioxide made on Stratoprobe balloon flights in August from Yorkton, Saskatchewan are presented. The vertical profiles were calculated by the inversion of measurements of absorption at wavelengths of 437.7, 444.8 and 450.0 nm as a function of solar zenith angle during sunrise and sunset. Four pairs of observations were obtained which show variations in NO2 levels with 15% at all heights, demonstrating the reliability of the measurement and analysis methods. The average NO2 concentration at sunset is found to increase from about 0.3 ppbv at 10 km to 10 ppbv at 35 km, and at sunrise to increase from 0.2 to 5 ppbv. A.L.W.

A82-25452 * Analysis of two Seasat synthetic aperture radar images of an urban scene. M. L. Bryan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Mar. 1982, p. 393-398. 19 refs. Contract No. NAS7-100.

Because the Seasat satellite is not polar-orbiting, the look-directions of its SAR radar on the basic ascending and descending orbits were neither in the same direction, orthogonal to, nor opposite to, one another. This calls for a technique by means of which to identify those features within a given geographic region which were imaged from two directions by Seasat SAR and are sensitive to radar orientation. It is demonstrated that images from the two orbits with different look directions can be registered and subtracted from one another, with the resulting difference image highlighting those features that are direction-sensitive. Although this depends on a precise registration the subtraction technique is straightforward once such registration has been obtained. O.C.

A82-26329 An investigation of the ozone plume from a small city. C. W. Spicer, D. W. Joseph, and P. R. Sticksel (Battelle Columbus Laboratories, Columbus, OH). *Air Pollution Control*

Association, Journal, vol. 32, Mar. 1982, p. 278-281. 6 refs. U.S. Environmental Protection Agency Contract No. 68-02-2439.

The results of upwind and downwind flights around a large and small city (population less than 100,000) to determine if the small city contributed to downwind O3 pollution are reported. The flights were around St. Louis, MO and Springfield, IL on summer days. A small increase was noted downwind from Springfield, along with O3 precursors. Significant differences were observed on one occasion, and were found to correspond with atmospheric conditions conducive to photochemical formation of O3. M.S.K.

A82-26403 A regional air quality model for the Kwinana industrial area of Western Australia. F. H. Kamst and T. J. Lyons (Murdoch University, Murdoch, Australia). *Atmospheric Environment,* vol. 16, no. 3, 1982, p. 401-412. 30 refs.

The Kwinana industrial area lies 32 km south of the city of Perth, Western Australia. Since this area represents the major concentration of heavy industry near Perth, it is essential to have a clear understanding of its present and future impact on the regional air quality. A description is presented of the development of a regional air dispersion model wherein the initial development has been limited to the stable atmosphere. The model was used to predict SO2 concentrations in the Kwinana area during the night of August 1-2, 1978, between 2300 and 0445 h. The obtained results are presented in graphs. Attention is given to a sensitivity analysis, the determination of the input parameters to the model and a comparison of model results with photographs. G.R.

A82-26621 * # The NASA participation in the 1980 EPA PEPE/NEROS field measurements program. E. Remsberg and R. Bendura (NASA, Langley Research Center, Hampton, VA). *American Meteorological Society, Joint Conference on Applications of Air Pollution Meteorology, 3rd, San Antonio, TX, Jan. 11-15, 1982, Paper.* 4 p.

The Persistent Elevated Pollution Episode (PEPE)/Northeast Regional Oxidant Study (NEROS) Project consisted of a series of field measurements sponsored by the EPA during July and August, 1980. NASA participation in the Project had several purposes: (1) use remote sensing to help determine mixed layer height and ozone profiles regionally; and (2) provide opportunity for development, testing and evaluation of several NASA 'emerging' airborne remote sensing systems. NASA also provided information on the hazy pollution episodes throughout the summer of 1980 with satellite imagery. This paper describes findings on atmospheric aerosols, ozone profile and ozone column and discusses the instruments (airborne and ground-based sensors) and techniques used to obtain the relevant data. Associated archived data is also discussed. C.D.

A82-26700 Diurnal variation of summer convection over West Africa and the Tropical Eastern Atlantic during 1974 and 1978. R. J. Reed and K. D. Jaffe (Washington, University, Seattle, WA). *Monthly Weather Review,* vol. 109, Dec. 1981, p. 2527-2534. 12 refs. NOAA-supported research; NSF Grant No. ATM-81-03697.

The behavior of convection during the Greater Atlantic Tropical Experiment period is compared with data from the summer of 1978, the initial operation summer of Meteosat-1. IR imagery from Meteosat-1 taken at 4-hr intervals from July 1-Sept. 30 covered 3 deg squares. The GATE data was for 1974, and similarities between the two years included explosive convective processes over land in the afternoon over elevated terrain, a weak or absent diurnal cycle near Dakar, a noontime maximum in the south of the region offshore, a peak near midnight SE of Dakar, and weak diurnal variations in some ocean regions. The existence of a large diurnal cycle in an eastern Atlantic region downstream from a land area with a large diurnal variation indicated a possible connection between land and oceanic convection. M.S.K.

A82-26721 Photogrammetry from aircraft side camera movies - Winter MONEX. C. Warner (Virginia, University, Charlottesville, VA). *Journal of Applied Meteorology,* vol. 20, Dec. 1981, p. 1516-1526. 14 refs. NSF Grants No. ATM-79-00233; No. ATM-80-12214.

Side-looking cloud movie photogrammetry during the MONEX winter flights over the South China Sea in 1979 is described. The films were made along the line of flight parallel to the cloud movement at heights ascertained from meteorological stations. Theoretical underpinnings to the method of calculation of cloud height using the technique are provided. Examples are given for photogrammetry of fractus, humilis, mediocris, congestus, and cumulonimbus clouds, along with height and width measurements. A method is outlined for measuring the cloud density in a field by use of a cardboard cutout against a projection of the recorded images, and density measurements are noted to have a factor of 2 uncertainty. M.S.K.

A82-26844 Humidity measurement by infrared thermometry. S. B. Idso (U.S. Water Conservation Laboratory, Phoenix, AZ). *Remote Sensing of Environment,* vol. 12, Mar. 1982, p. 87-91. 12 refs.

A promising new approach to the remote sensing of plant water stress involves the evaluation of an index that is dependent upon air temperature and vapor pressure, in addition to the basic foliage temperature. The air temperature measurement is already being made by an appropriate sensor incorporated into some infrared thermometers; but the vapor pressure measurement has required a second instrument. This paper describes a technique for obtaining the vapor pressure measurement by viewing the cloudless sky directly overhead with the infrared thermometer itself, thus doing away with the need for a second instrument in the remote field assessment of plant water stress by infrared thermometry. (Author)

A82-26980 * Low-latitude cloudiness and climate feedback - Comparative estimates from satellite data. R. D. Cess (National Center for Atmospheric Research, Boulder, CO; New York, State University, Stony Brook, NY), B. P. Briegleb (National Center for Atmospheric Research, Boulder, CO), and M. S. Lian (New York, State University, Stony Brook, NY). *Journal of the Atmospheric Sciences,* vol. 39, Jan. 1982, p. 53-59. 19 refs. NSF Grant No. CME-79-09065; Contract No. NAS1-16444.

Three studies of the relative albedo to the IR components of cloud amount feedback are reviewed, and an approach to the seasonal variability in low-level cloud numbers is presented. Comparisons are made and uncertainties calculated for the predictions of cloud amounts from satellite data sets for outgoing IR flux. IR data is used directly for a linear regression analysis and seasonal and latitudinal variations are considered in terms of monthly-annual means for particular latitude zones. Investigations of NOAA-NESS satellite data revealed that cirrus clouds are transparent in the 10.5-12.5 microns range and cloud albedos decrease at wavelengths greater than 0.7 micron, which suggests a possibility of cloud-sky and clear-sky albedo comparisons at 0.5-0.7 micron. The inclusion of Rayleigh scattering and atmospheric water vapor absorption of sunlight is recommended to test the effects on observed contracts. M.S.K.

A82-27040 # Detection of natural disasters via Meteosat. A. Robson, J. Morgan (ESA, European Space Operations Centre, Darmstadt, West Germany), R. W. Herschy (Department of the Environment, Water Data Unit, Reading, England), and J. Zschau (Kiel, Neue Universität, Kiel, West Germany). *ESA Bulletin,* no. 29, Feb. 1982, p. 10-18.

The operations, characteristics, and data distribution capabilities of the Meteosat 1 and 2 spacecraft which, due to separate system malfunctions, perform the mission capabilities of one satellite, are described. The GEO-situated satellites generate images in the visible and with two channels in the IR, at 11 and 6 microns. Sightings are made of hurricanes, cyclones, extratropical depressions, droughts, and floods, with whole-earth images being produced every 30 min. Raw images are received at the European Space Operations Center in Darmstadt, processed, and then sent back through the satellite to a dozen digital and over 200 analog user stations. Data Collection Platforms on board the spacecraft broadcast collected images at scheduled time intervals, when interrogated, or during an alert status when immediate information is required. Further applications to detect storm surges and earthquake activity are outlined. M.S.K.

A82-27627 # Analysis of a discrete-time linear model for geothermal flux reconnaissance from two or three aircraft infrared

measurements. J. L. Farah (Universidad Nacional Autónoma de México, Mexico City, Mexico). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 663-670. 10 refs.

Attention is given to a model of the earth's surface temperature which is fully based on work reported by Jaeger (1953), extensions of this work, and applications to remote-sensing problems in geology. The present investigation has the objective to perform a mathematical analysis of linearizations of these models. The basic equations are considered along with a model for g, questions of model linearization, direct and inverse relationships, and practical numerical considerations. The use of the linear model in producing maps of thermal inertia and/or of geothermal flux as viewed in the investigation, appears to yield a powerful tool for applications, mainly because at least in the case of the three-flight problem, one can take full advantage of the Fast-Fourier-Transform algorithms and of only three one-dimensional tables. G.R.

A82-27650 # Detection of volcanic ash fall area from Landsat MSS CCT data - Eruption of Mt. Ontake in 1979. S. Kishi and S. Yazaki (National Research Center for Disaster Prevention, Sakura, Ibaraki, Japan). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 919-928. 7 refs.

Results are presented from a digital analysis study, conducted to detect the volcanic ash fall area from the October 1979 eruption of Mt. Ontake in Japan, using Landsat MSS imagery taken a few days before and after the event. The value difference of Bands 4 and 7 was found to be the most useful in detecting the ash fall area, which was covered by a layer more than 1 mm thick. O.C.

A82-27657 # Detailed land use classification based on multitemporal Landsat-MSS-data. J. Lichtenegger (Zürich, Universität, Zurich, Switzerland) and K. Seidel (Zürich, Eidgenössische Technische Hochschule, Zurich, Switzerland). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 997-1005. 6 refs. Research supported by the Swiss National Science Foundation.

Use of the 'time dimension' is shown to improve the classification result in contrast to single frame analyses. Several Landsat multispectral scanner frames are registered by means of cross correlation and then superimposed on each other to form a multitemporal data set. These data are analyzed for detailed land use categories by a supervised classification algorithm. An example for the enhancement of the classification accuracy with a quantitative ground truth comparison is given. Finally data compression is performed by principal components analysis as a preprocessing procedure prior to conventional visual interpretation. A color representation of the main components demonstrates up to seven clearly distinguishable land use categories. (Author)

A82-27661 # Thermal IR detection of submarine gas seepages in the western Istra off-shore area /Yugoslavia/. M. Knapp and B. Koscec (Industroprojekt, Zagreb, Yugoslavia). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1039-1046.

A82-27665 * # Land cover classification accuracy as a function of sensor spatial resolution. B. L. Markham (NASA, Goddard Space Flight Center, Earth Survey Applications Div., Greenbelt, MD) and J. R. G. Townshend (NASA, Goddard Space Flight Center, Earth Survey Applications Div., Greenbelt, MD; Reading, University, Reading, Berks., England). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1075-1090. 12 refs.

The benefits obtained from sensor systems for monitoring earth resources will depend on the application and interpretation methods used. A frequently used analysis method is supervised per-pixel multispectral classification with a typical application being land cover classification. An investigation is conducted to evaluate the effect of spatial resolution on the ability to classify land cover types with per-pixel digital image classification techniques. Attention is also given to the documentation of changes in scene noise and the percentage of boundary pixels as a function of spatial resolution, in order to improve the understanding of the interrelationship between classification accuracy and spatial resolution. It is found that scene noise varies considerably between land cover categories. Changes in scene noise with coarsening resolution occur at different rates for different categories. G.R.

A82-27670 # Phenomena modelling of remotely sensed data by image rationing. J. Iisaka (IBM Japan, Ltd., Tokyo, Japan), N. Yoshimura, Y. Yasuda, and Y. Emori (Chiba University, Chiba, Japan). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, *Proceedings. Volume* 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1127-1140.

Phenomena modelling represents a useful approach to extract objective information from remotely sensed data in cases in which the resolution size is larger than the object. The concept of phenomena modelling has been applied to soil mapping, taking into account an elimination of the vegetation factor by an image rationing procedure. The considered study is concerned with an attempt to utilize phenomena modelling for an interpretation of information *regarding the metropolitan area of Tokyo. Attention is given to* problems regarding the detection of roughness features in the metropolitan area, aspects of modelling for the estimation of building height, the conduction of an experiment, a two-feature model for building height estimation, and a three-feature model for the building height estimation. G.R.

A82-27690 # Inventory of eroded areas in the state of Guanajuato Mexico, by automatic analysis of Landsat images. A. Benitez, R. Sánchez, and R. Vital (Ministry of Agriculture and Hydraulic Resources, Mexico City, Mexico). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1353-1362. 6 refs.

A82-27696 # Assessment of change in Bangladesh coastal regions. M. A. H. Pramanik (Bangladesh Space Research and Remote Sensing Organization, Dacca, Bangladesh), F. C. Polcyn, and N. E. G. Roller (Michigan, Environmental Research Institute, Ann Arbor, MI). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1425-1434. Research supported by the Food and Agriculture Organization.

A study was conducted with the objective to determine whether a net gain or loss of land occurred along the coastline of Bangladesh between 1972 and 1979. The information provided by the study is to furnish a basis for a prediction regarding the new land which will be formed in the future. It is hoped, that based on this quantitative assessment, it may be possible to define steps to accelerate the process of land formation and to stabilize any gains. Questions of methodology are examined, taking into account aspects of preprocessing, problems of categorization, questions of registration, change detection, and the output products. G.R.

A82-27701 # Utilisation of remote sensing in resources identification and land use in India - An integrated approach. R. K. Katti, M. G. Sardar, T. V. Pavate, and P. Venkatachalam (Indian Institute of Technology, Bombay, India). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1487-1497.

In this paper, remotely sensed data from Landsat-1 in the form of imagery, computer compatible tape (CCT) outputs, aerial photo-

graphs and topographic maps are used for forestry and terrain evaluation in geotechnical engineering appraisal. The study shows that it is possible to develop an integrated classification system encompassing forest resources evaluation and terrain evaluation for engineering uses in particular, and agriculture development and geological aspects in general. Thus the integrated approach helps in reducing repetitiveness of sampling on the one hand, and on the other facilitates the development of thematic maps in a more rational way. The approach concerns an understanding of the physical and chemical properties of deposits, and their relation to the surface features observed in remotely sensed data in the form of CCT digital output and imagery. Genetic and morphological factors are taken into account in the analysis. (Author)

A82-27704 # **Remote SO2 emission measurements with correlation spectrometers from volcanoes.** L. Daubner, J. Davies, M. Millan (Barringer Research, Ltd., Toronto, Canada), and R. Stoiber (Dartmouth College, Hanover, NH). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1519-1526. 17 refs.

The way in which correlation spectrometers can be used in monitoring emissions of SO2 from volcanoes as an indicator of volcanic activity is described. It is shown that volcanic gas geochemistry can provide indications of increasing magmatic contributions to eruption. Mass flows of SO2 at Mount Etna are found to correlate well with a model of magma movement within the conduit system proposed by Wadge (1977). A table giving the specifications of a correlation spectrometer is included. C.R.

A82-28133 † **The atlas 'Geographical Results of Spaceborne Multispectral Experiments' (Atlas 'Geograficheskie rezul'taty mnogozonal'nykh kosmicheskikh eksperimentov').** Iu. F. Knizhnikov and V. I. Kravtsova. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 37-41. In Russian.

A82-28152 * **Model studies of laser absorption computed tomography for remote air pollution measurement.** D. C. Wolfe, Jr. and R. L. Byer (Stanford University, Stanford, CA). *Applied Optics,* vol. 21, Apr. 1, 1982, p. 1165-1178. 41 refs. Grant No. NsG-2289; Contract No. F4920-77-C-0092.

Model studies of the potential of laser absorption-computed tomography are presented which demonstrate the possibility of sensitive remote atmospheric pollutant measurements, over kilometer-sized areas, with two-dimensional resolution, at modest laser source powers. An analysis of this tomographic reconstruction process as a function of measurement SNR, laser power, range, and system geometry, shows that the system is able to yield two-dimensional maps of pollutant concentrations at ranges and resolutions superior to those attainable with existing, direct-detection laser radars. O.C.

A82-28295 * # **Precipitation measurements from space - Workshop summary 28 April-1 May 1981, Greenbelt, MD.** D. Atlas and O. W. Thiele (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD). *American Meteorological Society, Bulletin,* vol. 63, Jan. 1982, p. 59-63. 6 refs.

The goals and methods for global precipitation measurements from space are examined. Records currently exist only for visible and IR scans of cloud properties, and are applied from GEO for detecting diurnal variations in precipitation. Microwave radiometry is noted to be a suitable method for supplementing the visible and IR data for measuring stratiform oceanic precipitation, and when used at up to 3 microns can detect areas, if not amounts, of precipitation from GEO. Applications of radar altimeters are proposed in terms of modifications to the Seasat-type 2.2 cm radar, the use of surface target attentuation radar, of frequency agile rain radar, or of adaptive pointing radar. Soil moisture sensing is available with passive microwave radiometry in the 20-50 cm bands, or active sensing in the 5-8 cm bands. The utilization of GARP ground truth data is explored, along with statistical methods for treating the data samples. M.S.K.

N82-16443*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

REMOTE SENSING DATA APPLIED TO LAND-USE SURVEY AT THE PARAIBA VALLEY

Nelson deJesusParada, Principal Investigator, Magda Adelaide Lombardo, Evlyn Marcia Leao DeMoraesNovo, Madalena Niero, and Celina Foresti May 1981 10 p refs Presented at the 7th Intern. Symp. on Machine Process. of Remotely Sensed Data, West Lafayette, Ind., 23-26 Jun. 1981 Sponsored by NASA ERTS

(E82-10025; NASA-CR-164812; INPE-2081-RPE/315) Avail: NTIS HC A02/MF A01 CSCL 08B

The Paraiba Valley (state of Sao Paulo) was selected as the test site in a study to develop a methodology for land-use survey and to determine the land-use modification rates using data of LANDSAT system. Both visual and automatic interpretation methods were employed to analyze seven land-use classes. They are: urban area, industrial area, bare soil, cultivated area, pastureland, reforestation and natural vegetation. By means of visual interpretation little spectral differences among those classes were observed. The automatic classification of LANDSAT MSS data using maximum likelihood algorithm shows a 39% average error of omission and a 3.4% error of commission for the seven classes. The classification results were under the influences of the complexity of land-uses in the study area, the large spectral variations of analyzed classes and the low resolution of LANDSAT data. Author

N82-16613# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.

DEMONSTRATION OF A LONG-RANGE ATMOSPHERIC TRACER SYSTEM USING PERFLUOROCARBONS

Gilbert J. Ferber, Kosta Telegadas, Jerome L. Heffter, C. Ray Dickson, Russell N. Dietz, and Philip W. Krey Apr. 1981 84 p refs

(Contract DE-AI01-80EV-10081)

(PB82-106246; NOAA-TM-ERL-ARL-101; NOAA-81080301) Avail: NTIS HC A05/MF A01 CSCL 13B

Regional-scale tracer experiments are needed to validate atmospheric dispersion aspects of air pollution models. The capability of a new system, using perfluorocarbon tracers (PFTs), for long-range dispersion experiments at reasonable cost was demonstrated in two experiments. Two PFTs (C7F14 and C8F16) were released simultaneously with SF6 and two heavy methanes. The PFT system provides automatic sequential samplers and rapid, inexpensive analyses down to 2 parts per 10 to the + 15th power of air. PFT concentrations were measured 600 km away, up to three days after release. Performance of the PFT system was excellent and a consistent set of tracer data was obtained. GRA

N82-17562*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CHARACTERIZING USER REQUIREMENTS FOR FUTURE LAND OBSERVING SATELLITES

J. L. Barker, P. J. Cressy, C. C. Schnetzler, and V. V. Salomonson Dec. 1981 56 p refs

(NASA-TM-83867) Avail: NTIS HC A04/MF A01 CSCL 05B

The objective procedure was developed for identifying probable sensor and mission characteristics for an operational satellite land observing system. Requirements were systematically compiled, quantified and scored by type of use, from surveys of federal, state, local and private communities. Incremental percent increases in expected value of data were estimated for critical system improvements. Comparisons with costs permitted selection of a probable sensor system, from a set of 11 options, with the following characteristics: 30 meter spatial resolution in 5 bands and 15 meters in 1 band, spectral bands nominally at Thematic Mapper (TM) bands 1 through 6 positions, and 2 day data turn around for receipt of imagery. Improvements are suggested for both the form of questions and the procedures for analysis of future surveys in order to provide a more quantitatively precise definition of sensor and mission requirements. A.R.H.

N82-18772*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MULTIDIMENSIONAL ASPECTS: OZONE, TEMPERATURE AND TRANSPORT
In its The Stratosphere 1981 Jan. 1982 99 p

Avail: NTIS HC A22/MF A01 CSCL 04A

The capability for obtaining four-dimensional data on stratospheric structure, dynamics, and zone is discussed. Progress in the development of multidimensional models of the stratosphere is reported. The discussion of multidimensional aspects of the stratosphere is divided into four major sections: observations, analysis and interpretation, modeling, and transport of trace species. T.M.

N82-18808*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLIMATE OBSERVING SYSTEM STUDIES: AN ELEMENT OF THE NASA CLIMATE RESEARCH PROGRAM: WORKSHOP REPORT
Sep. 1980 154 p refs
(NASA-TM-84040) Avail: NTIS HC A08/MF A01 CSCL 04B

Plans for NASA's efforts in climatology were discussed. Targets for a comprehensive observing system for the early 1990's were considered. A program to provide useful data in the near and mid-term, and a program to provide for a feasibility assessment of instruments and methods for the development of a long-term system were discussed. Climate parameters that cannot be measured from space were identified. Long-term calibration, intercomparison, standards, and ground truth were discussed. R.J.F.

N82-19256# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GENERAL CONFIGURATION AND INTERNAL DISPOSITION OF EQUIPMENT IN A SATELLITE FOR COLLECTING ENVIRONMENTAL DATA
Carlos deOliveira Lino and Aydano Barreto Carleial Oct. 1981 32 p refs In PORTUGUESE; ENGLISH summary Presented at 33d Ann. Meeting of SBPC, Salvador, 81-5 Jul. 1981
(INPE-2240-PRE/026) Avail: NTIS HC A03/MF A01

The general configuration of an experimental satellite for reception and retransmission to the Earth of environmental data is described. The data originates from small automatic Earth stations equipped with sensors and capable of operating in remote locations. The interrelationships among the equipment blocks constituting the satellite and between these and the outside medium, which were used in the search for an adequate disposition for the equipment blocks are presented. The proposed internal and external disposition for the blocks is presented in drawings. Some mechanical quantities (position of the center of mass, moments of inertia) resulting from the mass distribution inherent to the chosen configuration, are calculated. S.L.

N82-19601* Michigan Energy and Resource Research Association, Detroit.
RESOURCEFUL DECISIONS: LANDSAT IN MICHIGAN
Todd Anuskiewicz, Principal Investigator and Roy Meador [1982] 29 p Sponsored by NASA Original contains color imagery. *Original photography may be purchased from the EROS Data* Center, Sioux Falls, S.D. 57198. ERTS
(E82-10037; NASA-CR-164771) Avail: SOD HC CSCL 05B

The capabilities of LANDSAT and the continuous advantages the satellite offers in remote sensing are reviewed. The processing and application of data from the satellite to the study of resource and environmental needs in Michigan highlighted include: land use; classification of trophic states in lakes and the monitoring of water quality; prospecting for oil, gas, minerals, and water; identifying wetlands, wildlife habitats, and recreation areas; forest management; routing power lines; transportation planning; and surveying the Great Lakes Basin. The work of the Environmental Research Institute of Michigan in solving modern sensor technological problems and in gathering ground truth is reported as well as activities available through the University of Michigan remote sensing program. A.R.H.

N82-19609*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS *Semiannual Progress Report, 1 Nov. 1980 - 30 Apr. 1981*
W. Frank Miller, John S. Powers, Jon R. Clark, Jimmy L. Solomon, and Sidney G. Williams, Principal Investigators 30 Apr. 1981 106 p refs ERTS
(Grant NGL-25-001-054)
(E82-10033; NASA-CR-164746; SAPR-15) Avail: NTIS HC A06/MF A01 CSCL 05B

The methods and procedures used, accomplishments, current status, and future plans are discussed for each of the following applications of LANDSAT in Mississippi: (1) land use planning in Lowndes County; (2) strip mine inventory and reclamation; (3) white-tailed deer habitat evaluation; (4) remote sensing data analysis support systems; (5) discrimination of unique forest habitats in potential lignite areas; (6) changes in gravel operations; and (7) determining freshwater wetlands for inventory and monitoring. The documentation of all existing software and the integration of the image analysis and data base software into a single package are now considered very high priority items. A.R.H.

N82-19641# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
METHODOLOGY OF THE INTERPRETATION OF REMOTE SENSING DATA AND APPLICATIONS IN PEDOLOGY
Mario Valerio Filho, Jose Carlos Neves Epiphanio, and Antonio Roberto Formaggio Aug. 1981 55 p refs In PORTUGUESE; ENGLISH summary
(INPE-2211-MD/008) Avail: NTIS HC A03/MF A01

A global view of photointerpretation techniques in soil survey is presented. Photopedologic methods are described which served as a base for the systematic approach to orbital data interpretation for soil survey. Several pedology research projects in Brazil are described. A.R.H.

N82-19740# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
ATLAS OF THE GLOBAL DISTRIBUTION OF THE TOTAL OZONE CONCENTRATION ACCORDING TO SATELLITE MEASUREMENTS [ATLAS DER GLOBALVERTEILUNG DES GESAMTOZONBETRAGES NACH SATELLITENMESSUNGEN (APRIL 1970-MAY 1972)]
Anver Ghazi 1980 47 p refs In GERMAN
(Mitt-28; ISSN-0069-5882) Avail: NTIS HC A03/MF A01

An atlas of interdisciplinair research on the many different aspects of ozone research is presented. Maps were drawn from backscatter ultraviolet satellite observations. Data are compiled on global distribution of the total ozone layer. E.A.K.

N82-20588*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE UTILIZATION OF ORBITAL IMAGES AS AN ADEQUATE FORM OF CONTROL OF PRESERVED AREAS [UTILIZACAO DE IMAGENS ORBITAIS, COMO FORMA ADEQUADA NO CONTROLE DE AREAS DE PRESERVACAO]
Nelson deJesusParada, Principal Investigator and Joao Roberto dosSantos May 1981 14 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA; submitted for publication ERTS
(E82-10065; NASA-CR-165087; NAS 1.26:165087; INPE-2064-RPE/306) Avail: NTIS HC A02/MF A01 CSCL 08B

The synoptic view and the repetitive acquisition of LANDSAT imagery provide precise information, in real-time, for monitoring preserved areas based on spectral, temporal and spatial properties. The purpose of this study was to monitor, with the use of multispectral imagery, the systematic annual burning, which causes the degradation of ecosystems in the National Park of Araguaia. LANDSAT imagery of channel 5 (0.6 a 0.7 microns) and 7 (0.8 a 1.1 microns), at the scale of 1:250.000, were used to identify and delimit vegetation units and burned area, based on photointerpretation parameter of tonality. The results show that the gallery forest can be discriminated from the seasonally flooded 'campo cerrado', and that 4,14% of the study area was burned. Conclusions point out that the LANDSAT images can be used for the implementation of environmental protection in national parks. Author

N82-20592*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AMAZONAS PROJECT: APPLICATION OF REMOTE SENSING TECHNIQUES FOR THE INTEGRATED SURVEY

OF NATURAL RESOURCES IN AMAZONAS [PROJETO AMAZONAS APLICACAO DAS TECNICAS DE SENSORIAMENTO REMOTO PARA LEVANTAMENTO INTEGRADO DOS RECURSOS NATURAIS DO AMAZONAS]
Nelson deJesusParada, Principal Investigator Mar. 1981 95 p refs In PORTUGUESE Sponsored by NASA ERTS
(E82-10069; NASA-CR-165091; NAS 1.26:165091; INPE-2019-NTE/166) Avail: NTIS HC A05/MF A01 CSCL 08F

The use of LANDSAT multispectral scanner and return beam vidicon imagery for surveying the natural resources of the Brazilian Amazonas is described. Purposes of the Amazonas development project are summarized. The application of LANDSAT imagery to identification of vegetation coverage and soil use, identification of soil types, geomorphology, and geology and highway planning is discussed. An evaluation of the worth of LANDSAT imagery in mapping the region is presented. Maps generated by the project are included. J.D.H.

N82-20593*# Canada Centre for Remote Sensing, Ottawa (Ontario).
HEAT CAPACITY MAPPING MISSION (HCMM): INTERPRETATION OF IMAGERY OVER CANADA Final Report
Josef Cihlar, Principal Investigator and R. G. Dixon Aug. 1981 72 p refs Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send order to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E82-10070; NASA-CR-165092; NAS 1.26:165092) Avail: NTIS HC A04/MF A01 CSCL 05B

Visual analysis of HCMM images acquired over two sites in Canada and supporting aircraft and ground data obtained at a smaller subsite in Alberta show that nighttime surface temperature distribution is primarily related to the near-surface air temperature; the effects of topography, wind, and land cover were low or indirect through air temperature. Surface cover and large altitudinal differences were important parameters influencing daytime apparent temperature values. A quantitative analysis of the relationship between the antecedent precipitation index and the satellite thermal IR measurements did not yield statistically significant correlation coefficients, but the correlations had a definite temporal trend which could be related to the increasing uniformity of vegetation cover. The large pixel size (resulting in a mixture of cover types and soil/canopy temperatures measured by the satellite) and high cloud cover frequency found in images covering both Canadian sites and northern U.S. were considered the main deficiencies of the thermal satellite data. A.R.H.

N82-20595*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LAND USE IN THE PARAIBA VALLEY THROUGH REMOTELY SENSED DATA [USO DA TERRA NO VALE DO PARAIBA ATRAVES DE DADOS DE SENSORIAMENTO REMOTO - RELATORIO FINAL]
Nelson deJesusParada, Principal Investigator, Magda Adelaide Lombardo, Evlyn Marcia Leao deMoraes Novo, Madalena Niero, and Celina Foresti Dec. 1980 95 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(E82-10072; NASA-CR-165094; NAS 1.26:165094; INPE-1972-RPE/278) Avail: NTIS HC A05/MF A01 CSCL 08B

A methodology for land use survey was developed and land use modification rates were determined using LANDSAT imagery of the Paraiba Valley (state of Sao Paulo). Both visual and automatic interpretation methods were employed to analyze seven land use classes: urban area, industrial area, bare soil, cultivated area, pastureland, reforestation and natural vegetation. By means of visual interpretation, little spectral differences are observed among those classes. The automatic classification of LANDSAT MSS data using maximum likelihood algorithm shows a 39% average error of omission and a 3.4% error of inclusion for the seven classes. The complexity of land uses in the study area, the large spectral variations of analyzed classes, and the low resolution of LANDSAT data influenced the classification results. A.R.H.

N82-20615*# Florida Univ., Gainesville. Dept. of Fruit Crops.
A SATELLITE FROST FORECASTING SYSTEM FOR FLORIDA Final Report
J. David Martsolf *In its* Appl. of Satellite Frost Forecast Technol. to Other Parts of the U.S., Phase 2 Nov. 1981 42 p refs Presented at the Workshop on Appl. of Weather Data to Agr. and Forest Prod., Anaheim, Calif., 30-31 Mar. 1981; sponsored by American Meteorological Soc. and NSF
Avail: NTIS HC A12/MF A01 CSCL 04B

Since the first of two minicomputers that are the main components of the satellite frost forecast system was delivered in 1977, the system has evolved appreciably. A geostationary operational environmental satellite (GEOS) system provides the satellite data. The freeze of January 12-14, 1981, was documented with increasing interest in potential of such systems. Satellite data is now acquired digitally rather than by redigitizing the GOES-Tap transmissions. Data acquisition is now automated, i.e., the computers are programmed to operate the system with little, if any, operator intervention. A.R.H.

N82-20776 Bundesgesundheitsamt, Berlin (West Germany). Inst. fuer Wasser-, Boden- und Lufthygiene.
OPTIMAL NETWORK DENSITY FOR ATMOSPHERIC RECORDING [OPTIMALE NETZDICHTE FUER ATMOSPHAERISCHE BEOBACHTUNGEN. GRUNDLEGENDE BETRACHTUNGEN IHRER EXISTENZ UND ERMITTLUNG]
Walter Fett *In* Deutscher Wetterdienst Soc. Meteorol. Palatina, 1780-1795 1980 p 167-168 ref In GERMAN; ENGLISH summary
Avail: Issuing Activity

Statistical parameters are derived in a theoretical-statistical manner for space-correlated events. The procedure is applied to the case of heavy precipitation in a long range dense recording network and to cases of air pollution measurements in an urban network. J.M.S.

N82-20782 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
SOUNDING THE AEROSOL DISTRIBUTION OVER THE UPPER RHINE VALLEY IN THE VALLEY IN THE SPEYER AREA BY MEANS OF LIDAR [SONDIERUNG DER AEROSOLSCHICHTUNG UEBER DEM OBERRHEINGRABEN IN RAUM SPEYER MITTELS FLUGZEUGLIDAR]
P. Moerl, M. E. Reinhardt, W. Renger, and R. Schellhase *In* Deutscher Wetterdienst Soc. Meteorol. Palatina, 1780-1795 1980 p 183-184 refs In GERMAN

Avail: Issuing Activity

The aerosol lidar system on meteorological research airplanes is outlined. The sonde method makes the following observations: (1) soil measurements (smog layers with temperature boundary effects); (2) control of harmful material emission by large industrial complexes; (3) determination of fresh air flow course as an aid in construction planning; (4) precision sounding of smoke plumes; (5) sounding upper layers of clouds; and (6) fine structure and dynamic methods of aerosol stratification. Transl. by E.A.K.

N82-20802 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
DUST FROM THE SAHARA IN SATELLITE IMAGES [SAHARASTAUB IM SATELLITENBILD]
Ute Katergiannakis *In* Deutscher Wetterdienst Soc. Meteorol. Palatina, 1780-1795 1980 p 246-248 refs In GERMAN; ENGLISH summary

Avail: Issuing Activity

In satellite images of North Africa and the surrounding seas visibility is often obscured by sand and dust. This cloudiness appears in images of visible targets as a fine, light grey screen, which is probably a cirrostratus cloud. In infrared images sand and dust storms are seldom observed. Images of a dust wall in the inner Sahara desert, a sandstorm over the Mediterranean, and a dust cloud over the Atlantic ocean are shown. E.A.K.

N82-21667*# Research Triangle Inst., Research Triangle Park, N. C.
A STUDY OF MODEL PARAMETERS ASSOCIATED WITH THE URBAN CLIMATE USING HCMM DATA Quarterly

Progress Report
Nov. 1981 5 p HCMM
(Contract NAS5-26442)
(E82-10140; NASA-CR-168525; NAS 1.26:168525) Avail: NTIS HC A02/MF A01 CSCL 13B

The use of infrared and visible data from the Heat Capacity Mapping Mission (HCMM) and in situ data to study the intensity of the urban heat island of Saint Louis is described. Analysis of HCMM data shows that an urban heat island exists day and night in all seasons when clear skies prevail. The lower albedo value of the urban region during the day suggests that the higher temperatures are due to more absorption of solar radiation. Preliminary analysis of in situ meteorological data was performed after merging with HCMM data, and surface roughness, the exchange coefficient, and the soil moisture were calculated. J.D.

N82-21683*# Research Triangle Inst., Research Triangle Park, N. C. Geosciences Dept.
A STUDY OF MODEL PARAMETERS ASSOCIATED WITH THE URBAN CLIMATE USING HCMM DATA Quarterly Progress Report
Jul. 1981 7 p HCMM
(Contract NAS5-26442)
(E82-10159; NASA-CR-168542; NAS 1.26:168542) Avail: NTIS HC A02/MF A01 CSCL 13B

Infrared and visible data from the Heat Capacity Mapping Mission (HCMM) satellite were used to study the intensity of the urban heat island, commonly defined as the temperature difference between the center of the city and the surrounding suburban and rural regions, as a function of changes in the season and changes in meteorological conditions in order to derive various parameters which may be used in numerical models for urban climate. The analysis was focused on the city of St. Louis; and in situ data from St. Louis was combined with HCMM data in order to derive the various parameters. The HCMM data were mapped onto a Mercator projection map of the city and ground temperatures were established using data corrected for the effects of atmospheric absorption. The corrected and uncorrected HCMM data were compared to determine the magnitude of the error induced by atmospheric effects. M.G.

N82-21684*# Research Triangle Inst., Research Triangle Park, N. C. Geosciences Dept.
A STUDY OF MODEL PARAMETERS ASSOCIATED WITH THE URBAN CLIMATE USING HCMM DATA Quarterly Progress Report
Apr. 1981 7 p HCMM
(Contract NAS5-26442)
(E82-10160; NASA-CR-168543; NAS 1.26:168543) Avail: NTIS HC A02/MF A01 CSCL 13B

Progress in the study of the intensity of the urban heat island is reported. The intensity of the heat island is commonly defined as the temperature difference between the center of the city and the surrounding suburban and rural regions. The intensity is considered as a function of changes in the season and changes in meteorological conditions in order to derive various parameters which may be used in numerical models for urban climate. Twelve case studies were selected and CCT's were ordered. In situ data was obtained from sixteen stations scattered about the city of St. Louis. Upper-air meteorological data were obtained and the water vapor and the temperature data were processed. Atmospheric transmissivities were computed for each of the case studies. T.M.

N82-21685*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Final Report, Dec. 1977 - Dec. 1980
Toby N. Carlson, Principal Investigator 1 Dec. 1980 71 p refs Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Centr A for Rockets and Satellites'. HCMM
(Contract NAS5-24264)
(E82-10161; NASA-CR-168544; NAS 1.26:168544) Avail: NTIS HC A04/MF A01 CSCL 13B

A research summary is presented and is divided into two major areas, one developmental and the other basic science. In the first three sub-categories are discussed: image processing techniques, especially the method whereby surface temperature image are converted to images of surface energy budget, moisture availability and thermal inertia; model development; and model verification. Basic science includes the use of a method to further the understanding of the urban heat island and anthropogenic modification of the surface heating, evaporation over vegetated surfaces, and the effect of surface heat flux on plume spread. T.M.

03
GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A82-20340 † **Reconstruction of a present-day landscape map of a central part of Italy using space images (Obnovlenie karty sovremennykh landshaftov tsentral'noi chasti Italii po kosmicheskim snimkam).** E. V. Glushko, E. P. Romanova, and K. N. Sukhanova (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 19-26. 7 refs In Russian.

The possibility of reconstructing a landscape map on the basis of space images is demonstrated by the example of a landscape map of a portion of central Italy at a scale of 1:2,000,000. Multispectral scanner data were obtained on October 3, 1980 by the Meteor-satellite Fragment system in the 0.7-0.8 and 0.8-1.1 micron spectral bands for an area of 17,600 sq km. The images were used to produce a map scheme for interpreting the landscapes; this map is also compared with a natural-resources map of the same territory. B.J.

A82-20407 **Mapping in tropical forests - A new approach using the laser APR.** H. Arp, J. C. Griesbach (TRANARG CA, Caracas, Venezuela), and J. P. Burns. *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 91-100. 7 refs.

Novel techniques involving the Laser Airborne Profile Recorder (Laser APR) have been developed as a solution to the problem of topographic mapping in dense tropical forests. The narrow laser beam used is able not only to record profiles of the tree canopy, but penetrate through small openings to ground level. Tree heights are then determined by comparing recorded profiles. The system is applied to the mapping of the Rio Caura reservoir site in southern Venezuela, where topographic maps showing 5-10 m contours of the 800 sq km area were completed in five months by means of Laser APR flights at 1.5 km intervals. A special, three-channel Autotape, mounted on a helicopter, was used in photogrammetric control location by trilateration from ground stations to the hovering aircraft. Many Laser APR-derived elevations were identified on the existing, 1:50,000-scale photography used for the mapping. O.C.

A82-21036 **Application and experimental verification of an empirical backscattering cross section model for the earth's surface.** W. Keydel (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Hochfrequenztechnik, Oberpfaffenhofen, West Germany). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 67-71.

The spectral power density of ground clutter for a radar moving horizontally over the ground is calculated and the results are compared with measured values. An empirical model for the backscattering per unit area is employed to generate values for scattering cross sections from a sea surface. The predictions are found to agree well with 60% grazing angle measurements of the Baltic Sea. The analysis is concluded to hold for incoherent scattering, thereby extending the model's effectiveness into the statistical area. M.S.K.

A82-21037 **On randomly absorbing and scattering surface layers.** E. Schanda (Bern, Universität, Berne, Switzerland). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 72-76. 7 refs.

Radar wave scattering from a natural surface modelled as a heterogeneous layer of finite thickness consisting of randomly distributed concentrations and dilutions within a background dielectric is studied. The illumination of the modelled surface with a coherent plane wave yields a coherent and diffuse backscatter, and the dimensions of the fluctuations of the complex index of refraction is described by a delta correlation in the direction perpendicular to the mean surface and by a finitely extended correlation in the plane of the mean surface. A continuous distribution of random absorption and phase irregularities is formulated and consideration is given to albedo and emissivity. The replacement of the planar nature of the model with more realistic phase and absorption distributions, including the background medium and the natural parameters of the surface layer is indicated. M.S.K.

A82-21038 **A radar signature model for partially coherent scattering from irregular surfaces.** E. P. W. Attema, P. J. Van Kats, and L. Krul (Delft, Technische Hogeschool, Delft, Netherlands). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 76-84. 9 refs.

An electromagnetic scattering model for radar surface sensing is presented which accounts for spatial correlation beyond the contour of the illuminated area. Specifically, targets whose sizes of irregularities and radii of curvature are not larger than the radar wavelength and which have sizes which are not much smaller than the scanned area are considered. A two scale surface roughness is examined for small scale irregularities riding on gentle undulations. Particular attention is given to discrepancies between radar backscatter data from airborne scatterometry and from short-range scatterometry. The scattering model is compared with existing sea surface scatterometer data with favorable results. M.S.K.

A82-22147 **Landsat thermal imaging of alpine regions.** R. Lougeay (State University, New York, Geneseo, NY). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 269-273. 15 refs.

Satellite-borne thermal data from Landsat are shown to be of utility in alpine regions. Even the highly degraded Landsat-3 thermal data are shown to contain information which aids in the interpretation of imagery depicting highly glacierized landscapes with extreme topographic texture. Comparison is given between Landsat-3 visible (MSS band 5,600-700 nm) and thermal infrared (MSS band 8, 10,400-12,600 nm) images. Thermal patterns displayed on the Landsat thermal image are compared with ground level observations of radiometric emittance. The thermal data are shown to provide a rendition of topographic texture lacking in other spectral bands of Landsat data. (Author)

A82-25234 † **Orbital methods of celestial geodesy (Orbital'nye metody kosmicheskoi geodezii).** M. S. Urmaev. Moscow, Izdatel'stvo Nedra, 1981. 256 p. 74 refs. In Russian.

The book presents the state-of-the-art in the mathematical treatment of measurements used in orbital methods of celestial geodesy for the determination of the coordinates of satellite observation points. Basic principles of the use of orbital methods are examined, with attention given to the linearization of the fundamental equations and the solution of the overdetermined system of equations by the least squares method. The theory of the two-body problem is considered as the theoretical basis of the method, and a model of perturbed motion of a satellite is analyzed. The theory and methods of the calculation of the matrixant, a matrix of derivatives of the changing orbital elements with respect to their initial values, are examined in detail, and the numerical integration of the differential equations of motion by the Runge-Kutta, Adams, sequential approximation, Shenks, Bulirsh and Stoer, and Everhart methods is considered. The problem of the coordinate-time coupling of the results of spaceborne photography of the earth and moon by orbital methods is also discussed, and the nature of the measurements of orbital methods is examined in relation to the problem of observability. A.L.W.

A82-26012 **A structural synthesis of Brazil, based on the study of major lineaments derived from remote sensing imagery interpretation.** O. P. G. Braun (Companhia de Pesquisa de Recursos Minerais, Rio de Janeiro, Brazil). *Photogrammetria,* vol. 37, Feb. 1982, p. 77-108. 11 refs. Translation. Research sponsored by the Companhia de Pesquisa de Recursos Minerais.

A structural synthesis of the Brazil topography is presented, based on SAR imagery from Landsat and SLAR data. Lineaments are divided into straight or curved alignments of discontinuous linear and congruent elements, and linear features extending several hundred kilometers. Manifestations of fracture zones are reviewed, including quartz bands, intercrossed faults, and volcanic rock dykes. The extended lineaments are noted to originate from fault zones with high angle planes, and main zones are distinguished in terms of post-Bambui activity and diastrophism-originated faults. Tectonic

interpretations are given of the structural differences between the western and eastern parts of the country. Landsat topographic data was gathered on band 7 and phytophysiognomic properties on band 5. M.S.K.

A82-26048 Area determination by means of the method of finite elements (Flächenbestimmung mit der Methode der Finiten Elemente). G. Melykuti (Budapesti Muszaki Egyetem, Budapest, Hungary). *Bildmessung und Luftbildwesen,* vol. 50, Mar. 1, 1982, p. 49-58. In German. Research supported by the Alexander von Humboldt-Stiftung.

The method of finite elements provides very suitable approaches to take into consideration topographical characteristics and particularities in a mathematical description of the surface of the earth. The mathematical foundations of this method are discussed. The considered surface is a two-dimensional scalar field. The values of the scalar field and certain field characteristics are known at a finite number of points. Questions regarding the given relationships can be solved by differential geometry. The area can be determined with the aid of a differential equation and various boundary conditions. Approaches for solving the involved problems are discussed. An approximate solution can be obtained on the basis of the principle of the Ritz method by making use of a finite element procedure. This approach provides appropriate possibilities for taking into consideration the various boundary conditions. G.R.

A82-26266 * Harmonic structure of Pc 3-4 pulsations. K. Takahashi and R. L. McPherron (California, University, Los Angeles, CA). *Journal of Geophysical Research,* vol. 87, Mar. 1, 1982, p. 1504-1516. 49 refs. Grant No. NGL-05-007-004; Contract No. N00014-75-C-0396.

Power spectra of magnetic pulsations observed at synchronous orbit by the ATS 6 satellite often show several spectral peaks simultaneously. Such pulsations, called harmonic events because of the nearly constant separation between successive peaks, are continuously observed in the dayside in the Pc 3-4 frequency range (6.6-100 mHz). The harmonic events are seen clearly only in the east-west magnetic field component. The spectral peaks are regularly spaced with a typical minimum separation of 14 mHz in the morning gradually decreasing to 10 mHz in the afternoon. In the dynamic spectra of harmonic events, the fundamental mode is usually absent. In addition, the relative amplitudes of the higher harmonics depend on the magnetic latitude. These observed features can be explained by a standing Alfven wave consisting of many discrete harmonic frequencies. A statistical analysis of power spectra demonstrates that at least 10-30% of Pc 3 pulsations can be classified as harmonic events. For a selected event on August 7, 1975, the plasma mass density at the synchronous orbit is estimated to be 3-8 hydrogen mass/cu cm. (Author)

A82-26843 Cliff and slope topography of part of the Grand Canyon, Arizona as characterized on a Seasat radar image. G. L. Berlin, G. C. Schaber, R. C. Kozak, and P. Chavez, Jr. (U.S. Geological Survey, Flagstaff, AZ). *Remote Sensing of Environment,* vol. 12, Mar. 1982, p. 81-85.

A82-27507 † Investigation of the earth on the basis of space photographic data (Issledovanie planety zemlia po materialam kosmicheskoi fotoinformatsii). V. D. Bol'shakov. In: Scientific lectures on aviation and astronautics 1980.
Moscow, Izdatel'stvo Nauka, 1981, p. 57-66. In Russian.

The remote sensing of the earth's surface using the Zond and Salyut spacecraft is discussed, with particular emphasis on the use of space data for small-scale mapping and the revision of existing maps. The significance of color and multispectral photography for the remote sensing of earth resources is considered, and results on the study of the earth's figure from its planetary photographs are presented. Attention is also given to the development of efficient and automated operational systems of complex and thematic interpretation. B.J.

A82-27584 # Airborne laser systems use in terrain mapping. L. E. Link and J. G. Collins (U.S. Army, Engineer Waterways Experiment Station, Vicksburg, MS). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 95-110. 21 refs.

Perhaps the most significant recent advancements in measurement technology have resulted from the invention of the laser. As early as the mid-1960's, lasers were being placed in aircraft to examine their applicability to terrain mapping. The emerging new mapping technique has the potential to dramatically improve the capability to map topographic features and to provide quantitative environmental quality data that was previously impractical to acquire over large areas. Airborne laser mapping systems have two major components. A laser altimeter accurately measures the distance from the aircraft to a reflecting surface. Simultaneously, the positioning system records the location and orientation of the aircraft. Attention is given to details of laser system operation, positioning system operation, the status of available airborne systems, and airborne laser systems applications. G.R.

A82-27611 # Application of side-looking color infrared photography for structure detection in subtle topography. J. Aghassy (Pittsburgh, University, Pittsburgh, PA) and Z. Berger (Exxon Production Research Co., Houston, TX). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 491-497. 7 refs.

Examples are cited from a pilot study evaluating surface-form relationships in subtle topographies. Sequential photography taken from 150 m, 300 m, and 500 m above ground level at varying distances from the rims surrounding certain geological structures illustrates that the optimal height coupled with the optimal distance can unveil important stream and slope elements that aid in identifying structures. In addition, a comparison between color photography and Side-Looking Color Infrared (SLCIR) shows that in regular color photography, the close elements of topography are clear whereas the more remote ones are masked by haze in spite of filtering devices. In color IR, the effect of haze on distant elements is much less pronounced, and the details of successive parallel ridges are more clearly visible. SLCIR photos provide valuable insight into the normal evolutionary erosional process of surface expression and drainage components generated above different geological structures, thereby aiding in the verification of anomalies observed in Landsat imagery. C.R.

A82-27615 # Topographic mapping using Landsat data. G. D. Lodwick (Calgary, University, Calgary, Alberta, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 527-534.

The reported work developed from a major research project recently completed, which resulted in the development of a comprehensive computer system to identify and monitor ecological changes in multitemporal Landsat data. The project involved investigation of a study area in the upper Hunter Valley of New South Wales, Australia. A sequence of seven images taken in 1976 was analyzed. The method of cartographic adjustment was to model the surface of each image using complete cubic polynomials, spatially resected onto 21 ground control points. Attention is given to the prediction of site slope and the refinement of slope prediction. For this research project, data interpretation is concerned with evaluating the principal components and their scores. This involves broad observation throughout the study area, as well as specific observation at 25 sample sites using scores from all seven Landsat images. G.R.

A82-27631 * # Wide area, coarse resolution imaging with satellite-borne synthetic aperture radars in low-earth and geosynchronous orbits. K. Tomiyasu (GE Valley Forge Space Center, Philadelphia, PA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p.701-709. 9 refs. Contract No. NAS1-15657.

The LEOSAR (low-earth-orbit synthetic aperture radar) can map around the earth, while the GEOSAR (geosynchronous synthetic aperture radar) can map a large global area bounded in both longitudinal and latitudinal ranges. This paper presents the mapping capabilities and power requirements of both LEOSAR and GEOSAR. For a low-earth-orbit SAR, images of swath widths of the order of 700 km are possible with 100-m resolution and 300 watts of average transmitter power at 9375 MHz. From a SAR in a 50-deg inclined geosynchronous circular orbit, the contiguous United States can be imaged in about 6.4 hours with 100-m resolution, 345 watts of average transmitter power, and a data rate of 6 megabits/sec at 2450 MHz. B.J.

A82-27632 * # **A shuttle scanning laser altimeter for topographic mapping.** M. Kobrick and C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 711-714.

The shuttle scanning laser altimeter is an instrument, currently under development at JPL, capable of producing a three-dimensional elevation map of the topography along a wide swath beneath a spaceborne platform. Operating on the same principle as radar (broadcast of a short pulse of radiation and timing the reception of an echo) the very narrow beamwidths and high pulse rates of modern lasers would allow a significant breakthrough in the areal resolution capability of altimeters. Specifically, the copper vapor laser currently available and planned for use would provide 50 meter horizontal and 3 meter vertical resolution over a 10 kilometer continuous swath or, in a snapshot mode, a 50 kilometer square area. (Author)

A82-28134 † **Analytic methods of geodetic referencing of nontopographic images (Analiticheskie metody geodezicheskoi priviazki netopograficheskikh izobrazhenii).** V. I. Akovetskii, Iu. N. Korneev, and A. S. Sergeev. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 41-49. 6 refs. In Russian.

The paper examines the mathematical details of an analytic method for determining coordinates on the earth's surface from nontopographic images; the method can be used to solve a number of topographic and thematic problems. The method implemented on the Riad computer, has been experimentally verified and shown good results. The algorithm for solving a given problem consists of two independent elements: the solution of the direct photogrammetric intersection problem, and the solution of the inverse problem. B.J.

A82-28138 † **Possibilities of using experience gained from the thematic mapping of the moon in studies of earth resources by remote sensing methods (O vozmozhnostiakh ispol'zovaniia opyta tematicheskogo kartografirovaniia luny pri issledovanii prirodnykh resursov zemli distantsionnymi metodami).** N. N. Evsiukov, I. Iu. Levitskii, and I. G. Chervanev. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana. Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 66-72. 9 refs. In Russian.

Kharkov University has a facility that specializes in the mapping of the lunar surface on the basis of the photometric processing of photographic images; the facility incorporates automated processing of remote sensing images and mathematical techniques of cartographic analysis. This paper examines the possibility of applying techniques developed at this facility to the remote sensing and mapping of earth resources. Particular attention is given to the potential usefulness of a two-parameter map of the lunar surface. B.J.

A82-28139 † **Potential use of space photographs obtained from the manned orbital station Salyut-5 in order to compile a set of small-scale thematic maps of mountain and piedmont regions of Central Asia (Vozmozhnosti ispol'zovaniia kosmicheskikh snimkov, poluchennykh s orbital'noi pilotiruemoi stantsii 'Saliut-5', dlia sostavleniia kompleksa melkomasshtabnykh tematicheskikh kart-skhem gornykh i predgornykh raionov Srednei Azii).** G. G. Bakai and E. M. Nikolaeva. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 72-76. In Russian.

N82-17599 Colorado State Univ., Fort Collins.
REGIONAL PROPERTIES OF ANGULAR REFLECTANCE MODELS Ph.D. Thesis
John Michael Davis 1981 215 p
Avail: Univ. Microfilms Order No. 8126427

The inference of the reflected flux density from satellite radiance measurements requires a knowledge of the angular properties of the reflected radiance field. The angular dependence and the spatial variability of the radiance fields reflected from 30 regional atmospheric scenes were examined. The reflected radiance data set was collected from a high altitude aircraft during the Summer Monsoon Experiment using a unique multi-detector instrument which permitted an instantaneous sampling of the radiance fields from twelve angular veiwing coordinates. All of the scenes display sufficient anisotropy to conclude that neglecting the angular variation of the reflected radiances would lead to significant errors (10-100%) in the inferred flux density. Radiances over the relatively isotropic scenes converge to their regional mean values on a spatial scale which is small compared to that of the total region. Dissert. Abstr.

N82-17708*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SESSION III OF THE VLBI/LASER INTERCOMPARISON TASK OF THE NASA CRUSTAL DYNAMICS PROJECT
Henry Fliegel 1 Nov. 1981 50 p refs
(Contract NAS7-100)
(NASA-CR-168427; JPL-Pub-81-96) Avail: NTIS HC A03/MF A01 CSCL 08E

Baseline vector measurements are reported for a line crossing most of the state of California from Quincy to Mt. Otay near the Mexican border. They were obtained to compare three space geodetic techniques: very long baseline interferometry, satellite laser ranging, and Doppler satellite tracking. A.R.H.

N82-17711# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PARTICLE PRECIPITATION AND ATMOSPHERIC X-AND GAMMA-RAYS IN THE SOUTH ATLANTIC MAGNETIC ANOMALY BY BALLOON EXPERIMENTS Progress Report, 1968 - 1981
Jose Marques daCosta Jun. 1981 10 p refs Presented at the 1st Aeronomy Workshop Brazil-Argentina, Foz do Iguacu, Brazil, 18-20 Jul. 1981 Sponsored in part by the Fundo Nacional de Desenvolvimento Cientifico e Technologico - FNDCT
(INPE-2119-RPE/343) Avail: NTIS HC A02/MF A01

Particle precipitation from the Van Allen belts into the atmosphere of the South Atlantic magnetic anomaly region, were observed with balloon-borne instrumentation. Balloons carrying onboard charged particle and X-and gamma ray detectors formed by plastic scintillators were used. Measurements of bremsstrahlung X-rays and low energy gamma rays as well as the charged particles themselves were made at the altitude of the stratospheric balloons, and simultaneous measurements of the geomagnetic variations were made by rapid run ground magnetometers. S.L.

N82-17714*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME NEW METHODS IN GEOMAGNETIC FIELD MODELING APPLIED TO THE 1960 - 1980 EPOCH
R. A. Langel, R. H. Estes (Business and Technological Systems, Seabrook, Md.), and G. H. Mead Dec. 1981 42 p refs Submitted for publication
(NASA-TM-83868) Avail: NTIS HC A03/MF A01 CSCL 08N

The utilization of satellite and surface data together permitted the incorporation of a solution for the anomaly field at each observatory. The residuals of the observatory measurements to such models is commensurate with the actual measurment accuracy. Incorporation of the anomaly estimation enabled the inclusion of stable time derivatives of the spherical harmonic coefficients up to the third derivative. A spherical harmonic model

is derived with degree and order 13 in its constant and first time derivative terms, six in its second derivative terms and four in its third derivative terms. E.A.K.

N82-17715*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE AND SURFACE GEOPHYSICAL EXPRESSION OF ANOMALOUS CRUSTAL STRUCTURE IN KENTUCKY AND TENNESSEE
M. A. Mayhew (BTS, Inc.), H. H. Thomas, and P. J. Wasilewski Jul. 1981 29 p refs
(NASA-TM-82163) Avail: NTIS HC A03/MF A01 CSCL 08N

An equivalent layer magnetization model is discussed. Inversion of long wavelength satellite magnetic anomaly data indicates a very magnetic source region centered in south central Kentucky. Refraction profiles suggest that the source of the gravity anomaly is a large mass of rock occupying much of the crustal thickness. The outline of the source delineated by gravity contours is also discernible in aeromagnetic anomaly patterns. The mafic plutonic complex, and several lines of evidence are consistent with a rift association. The body is, however, clearly related to the inferred position of the Grenville Front. It is bounded on the north by the fault zones of the 38th Parallel Lineament. It is suggested that such magnetization levels are achieved with magnetic mineralogies produced by normal oxidation and metamorphic processes and enhanced by viscous build-up, especially in mafic rocks of alkaline character. E.A.K.

N82-18930# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
MATRIX DATA ANALYSIS: COLOR/B AND W CODING IS NOT ALWAYS ENOUGH Interim Report, 1976 - 1981
Marshall B. Faintich 1981 6 p refs
(AD-A108406) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Defense Mapping Agency produces digital data bases that describe the physical appearance of the surface of the Earth. These data bases include, but are not limited to, terrain elevation, culture including landscape characteristics, and vertical features. This data is collected from digitized source maps, from optically or digitally correlated stereopairs of photographic imagery, and from digital multi-spectral sensor data. A dramatic impact has been made in the ability to analyze these digital data bases by applying state-of-the-art digital image technology processing and display concepts. These include a variety of color and/or black and white displays of not only intensity/color coded matrix data, but also image processed data using specialized convolution filters, texture discrimination, and special color representation techniques. In addition, computer generated imagery from these data bases serve as a final analysis tool. Author (GRA)

N82-18931# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
PROFILING SENSITIVITY TO IMAGE QUALITY Final Report
Dennis E. Moellman Oct. 1981 21 p refs
(AD-A108405) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper reports results from a study conducted by the Defense Mapping Agency (DMA) to determine the sensitivity of terrain profiling accuracy to input image quality. The study was accomplished by building a set of stereo test models over a test site; exercising those test models with current instruments; reducing the resultant profile data and comparing the results to existing ground control for the test site. The test models were produced from a single model by repeated steps of photographic enlargement, reduction and resolution degradation. The resultant 25 test models represented all combinations of five specific image scales and resolutions. The instruments were operated in both manual and automatic correlation modes. As a consequence the results portray the interdependence of profile accuracy with both scale and resolution as well as the effects of both manual and automatic profiling. The results also provide insight into the behavior of automatic correlation when approaching and exceeding the instrument's theoretical minimum resolution threshold. Author (GRA)

N82-19603 Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
HELMUT WOLF: ON THE OCCASION OF HIS 70TH BIRTHDAY [HELMUT WOLF ZUM 70. GEBURTSTAG]
Verlag der Bayerischen Akademie der Wissenschaften 1980 45 p refs In GERMAN Presented at Bonn, 2 May 1980
(Ser-E-18; ISSN-0065-5341; ISBN-3-7696-9663-8) Copyright. Avail: Issuing Activity

The life and accomplishments of Helmut Wolf, and his contribution to theoretical geodesy are described. A collection of publications and lectures in the geodetic sciences is presented. Wolf's contribution to the development of geodestic surveys and to the mathematical and stochastic model of photogrammetry are outlined. Transl. by E.A.K.

N82-19604 Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
DEVELOPMENTS IN GEODESY WITHIN THE SCOPE OF HELMUT WOLF'S WORK [DIE ENTWICKLUNG DER ERDMESSUNG IN SPIEGEL DES WERKES HELMUT WOLFS]
Helmut Moritz *In its* Helmut Wolf: On the Occasion of his 70th Birthday 1980 p 5-12 In GERMAN

Avail: Issuing Activity

Twenty years of progress in geodetic surveys, the use of artificial satellites and their practical applications are described. Gravimetric methods, astrogeodetic methods, statistical procedures in the physical geodesy, and geodetic problems in geodynamics are discussed. It is found that in the geometric reference system of deep geodynamic observations the axis of rotation of the Earth is a fundamental direction of reference which changes, whether it is in the universe or on terrestrial bodies. E.A.K.

N82-19605 Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
MATHEMATICAL AND STOCHASTIC MODELS IN PHOTOGRAMMETRY RELATING TO HELMUT WOLF'S WORK [DAS MATHEMATISCHE UND STOCHASTISCHE MODELL DER PHOTOGRAMMETRIE MIT BEZUG AUF DAS WERK HELMUT WOLFS]
Hellmut Schmid *In its* Helmut Wolf: On the Occasion of his 70th Birthday 1980 p 13-27 In GERMAN

Avail: Issuing Activity

The development of a mathematical model which is applied to interpret the measured variables and random variables with their characteristic random noise is discussed. It is posited that for typical geometric problems, as well as for geodetic and photogrammetric tasks it is possible to analyze specific geometrically established solvent algorithms quantitatively and qualitatively. Such a computing method is often advantageous, especially because it can be applied to practical engineering. E.A.K.

N82-19616*# Business and Technological Systems, Inc., Seabrook, Md.
EQUIVALENT SOURCE MODELING OF THE MAIN FIELD USING MAGSAT DATA Quarterly Report, 1 Apr. - 30 Jun. 1981
11 Aug. 1981 4 p ERTS
(Contract NAS5-26047)
(E82-10041; NASA-CR-164918; QR-6) Avail: NTIS HC A02/MF A01 CSCL 08G

Magsat dipole solution models were obtained with both 32 deg and 21 deg resolution based on a data set extending over 4 months. Time dependence was modeled using first time derivatives for the dipole magnetization vector components. This doubles the n total number of parameters in the solution. The solutions displayed a very slow convergence in time derivatives although at each iteration the conversion of the dipole parameters to spherical harmonic coefficients showed close agreement with the MGST (12/80) spherical harmonic model to degree 13 in the constant terms and 8 in the secular variation terms. The program error in the option to simultaneously estimate observatory anomaly biases was found and corrected. A 32 deg resolution dipole model was generated using the selected magnetic observatory data from 1960-1977 used in the GSFC (9/80) spherical harmonic model. A.R.H.

N82-19618*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
ELECTROMAGNETIC DEEP-PROBING (100-1000 KMS) OF THE EARTH'S INTERIOR FROM ARTIFICIAL SATELLITES:

CONSTRAINTS ON THE REGIONAL EMPLACEMENT OF CRUSTAL RESOURCES. Quarterly Progress Report, 30 Jun. - 30 Sep. 1981
John F. Hermance, Principal Investigator 30 Sep. 1981 9 p refs ERTS
(Contract NAS5-26138)
(E82-10043; NASA-CR-164920; QPR-5) Avail: NTIS HC A02/MF A01 CSCL 08G

An algorithm was developed to address the problem of electromagnetic coupling of ionospheric current systems to both a homogeneous Earth having finite conductivity, and to an Earth having gross lateral variations in its conductivity structure, e.g., the ocean-land interface. Typical results from the model simulation for ionospheric currents flowing parallel to a representative geologic discontinuity are shown. Although the total magnetic field component at the satellite altitude is an order of magnitude smaller than at the Earth's surface (because of cancellation effects from the source current), the anomalous behavior of the satellite observations as the vehicle passes over the geologic contact is relatively more important pronounced. The results discriminate among gross lithospheric structures because of difference in electrical conductivity. A.R.H.

N82-19619*# Brown Univ., Providence, R. I.
ELECTROMAGNETIC DEEP-PROBING (100-1000 KMS) OF THE EARTH'S INTERIOR FROM ARTIFICIAL SATELLITES: CONSTRAINTS ON THE REGIONAL EMPLACEMENT OF CRUSTAL RESOURCES Quarterly Progress Report, 31 Mar. 1980 - 30 Jun. 1981
John F. Hermance, Principal Investigator 30 Sep. 1981 5 p ERTS
(Contract NAS5-26138)
(E82-10044; NASA-CR-164921; QPR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

Efforts continue in the development of a computer program for looking at the coupling of finite-dimensional source fields with a laterally heterogeneous Earth. An algorithm is also being developed for calculating a time-varying reference field using ground-based magnetic observatory data. It was discovered that ground-based standard magnetic observation is not as so available for the time of the MAGSAT mission as might be expected. Attempts are being made to determine the exact times and observatories from which data are avaliable. A.R.H.

N82-19620*# Business and Technological Systems, Inc., Seabrook, Md.
MAGSAT SCIENCE INVESTIGATIONS Quarterly Report, 1 Jun. - 30 Aug. 1981
30 Aug. 1981 4 p ERTS
(Contract NAS5-26328)
(E82-10045; NASA-CR-164922; QR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

The optimal source spacing for the computer delta-B data set was determined from the intermediate attitude tapes. A U.S. magnetization map based on this result is in preparation. Computed delta-B from the fine-attitude tapes is unexpectedly noisy; the reason for this is being sought. A.R.H.

N82-19625*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STUDIES RELATED TO MAGSAT Progress Report, period ending Sep. 1981
David P. Stern, Principal Investigator 30 Sep. 1981 21 p ERTS
(E82-10050; NASA-TM-84129) Avail: NTIS HC A02/MF A01 CSCL 08G

The westward drift of the geomagnetic field was analyzed using models from Magsat which include secular variation. Two approaches were utilized. A straightforward covariance method gave large drift rates (0.25 degr./yr and up) and suggested that the drift was larger in the Southern Hemisphere than in the Northern, and was small near the poles. The drawback was a rather large noise level superimposed on a small signal. The other approach followed the method of A.D. Richmond and obtained drifts of the order of 0.1 deg/yr. The use of Magsat to study the Backus effect is explored. Particular attention is drawn to the comparison with resuls of general inverse analysis. A.R.H.

N82-19626*# Phoenix Corp., McLean, Va.
IMPROVED DEFINITION OF CRUSTAL ANOMALIES FOR MAGSAT DATA Quarterly Report
25 Mar. 1981 11 p ERTS
(Contract NAS5-25882)
(E82-10051; NASA-CR-164928; QR-6) Avail: NTIS HC A02/MF A01 CSCL 08G

A scheme was developed for separating the portions of the magnetic field measured by the Magsat 1 satellite that arise from internal and external sources. To test this method, a set of sample coefficients were used to compute the field values along a simulated satellite orbit. This data was then used to try to recover the original coefficients. Matrix inversion and recursive least squares methods were used to solve for the input coefficients. The accuracy of the two methods are compared. M.G.

N82-19648# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
THE DIAGNOSIS SETTLEMENT 1980 OF THE GERMAN MAIN TRIANGULATION NETWORK. PART 2: TRAJECTORIES [DIE DIAGNOSEAUSGLEICHUNG 1980 DES DEUTSCHEN HAUPTDREICKSNETZES. 2: STRECKEN]
Rudolf Schmidt Frankfurt am Main Verlag des Instituts fuer Angewandte Geodaesie 1981 501 p refs In GERMAN
(SER-B-253-Mitt-159-Pt-2; ISSN-0071-9196) Avail: NTIS HC A22/MF A01

Diagnostic balancing in triangulation networks was investigated. The purpose of defining the network for diagnostic balancing is to reduce the balance of the edge effect. The computer program is based on observations of the geographic coordinates system. The following tasks were performed: compilation of results from end to end measurements; execution of end to end measurements in the triangulation network; reduction of field length; and, calculation of end to end measurements. E.A.K.

N82-19731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFORMATION THEORY LATERAL DENSITY DISTRIBUTION FOR EARTH INFERRED FROM GLOBAL GRAVITY FIELD
David Parry Rubincam Oct. 1981 64 p refs Submitted for publication
(NASA-TM-83825) Avail: NTIS HC A04/MF A01 CSCL 08N

Information Theory Inference, better known as the Maximum Entropy Method, was used to infer the lateral density distribution inside the Earth. The approach assumed that the Earth consists of indistinguishable Maxwell-Boltzmann particles populating infinitesimal volume elements, and followed the standard methods of statistical mechanics (maximizing the entropy function). The GEM 10B spherical harmonic gravity field coefficients, complete to degree and order 36, were used as constraints on the lateral density distribution. The spherically symmetric part of the density distribution was assumed to be known. The lateral density variation was assumed to be small compared to the spherically symmetric part. The resulting information theory density distribution for the cases of no crust removed, 30 km of compensated crust removed, and 30 km of uncompensated crust removed all gave broad density anomalies extending deep into the mantle, but with the density contrasts being the greatest towards the surface (typically + or 0.004 g cm 3 in the first two cases and + or - 0.04 g cm 3 in the third). None of the density distributions resemble classical organized convection cells. The information theory approach may have use in choosing Standard Earth Models, but, the inclusion of seismic data into the approach appears difficult. Author

N82-19732*# Woods Hole Oceanographic Institution, Mass.
GRAVITY AND GEOID ANOMALIES OF THE PHILIPPINE SEA: EVIDENCE ON THE DEPTH OF COMPENSATION FOR THE NEGATIVE RESIDUAL WATER DEPTH ANOMALY
Carl Bowin [1982] 27 p refs
(Grant NAG5-18)
(NASA-CR-168639; WHOI-4931) Avail: NTIS HC A03/MF A01 CSCL 08G

A negative free-air gravity anomaly which occurs in the central part of the Philippine Sea was examined to determine the distribution and nature of possible regional mass excesses or deficiencies. Geoid anomalies from GEOS-3 observation were positive. A negative residual geoid anomaly consistent with the area of negative free-air gravity anomalies were found. Theoretical

gravity-topography and geoid-topography admittance functions indicated that high density mantle at about 60 km dept could account for the magnitudes of the gravity and residual geoid anomaly and the 1 km residual water depth anomaly in the Philippine Sea. The negative residual depth anomaly may be compensated for by excess density in the uppermost mantle, but the residual geoid and regional free-air gravity anomalies and a slow surface wave velocity structure might result from low-density warm upper mantle material lying beneath the zone of high-density uppermost mantle. From a horizontal disk approximation, the depth of the low-density warm mantle was estimated to be on the order of 200 km. M.D.K.

N82-20580# Bayerische Akademie der Wissenschaften, Munich (West Germany).
SOME CRITERIA FOR THE ACCURACY AND THE RELIABILITY OF NETWORKS
Hans Pelzer *In its* Contrib. from the Federal Rep. of Ger. to the 17th Gen. Assembly of Intern. Union of Geodesy and Geophys. 1980 p 55-67 refs

Avail: NTIS HC A06/MF A01

Design criteria for optimizing the quality of a geodetic network, taking both the functional and the stochastic model of the network into account, are derived. An effective global accuracy criterion is shown to be obtainable from the maximum eigenvalue of the cofactor matrix of the vector of points coordinates. The essential eigenvectors of the same matrix are identified as indicators for functions with maximum variance. A reliability criterion can be obtained by means of a reliability parameter constructed by gross error testing of each observation. To this end a nomogram is made available. Author (ESA)

N82-20581# Bayerische Akademie der Wissenschaften, Munich (West Germany).
EXPERIMENTS IN SATELLITE DOPPLER CONTROL POSITIONING AT SEA
Guenter Seeber, Delf Egge, and Hans Werner Schenke *In its* Contrib. from the Federal Rep. of Ger. to the 17th Gen. Assembly of Intern. Union of Geodesy and Geophys. 1980 p 69-80 refs Sponsored by Bundesministerium fuer Forschung- und Technologie and Deutsche Forschungsgeimschaft

Avail: NTIS HC A06/MF A01

Experiments on the application of the transit satellite system, which utilizes Doppler control positioning, for an extension of classical continental geodetic networks beyong the shore lines are described. The experiments were conducted in the North Sea area and deal with: (1) fixed point positioning on a platform; (2) positioning of a moored buoy; (3) positioning of a drifting buoy. The evaluation indicates that for fixed or stationary motion conditions no accuracy decrease occurs provided an accumulated solution is made. For nonstationary motion one has to resort to position fixes with single satellite passes so that no accumulated increase of precision can be obtained. Experiments to assess the inherent accuracy of the Doppler satellite method in a single pass solution are presently underway. Author (ESA)

N82-20583# Bayerische Akademie der Wissenschaften, Munich (West Germany).
RECENT RESULTS OF GEOID DETERMINATION BY COMBINATION TECHNIQUES IN THE NORTH SEA TEST AREA
Hans-Georg Wenzel *In its* Contrib. from the Federal Rep. of Ger. to the 17th Gen. Assembly of Intern. Union of Geodesy and Geophys. 1980 p 95-121 refs Sponsored by Deutsche Forschungsgeimschaft

Avail: NTIS HC A06/MF A01

Gravity anomalies, GEOS 3 satellite altimetry and astrogeodetic vertical deflections were used to determine gravimetric, altimetric and astrogeodetic geoids in the North Sea test area. The agreement between these independent geoids is below the 1 m level and no sea surface topography could be detected. Simple averaging techniques, and stokes and least square collocations are used to determine combined geoids with an accuracy believed to be below the 0.5 m level. Author (ESA)

N82-20585*# Wisconsin Univ., Madison.
INVESTIGATION OF ANTARCTIC CRUST AND UPPER MANTLE USING MAGSAT AND OTHER GEOPHYSICAL DATA Quarterly Progress Report
C. R. Bentley, Principal Investigator 9 Sep. 1981 2 p refs ERTS
(Contract NAS5-25977)
(E82-10062; NASA-CR-165084; NAS 1.26:165084; QPR-6) Avail: NTIS HC A02/MF A01 CSCL 08G

Progress in processing and analysis of Investigator B MAGSAT data is reported. Data processing tasks required prior to data analysis, including translation and reformatting of tapes and development of computer routines, were performed. A scalar anomaly map of Antarctica is near completion. Data analysis included a qualitative correlation of NASA's 4/81 scalar map of Antarctica with other geopotential data and correlation of POGO and continental scale gravity data with MAGSAT data. A magnetic high was found to exist over the Ross Embayment. J.D.H.

N82-20589*# Analytic Sciences Corp., Reading, Mass.
[MAGSAT ANOMALY PROFILES OF THE EASTERN INDIAN OCEAN] Quarterly Progress Report, 1 Apr. - 30 Jun. 1981
Richard V. Sailor, Principal Investigator and Andrew R. Lazarewicz 15 Aug. 1981 21 p refs ERTS
(Contract NAS5-26424)
(E82-10066; NASA-CR-165088; NAS 1.26:165088; PR-1325-2) Avail: NTIS HC A02/MF A01 CSCL 05B

Ground tracks from SEASAT were used in an effort to develop qualititative relationships between the gravity field and MAGSAT magnetic anomalies in the eastern Indian Ocean. Investigation of data quality led to analyses of the average value (over 80 vector data points, or approximately 36 km intervals) and of the standard deviation of this average, as a mean of identifying noisy portions of the data. It was discovered that the plots of the average value minus the individual (measured) point value are most useful for identifying noisy areas and data spikes. Spectrum analysis using edited (spikes removed) data show that the noise floor is less than 1 nT and the slope of the spectrum in the region of wavelengths between 1200 km and 250 km is approximately -3. Consequently the estimated resolution limit improved from approximately 360 km to approximately 250 km. A.R.H.

N82-20598*# Liverpool Univ. (England).
SPHERICAL HARMONIC REPRESENTATION OF THE MAIN GEOMAGNETIC FIELD FOR WORLD CHARTING AND INVESTIGATIONS OF SOME FUNDAMENTAL PROBLEMS OF PHYSICS AND GEOPHYSICS Progress Report
D. R. Barraclough, R. Hide, B. R. Leaton, F. J. Lowes, S. R. C. Malin, and R. L. Wilson, Principal Investigators 1 Oct. 1981 8 p refs Sponsored by NASA ERTS
(E82-10075; NASA-CR-165097; NAS 1.26:165097) Avail: NTIS HC A02/MF A01 CSCL 08G

Quiet-day data from MAGSAT were examined for effects which might test the validity of Maxwell's equations. Both external and toroidal fields which might represent a violation of the equations appear to exist, well within the associated errors. The external field might be associated with the ring current, and varies of a time-scale of one day or less. Its orientation is parallel to the geomagetic dipole. The toriodal field can be confused with an orientation in error (in yaw). It the toroidal field really exists, its can be related to either ionospheric currents, or to toroidal fields in the Earth's core in accordance with Einstein's unified field theory, or to both. Author

N82-21475# Canada Centre for Remote Sensing, Ottawa (Ontario).
RELIEF EFFECTS AND THE USE OF TERRAIN MODELS IN SAR IMAGE PROCESSING
B. Guindon, P. M. Teillet, D. G. Goodenough, K. Dickinson (INTERA Environmental Consultants, Calgary, Canada), and J. F. Meunier (INTERA Environmental Consultants, Calgary, Canada) *In* ESA SAR Image Quality Jun. 1981 p 89-92 refs

Avail: NTIS HC A05/MF A01; ESA, Paris FF 55 (US $12)

The use of digital terrain models in Canada to overcome the effects of topographic relief on geometric and radiometric fidelity of SAR imagery is discussed. Digital elevation models (DEM) can reduce, to 15 m, errors incurred in overlaying multipass SAR imagery of mountainous terrain. Neglect of topography can result in errors of hundreds of meters. Shadow or layover problem areas can be identified using DEM's. Author (ESA)

N82-21659*# Paris VI Univ. (France).
PRELIMINARY MODELS OF THE CORE FIELD Progress Report
Jean-Louis LeMouel, Principal Investigator, Armand Galdeano, and Joel Ducruix 1 Aug. 1981 5 p Sponsored by NASA ERTS
(E82-10129; NASA-CR-168513; NAS 1.26:168513) Avail: NTIS HC A02/MF A01 CSCL 05B

Using the CHROFIN tapes containing MAGSAT data for the month of December, two spherical harmonic models were prepared. One of these models was specially designed to study the Bangui anomaly region. For this region an attempt was made to downward continue the data and to compare it with the existing ground level map. M.G.

N82-21674*# Wisconsin Univ., Madison.
INVESTIGATION OF ANTARCTIC CRUST AND UPPER MANTLE USING MAGSAT AND OTHER GEOPHYSICAL DATA Quarterly Status and Technical Progress Report
C. R. Bentley, Principal Investigator 30 Nov. 1981 6 p refs ERTS
(Contract NAS5-25977)
(E82-10147; NASA-CR-168532; NAS 1.26:168532; QTPR-7) Avail: NTIS HC A02/MF A01 CSCL 08G

The isolation of the crustal magnetic anomaly field is discussed. Slowly spatially varying ring current fields were modeled as a least squares fit to each MAGSAT pass over Antarctica. Selection criteria were applied to data from 3000 MAGSAT passes to remove field aligned currents, yielding 87 data sets used to construct a scalar magnetic anomaly map for regions south of 55 S latitude. Internal tests performed on MAGSAT data and omparisons with the POGO map indicated that the general anomaly features are of crustal origin. The sources of anomalies generated in continental and in oceanic regions are discussed. Correlations were found between crustal magnetic anomalies and known geologic features over West and East Antarctica and over the surrounding oceanic regions. J.D.

N82-21675*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARISON OF STORM-TIME CHANGES OF GEOMAGNETIC FIELD AT GROUND AND AT MAGSAT ALTITUDES Progress Report
Rajaram Purushottam Kane and Nalin Babulal Trivedi Dec. 1981 15 p refs Sponsored by NASA ERTS
(E82-10148; NASA-CR-168533; NAS 1.26:168533) Avail: NTIS HC A02/MF A01 CSCL 08G

Computations concerning variations of the geomagnetic field at MAGSAT altitudes were investigated. Using MAGSAT data for the X, Y, and Z components of the geomagnetic field, a computer conversion to yield the H component was performed. Two methods of determining delta H normalized to a constant geocentric distance R sub 0 = 6800 were investigated, and the utility of elta H at times of magnetic storms was considered. Delta H at a geographical latitude of 0 at dawn and dusk, the standard Dst, and K sub p histograms were plotted and compared. Magnetic anomalies are considered. Examination of data from the majority of the 400 passes of MAGSAT considered show a reasonable delta H versus latitude variation. Discrepancies in values are discussed. J.D.

N82-21679*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
ELECTROMAGNETIC DEEP-PROBING (100-1000 KMS) OF THE EARTH'S INTERIOR FROM ARTIFICIAL SATELLITES: CONSTRAINTS ON THE REGIONAL EMPLACEMENT OF CRUSTAL RESOURCES Quarterly Progress Report, 30 Sep. - 31 Dec. 1981
John F. Hermance, Principal Investigator 31 Dec. 1981 16 p refs ERTS
(Contract NAS5-26138)
(E82-10155; NASA-CR-168540; NAS 1.26:168540; QPR-6) Avail: NTIS HC A02/MF A01 CSCL 08G

Model simulations show that induction in a spherical Earth by distant magnetospheric sources can contribute magnetic field fluctuations at MAGSAT altitudes which are 30 to 40 percent of the external field amplitudes. When the characteristic dimensions (e.g. depth of penetration, etc) of a particular situations are small compared with the Earth's radius, the Earth can be approximated by a plane horizontal half space. In this case, electromagnetic energy is reflected with close to 100 percent efficiency from the Earth's surface. This implies that the total horizontal field is twice the source field when the source is above the satellite, but is reduced to values which are much smaller than the source field when the source is below the satellite. This latter effect tends to enhance the signature of gross electrical discontinuities in the lithosphere when observed at satellite altitudes. A.R.H.

N82-21686*# Colorado Univ., Boulder. Dept. of Astrogeophysics.
INVESTIGATION OF GEOMAGNETIC FIELD FORECASTING AND FLUID DYNAMICS OF THE CORE Quarterly Status Technical Progress Report, 1 Jul. - 30 Sep. 1981
Edward R. Benton, Principal Investigator 1 Oct. 1981 14 p ERTS
(Contract NAS5-25957)
(E82-10162; NASA-CR-168545; NAS 1.26:168545; QSTPR-7) Avail: NTIS HC A02/MF A01 CSCL 08G

The magnetic determination of the depth of the core-mantle boundary using MAGSAT data is discussed. Refinements to the approach of using the pole-strength of Earth to evaluate the radius of the Earth's core-mantle boundary are reported. The downward extrapolation through the electrically conducting mantle was reviewed. Estimates of an upper bound for the time required for Earth's liquid core to overturn completely are presented. High order analytic approximations to the unsigned magnetic flux crossing the Earth's surface are also presented. T.M.

N82-21689# Army Engineer Topographic Labs., Fort Belvoir, Va.
A DIGITAL TECHNIQUE FOR CONSTRUCTING VARIABLE-WIDTH LINES
Richard L. Rosenthal Mar. 1982 10 p
(AD-A110287; ETL-R031) Avail: NTIS HC A02/MF A01 CSCL 08/2

This paper describes a digital technique for constructing variable-width cartographic lines. Specifically, an algorithm is developed for generating symbolized lines using multiply-stoked centerline data. Algorithmic development considers three factors: cartographic principles, inherent problems with existing algorithms, and hardware constraints imposed by specific output devices including the Defense Mapping Agency's Laser Plotemaker. Software developed from the algorithm uses simple trigonometric functions and may be implemented in applications using vector data with vector or raster plotters. Author (GRA)

N82-21690# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
EXPERIENCES WITH DIGITAL TERRAIN ELEVATION DATA CONTOURING PROGRAMS Interim Report
Philip K. Alderman 26 Jan. 1982 12 p refs
(AD-A110280) Avail: NTIS HC A02/MF A01 CSCL 08/2

The DMA digital terrain elevation data base has been expanding steadily since its inception. With increasing coverage there has been a greater opportunity to apply this data, including the automatic derivation of contours from digital elevation data for aerospace charts. GRA

N82-21697# Royal Aircraft Establishment, Farnborough (England).
COMPUTER BASED TECHNIQUE FOR CONVERTING A CONTOUR MAP INTO AN EQUISPACED GRID OF POINTS
P. A. Roberts London HMSO Sep. 1980 68 p
(RAE-TR-80110; RAE-Space-586; BR77598) Avail: NTIS HC A04/MF A01

The purpose of the grid representation is to enable the map data to be handled more easily in a computer. Contours are assumed to represent some physical quantity and thus the variable represented by the contour height is a single valued function of the map coordinates. It is also assumed that the variable is smooth and continuous. The technique has applications in image processing where it may be necessary to compare (by ratioing) an image and a contour map. A grid representation is also an essential prerequisite for degrading the spatial resolution of a contour map by convolution, thus enabling contour maps having different resolutions to be compared at a common resolution. The interpolation algorithms and the reasons for their use are described in detail. Operations are described which may be

required to be performed on a grid; those of expanding (or contracting) the number of data points in the grid, and the construction of cross sections. Listings of all programs, written in ANSI FORTRAN V are given. Author (ESA)

N82-21796*# *Massachusetts Inst. of Tech., Cambridge.* Dept. of Earth and Planetary Sciences.
APPLICATIONS TO EARTH PHYSICS: VERY-LONG-BASELINE INTERFEROMETRY AND DATA ANALYSIS Final Technical Report, 1 Apr. 1974 - 15 Mar. 1982
Charles C. Counselman, III and Irwin I. Shapiro Apr. 1982 197 p refs
(Contract NGR-22-009-839)
(NASA-CR-168743; NAS 1.26:168743) Avail: NTIS HC A09/MF A01 CSCL 08G

A range of very long baseline interferometry experiments applied to Earth physics are covered. N.W.

04
GEOLOGY AND MINERAL RESOURCES

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

A82-20338 † **Analysis of space imagery to compile a geomorphological map of the world (Analiz kosmicheskikh snimkov dlia sostavleniia geomorfologicheskoi karty mira).** N. V. Bashenina and N. N. Tal'skaia (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 5-12. 10 refs. In Russian.

The paper presents and examines portions of a geomorphological map of the earth, with a scale of 1:15,000,000, compiled on the basis of space imagery and photomosaics. The use of space photographs has made it possible to delineate the general morphostructural plan of large areas of continents and the natural patterns of morphostructures. B.J.

A82-20341 † **The relationship between seismicity and lineaments of the Anatolian-Caucasian-Iranian segment of the Mediterranean fold belt (K voprosu o sootnoshenii seismichnosti s lineamentami Anatoliisko-Kavkazsko-Iranskogo segmenta Sredizemnomorskogo poiasa).** T. L. Korovina (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) and A. S. Karakhanian (Akademiia Nauk Armianskoi SSR, Institut Geologicheskikh Nauk, Yerevan, Armenian SSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 27-34. 15 refs. In Russian.

A comparison of remotely sensed data from Meteor, Soyuz, and Salyut data with statistical data on seismic activity made it possible to determine the regional and superregional lineaments that control seismic activity in the Anatolian-Caucasian-Iranian segment of the Mediterranean fold belt. The junctions of the lineaments considered are the seismic foci of intense earthquake zones. The general relationship obtained here can be used as an additional criterion for the forecasting of earthquakes. B.J.

A82-20342 † **Structural analysis of the basement of the East European platform by remote sensing methods (Analiz struktur fundamenta Vostochno-Evropeiskoi platformy distantsionnymi metodami).** D. V. Lopatin (Akademiia Nauk SSSR, Institut Geologii i Geokhronologii Dokembriia, Leningrad, USSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 35-40. 13 refs. In Russian.

It is shown that the interpretation of aerial and space imagery and geomorphological analysis can assist in the identification of Precambrian basement structures under sedimentary cover in Eastern Europe. The existence of early Archaen mobile zones dividing the platform into three large geoblocks was confirmed. In addition, early Proterozoic Rapakivi granitoid massifs were found to be volcano-plutonic structures of central type. B.J.

A82-25453 **Dip determinations in photogeology.** M. Ricci. *Photogrammetric Engineering and Remote Sensing,* vol. 48, Mar. 1982, p. 407-414. 21 refs.

A photogeological dip determination method which is free of conceptual error and, in addition, is both rapid and accurate, is presented. The method is based on (1) parallax difference measurements and (2) the use of a trigonometric formula which incorporates perspective correction, and is shown capable of determining dip angles independently of the position and orientation of the photographic inclined bed images for the entire range of angle values. Comparisons are presented of the present method's results with those of previously published methods. O.C.

A82-26013 **The Pampean Plain studied with Landsat images.** P. Pasotti and C. A. Canoba (Rosario, Universidad Nacional, Rosario, Argentina). *Photogrammetria,* vol. 37, Feb. 1982, p. 109-130. 31 refs.

Topographical charts, aerial photographs, and Landsat imagery from bands 5 and 7 were employed for a visual investigation of the tectonics in the Pampean Plain in the Sante Fe Province of Argentina. Satellite imagery was examined by magnifying glass inspection, and a mosaic of photographs was built to portray the low flooded zones. The last hydrographic network of the Pleistocene age was identified, and is formed of many parallel and straight depressions running SW-NE from the western mountains. A smooth sinusoidal flexure with a large radius of curvature generating one depressed and two uplifted subregions comprise the tectonic movements, and hydrographic studies are indicated to determine the characteristics of geofracture dividing the pampas. Additional color composites using different combinations of bands 4-7 were explored for information on lineaments, valleys, and the depressed zones. M.S.K.

A82-26014 **Remote sensing applied to basement tectonics of the calcareous High Atlas /Morocco/.** A. Bahmad (Service Régional de la Géologie, Midelt, Morocco), H. Chariai (Service Régional de la Géologie, Marrakech, Morocco), A. Djerrari, A. El Kochri (Paris VI, Université, Paris, France), E. A. Hilali (Direction de la Géologie, Rabat, Morocco), D. Ratz, A. L. G. Tamain (Paris XI, Université, Orsay, Essonne, France), and T. Saqalli (Société de Sel de Mohammedia, Mohammedia, Morocco). *Photogrammetria,* vol. 37, Feb. 1982, p. 131-150. 38 refs.

The use of Landsat generated imagery as the first step in geological research of the Moroccan High Atlas is reviewed. Initial examination of photographs results in the construction of structural and lineaments maps. Comparisons with existing geological maps yield further, structural and fractural charts. Little cloud cover was observed on the high summits, and the detection of anticlines, synclines, and continuous and discontinuous faults is discussed. A parallelism was found between the direction of the faults and the lengthening of the folded regions, indicating subvertical tectonic faults. The distribution of alkaline magmatism is outlined, having settled in the upper Jurassic to early Cretaceous periods, and dense wefts are taken as further evidence that the faults tend toward the vertical with greater depth. M.S.K.

A82-26015 **Relationship of hydrothermal phenomena within the Leinster Granite to crustal fractures delineated from Landsat imagery.** P. M. Brück (University College, Cork, Ireland) and P. J. O'Connor (Geological Survey of Ireland, Dublin, Ireland). *Photogrammetria,* vol. 37, Feb. 1982, p. 151-159. 16 refs.

Landsat imagery was combined with existing geologic maps of the Leinster Granite in SE Ireland to develop a model of hydrothermal processes in the area and detect the fracture zones. Observed linears were interpreted as fractures, and satellite imagery allowed the discernment of hydrothermal alteration zones, occurrences of spodume and red-feldspar pegmatites, and explosion breccias. Pb-Zn mineralization sites displayed a spatial association with a transverse fracture system, with galena and sphalerite the main ores in veins with thicknesses ranging from a few meters to a few cm. Hydrothermal processes which may have led to the formation of the Leinster Granite are detailed, along with a suggestion that fractures occuring late in the cooling granite's history formed channels for circulating ground waters. M.S.K.

A82-26016 **Geophysical and Landsat lineament mapping - An approach illustrated from west-central and south India.** M. N. Qureshy (Department of Science and Technology, New Delhi, India). *Photogrammetria,* vol. 37, Feb. 1982, p. 161-184. 35 refs.

Linear zones correlated with surface geology, geophysical data, and Landsat data for parts of India are reviewed, along with mappings of magnetic and gravitational anomalies correlated with the tectonic framework of the subcontinent. Reactivation tendencies were observed in a megalineament in west central India, and is taken as evidence of continued activity of global tectonic forces. Linears were detected to cluster around regions of a gravitational high, and the recurrence of particular mineral-bearing lineaments with successive phases of activity is suggested. The use of Landsat data in conjunction with photogeological studies at the surface is considered as useful for determining surface features which originate in processes in the mantle. M.S.K.

A82-26017 **One orogenic belt or two - A structural reinterpretation supported by Landsat data products of the Precam-**

brian metamorphics of Singhbhum, eastern India. A. N. Sarkar (Geological Survey of India, Map Div., Calcutta, India) and D. K. Chakraborti (Geological Survey of India, Agartala, India). *Photogrammetria*, vol. 37, Feb. 1982, p. 185-201. 27 refs.

A stratigraphic/tectonic analysis of the Singhbhum district in India, aided by imagery from Landsat I, is presented. Analyses of the rocks found in the area are reviewed, with particular attention to the potential existence of an Iron Ore and a Singhbhum Group of rocks of different geologic ages delineating northern metamorphic rocks and southern older rocks, with the southern rocks actually part of the same stratigraphic group as the northern rocks. An observed shear zone running E-W is concluded not to demarcate two different metamorphic belts, and deformation actually occurred during the orogenesis which ended in an ENE-WSW diagonal sinistral shearing in the western part of the district. M.S.K.

A82-26604 * Ore deposits in Africa and their relation to the underlying mantle. H.-S. Liu (NASA, Goddard Space Flight Center, Greenbelt, MD). *Modern Geology*, vol. 8, no. 1, 1981, p. 23-36. 70 refs.

African magmatism is largely related to the tensional stress regimes of the crust which are induced by the hotter upwelling mantle rocks. These mantle rocks may provide emanating forces and thermal energy for the upward movements of primary ore bodies with fluid inclusions in the tensional stress regimes of the crust. In this paper, the Goddard Earth Gravity Model is used to calculate a detailed subcrustal stress system exerted by mantle convection under Africa. The resulting system is found to be correlated with the African metallogenic provinces. Recognition of the full spectrum of ore deposits in Africa that may be associated with the hotter upwelling mantle rocks has provided an independent evidence to support the hypothesis of mantle-derived heat source for ore deposits. (Author)

A82-27466 † Application of aerial and space photographic data in the study of subsurface water and tectonic structures (Primenenie materialov aerokosmicheskikh s'emok v issledovanii podzemnykh vod i tektonicheskikh struktur). E. Radai. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 70-76. In Russian

The paper examines the use of aerial and space photography data to create a network for monitoring subsurface water in karst areas of the Danube region. The interpretation of space remote sensing images has made it possible to obtain new data on the geological structure of a basin in the area as well as to detect tectonic structures in two massifs. B.J.

A82-27600 * # A data base of geologic field spectra. A. B. Kahle, A. F. H. Goetz, H. N. Paley, R. E. Alley, and E. A. Abbott (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 329-337. NASA-supported research.

It is noted that field samples measured in the laboratory do not always present an accurate picture of the ground surface sensed by airborne or spaceborne instruments because of the heterogeneous nature of most surfaces and because samples are disturbed and surface characteristics changed by collection and handling. The development of new remote sensing instruments relies on the analysis of surface materials in their natural state. The existence of thousands of Portable Field Reflectance Spectrometer (PFRS) spectra has necessitated a single, all-inclusive data base that permits greatly simplified searching and sorting procedures and facilitates further statistical analyses. The data base developed at JPL for cataloging geologic field spectra is discussed. C.R.

A82-27612 # Automatic linear recognition and analysis using computer program LIRA. D. H. Coupland and R. K. Vincent (Geospectra Corp., Ann Arbor, MI). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 499-508.

Computer program LIRA will automatically recognize and map linear features in digital images. Input to the program is a magnetic tape containing the image to be analyzed; output is a list of linears found and a linear plot which overlays the original image. LIRA does not replace the human interpreter, but speeds his work and provides an objective criterion for interpreting linear features in tonal images. Linears recognized by LIRA map major faults, lithologic boundaries, drainage and erosional patterns, and other features of geologic interest. In Landsat frame La Ronge (northern Saskatchewan), linear recognition maps produced by LIRA show a detailed relationship to published geologic maps. Significant variations in linear density and azimuthal distribution are seen between major geologic regions. (Author)

A82-27635 # Seasat satellite investigation of the structure of Western Nebraska and its application to the evaluation of geothermal resources. J. Stix (Los Alamos National Laboratory, Los Alamos, NM). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 735-750. 43 refs.

Seasat synthetic aperture radar (SAR) satellite imagery was used to interpret the structural framework and, indirectly, the geothermal potential of an area in Western Nebraska. Lineaments were mapped from the imagery and then compared to known structure. It was found that Seasat does record surface manifestations of subtle basement structures, particularly faulting. Furthermore, four areas with geothermal potential were delineated using Seasat and other data. It is stressed that more subsurface geology and geophysical data are needed before a final evaluation of the geothermal potential can be made. Seasat imagery is a useful reconnaissance exploration tool in the interpretation of regional structure within areas of little topographic relief. (Author)

A82-27672 # Integration of Landsat, geological and geophysical data for use in thematic mapping at regional scale. C. M. Marino, G. Miglio, E. Zini (Milano, Università, Milan, Italy), and P. M. Rossi (CNR, Centro di Studio per la Stratigrafia e Petrografia delle Alpi Centrali, Milan, Italy). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1153-1162. 12 refs.

This paper describes a study on the integration of Landsat, geological and geophysical data over a large test-site in the western portion of Northern Apennines Range. In this framework particular attention was devoted to the use of hydrographic network as a new parameter to be considered in the process of temporal classification of linear phenomena. Moreover reference is made to the regional contribution of geophysical data mainly to test the validity of some hypotheses arisen from the analysis of satellite images. (Author)

A82-27694 # Non-parametric classification of abandoned coal mine features using multioriented and ratio transformed Landsat data. P. W. Mausel, R. C. Howe, and K. Lulla (Indiana State University, Terre Haute, IN). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1397-1409. 7 refs.

A82-27695 # Airborne remote sensing in east Greenland. J.-C. Favard (Centre National d'Etudes Spatiales, Toulouse, France), J. F. Scanvic (Bureau de Recherches Géologiques et Minières, Orléans, France), A. L. Friedman (Christian Rovsing A/S, Herlev, Denmark), and T. Thyrsted (Gronlands Geologiske Undersogelse, Copenhagen, Denmark). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1411-1424.

A joint French-Danish investigation was conducted with the objective to study the feasibility of an employment of multispectra observation techniques in geological research projects. A region in east Greenland was selected as a test site in connection with a

number of advantages provided by the involved area. These advantages are related to a wind range of geological environments, a wide variety of mineralization types, and limitations with respect to vegetation and secondary cover. Three test areas were studied. Two multispectral scanners were employed in the investigation, including one instrument for the visible and near-infrared spectral region, and another instrument used as thermal scanner. Flight altitudes at 2,500 m and 5,000 m above ground were used. The obtained data are found to make a meaningful contribution to mining prospection, because they provide mapping precision or define original prospection aims. G.R.

A82-27705 # **Applications of aircraft and satellite data for the study of archaeology and environment - Mekong Delta, Vietnam.** A. Lind (Vermont, University, Burlington, VT). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1529-1537.

An account is given of the way in which Landsat data have been used in conjunction with aerial photography to study and map the imprints of early hydraulic civilizations and the pattern of geomorphic changes of a dynamic delta environment. It is noted that many studies have demonstrated the applicability of remote sensing data to the investigation of fluvial and coastal environments. Data of this type are applied here to reconstructing geomorphic conditions in the Trans-Bassac, a plain bounded by the Bassac River and the Gulf of Thailand. Landsat is shown to provide a broader perspective of the canals previously discerned by aerial photography and to give clues to extensions of these canals. C.R.

A82-28136 † **Ring structures in the earth's crust, and their significance for geology and methods for their investigation (Kol'tsevye struktury zemnoi kory, ikh znachenie dlia geologii i metody izucheniia).** A. E. Mikhailov. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka*, no. 1, 1982, p. 55-59. In Russian.

The use of satellite remote-sensing techniques to study ring structures is considered. The occurrence of ring structures on Soviet territory is discussed, and the volcano-plutonic mechanism for the formation of such structures is examined. Recommendations on the use of remote sensing techniques for the further study of these structures are given. B.J.

N82-16442*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REPORT ON A SHORT COURSE IN REMOTE SENSING AND THE GEOLOGICAL APPLICATIONS OF LANDSAT MSS IMAGERY AT INPE
Nelson deJesusParada, Principal Investigator and Kampta Persaud (Geological Survey Dept. (Guyana)) Oct. 1980 48 p refs Sponsored by NASA ERTS
(E82-10024; NASA-CR-164813; INPE-1923-RPE/249) Avail: NTIS HC A03/MF A01 CSCL 05B

Training in the theory of remote sensing in Brazil involves studying the principles of electromagnetic radiation and the instrumentation used to measure the radiation characteristics of a body. The overall LANDSAT system is considered with emphasis on the multispectral band scanner and Brazil's participation in the LANDSAT Program. Geologic information from MSS imagery is at a regional scale, and three basic types are available: rock and soil, geologic structures, and landforms. Discrimination between alluvium and sedimentary or crystalline bedrock, and between units in thick sedimentary sequences is best, primarily because of topographic expressions and vegetation differences. Discrimination between crystalline rock types is poor. Folds and fractures are the best displayed geologic features and are recognizable by topographic expressions, drainage patterns, and rock or vegetational tonal patterns. Landforms are easily discriminated by their familiar shapes and patterns. The IMAGE-100 computer has the ability to extract thematic information and to enhance the image. A.R.H.

N82-16446*# Stanford Univ., Calif. Remote Sensing Lab.
INTEGRATION OF LANDSAT WITH GEOLOGY AND AIRBORNE GEOPHYSICS INTO AN OPERATIONAL MINERAL EXPLORATION SYSTEM Final Report, Jun. 1978 - Dec. 1980
R. J. P. Lyon and M. F. Crawford, Principal Investigators Mar. 1981 270 p refs Prepared for JPL, Pasadena, Calif. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Contract JPL-955047)
(E82-10028; NASA-CR-164433) Avail: NTIS HC A12/MF A01 CSCL 08G

Digital data, gamma-ray spectrometry and aeromagnetic data were digitally combined and analyzed for the Bearlodge area (northeastern Wyoming) where potential resources of thorium and rare earths occur. The combined LANDSAT-geophysical data set revealed several geologic structures that were not evident in a single data set for the study area. Both qualitative and quantitative methods of analysis were performed on the combined data sets. Qualitative analysis of the data was done on a computer controlled, interactive color TV display system by overlaying the various data sets in different colors. In the Bearlodge area, this analysis revealed a pair of northwest-southeast tranding lineaments in the LANDSAT image which appeared to truncate a zone of high radioactivity. An elliptical feature formed by drainages is found. An intense thorium-gamma ray anomaly which coincides with thorium-rare earth mineralization, occurs inside this elliptical feature. T.M.

N82-19624*# Iowa Univ., Iowa City. Dept. of Geology.
USE OF MAGSAT ANOMALY DATA FOR CRUSTAL STRUCTURE AND MINERAL RESOURCES IN THE US MIDCONTINENT Quarterly Report, period ending 30 Sep. 1981
Robert S. Carmichael, Principal Investigator 28 Sep. 1981 10 p Original contains color illustrations ERTS
(Contract NAS5-26425)
(E82-10049; NASA-CR-164926; QR-3) Avail: NTIS HC A02/MF A01 CSCL 08G

Magnetic profiles on individual satellites tracks were examined to identify bad (nonterrestrially-based) data points r profiles. Anomaly profiles for the same satellite track, but at different passes were compared for parallel tracks and for tracks that cross. The selected and processed data were plotted and contoured to develop a preliminary magnetic anomaly map. The map is similar in general morphology to NASA's Magsat global scalar anomaly map, but has more detail which is related to crustal properties. Efforts have begun to interpret the satellite magnetic anomalies in terms of crustal character. The correlation of magnetics with crustal petrology may have a much larger tectonic implication. Th possibility of there being an ultramafic lower crust along one zone as a consequence of a continental collision/subduction which helped form the midcontinent craton in Precambrian times is being investigated. A.R.H.

N82-19642# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
METHODOLOGY OF THE INTERPRETATION OF REMOTE SENSING DATA AND APPLICATIONS IN GEOMORPHOLOGY
Tania Maria Sausen and Evlyn Marcia Leao deM. Novo Aug. 1981 42 p refs In PORTUGUESE; ENGLISH summary
(INPE-2209-MD/007) Avail: NTIS HC A03/MF A01

Remote sensing techniques not only permit the acquisition, in a short time, of a large volume of information about phenomena occurring at the Earth's surface, but also provide a constant flux of data showing variations in spatial distribution patterns, which is of value in predicting and controlling geomorphological events. The use of aerial panchromatic, color, and multispectral photography is discussed as well as the interpretation of radar and thermal infrared imagery. Methods for interpreting multispectral imagery from LANDSAT are examined. A.R.H.

N82-20596*# Consiglio Nazionale delle Ricerche, Milan (Italy).
HEAT CAPACITY MAPPING MISSION (HCMM) PROGRAM: STUDY OF GEOLOGICAL STRUCTURE OF SICILY AND OTHER ITALIAN AREAS Final Report
Roberto Cassinis, Giovanni Lechi, Principal Investigators, Eugenio Zilioli, Alberto Marini, Pietro A. Brivio, and Nicola Tosi Aug. 1981 34 p refs Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic

users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E82-10073; NASA-CR-165095; NAS 1.26:165095) Avail: NTIS HC A03/MF A01 CSCL 05B

The usefulness of thermal inertia mapping in discriminating geolithological units was investigated using Sardinia and the Gulf of Orosei as test sites. Software designed for LANDSAT data were modified and improved for HCMM tapes. A first attempt was made to compare the geological cross section, the topography, the IR radiance, and the thermal inertia along selected profiles of the test site. Thermal inertia profiles appear smoothed in comparison with the thermal radiance. The lowest apparent thermal inertia (ATI) was found on granitic and basaltic outcrops where their image is of sufficient extent, while ATI is higher on carbonatic and dolomitic or moist deposits. Almost every fault is marked by a jump of ATI, the interval being sometimes of the order of one pixel. This seems to demonstrate the ability of ATI to detect contacts or tectonically disturbed zones with a good resolution. It seems more difficult to measure the differences in ATI between homogeneous materials having different lithology. Ground surveys conducted and a simulation model of diurnal temperatures of rocks having different thermal inertia are discussed. A.R.H.

N82-20599*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY PROJECT OF INTRUSIVE ROCKS: STATES OF ESPIRITO SANTO AND RIO DE JANEIRO, SOUTH AND EAST OF MINAS GERAIS AND SOUTHEAST OF THE STATE OF SAO PAULO [PROJETO ESTUDO DAS ROCHAS INTRUSIVAS: ESTADOS DO ESPIRITO SANTO E DU RIO DE JANEIRO, PARTES SUL E LESTE DE MINAS GERAIS E SUDESTE DO ESTADO DE SAO PAULO]
Nelson deJesusParada, Principal Investigator, Athos Ribeiro dosSantos, Celio Eustaquio dos Anjos, Marx Prestes Barbos, and Paulo Veneziani Jul. 1981 19 p refs In PORTUGUESE; ENGLISH summary Presented at the 3rd Simposio Regional de Geol., Curitiba, Brazil, 12-15 Nov. 1981 Sponsored by NASA ERTS
(E82-10076; NASA-CR-168397; NAS 1.26:168397; INPE-2190-RPE/002) Avail: NTIS HC A02/MF A01 CSCL 08B

The feasibility of mapping intrusive rocks in polycyclic and polymetamorphic areas using the logic method for photointerpretation of LANDSAT and radar imagery was investigated. The resolution, scale and spectral characteristics of the imagery were considered. Spectral characteristics of the intrusive rock units mapped using image 100 were investigated. It was determined that identification of acidic and basic intrusive bodies and determination of their relationships with principal structural directions using the logic method was feasible. Tectonic compartments were subdivided into units according to their predominant lithographic types, ignoring stratigraphy. The principal directions of various foliations, faults, megafolds, and fractural systems were defined. Delineation of the boundaries of intrusive bodies mapped using the spectral characteristics of Image 100 imagery ws determined to be more accurate than visual analysis. A 1:500,000 scale map of intrusions in the areas studied was generated. J.D.H.

N82-21662*# Stanford Univ., Calif. Dept. of Geology.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA Final Report
Ernest I. Rich, Principal Investigator May 1981 26 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-24479)
(E82-10135; NASA-CR-168518; NAS 1.26:168518) Avail: NTIS HC A03/MF A01 CSCL 08G

Heat capacity mapping mission images of about 80,000 sq km in northern California were qualitatively evaluated for usefulness in regional geologic investigations of structure and lithology. The thermal characteristics recorded vary among the several geomorphic provinces and depend chiefly on the topographic expression and vegetation cover. Identification of rock types, or groups of rock types, was most successfully carried out within the semiarid parts of the region; however, extensive features, such as faults, folds and volcanic fields could be delineated. Comparisons of seasonally obtained HCMM images are of limited value except in semiarid regions. Author

N82-21664*# Geological Survey, Denver, Colo. Petrophysics and Remote Sensing.
APPLICATION OF HCMM DATA TO REGIONAL GEOLOGIC ANALYSIS FOR MINERAL AND ENERGY RESOURCE EVALUATION Progress Report, Jun. - Aug. 1981
Kenneth Watson, Principal Investigator and Susanne H-Miller Aug. 1981 4 p Sponsored by NASA HCMM
(E82-10137; NASA-CR-168522; NAS 1.26:168522) Avail: NTIS HC A02/MF A01 CSCL 08G

Experimentation with several potentially promising techniques led to the selection of a fairly simple scheme for registration of data from the HCMM using an affine transformation. A method based solely on remote sensing was developed to estimate those meteorological effects which are required for thermal inertia mapping. It assumes that the atmospheric fluxes are spatially invariant and that the solar, sky and sensible heat fluxes can be approximated by a simple mathematical form. Coefficients are determined from least squares method by fitting observational data to the thermal model.

N82-21677*# Iowa Univ., Iowa City. Dept. of Geology.
USE OF MAGSAT ANOMALY DATA FOR CRUSTAL STRUCTURE AND MINERAL RESOURCES IN THE US MIDCONTINENT Quarterly Report, period ending 30 Jun. 1981
Robert S. Carmichael, Principal Investigator 30 Jun. 1981 4 p ERTS
(Contract NAS5-26425)
(E82-10152; NASA-CR-168537; NAS 1.26:168537; QR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

While the preliminary magnetic anomaly map for the centra midcontinent is only in the hand-drawn stage, it agrees in broad aspects with the preliminary global MAGSAT map provided by NASA. Because of data evaluation and finer scale averaging, there are more detailed features which hold promise for eventual geological/crustal interpretation. Some current analysis is directed at examining whether a map data feature such as an elongated anomaly or trend, which seems parallel to satellite data tracks, is likely of crustal origin or is an artifact of the data set. A.R.H.

05
OCEANOGRAPHY AND MARINE RESOURCES

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

A82-19139 **Analyses of the Eastern Pacific without ship PAPA data.** J. Spagnol, M. Horita, and P. Haering (Department of the Environment, Pacific Weather Centre, Vancouver, Canada). In: Conference on Weather Forecasting and Analysis, 8th, Denver, CO, June 10-13, 1980, Preprints. Boston, MA, American Meteorological Society, 1980, p. 150-155.

Two cases (Oct. 21-22 and Oct. 25-26, 1979) were chosen to illustrate the effect of poor numerical analyses and the ability of improving them using the resources available at the Pacific Weather Centre. It was found that without adequate alternative data sources the loss of Ocean Station PAPA data can have a detrimental effect on the Canadian Meteorological Centre (CMC) objective analysis over the Eastern Pacific. In periods of intense weather activity, without the anchoring effect of this data the uncorrected errors in the analyses may propagate westward to the coast causing the rejection of valid coastal radiosonde observations. However, the Pacific Weather Centre regional analyses can complement the CMC national analyses and partly offset the expected data void created by the loss of Ocean Station PAPA data in 1981. G.R.

A82-19560 # **Microwave brightness temperature pattern over the Indian subcontinent and the surrounding oceans as observed by the satellite microwave radiometer /SAMIR/ onboard Bhaskara.** O. P. N. Calla, G. Raju, S. S. Rana, and S. Balasubramanian (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). In: European Microwave Conference, 10th, Warsaw, Poland, September 8-12, 1980, Proceedings.
Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd., 1981, p. 588-599.

A82-20344 † **The use of Meteor-satellite image data in oceanography (Opyt ispol'zovaniia videoinformatsii s ISZ 'Meteor' dlia issledovaniia iavlenii v okeane).** A. S. Kaz'min and V. E. Skliarov (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 48-57. 13 refs. In Russian.

A82-20445 * # **Influence of dissolved organic materials on turbid water optical properties and remote-sensing reflectance.** W. G. Witte, C. H. Whitlock, R. C. Harriss, J. W. Usry, L. R. Poole, W. M. Houghton, W. D. Morris, and E. A. Gurganus (NASA, Langley Research Center, Hampton, VA). *Journal of Geophysical Research,* vol. 87, Jan. 20, 1982, p. 441-446. 18 refs.

The effects of dissolved organic materials on turbid-water optical properties are assessed, by means of field measurements and laboratory simulations in which upwelled reflectance, attenuation, absorption, and backscatter spectral properties at wavelengths from 450 to 800 nm are examined in relation to water chemistry. The data show that dissolved organic materials decrease upwelled reflectance from turbid waters, and that the decrease in reflectance is a nonlinear function of concentration with the largest gradients at low carbon concentrations, depending on wavelength. Upwelled reflectance is found to be highly correlated with two backscatter-absorption parameters used in some optical models, which are nonlinear with dissolved organic material concentration change. O.C.

A82-20447 * # **Structure and variability of the Alboran Sea frontal system.** R. E. Cheney (NASA, Goddard Space Flight Center, Greenbelt, MD) and R. A. Doblar (U.S. Navy, Naval Ocean Research and Development Activity, Bay St. Louis, MS). *Journal of Geophysical Research,* vol. 87, Jan. 20, 1982, p. 585-594. 8 refs. Navy-sponsored research.

A distinct oceanic front coinciding with the jet of incoming North Atlantic water, and an associated anticyclonic gyre in the western half of the basin, were observed during a ship and aircraft survey of the physical characteristics of the Alboran Sea in the western Mediterranean in October 1977. The front was confined to the upper 200 m and was a continuous feature, extending from the Strait of Gibraltar 500 km eastward to the prime meridian. It is noted that in ten days between two surveys, the center of the gyre shifted 50 km westward. This variability of the anticyclonic gyre may correspond to changes of North Atlantic inflow strength, as inferred by local wind and the average atmospheric pressure over the western Mediterranean. O.C.

A82-21917 * **SASS measurements of the Ku-band radar signature of the ocean.** L. C. Schroeder, W. L. Grantham (NASA, Langley Research Center, Hampton, VA), J. L. Mitchell, and J. L. Sweet (Kentron Technical Center, Hampton, VA). *IEEE Journal of Oceanic Engineering,* vol. OE-7, Jan. 1982, p. 3-14. 13 refs.

SeaSat-A Satellite Scatterometer (SASS) measurements of normalized radar cross section (NRCS) have been merged with high quality surface-wind fields based on in situ, to create a large data base of NRCS-wind signature data. These data are compared to the existing NRCS-wind model used by the SASS to infer winds. Falso-color maps of SASS NRCS and ocean winds from multiple orbits show important synoptic trends. (Author)

A82-21921 **Some peculiarities of formulation and solution of inverse problems in microwave radiometry of the ocean surface and atmosphere.** A. M. Shutko and A. G. Grankov (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *IEEE Journal of Oceanic Engineering,* vol. OE-7, Jan. 1982, p. 40-43. 10 refs.

The use of multifrequency radiometers to determine certain emission properties of the sea surface is considered, as is the dependence of the radiometer on wind speed, atmospheric water vapor content, and liquid water content in clouds. Attention is given to the sea state influence on the radiative characteristics of the ocean-atmosphere system and to calibrating the data of range measurement. Also considered is the problem of choosing those spectral bands which provide optimum accuracy for determining geophysical parameters with due regard to the spectral peculiarities of the functional relationships between the radiophysical and geophysical parameters and their uncertainties. Data are presented on an experiment for determining different hydrometeorological conditions and estimating the accuracy of applied retrieval procedures. C.R.

A82-24061 * **The Seasat low rate data processing system.** J. W. Brown, J. C. Klose, and M. L. MacMedan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: Oceans '80; International Forum on Ocean Engineering in the '80s, Seattle, WA, September 8-10, 1980, Conference Record.
New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 518-526. 6 refs. Contract No. NAS7-100.

The development of the algorithms for data processing and distribution, the circuitry, and the performance of the Seasat low rate data processing system are reviewed. The system controls data from the radar altimeter, scatterometer, microwave radiometer, and the visible and IR radiometer for independent transmission of each instrument's readings. The downlink operates at 25 kb/sec, and a yearlong program of geophysical evaluation proceeded shortly after launch, allowing on-line engineering evaluation and alteration of the control algorithms in the system. Some data is preformatted for immediate distribution and storage in archival quality. A catalog and abstracts are provided to users allowing a RAM search from remote terminals for historical conditions. Procedures for verifying and altering the algorithms are detailed. M.S.K.

A82-24063 * **Comparison of conventionally measured sea surface temperature and wind speed with data retrieved from satellite-borne microwave radiometry.** R. Hofer and E. G. Njoku (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: Oceans '80; International Forum on Ocean Engineering in the '80s, Seattle, WA, September 8-10, 1980, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 531-534. Re-

search supported by the National Academy of Sciences; Contract No. NAS7-100.

The Scanning Multichannel Microwave Radiometer aboard both the Seasat and Nimbus-7 satellites was designed to estimate sea surface temperature (SST) and wind speed (WS) over an extended range of atmospheric conditions. The retrieval technique is described briefly, and it is demonstrated in a case study that the instrument design goals (SST:1.5 C; WS:2 m/s) appear to be feasible. (Author)

A82-24822 Workshop on the application of existing satellite data to the study of ocean surface energetics, 19-21 November 1980, University of Wisconsin-Madison. C. Gautier (Wisconsin, University, Madison, WI) and D. McConnell (NOAA, National Climate Program Office, Rockville, MD). *American Meteorological Society, Bulletin*, vol. 62, Dec. 1981, p. 1679-1689.

A82-27091 * # Topex orbit sustenance maneuver design. J. A. Kechichian (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, Paper 82-0202.* 15 p. 6 refs. NASA-supported research.

A trade-off analysis between maneuver period, execution errors, and orbit determination uncertainties is carried out for the Ocean Topography Experiment spacecraft for a given nodal equatorial constraint. Semimajor axis and eccentricity are controlled with minimum impulse using the linear theory of optimal transfer between close coplanar near-circular orbits. Ellipses of equal minimum and average maneuver periods are presented in the (3 execution error, 3 orbit determination uncertainty) space for different nodal equatorial constraints enabling the determination of the appropriate combination of execution errors and orbit determination uncertainties that guarantees a mission required minimum maneuver period for a given nodal deadband. (Author)

A82-27596 * # Optimal spatial filtering and transfer function for SAR ocean wave spectra. A. D. Goldfinger, R. C. Beal, and D. G. Tilley (Johns Hopkins University, Laurel, MD). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 291-297. 5 refs. NASA-supported research; Contract No. NOAA-MO-A01-78-00-4330.

The Seasat Synthetic Aperture Radar (SAR) has proved to be an instrument of great utility in the sensing of ocean conditions on a global scale. An analysis of oceanographic and atmospheric aspects of Seasat data has shown that the features observed in the imagery are linked to ocean phenomena such as storm sources and their resulting swell systems. However, there remains one central problem which has not been satisfactorily solved to date. This problem is related to the accurate measurement of wind-generated ocean wave spectra. Investigations addressing this problem are currently being conducted. The problem has two parts, including the accurate measurement of the image spectra and the inference of actual surface wave spectra from these measurements. A description is presented of the progress made towards solving the first part of the problem, taking into account a digital rather than optical computation of the image transforms. G.R.

A82-27602 # Integrated sensor system for collection of wave data applied to coastal engineering design. D. E. Lichy, T. L. Miloser, and D. W. Berg (U.S. Army, Coastal Engineering Research Center, Fort Belvoir, VA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 357-365. 11 refs.

Ocean wave climate is a primary consideration in the design of coastal structures. Wave data are a major parameter for use in longshore current and transport mathematical models. During October and November 1980, more than 30 organizations took part in the 56-day Atlantic Remote Sensing Land Ocean Experiment (ARSLOE) near Duck, North Carolina. A total of 47 wave measuring devices, in situ to remote sensing, were tested. This paper discusses the various considerations involved in designing an integrated system for the collection of ocean wave data, along with the limitations and advantages of the systems tested during ARSLOE and other field experiments. B.J.

A82-27608 # The first ESA remote sensing satellite system ERS-1. G. Duchossois and C. Honvalut (ESA, Directorate of Application Programmes, Paris and Toulouse, France). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 461-477.

The mission objectives of the ESA remote sensing satellite system ERS-1 is to develop applications related to a better knowledge of ocean parameters and sea-state conditions and to increase scientific understanding of coastal zones and global ocean processes. In particular, offshore activities, ship routing, physical oceanography and glaciology, climate research, and marine biology will be benefited. The main payload will consist of a C-band active microwave instrumentation, and ocean color monitor, and a radar altimeter. Launched by Ariane 2 or 3, the system will use the Multimission Platform developed in the framework of the French national SPOT program. The requirements and constraints for the ERS-1 mission include coverage, instrument duty cycles, stations network, processing levels/products, and ground segment concept. The development program is described. ERS-1 will be both an experimental and an operational system. C.D.

A82-27619 # Comparisons of laser profilometer sea ice roughness statistics with surface truthed data and SLAR imagery. M. E. Kirby and J. T. Sutton (INTERA Environmental Consultants, Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 563-575. 6 refs.

In connection with programs related to the exploration and development of sources of petroleum in remote offshore regions of the high Arctic, the presence of sea ice has usually a significant effect on the activities involved in the implementation of such a program. In anticipation of year-round operations, models have been developed which calculate the predicted performance levels of ships and drill rigs under various design characteristics and ice conditions. These models are very dependent on historical ridge data sets. The method most widely used in the acquisition of ice ridge statistics involves the analysis of laser profilometer data. However, a detailed validation test of the laser profilometer method has not been conducted. The present investigation has the objective to compare airborne laser profilometer data of sea ice with measurements taken on the ice. A close positive correlation between radar brightness and ridge density could be observed. G.R.

A82-27620 # A method for the retrieval of phytoplankton and suspended sediment concentrations from remote measurements of water colour. S. Tassan (Commission of the European Communities, Joint Research Centre, Ispra, Italy). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 577-586. 19 refs.

A82-27640 # High precision radiometric temperature measurements of the ocean surface. K. Peacock, R. F. Gasparovic, and L. D. Tubbs (Johns Hopkins University, Laurel, MD). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 793-802.

Characteristics of a unique imaging radiometer used to make measurements over areas of the North Atlantic at infrared wavelengths are described. Examples are presented of the surface temperature spatial variation, the radiometric temperature variation with viewing angle, atmospheric effects, influence of scattered clouds, and the wavenumber variance spectrum. The radiometric environment typically encountered is discussed. It is shown that the capabilities of the radiometer permit the obtaining of precise radiance data for estimating corrections necessary for extracting accurate sea surface temperatures. D.L.G.

A82-27674 # **A formation process of an oceanic vortex analyzed by multi-temporal remote sensing.** Y. Hatakeyama (Asia Air Survey Co., Ltd., Tokyo, Japan), S. Tanaka (Remote Sensing Technology Center of Japan, Tokyo, Japan), and T. Nishimura (Tokyo Science University, Noda, Japan). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1173-1186. 6 refs.

Investigations of the flow characteristics in the coastal seas of Japan are required in connection with water-quality problems related to rapid urbanization or industrialization. The present study is concerned with an observation of the dynamic aspects of an interaction between the Kuroshio current and coastal water in October 1979, after Typhoon-20 had passed through Japan. The observational data were obtained with the aid of a multitemporal remote sensing method. A vortex at the mouth of Suruga Bay was detected on the basis of the fluid-mechanical interpretation of the data. Attention is given to the marine background of the site, an analysis of temporal static aspects of the vortex with the aid of Landsat data, the analysis of dynamic vortex processes, and approaches for observing a vortex with the aid of remote-sensing data. G.R.

A82-27684 # **Response of the marine community to satellite-derived oceanic information.** N. J. Hooper (Metrics, Inc., Atlanta, GA) and J. W. Sherman, III (NOAA, National Earth Satellite Service, Washington, DC). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1285-1295. 8 refs.

The present investigation has the objective to merge the marine data requirements identified at the NOAA Workshop on Oceanic Remote Sensing with those reflected by the response of the marine community to the National Oceanic Satellite System (NOSS) Conference Worksheets. The result of such an effort provides a summary of the civil marine community's oceanic remote sensing data requirements as they are currently understood. Oceanic remote sensing had been defined as being restricted to the use of electromagnetic energy to observe or measure properties of the ocean while remotely located from that portion of the ocean being observed. G.R.

A82-28031 # **Estimation of sea surface temperature from remote sensing in the 3.7 micron window region.** T. Takashima and Y. Takayama (Meteorological Research Institute, Tsukuba, Ibaraki, Japan). *Meteorological Society of Japan, Journal,* vol. 59, Dec. 1981, p. 876-891. 16 refs.

Temperature measurement deviation in satellite remote sensing during day and night is considered. Atmospheric gases are taken as absorbent constituents and aerosols as scatterers in an atmosphere-ocean model. The solar input is chosen at 1.94 cal/min at the surface, and a standard atmosphere is assumed. Optical thickness calculations for the 3.7 micron band include the effects of water vapor lines and continua, the collision-induced N2 band near 4 microns, and mixed gases. The atmosphere is characterized by nine layers, each with 14 homogeneous sublayers. Optical thicknesses are calculated over the 9 layers, averaged and weighted by the NOAA-6 filter response. The refractive index is also calculated, and the surface is treated as a specular reflector. Except for sun glint, deviations in observed to measured temperatures were less in the day than at night. Greater than 50 deg differences were detected in the specular direction, and were correctable by simulation. The surface wind speeds are required in order to correct for sun glint. M.S.K.

A82-28135 † **Polarimetric method for the remote sensing of oil slicks on the sea surface (Poliarizatsionnyi metod distantsionnoi indikatsii plenok nefti na poverkhnosti moria).** A. A. Buznikov and G. A. Lakhtanov. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 50-54. 10 refs. In Russian.

The polarimetric method for the remote sensing of oil slicks on the sea surface is described, and some previous studies using this method are briefly reviewed. Particular attention is given to the use of lidar polarimeters, and results of single-channel polarimetric studies of pollution in the Caspian Sea are discussed. B.J.

A82-28145 † **The use of data from satellite-borne microwave scanning radiometers for the automated compilation of operational maps of ice cover for the Arctic Ocean (Ispol'zovanie dannykh sputnikovykh skaniruiushchikh SVCh radiometrov dlia avtomatizirovannogo sostavleniia operativnykh kart ledianogo pokrova Severnogo Ledovitogo Okeana).** V. V. Bogorodskii, N. D. Liubovnyi, and P. A. Nikitin. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 108-111. In Russian.

N82-16331# Mitre Corp., Bedford, Mass.
COHERENT SCATTER OF MICROWAVES FROM MODERATELY ROUGH SURFACES
M. M. Weiner and G. A. Robertshaw Aug. 1981 33 p refs
(Contract F19628-81-C-0001; AF Proj. 4290)
(AD-A106133; MTR-8299) Avail: NTIS HC A03/MF A01 CSCL 20/14

An improved model is reported for the effect of surface roughness on coherent scatter of microwaves from moderately rough terrain and sea surfaces. This model gives agreement with microwave and acoustical experimental data for surface height standard deviations as much as 400% larger than for a widely accepted model discussed by Beckmann and other investigators. The improved agreement with data is achieved by assuming a symmetrical exponential probability density of the surface height random variable. This model lends itself to an interesting physical interpretation of the stochastic process associated with the surface profile. Author (GRA)

N82-16683*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
NOSS ALTIMETER ALGORITHM SPECIFICATIONS
D. W. Hancock, R. G. Forsythe, and J. D. McMillan (Washington Analytical Services Center, Pocomoke City, Md.) Jan. 1982 112 p refs
(NASA-RP-1083) Avail: NTIS HC A06/MF A01 CSCL 08C

A description of all algorithms required for altimeter processing is given. Each description includes title, description, inputs/outputs, general algebraic sequences and data volume. All required input/output data files are described and the computer resources required for the entire altimeter processing system were estimated. The majority of the data processing requirements for any radar altimeter of the Seasat-1 type are scoped. Additions and deletions could be made for the specific altimeter products required by other projects. T.M.

N82-16697# SRI International Corp., Menlo Park, Calif.
AN EXPERIMENTAL PROGRAM TO PROVIDE REMOTE MEASUREMENT AND ANALYSIS OF OCEAN WAVES, SEA LEVEL WINDS AND BALANCED PRESSURE IN SUPPORT OF SEASAT-A Final Report
J. W. Maresca, Jr., R. M. Endlich, C. T. Carlson, and D. E. Wolf Feb. 1981 50 p refs
(Contract NA79SA-C-00738; SRI Proj. 8808)
(PB81-246035; NOAA-81071410) Avail: NTIS HC A03/MF A01 CSCL 08C

Wide Aperture Research Facility (WARF) HF skywave radar and Seasat-A measurements of rms wave height and wind direction were compared for 17 July and 3 October 1978. Estimates of rms wave height were made during the 2 October period from skywave radar data recorded directly below the satellite. Sea level balanced pressure fields were computed from the Seasat-A satellite scatterometer (SASS) derived wind field on both days and compared to the National Weather Service (NWS) surface pressure charts. GRA

N82-17561*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN OPTICAL MODEL FOR THE MICROWAVE PROPERTIES OF SEA ICE
P. Gloersen and J. K. Larabee Nov. 1981 28 p refs Submitted for publication
(NASA-TM-83865) Avail: NTIS HC A03/MF A01 CSCL 08L

The complex refractive index of sea ice is modeled and used to predict the microwave signatures of various sea ice types. Results are shown to correspond well with the observed values of the complex index inferred from dielectic constant and dielectric loss measurements performed in the field, and with observed microwave signatures of sea ice. The success of this *modeling procedure vis a vis modeling of the dielectric properties* of sea ice constituents used earlier by several others is explained. Multiple layer radiative transfer calculations are used to predict the microwave properties of first-year sea ice with and without snow, and multiyear sea ice. Author

N82-17563*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE-DERIVED ICE DATA SETS NO. 1: ANTARCTIC MONTHLY AVERAGE MICROWAVE BRIGHTNESS TEMPERATURES AND SEA-ICE CONCENTRATIONS, 1973 - 1976
H. J. Zwally Nov. 1981 35 p refs Submitted for publication
(NASA-TM-83812) Avail: NTIS HC A03/MF A01 CSCL 08L

A summary data set concerning 4 years of Antarctic sea-ice conditions was created and is available on magnetic tape. The data were derived from electrically scanning microwave radiometer brightness temperatures and were mapped into a polar stereographic grid enclosing the 50 deg S latitude circle. The grid size varies from about 32 by 32 sq km at the poles to about 28 by 28 sq km at 50 deg S. The microwave brightness temperatures of Antarctic sea ice are predominantly characteristic of first-year ice with an emissivity of 0.92 at 19 GHz frequency. Sea ice concentrations were calculated from the brightness temperature data for each grid element with an algorithm that uses an emissivity value of 0.92 and an ice physical temperature estimate from climatological surface air temperatures. Monthly, multiyear monthly, and yearly maps of brightness temperatures and sea ice concentrations were created for the 4 years, except for 7 months for which useable data were insufficient. Author

N82-17566# Research Inst. of National Defence, Stockholm (Sweden).
REMOTE SENSING TECHNIQUES SUITABLE FOR EXPLORATION AND NAVIGATION IN AND UNDER SEA ICE
Ragnar Thoren 1981 44 p refs Presented at Intern. Colloq. of the Intern. Soc. of Photogrammetry and Remote Sensing on Spectral Signatures of Objects in Remote Sensing, Avignon, France, 8-11 Sep., 1981
(FOA-Rept-Vol-15-No-2; FOA-B-60002-M7;
ISBN-91-7056-057-9) Avail: NTIS HC A03/MF A01; Research Inst. of National Defence, Stockholm Kr 9

The performance of advanced satellite navigation used aboard Swedish and Soviet icebreakers is reported. It is shown that the ships' position was obtained with very high precision in spite of frequent fog. Further development of remote sensing satellite systems for ocean monitoring, the development of LORAN C into an expanded and improved aid to navigation, and the importance of visual ice reconnaissance in combination with optical viewing systems in arctic waters are also addressed. Developments in underwater technology, including hydroacoustics, hydrooptics, laser depth sounding, underwater communication, and subsea exploratory drilling are included. J.M.S.

N82-17567# Office of Naval Research, Pasadena, Calif.
ARABIAN SEA PROJECT OF 1980: COMPOSITES OF INFRARED IMAGES
Ben J. Cagle and Robert Whritner Aug. 1981 67 p
(AD-A107910; ORNWEST-81-5) Avail: NTIS HC A04/MF A01 CSCL 08/1

A technique was developed for determining the mesoscale features of the Arabian Sea, and reported on in ONRWEST Report 81-3. A method for assembling composites of images in mosaic form is presented. Enhanced images are presented with surface interpretations for the spring and fall transition periods related to the Northeast and Southwest Monsoons, respectively.
Author (GRA)

N82-17798*# *Old Dominion Univ., Norfolk, Va.* Dept. of Oceanography.
THE RELATIONSHIP AMONG SEA SURFACE ROUGHNESS VARIATIONS, OCEANOGRAPHIC ANALYSES, AND AIRBORNE REMOTE SENSING ANALYSES Final Report, 16 May - 31 Oct. 1981
George F. Oertel and Terry L. Wade Dec. 1981 252 p refs (Grant NAG1-189)
(NASA-CR-168444; TR-81-2) Avail: NTIS HC A12/MF A01 CSCL 08C

The synthetic aperture radar (SAR) was studied to determine whether it could image large scale estuaries and oceanic *features such as fronts and to explain the electromagnetic* interaction between SAR and the individual surface front features. Fronts were observed to occur at the entrance to the Chesapeake Bay. The airborne measurements consisted of data collection by SAR onboard an F-4 aircraft and real aperture side looking radar (SLAR) in Mohawk aircraft. A total of 89 transects were flown. Surface roughness and color as well as temperature and salinity were evaluated. Cross-frontal surveys were made. Frontal shear and convergence flow were obtained. Surface active organic materials, it was indicated, are present at the air-sea interface. In all, 2000 analyses were conducted to characterize the spatial and temporal variabilities associated with water mass boundaries. N.W.

N82-17802# European Space Agency, Paris (France).
SEA STATE MEASUREMENT WITH A TWO FREQUENCY SCATTEROMETER (THEORY)
Michael Kleintz Dec. 1981 177 p refs Transl. into ENGLISH of "Seegangsbestimmung mit dem Zweifrequenz-Scatterometer (Theoretische Grundlagen)" Rept. DFVLR-FB-80-32 Oberpfaffenhofen, West Germany, May 1980 Original report in GERMAN previously announced as N81-22675
(ESA-TT-710; DFVLR-FB-80-32) Avail: NTIS HC A09/MF A01; DFVLR, Cologne DM 31.20

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

N82-17803# National Oceanic and Atmospheric Administration, Rockville, Md. Ocean Technology and Engineering Services.
ERROR ANALYSIS OF PULSE LOCATION ESTIMATES FOR SIMULATED BATHYMETRIC LIDAR RETURNS
Gary C. Guenther and Robert W. L. Thomas Jul. 1981 59 p refs Prepared in cooperation with EG and G Washington Analytical Services Center, Inc., Rockville, Md.
(PB82-109448; NOAA-TR-OTES-1; NOAA-81081101) Avail: NTIS HC A04/MF A01 CSCL 08J

A Poisson count simulator is used to generate precision and offset results for the estimated temporal location of quantum limited laser pulses. Pulse sizes, shapes, and charge integration times are varied over appropriate ranges. A number of location estimators including variations on peak, centroid, and threshold detectors are examined. Comparisons with experimental results are presented. Hardware and software design parameters of an airborne lidar hydrography system are discussed. GRA

N82-17805# National Bureau of Standards, Boulder, Colo. Wave Propagation Lab.
RECOVERING OCEAN WAVEHEIGHT FROM HF RADAR SEA ECHOES DISTORTED BY IMPERFECT IONOSPHERIC REFLECTION
T. M. Georges, J. W. Maresca, C. T. Carlson, J. P. Riley, R. M. Jones, and D. E. Westover May 1981 156 p refs
(PB82-113283; NOAA-TM-ERL-WPL-73; NOAA-81081901) Avail: NTIS HC A08/MF A01 CSCL 08C

A real-time signal processing package to collect high-quality sea-echo Doppler spectra under many different ionospheric conditions found in nature was developed. Graphical displays and objective quality indices help the radar operator sort undistorted spectra from those distorted by *imperfect ionospheric* reflection, so that ocean wave height can be reliably estimated while the data are being collected. The package can be used either off-line on archival data or for on-line adaptive processing of radar data as part of an ocean-scanning strategy.
Author (GRA)

N82-18660*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT DATA UTILIZATION PROJECT Final Report
G. H. Born, D. N. Held, D. B. Lame, R. G. Lipes, D. R. Montgomery, P. J. Rygh, and J. F. Scott 30 Sep. 1981 62 p refs
(NASA-CR-168557; Rept-622-233) Avail: NTIS HC A04/MF A01 CSCL 05B

During the three months of orbital operations, the satellite returned data from the world's oceans. Dozens of tropical storms, hurricanes and typhoons were observed, and two planned major intensive surface truth experiments were conducted. The utility of the Seasat-A microwave sensors as oceanographic tools was determined. Sensor and geophysical evaluations are discussed, including surface observations, and evaluation summaries of an altimeter, a scatterometer, a scanning multichannel microwave radiometer, a synthetic aperture radar, and a visible and infrared radiometer. N.W.

N82-18844# Office of Technology Assessment, Washington, D. C.
TECHNOLOGY AND OCEANOGRAPHY: AN ASSESSMENT OF FEDERAL TECHNOLOGIES FOR OCEANOGRAPHIC RESEARCH AND MONITORING
Jun. 1981 27 p
(OTA-O-142) Avail: NTIS HC A03/MF A01

The status of technologies used to collect data about the ocean and to conduct experiments in the ocean is addressed. Problems and opportunities are analyzed and the Federal agencies and programs charged with conducting oceanic studies and providing the necessary management and hardware systems are examined. Selected national programs directed toward conserving and managing marine fishery resources, developing an oceanographic satellite system investigating the geology and possible resource potential of the continental margins beneath the deep ocean, and developing a climate prediction capability are analyzed. S.L.

N82-19435# Washington Univ., Seattle. Polar Science Center.
SEA ICE MOVEMENTS FROM SYNTHETIC APERTURE RADAR Final Report, 1 Apr. 1979 - 30 Jun. 1981
David A. Rothrock and Alan S. Thorndike 1 Dec. 1981 84 p refs
(Contract N00014-79-C-0418; NR Proj. 307-428)
(AD-A109002) Avail: NTIS HC A05/MF A01 CSCL 08/12

The spatial structure of the sea ice velocity field determines ridging, open water production and ice stress. The velocity has been measured roughly every 2 km along an 865 km track from SEASAT synthetic aperture radar. The movement shows individual pieces as large as 100 km. The spatial autocorrelation function of velocity has been estimated from these data and FGGE and AIDJEX buoy data, and has a length scale of roughly 1000 km. A model of the movement of a set of pieces shows the large uncertainty in opening and ridging estimated from velocities measured at only three points. Author (GRA)

N82-19704# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY RESULTS OF A STUDY OF MAPPING THERMAL DISCHARGE IN THE OCEAN, USING REMOTE SENSING DATA
Merritt Raymond Stevenson, Carlos Alberto Steffen, and Hector Manual Inostroza Villagra Sep. 1981 23 p refs In PORTUGUESE; ENGLISH summary Presented at 33d Ann. Meeting of SBPC, Salvador, 8-15 Jul. 1981
(INPE-2229-PRE/021) Avail: NTIS HC A02/MF A01

The spatial and temporal variations of the sea surface temperature, utilizing data obtained from sea surface, aircraft and satellite platforms were studied. The objective of the study is the evaluation and mapping of small scale variations in the sea surface temperature, caused by the thermal discharge from a nuclear power plant at Angra dos Reis, Brazil. Evaluation of data from ANGRA 01, the first experiment made on December 19, 1980, showed the surface temperature to be quite isothermal. Temperature from the aircraft and satellite radiometers were about 0.6 C and 5.0 C cooler, respectively, than the temperatures measured from the boat. These thermal offsets are readily accounted for by differences in emissivities of the sea surface and the intervening water vapor in the lower atmosphere.Author

N82-19756 British Library Lending Div., Boston Spa (England).
CLASSIFICATION OF THE FIELDS OF ANOMALY IN MONTHLY WATER TEMPERATURE OF THE NORTH ATLANTIC DURING THE COLD HALF-YEAR
R. M. Vilfand 27 Jul. 1981 6 p refs Transl. into ENGLISH from Gidromet. Nauch.-Issled. Tsentr. SSSR (USSR), v. 231, 1980 p 123-126
(BLL-Trans-1509-(9022.552)) Avail: British Library Lending Div., Boston Spa, Engl.

The use of the thermal characteristics of ocean surface in making long-term forecasts is examined. Fields of anomaly in the mean monthly water temperature of the North Atlantic were classified and analyzed. R.J.F.

N82-19778# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CONVERGENCE ZONES IN THE SOUTH ATLANTIC AND THEIR INFLUENCE ON THE PRECIPITATION REGIME IN NORTHEASTERN BRAZIL M.S. Thesis [ZONAS DE CONVERGENCIA NO ATLANTICO SUL E SUAS INFLUENCIAS NO REGIME DE PRECIPITACAO NO NORDESTE DO BRASIL]
Lucimar Luciano deOliveira Jan. 1982 125 p refs In PORTUGUESE; ENGLISH summary
(INPE-2307-TDL/074) Avail: NTIS HC A06/MF A01

The relationship between the convergence zones in the South Atlantic and the rainfall variability on Northeast Brazil was studied. Radiosonde data from the Posto Oceanografico da Ilha da Trindade, wind charts from the National Meteorological Center, USA, precipitation data of selected coastal stations and satellite imagery were utilized. Monthly and half-yearly brightness charts were constructed from such satellite imagery between the parallels of 10 degrees N and 55 degrees S and the meridians of 010 degrees E and 080 degrees W, for a dry and a rainy year. The results reveal that dry years correspond to the permanence of the Spring pattern of interaction between the intertropical convergence zone and the South Atlantic convergence zones, the Bolivian high (in 200 mb) being more developed; in such dry years a stronger and more regular Walker circulation seems to be present. R.J.F.

N82-19781*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ESTIMATING OCEAN-AIR HEAT FLUXES DURING COLD AIR OUTBREAKS BY SATELLITE
Shu-Hsien Chou and David Atlas Nov. 1981 52 p refs Submitted for publication Original contains color illustrations
(NASA-TM-83854) Avail: NTIS HC A04/MF A01 CSCL 04B

Nomograms of mean column heating due to surface sensible and latent heat fluxes were developed. Mean sensible heating of the cloud free region is related to the cloud free path (CFP, the distance from the shore to the first cloud formation) and the difference between land air and sea surface temperatures, theta sub 1 and theta sub 0, respectively. Mean latent heating is related to the CFP and the difference between land air and sea surface humidities q sub 1 and q sub 0 respectively. Results are also applicable to any path within the cloud free region. Corresponding heat fluxes may be obtained by multiplying the mean heating by the mean wind speed in the boundary layer. The sensible heating estimated by the present method is found to be in good agreement with that computed from the bulk transfer formula. The sensitivity of the solutions to the variations in the initial coastal soundings and large scale subsidence is also investigated. The results are not sensitive to divergence but are affected by the initial lapse rate of potential temperature; the greater the stability, the smaller the heating, other things being equal. Unless one knows the lapse rate at the shore, this requires another independent measurement. For this purpose the downwind slope of the square of the boundary layer height is used, the mean value of which is also directly proportional to the mean sensible heating. The height of the boundary layer should be measurable by future spaceborn lidar systems. B.W.

N82-19796# Florida State Univ., Tallahassee. Dept. of Meteorology.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. ATLAS OF THE JOINT I AIRCRAFT WINDS FOR THE 500 FOOT LEVEL Final Report
D. W. Stuart, A. I. Watson, and W. P. Duval Jun. 1981 73 p refs

(Grant NSF OCE-77-27735)
(PB82-114703; NSF/IDOE-81-44; FSU-MET-STU-81/2; NSF/IDOE/CUEA/TR-39) Avail: NTIS HC A04/MF A01 CSCL 04B

Maps of winds at 500 ft are presented for 17 individual flights and for 3 mean wind regimes using aircraft data gathered during daytime flights made in February-March 1974 as part of JOINT I. The total wind field is shown by maps of the streamlines and isotachs while the north-south component is shown by maps of isotachs and averaged offshore and alongshore profiles. GRA

N82-19801*# National Aeronautics and Space Administration, Washington, D. C.
NASA OCEANIC PROCESSES PROGRAM, FISCAL YEAR 1981 Annual Report
Mar. 1982 132 p refs
(NASA-TM-84467) Avail: NTIS HC A07/MF A01 CSCL 08C

Summaries are included for Nimbus 7, Seasat, TIROS-N, Altimetry, Color Radiometry, in situ data collection systems, *Synthetic Aperture Radar (SAR)/Open Ocean, SAR/Sea Ice*, Scatterometry, National Oceanic Satellite System, Free Flying Imaging Radar Experiment, TIROS-N/Scatterometer and/or ocean color scanner, and Ocean Topography Experiment. Summaries of individual research projects sponsored by the Ocean Processes Program are given. Twelve investigations for which contracting services are provided by NOAA are included. N.W.

N82-19802# Electronics Research Lab., Adelaide (Australia).
AN AERIAL SURVEY OF WATER TURBIDITY AND LASER DEPTH SOUNDING PERFORMANCE ALONG THE QUEENSLAND COAST
D. M. Phillips and R. H. Abbot Apr. 1981 29 p refs
(AD-A109050; ERL-0192-TR) Avail: NTIS HC A03/MF A01 CSCL 08/10

The performance of the WRELADS laser airborne depth sounder has been assessed in North Queensland coastal waters from Townsville to Torres Strait. This was achieved by recording water turbidity and maximum sounding depth in the aircraft along the flight path. The parameter used in the aerial survey as a measure of water turbidity was related to beam attenuation coefficient measured from a boat in a joint aircraft and boat trial. Data relating the statistical distribution of turbidity to water depth were obtained and compared with the observed performance characteristic in order to indicate the proportion of Queensland coastal waters suitable for sounding with an airborne laser sounder. Author (GRA)

N82-19805# Ecole Nationale Superieure des Mines, Valbonne (France). Centre de Teledetection et d'Analyse des Milieux Naturels.
THE TOCIND EXPERIMENT Final Report [EXPERIENCE TOCIND]
L. Wald Paris ESA Jul. 1981 21 p refs In FRENCH Sponsored in cooperation with CNES
(Contract ESA-4423/80/F-FC(SC))
(CTAMN/81/R/10; ESA-CR(P)-1479) Avail: NTIS HC A02/MF A01

The relation between surface isotherms and current is discussed. Predicting surface current from satellite thermographs is investigated. Ship measurements of Indian Ocean currents are compared with Meteosat images. Extensive cloud cover makes it impossible to compare results. Results from a horizontal heat advection model agree closely with measurements. Author (ESA)

N82-20823*# California Univ., La Jolla. Inst. of Marine Resources.
SHIP AND SATELLITE BIO-OPTICAL RESEARCH IN THE CALIFORNIA BIGHT
Raymond C. Smith and Karen S. Baker [1982] 23 p refs
(Grant NsG-1641)
(NASA-CR-168681; NAS 1.26:168681) Avail: NTIS HC A02/MF A01 CSCL 08A

Mesoscale biological patterns and processes in productive coastal waters were studied. The physical and biological processes leading to chlorophyll variability were investigated. The ecological and evolutionary significance of this variability, and its relation to the prediction of fish recruitment and marine mammal distributions was studied. Seasonal primary productivity (using chlorophyll as an indication of phytoplankton biomass) for the entire Southern California Bight region was assessed. Complementary and contemporaneous ship and satellite (Nimbus 7-CZCS) bio-optical data from the Southern California Bight and surrounding waters were obtained and analyzed. These data were also utilized for the development of multi-platform sampling strategies and the optimization of algorithms for the estimation of phytoplankton biomass and primary production from satellite imagery. R.J.F.

N82-20824# National Research Inst. for Oceanology, Stellenbosch (South Africa). Physical Oceanography Div.
INTERACTION BETWEEN THE AGULHAS CURRENT AND THE SUBTROPICAL CONVERGENCE
J. R. E. Lutjenarms Feb. 1981 42 p refs Presented at the 4th Natl. Oceanographic Symp., Cape Town, 10-13 Jul. 1979
(CSIR-RR-384) Avail: NTIS HC A03/MF A01

The Agulhas Current which loses its essential character as a western boundary current south of South Africa is discussed. This ocean area is known as an area of dramatic dynamical variability. To investigate this variability, and the mechanisms responsible, a number of satellite products covering a period of over two years were studied. A number of dynamical phenomena were observed and are described. These include the genesis and growth of sheer edge eddies on the landward border of the current, the nature and location of the Agulhas retroflection region, the formation of Agulhas rings in the south-east Atlantic Ocean, and the nature and variability of planetary waves in the subtropical convergence. The possible interaction between these features of the circulation is discussed in so far as the limited data allow this, and a conceptual image of the macroscale current dynamics in the area is presented. Author

N82-20827# Naval Research Lab., Washington, D. C. Aerospace Systems Div.
SURFACE WAVE STATISTICS AND SPECTRA DURING HIGH SEA STATE CONDITIONS IN THE NORTH ATLANTIC
C. R. McClain, D. T. Chen, and W. D. Hart 30 Dec. 1981 33 p refs
(RR0320841; WF59553000)
(AD-A109832; NRL-MR-4722) Avail: NTIS HC A03/MF A01 CSCL 08/3

Surface wave data collected using an airborne laser profilometer during high sea state conditions are analyzed to produce statistical cumulants up to the fifth order and power spectra. Theoretically, the third cumulant, skewness, is directly proportional to the wind-wave significant slope. This relationship is supported by wind-wave tank data, but little field data of this kind is available in the literature. Also, it has been suggested that if skewness can be derived from radar altimeter data, the significant slope would be computed and together with another altimeter product, the rms wave height, the wave spectra can be estimated using the Wallops Spectral Model (WSM). The results of this study indicate that the skewness relationship is valid for wind-wave dominated seas but as the swell contribution to rms wave height increases, the combined wave field skewness monotonically decreases below the predicted value. The WSM yields excellent reproductions of the wind-wave spectra even in *multiple-peaked seas providing that the model inputs are properly* determined for the wind-wave subfield. Finally the altimeter-WSM scheme should work reasonably well when the seas are wind-wave dominated provided that the altimeter can accurately measure skewness. More research on intermediate and swell dominated conditions is recommended. Author (GRA)

N82-21469# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
TWO-DIMENSIONAL POWER SPECTRA OF SEASAT SAR IMAGERY
H. Seichter *In* ESA SAR Image Quality Jun. 1981 p 55-58

Avail: NTIS HC A05/MF A01; ESA, Paris FF 55 (US $12)

A least complication attempt was made to produce ocean wave power spectra of SEASAT SAR imagery. Two-dimensional power spectra of ocean SAR imagery with a pixel spacing of 12.5 m or multiples of it and side lengths of 1.6 km to 25.6 km were produced and converted to photo products. The most favorable sizes are dependent on wave properties. Author (ESA)

N82-21691# Naval Surface Weapons Center, Dahlgren, Va.
SOME ALTIMETRIC SIGNATURES FROM SEASAT OVER THE MID-PACIFIC SEAMOUNT RANGE *Final Report*
Bernd Zondek Oct. 1981 10 p ref
(AD-A110419; NSWC/TR-81-440) Avail: NTIS HC A02/MF A01 CSCL 08/10

Altimetric signatures from SEASAT tracks in the mid-Pacific seamount range reveal that some seamount signatures are not correlated with features in the reference bathymetry. GRA

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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.

A82-19559 # Microwave radiation from a natural snow field. M. Tiuri and H. Schultz (Helsinki University of Technology, Esbo, Finland). In: European Microwave Conference, 10th, Warsaw, Poland, September 8-12, 1980, Proceedings.
Sevenoaks, Kent, England, Microwave Exhibitions and Publishers, Ltd., 1981, p. 574-578. 5 refs.

The brightness temperature of a natural snow field in Finland has been studied theoretically and experimentally at 5, 12 and 37 GHz for satellite remote sensing applications. A snow model consisting of ice spheres covered by a water shell has been used in theoretical calculations taking into account scattering and absorption. The brightness temperature of a natural snow field as a function of view angle has been measured from a tower in 1978 and 1979. The measured brightness temperature curves can be fitted with calculated ones by assuming reasonable values for the wetness and the particle size of snow. Experimental results also show that relatively small changes in the snow conditions cause large changes in the brightness temperature. (Author)

A82-19831 † A photometric method for depth determination by aerial photography (O fotometricheskom sposobe opredeleniia glubin po aerofotosnimku). E. S. Zubchenko and V. D. Kondiurin. *Geodeziia i Kartografiia,* Nov. 1981, p. 47-49. In Russian.

A modified photometric method for the determination of water depth based on an exponential approximation of the dependence of the brightness recorded by an aerial photograph on the depth is presented. The formulas employed calculate depth from measurements of the luminous flux having passed through the image, as well as the optical density of the image, so that it is not necessary to measure signals on portions of the photograph with optically infinite depths. Evaluation of the accuracy of the photometric method by comparison with results of sonic depth sounder measurements for a coastal region has shown it to be accurate to within 0.25 m rms for depths between 0.5 and 11.8 m, representing a significant improvement in accuracy. The method is thus recommended for use in bottom relief mapping in coastal shelf regions. A.L.W.

A82-20343 † Investigation of the dynamics of the regional underground runoff of the Aral sea basin using space photography (Izuchenie dinamiki regional'nogo podzemnogo stoka basseina Aral'skogo moria s ispol'zovaniem s'emki iz kosmosa). N. S. Semina (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 41-47. 6 refs. In Russian.

A82-21922 Optical properties of snow. S. G. Warren (Cooperative Institute for Research in Environmental Sciences, Boulder, CO). *Reviews of Geophysics and Space Physics,* vol. 20, Feb. 1982, p. 67-89. 99 refs. NSF Grant No. ATM-80-24641.

The reflection, absorption and transmission of light in the solar and infrared regions by snow are reviewed in light of the importance of optical properties in radiation budget and remote sensing studies. Measurements of snow albedo, bidirectional reflectance, flux extinction and intensity extinction are discussed, and the development of modeling of snow optical properties is outlined. Consideration is then given to the effects of snow grain size, liquid water content and impurities on snow albedo, and to spectrally integrated and spectral flux extinction in the transmission of light through snow. The dependence of snow and spectrally integrated planetary albedos on sun angle is examined, and effects of cloud cover are noted. A complete description of the bidirectional reflectance of snow is presented for use in satellite measurements, and the azimuthally averaged reflectance is supplied for flux calculations. Attention is also given to the thermal infrared emissivity and brightness temperature properties of snow and to the remote sensing of snow parameters based on solar infrared and microwave spectra. A.L.W.

A82-22145 Use of GOES and TIROS/NOAA satellite data for snow-cover mapping. T. M. Lillesand, D. E. Meisner, A. LaMois Downs, and R. L. Deuell (Minnesota, University, St. Paul, MN). *(American Society of Photogrammetry, Annual Convention, Washington, DC, Feb. 22-27, 1981.) Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 251-259. 14 refs. Research supported by the University of Minnesota; Grant No. NOAA-NA-80AAD0019.

Using Minnesota as a test area, a study was conducted to evaluate the imaging characteristics of snow in open agricultural areas, under heavily forested conditions, and in zones of transition between the two cover types. Both GOES and NOAA/TIROS data were analyzed and both visual and digital data analysis techniques were employed. Satellite and ground-based snow survey data were compared for the winters of 1978-79 and 1979-80. Attention is given to aspects of data acquisition, visual image interpretation, and digital data analysis. It was found that visual interpretation of snow extent in nonforested regions would provide very useful input to the snow mapping techniques currently used in Minnesota. The satellite data provide an improved portrayal of the spatial distribution of snow when used in conjunction with ground data. GOES images were found to be more useful than TIROS/NOAA images. G.R.

A82-22873 The use of satellite data in rainfall monitoring. E. C. Barrett (Bristol, University, Bristol, England) and D. W. Martin (Madison, University, Madison, WI). London and New York, Academic Press, 1981. 350 p. 310 refs. $57.

Applications, limitations, and prospectives for future improvements in satellite data gathering for rainfall hydrometeorology are examined. Basic parameters of rainfall amenable to satellite observation are reviewed, along with existing satellites and systems for rainfall observations. Specific attention is given to observation methods such as preliminary studies, cloud-indexing, life-histories, bi-spectral and cloud model methods, rainfall detection from visible and IR images, and properties of microwave radiation in the atmosphere. Satellite rainfall monitoring applications are explored in terms of rainfall inventories on macro- and mesoscales, and for use in hydrology, for studying floods, droughts, and plagues, and for monitoring crop growth and production. Finally, future prospects are discussed for active microwave systems and integrated and international programs for rainfall monitoring. M.S.K.

A82-24959 Change detection in the Peace-Athabasca Delta using digital Landsat data. G. M. Wickware (Canada Centre for Inland Waters, Burlington, Ontario, Canada) and P. J. Howarth (McMaster University, Hamilton, Ontario, Canada). *Remote Sensing of Environment,* vol. 11, Mar. 1981, p. 9-25. 21 refs. Research supported by Parks Canada and Natural Sciences and Engineering Research Council of Canada.

The extensive Peace-Athabasca Delta has experienced major changes in water boundaries and vegetation types due to flooding. To determine the feasibility of Landsat digital data to monitor such changes, comparisons of parts of the delta under normal and flooded conditions have been made. The analysis involved supervised classification of the digital data on two dates followed by post-classification change detection. Comparison of the digital analysis results with aerial photography and existing maps showed good classification accuracy, although a considerable number of pixels remained unclassified. Change detection involved registration of the images on the Image 100 monitor followed by class comparison on a pixel-by-pixel basis. This demonstrated not only that changes had occurred, but also the nature of the changes. Evaluation of the original reflectance values for each class helped in the explanation of the known water and vegetational changes. Results of the study indicate that this type of wetland environment can be effectively mapped and changes readily determined using digital Landsat data. Care must be taken, however, in the analysis of statistical information generated on a pixel-by-pixel basis, particularly for linear features where there are frequent boundaries between classes. (Author)

06 HYDROLOGY AND WATER MANAGEMENT

A82-24960 * Spectral reflectance of hydrophytes. R. G. Best, M. E. Wehde, and R. L. Linder (South Dakota State University, Brookings, SD). *Remote Sensing of Environment*, vol. 11, Mar. 1981, p. 27-35. 9 refs. Research supported by the South Dakota State University, South Dakota Department of Game, Fish and Parks, and U.S. Fish and Wildlife Service; Grant No. NGL-42-003-007.

Identification of hydrophytes will improve the delineation and classification of wetlands on remotely sensed imagery. Spectral reflectance measurements of 10 species of hydrophytes were made with an Exotech radiometer during three phenological stages, flowering and early seed, senescent, and early emergent. Reflectance data were analyzed to determine significant (P not greater than 0.5) differences between species in each of four spectral regions during each phenological stage. Eight species had significantly (P not greater than 0.05) different reflectances during the flower and early seed stage. Among the ten species only one could not be spectrally isolated during at least 1 phenological stage. The results indicate that films sensitive to both visible and infrared spectra (e.g., Ektachrome infrared) should enable recognition of different species of hydrophytes. (Author)

A82-26838 Geotechnical applications of Landsat image analysis of Bhakra Dam Reservoir, India. R. P. Gupta and J. Bodechtel (Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany). *Remote Sensing of Environment*, vol. 12, Mar. 1982, p. 3-13. 16 refs.

Repetitive coverages of Landsat MSS images over Bhakra Dam Reservoir, India, are analyzed and processed on an optical-analog processing device for feature enhancement. The investigations are made with respect to the geological-structural set-up of the area, reservoir lake monitoring, and silting hazards in the reservoir, with emphasis on the importance of remote sensing in water resources management. A lineament-tectonic map of the area is prepared, and temporal variations in the lake reservoir are mapped from the images, the accuracy of which can be improved through digital processing. A method for volumetric estimation of stored water from the Landsat data is proposed. D.L.G.

A82-26839 * Remote sensing of salinity in the San Francisco Bay Delta. S. Khorram (California, University, Berkeley, CA; North Carolina State University, Raleigh, NC). *Remote Sensing of Environment*, vol. 12, Mar. 1982, p. 15-22. 32 refs. Research supported by the University of California; Grant No. NsG-5256.

Landsat multispectral scanner data and color and color infrared photographs acquired from a U-2 aircraft are combined with surface measurements for salinity mapping of the San Fransisco Bay Delta. A regression model is developed between the surface truth data and Landsat digital data for 29 sample sites, and is then extended over the entire study area. Results are in general agreement with reported salinity distribution values. It appears to be impossible to establish any quantitative judgement regarding the salinity values by visual interpretation of the imagery within the test site. D.L.G.

A82-27457 Aerospace methods for the study of water resources and their pollution (Aerokosmicheskie metody pri issledovanii vodnykh resursov i ikh zagriazneniia). Edited by V. V. Kupriianov and V. F. Usachev. Leningrad, Gidrometeoizdat (Gosudarstvennyi Gidrologicheskii Institut, Trudy, No. 285, 1981. 152 p. In Russian.

Papers are presented on such topics as the use of satellite remote sensing data to study meltage runoff in mountain basins, the investigation of the dynamics of snow cover, the use of satellite multispectral photography to study snow meltage fronts, and the evaluation of the pollution of snow cover in industrial regions on the basis of remote sensing data. Also considered are the determination of the albedo and brightness coefficients of snow cover, the use of remote sensing to study subsurface water and tectonic structures, the investigation of the thermal pollution of rivers on the basis of infrared aerial photography, remote sensing methods for monitoring water quality, and microwave sensing methods for the investigation of water resources and their pollution. B.J.

A82-27458 † The possibilities of microwave remote sensing for the study of water resources and their pollution (Vozmozhnosti mikrovolnovoi distantsionnoi indikatsii dlia izucheniia vodnykh resursov i ikh zagriazneniia). K. Ia. Kondrat'ev, Iu. I. Rabinovich, and E. M. Shul'gina. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 5-12. 7 refs. In Russian.

The application of microwave remote sensing to the following hydrological tasks is considered: (1) the mapping of water bodies and ice formations on these bodies; (2) the determination of soil moisture; (3) the evaluation of certain types of water-surface pollution; and (4) the sensing of precipitation zones. It is shown that the use of microwave sensing and active radar techniques in hydrological studies will provide important information on the state of the atmosphere and the underlying surfaces. B.J.

A82-27459 † Remote-sensing functions in the interpretation of moisture from aerial and space images (Indikatsionnye funktsii pri deshifrirovanii uvlazhneniia po aerokosmicheskim izobrazheniiam). B. V. Vinogradov. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 13-24. 17 refs. In Russian.

A remote-sensing function is a quantitative description of data transformations in the transition from the object under study to the remote image of the object. A remote-sensing function is determined by analytic functional relationships, modulation transfer functions, or statistical analysis. A complete remote-sensing function contains a number of data-transmission units: instrumental, atmospheric, botanical, soil-related, hydrological, and geological. Several different remote-sensing functions are examined, and approximating equations are obtained for geophysical, botanical, soil functions for soil moisture and ground water. B.J.

A82-27460 † Remote-sensing determination of the characteristics of hydrological objects (Opredelenie kharakteristik gidrologicheskikh ob'ektov distantsionnym metodom). G. Tovizi. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 25-28. In Russian.

Remote sensing studies of water resources in Hungary are described. Most favorable spectral regions have been established for shorelines (0.8-0.9 micron), bottoms (0.45-0.65 micron), geological and tectonic formations (0.6-1.1 micron), and snow and ice cover (0.5-0.7 micron). The use of aerial photography to study water turbidity, silt formation in reservoirs, water flow rate and temperature, and surface pollution of water is discussed. Spectral regions most suitable for the study of these characteristics are indicated. B.J.

A82-27461 † Application of satellite data to analyze and predict meltage runoff in a mountain basin (Primenenie sputnikovoi informatsii dlia rascheta i prognoza talogo stoka v gornom basseine). N. V. Vostriakova. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 29-37. 9 refs. In Russian.

The use of satellite remote sensing images to analyze and predict meltage runoff during spring and summer periods is examined using the basins of the Sayan-Altai river system as an example. The following relationships are examined: (1) the dependence of changes in basin snow cover on the sum of positive values of air temperature; (2) the relationship between the rate of rise of the snow line and the water content during the high-water period; (3) the dependence of runoff volume on the area of snow meltage and the heat influx to the remaining high-water period on the size of the snow-covered area of the basin. The need to use multispectral imagery to study mountain river runoff is emphasized. B.J.

A82-27462 † Dynamics of snow cover in mountain regions of the Aral Sea basin, studied using satellite photographs (Dinamika snezhnogo pokrova v gornykh raionakh basseina Aral'skogo Moria po sputnikovym snimkam). M. V. Sitnikova, B. K. Tsarev, and V. Iu. Chernov. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 38-44. 8 refs. In Russian.

A82-27463 † The possibility of determining snow-meltage fronts using Meteor-satellite multispectral data /with Kazakhstan considered as an example/ (O vozmozhnosti opredeleniia fronta snegotaianiia po mnogozonal'noi informatsii s ISZ 'Meteor' /na primere Kazakhstana/). E. I. Pankratova. In: Aerospace methods for

the study of water resources and their pollution.
Leningrad, Gidrometeoizdat, 1981, p. 47-55. 5 refs. In Russian.

A82-27464 † **Evaluation of snow-cover pollution in industrial regions using satellite TV images (Otsenka zagriaznennosti snezhnogo pokrova promyshlennykh raionov po sputnikovym TV izobrazheniiam).** V. N. Vasilenko, V. G. Prokacheva, and Sh. D. Fridman. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 56-63. In Russian.

A subsatellite experiment was conducted in the spring of 1978 to investigate the pollution of snow cover in the Vorkuta industrial center of the USSR; Meteor-satellite TV images were interpreted. In addition, ground-based measurements of albedo, snow height and density, and dust concentrations in the snow cover were carried out along with aerial visual and photographic observations over an area of about 2500 sq km. Preliminary relationships were obtained between albedo, dust density in the snow, and the brightness of the snow cover on satellite images. B.J.

A82-27465 † **Albedo and brightness coefficients of snow cover (Ob al'bedo i koeffitsientakh iarkosti snezhnogo pokrova).** V. F. Usachev, V. A. Mikhailov, and V. G. Prokacheva. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 64-69. In Russian.

Parallel measurements of integral albedo (0.3-2.4 microns) and spectral brightness coefficients (420, 525, 622, and 787 nm) of snow cover were carried out near the city of Monchegorsk during the period of snow meltage. The albedo was measured by the M-60 field albedometer, while the spectral brightness coefficients were measured photoelectrically using a four-channel spectrophotometer. The field measurements (64 series) showed that the relationship between the integral albedo and the spectral brightness coefficients is quasi-linear. The use of satellite TV imagery to determine the brightness of snow cover is considered. B.J.

A82-27467 † **Survey and mapping of shallow water bodies and the distribution of the river runoff of solids on the basis of multispectral aerial and space photographs (Issledovanie i kartografirovanie melkovodnykh akvatorii i raspredeleniia tverdogo stoka rek po mnogozonal'nym aerokosmicheskim snimkam).** Iu. F. Knizhnikov, V. I. Kravtsova, and I. A. Labutina. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 77-84. In Russian

Shallow areas of the northeastern Caspian were mapped using multispectral photographs from Soyuz-22. Geomorphological, bathymetric, relief, bottom-deposit, underwater-vegetation, and underwater-landscape maps were compiled. Attention is also given to general aspects of the use of multispectral photography to study the flow of suspensions carried by rivers into the coastal regions of seas and lakes. B.J.

A82-27468 † **The use of space photographs for hydrogeological studies of the Baikal region and Mongolia (Ispol'zovanie kosmicheskikh snimkov dlia gidrogeologicheskikh issledovanii raionov Pribaikal'ia i Mongolii).** Iu. L. Ob'edkov. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 85-96. 10 refs. In Russian.

The principles of the hydrogeological interpretation of space remote sensing images are discussed, with particular attention given to the determination of the relationship between various hydrogeological objects and landscape elements. A detailed analysis of space photographs makes it possible to determine the locations and boundaries of artesian basins, to characterize the water-conducting and collecting properties of water-containing rocks, and to evaluate subsurface water resources. The proposed method was used to study the hydrogeology of the Baikal region and the western part of central Mongolia. B.J.

A82-27469 † **The effect of anthropogenic factors on the dynamics of lakes in the plains of Central Asia /studied on the basis of space photographs/ (Vliianie antropogennykh faktorov na dinamiku ravninnykh ozer Srednei Azii /po materialam kosmicheskikh s'emok/).** A. M. Nikitin and Iu. N. Lesnik. In: Aerospace methods for the study of water resources and their pollution.
Leningrad, Gidrometeoizdat, 1981, p. 97-102. 5 refs. In Russian.

A82-27470 † **Primary processing of and possibilities of using data from the meteorological satellite TIROS-N (Pervichnaia obrabotka i vazmozhnosti ispol'zovaniia dannykh meteorologicheskogo sputnika 'Tairos-N').** Sh. Kyevskii and V. Tollinger. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 103-107. In Russian.

Results of the primary processing of images of Czechoslovakia obtained with TIROS-N are presented. Geometric and radiative correction in three spectral intervals was used along with quantization and synthesis of images in conditional colors. The applicability of these data to hydrology is examined. B.J.

A82-27471 † **Monitoring of the thermal pollution of natural channels of water using infrared aerial photography (Obsledovanie teplovogo zagriazneniia estestvennykh vodotokov s ispol'zovaniem infrakrasnoi aeros'emki).** D. Domokosh. In: Aerospace methods for the study of water resources and their pollution.
Leningrad, Gidrometeoizdat, 1981, p. 108-113. In Russian.

It is proposed that infrared and aerial photography techniques be used to study river pollution resulting from power-plant emissions. As an illustration of the method, aerial photography in the visible (0.38-0.76 micron) and near IR (2.0-5.0 microns) was used to study the pollution of a section of the Danube in Hungary. A pollution distribution map of a 10-km section of the river was obtained (including the propagation of thermal waters only along the left bank). Stereophotogrammetry was used to determine the flow velocity. B.J.

A82-27472 † **Investigation of silting and currents in Lake Balaton by use of hydraulic models and aerial and space photographs (Issledovanie zaileniia i techenii oz. Balaton s primeneniem gidravlicheskikh modelei i aerokosmicheskikh snimkov).** L. Goda. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 114-119. In Russian.

A82-27473 † **Interpretation of multispectral aerial photographs of Lake Müggelsee (Deshifrirovanie mnogozonal'nykh aerofotosnimkov oz. Miugel'zee).** E. Iung. In: Aerospace methods for the study of water resources and their pollution.
Leningrad, Gidrometeoizdat, 1981, p. 120-122. In Russian.

A82-27474 † **Spectrometric studies of the water composition of Lake Müggelsee (Spektrometricheskie issledovaniia sostava vod oz. Miugel'zee).** D. Slavik. In: Aerospace methods for the study of water resources and their pollution.
Leningrad, Gidrometeoizdat, 198, p. 123-126. In Russian.

A hand-held spectrometer operating in the 335-1150 nm range was used to study the reflectance of water samples from Lake Müggelsee. The reflectance in this spectral range was studied as a function of the concentration of sediments in the water. The influence of suspensions of peat, green algae, and blue-green algae on the reflectance of the water is examined. B.J.

A82-27475 † **Noncontact methods for the quality control of water resources (Nekontaktnye metody kontrolia kachestva vod).** Iu. V. Zavolokin, L. A. Shliakhova, V. I. Rodzin, and V. A. Kriul'kov. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 127-134. 17 refs. In Russian.

Remote sensing methods for the operational quality control of water resources are described. Results of remote measurements of the physical and chemical properties of water bodies and water mineralization are presented. The recording, storage, and processing of the remote sensing data using television systems and analog/digital conversion techniques are considered. The development of a general model for the remote monitoring of water resources is discussed. B.J.

A82-27476 † **Analog devices for the processing of aerial and space images for the study of water resources (Analogovye ustroistva**

dlia obrabotki aerokosmicheskikh fotoizobrazhenii pri izuchenii vodnykh resursov). V. A. Mikhailov and V. F. Usachev. In: Aerospace methods for the study of water resources and their pollution. Leningrad, Gidrometeoizdat, 1981, p. 135-140. In Russian.

The paper examines the use of analog devices for the interpretation of remote sensing images, particularly, the delineation of contours of varying optical density and the determination of their areas. The application of such devices in the study of water resources is considered, and the incorporation of such devices in systems for the automated processing of remote sensing images is examined. B.J.

A82-27592 * # **Spatial reasoning in remotely sensed data.** J. Campbell, R. W. Ehrich, D. Elliott, R. M. Haralick, and S. Wang (Virginia Polytechnic Institute and State University, Blacksburg, VA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 223-235. Contract No. NAS5-26276.

Photointerpreters employ a variety of implicit spatial models to provide interpretations from remotely sensed aerial or satellite imagery. In this paper one application is illustrated: how ridges and valleys can be automatically interpreted from Landsat imagery of a mountainous area, and how a relative elevation terrain model can be constructed from this interpretation. How to examine valleys for the possible presence of streams or rivers is shown, and how a spatial relational model can be set up to make a final interpretation of the river drainage network is explored. (Author)

A82-27610 # **Inland water quality assessment from Landsat data.** D. J. Carpenter (Australian National University, Canberra, Australia). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 483-490.

Landsat MSS data have been successfully applied to the collection of inland water quality data using multiple linear regressions. The data came from seven satellite acquisitions and simultaneous ground surveys of four lakes in the Southern Tablelands region of South East Australia. The linear models developed included the four band spectral radiances and the sun elevation as predictors and accounted for over 90% of the variance of the dependent variables. These were the water quality parameters turbidity and algal pigments. (Author)

A82-27613 # **Satellite sensing for extraction of groundwater resources information.** S. S. Kumar and S. Thiruvengadachari (National Remote Sensing Agency, Hyderabad, India). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 509-518.

Satellite derived data were used to generate regional level groundwater resources information in the chronically drought affected parts of central and southern India. Two different methodologies were adopted in the two different regions. In the first area, where geomorphology exercises a significant control over groundwater movement and occurrence, this relationship has been utilized to arrive at potential groundwater zones, whereas in Tamilnadu in south India basic resources information in regard to geology, geomorphology, hydrologic land use and soils were extracted and integrated to support a regional groundwater resources evaluation program. The two contrasting methodologies along with the case studies are described. Selection of suitable methodology in any area will depend upon the complexity of control over groundwater occurrence and movement, cost of survey and level of information required. (Author)

A82-27614 # **Snow cover monitoring using AVHRR data from TIROS and NOAA satellites.** G. Saint, P. Herbert (Centre National d'Etudes Spatiales, Toulouse, France), C. Leprieur (Grouppement pour le Développement de la Télédétection Aérospatiale, Toulouse, France), and M. Deneau (Electricité de France, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 519-526. 5 refs.

It is pointed out that the management of dams in hydroelectric projects could be substantially improved by monitoring the extent of the existing snow cover. In a study concerning the feasibility of such monitoring activities, it was found that the Advanced Very High Resolution Radiometer (AVHRR) carried by the TIROS-N series satellites would be the most suitable instrument for obtaining the required data. Attention is given to the characteristics of the AVHRR data, the principles of image segmentation, a description of the processing, the ground estimate, and a comparison of ground estimate and processing results. G.R.

A82-27634 # **Calcium carbonate precipitation in Pyramid Lake, Nevada, as monitored by satellite - 1978 and 1980.** C. P. Berg, S. R. Schneider (NOAA, National Earth Satellite Service, Washington, DC), and D. L. Galat (Colorado State University, Fort Collins, CO). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 721-731. 16 refs.

Satellite data from the summers of 1978 and 1980 on calcium carbonate precipitation in Pyramid Lake, Nevada, are presented. The whiting sequence, the growth, distribution pattern, and cessation of the phenomenon were documented by NASA's Landsat and NOAA's GOES. Results from water chemistry sampling verify the satellite imagery, and give evidence of a relationship between particulate calcium concentration and observed brightness. An optimum spectral interval of 0.5-0.6 microns is verified, and a significant reduction of light penetration into the lake, and therefore light available for photosynthesis, is found to be caused by the whitings. D.L.G.

A82-27637 # **Use of Landsat imagery to delineate glaciofluvial aquifers in southeast South Dakota.** E. F. Bugliosi (U.S. Geological Survey, Huron, SD). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2: Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 761-769. 7 refs.

An analysis of Landsat satellite imagery has been used in the delineation of buried glaciofluvial aquifers in southeastern South Dakota. A color and tonal pattern analysis was performed on a band 7 and a false color composite Landsat image obtained in April 1974 to detect linear and curvilinear patterns, and the patterns were compared with drainage and geomorphological overlays to locate any anomalies indicative of a buried glaciofluvial deposit. Test drilling at 50 locations within the Landsat area confirmed the presence or absence of aquifers predicted by the image analysis in 72% of the cases. Of the 17 holes drilled where Landsat predicted no deposits, 10 detected a glaciofluvial deposit, however five of these were either dry or located 30 m or more below the surface. Results demonstrate the feasibility of using Landsat images to delineate glaciofluvial aquifers at depths less than about 24 m below land surface. A.L.W.

A82-27639 # **Remote sensing of rainfall rates using airborne microwave rain-scatterometer/radiometer.** H. Inomata, K. Okamoto, T. Ojima, H. Masuko, S. Yoshikado, and N. Fugono (Ministry of Posts and Telecommunications, Radio Research Laboratories, Koganei, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 781-792.

Characteristics of an airborne microwave rain-scatterometer and radiometer operating at X-band and Ka-band are summarized. Data analysis techniques for deriving rainfall rates from the received powers of the scatterometer are briefly described. Some preliminary results of flight experiments performed in October 1980 for rain on the sea are discussed. Qualitative correlations between rainfall rates calculated from the X-band scatterometer data and antenna temperatures of the X-band radiometer data are clearly found. They also correlate fairly well with the attenuation of backscattered powers from sea surfaces. Typical displays of analyzed data in the flight experiment are shown. The ground-based experiment for strong rainfall from the rainfront stimulated by the typhoon in September 1980 are also discussed. An example of time sequential display of

rainfall rates distribution are presented. Average wind speeds and falling speeds of raindrops can be easily estimated from the display. (Author)

A82-27692 # **Mapping of water quality using Landsat imagery.** L. T. Lindell (Statens Naturvardsverk, Uppsala, Sweden). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1375-1385. 9 refs.

This paper discusses the possibilities of using Landsat imagery for purposes of mapping water quality. The methodology was first worked out on Lake Malaren, Sweden, where most of the practical procedures were tried and the variables to be mapped were chosen. The county of Orebro was selected as a test area for the country-wide mapping. This area contains more than 500 lakes larger than 10 ha ranging in trophic state from oligotrophic to eutrophic and, in elevation from mountain to lowland. Variables studied include turbidity, Secchi disc depth and lake surface area. The satellite data were geometrically corrected and color printed on a scale of 1:100 000 using an ink jet plotter. The experiences from this work will be used to develop a map of the water quality of Sweden. Mapping should be repeated frequently to record changes in water quality. Changes in water quality are displayed together with a separate field data base, which is used to determine possible causes for the changes. (Author)

A82-28137 † **The use of space photographs to compile water-amelioration maps (Ispol'zovanie kosmicheskikh snimkov pri sostavlenii meliorativno-vodokhoziaistvennykh kart).** T. V. Vereshchaka, B. V. Krasnopevtseva, and V. V. Usova. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 60-65. In Russian.

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Ralph W. Kiefer, Principal Investigator Jul. 1980 45 p ERTS (Grant NGL-50-002-127)
(E82-10021; NASA-CR-164815) Avail: NTIS HC A03/MF A01 CSCL 08H

Progress is reported in the following NASA-funded projects: (1) sediment plume study; (2) atmospheric correction to LANDSAT imagery; (3) demonstrating and evaluating opportunites for operational application of LANDSAT data in Wisconsin; and (4) the development of a facility to process imagery for the study of land cover, land use, water quality, electrophoresis gel analysis, prediction of storm and snow flow conditions, physical oceanography, and soils. Associated projects summarized are concerned with vegetation mapping in Sheboygan Marsh, surveying the Green Bay watershed to estimate the impact of land development on bay water quality; thermal scanning of ocean fronts; lake water quality, the Irondequoit River watershed, a model of thermal environment for land use planning, and changes in wetland vegetation near the Columbia Generating Station. Emphasis was focused on the selection of equipment for the efficient processing of images used for water-quality analysis and the development of supporting software for application by users. A.R.H.

N82-17601 Michigan Univ., Ann Arbor.
SPECTRAL REFLECTANCES OF FRESHWATER ICE AND SNOW FROM 340 THROUGH 1100 nm Ph.D. Thesis
Stanley Joseph Bolsenga 1981 159 p
Avail: Univ. Microfilms Order No. 8125073

Measured spectral reflectances of new and moderately metamorphosed snow were generally > 80% from 340 to 950 nm. From 950 to 100 nm a characteristic dip and rise of spectral reflectances occurred. One scan over a deteriorated snow patch showed much lower spectral reflectances than fresh snow, but the shape of the curve remained similar to fresher snow. Spectral reflectances for clear ice contrasted sharply with those for snow. In general, values were < 10% and the curves lacked distinctive shape. Higher spectral reflectances, due to lighter colored ice in the measurement area, were measured at some sites. Secondary ice types (refrozen slush, pancake, brash, slush curd) revealed spectral reflectance curves similar in form to each other, but which varied significantly in the range of spectral reflectances for each ice type. All measurements were acquired with a pair of scanning spectroradiometers adapted to obtain automatically simultaneous readings of incident and reflected radiation from 340 to 100 nm. Dissert. Abstr.

N82-17602 Colorado State Univ., Fort Collins.
WATERSHED MODEL STUDY USING LANDSAT DATA Ph.D. Thesis
Tien-Po Chang 1981 331 p
Avail: Univ. Microfilms Order No. 8126421

In connection with the use of remote sensing techniques, a digital terrain model that characterizes geometric features and other terrain conditions of a watershed is necessary for watershed modeling. As a result of constructing a watershed cell system on the digital terrain model, the mathematical formation on simulated physical processes can be simplified since the mathematical expressions only handle the small-sized, well-defined and relatively homogeneous components of the physical processes within a watershed cell. Four submodels that link the processing of the remote sensed data to the watershed analysis were developed. The submodels are LANDSAT image data processing model, digital terrain model, hydrologic simulation model, and landslide-hazard potential delineation model. The structure, function, and computer programs related to these models, along with the results of watershed simulation using the models, are presented and discussed. Dissert. Abstr.

N82-18469# Army Cold Regions Research and Engineering Lab., Hanover, N. H. Ice Engineering Research Branch.
ELECTROMAGNETIC SUBSURFACE MEASUREMENTS
Arnold M. Dean, Jr. Oct. 1981 24 p
(Proj. CWIS-31350)
(AD-A108192; CRREL-SR-81-23) Avail: NTIS HC A02/MF A01 CSCL 17/9

In 1974, personnel at the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) began using an impulse radar system to profile accumulations of ice forms. The system was modified for effective use as a profiling system in a ground or airborne configuration, in certain high-noise environments. The system can penetrate fresh water and media with a high water content. Frazil and brash ice accumulations with approximately 50% water were profiled to a depth of 25 to 35 ft. As a result of the CRREL modifications, the system has found extensive and varied applications as a low-level remote sensing tool. Applications include profiling ice accumulations (including ice jams), river beds, sheet ice, permafrost, subsurface ice masses, river bank revetments through air-entrained water, snow covers, sea ice, icebergs, and peat bogs. Limited laboratory work has also shown that the impulse radar system may be able to detect oil and gas under sea ice. Selected applications and data are presented. Since it was used mainly for research, the CRREL system needs further development to make it useful to operational units. Additional development of hardware and software is recommended. GRA

N82-18663*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL ALBEDOS OF MIDLATITUDE SNOWPACKS
Bhaskar Choudhury Nov. 1981 41 p refs Submitted for publication
(NASA-TM-83858) Avail: NTIS HC A03/MF A01 CSCL 08L

Spectral albedos of impure-nonhomogeneous snowpacks, typical of midlatitudes, from 400 to 2200 nm were modeled through a numerical solution of the radiative transfer equation in the two-stream approximation. Discrete depth-dependent values of density, grain size and impurity concentration were used to characterize the snowpacks. The model is for diffuse incident radiation, and the numerical method is based on doubling and invariant imbedding. The effect of soot impurities on snowpack albedos is illustrated when a snowpack is several centimeters deep and soot reduces the albedos at visible wavelengths, however, when a snowpack is only a few centimeters deep, soot may increase the albedos at visible wavelengths. By adjusting soot content and snow grain size, good quantitative agreement with some observations at the Cascade Mountains (Washington) and at Point Barrow (Alaska) are obtained; however, the model grain sizes are found to be fifty to four hundred percent larger than the measured values. For satellite snowcover observations,

a model for effective albedo of partially snow-covered areas was developed and compared with some NOAA-2 observations of the southeastern United States. T.M.

N82-18664*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GROUND-TRUTH OBSERVATIONS OF ICE-COVERED NORTH SLOPE LAKES IMAGED BY RADAR
W. F. Weeks Oct. 1981 24 p refs Prepared in cooperation with CRREL, Hanover, N.H.
(NASA-TM-84127; AD-A108342; CRREL-81-19) Avail: NTIS HC A02/MF A01 CSCL 08/8

Field observations support the interpretation that differences in the strength of radar returns from the ice covers of lakes on the North Slope of Alaska can be used to determine where the lake is frozen completely to the bottom. An ice/frozen soil interface is indicated by a weak return and an ice/water interface by a strong return. The immediate value of this result is that SLAR (side-looking airborne radar) imagery can now be used to prepare maps of large areas of the North Slope showing where the lakes are shallower or deeper than 1.7m (the approximate draft of the lake ice at the time of the SLAR flights). The bathymetry of these shallow lakes is largely unknown and is not obvious from their sizes or outlines. Such information could be very useful, for example in finding suitable year-round water supplies. Author (GRA)

N82-18670# World Meteorological Organization, Geneva (Switzerland). Rapporteur on Sediment Transport.
MEASUREMENT OF RIVER SEDIMENTS
1981 69 p refs
(WMO-561; OHR-16; ISBN-92-63-10561-8) Avail: NTIS MF A01; print copy available at WMO, Geneva

Samples and remote sensing techniques for measuring sediment discharge in alluvial rivers are reviewed, noting that the simplest as well as sophisticated methods are not mutually exclusive. It is demonstrated that, in many cases, the optimum means for systematic sediment measurement is a combination of traditional and advanced methods and instruments. Areas where further improvement is needed, e.g., automation and telemetering as well as the international standardization of water pollution aspects of sediment monitoring, are indicated. Author (ESA)

N82-18671# World Meteorological Organization, Geneva (Switzerland).
FLASH FLOOD FORECASTING
A. J. Hall 1981 49 p refs
(WMO-577; OHR-18; ISBN-92-63-10577-4) Avail: NTIS MF A01; print copy available at WMO, Geneva SwFr 6

The problem of flash floods is reviewed and basic flash flood forecasting techniques, warning systems, and non-real time solutions to flash flooding are discussed. Data sources for flash flood forecasting are identified, including radar, satellites and quantitative precipitation forecasting. Flash flood forecasting can be based on meteorological, hydrological, meteorological-hydrological or dam break techniques. The design and establishment of flash flood warning systems, ranging from simple networks and procedures to sophisticated computerized automatic systems are described. The success of a flash flood warning system is measured by public response to warnings, the saving of life, and reduction of damage to property. Community involvement is evaluated, indicating the complex interactions among agencies, information dissemination subsystems and the public. Flood plain zoning, and basin management and the construction of engineering works are considered. The limitations and advantages of flood damage reduction measures are also analyzed. Author (ESA)

N82-19304# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DATA COLLECTION PLATFORMS: APPLICATIONS TO HYDROLOGY [PLATFORMAS DE COLETA DE DADOS: APLICACAO A HIDROLOGIA]
Jose Roberto deOliveira Oct. 1981 14 p refs In PORTUGUESE: ENGLISH summary Presented at 4th Brazilian Symp. on Hydrol. and Hydrol. Resources, 15-19 Nov. 1981
(INPE-2246-PRE/030) Avail: NTIS HC A02/MF A01

Data collection platforms which use artificial satellites as data relayers of meteorological data to receiving centers are discussed. The main systems available for data collection, and their advantages and limitations relative to hydrologic applications are discussed. R.J.F.

N82-19638*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
DIELECTRIC PROPERTIES OF SNOW Interim Technical Report
W. H. Stiles and F. T. Ulaby Greenbelt, Md. NASA. Goddard Space Flight Center Dec. 1981 43 p refs
(Grant NAG5-163)
(NASA-CR-166764; RSL-TR-527-1) Avail: NTIS HC A03/MF A01 CSCL 08L

The dielectric properties of snow in the radio frequency range from 100 KHz to 35 GHz are reviewed. Applicable dielectric mixing formulas are discussed and compared to available experimental data. S.L.

N82-19646*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
ACTIVE MICROWAVE INVESTIGATION OF SNOWPACKS: EXPERIMENTAL DOCUMENTATION, COLORADO 1979-1980
W. H. Stiles, Fawwaz T. Ulaby, A. Aslam, and M. Abdelrazik *Jul. 1981 188 p refs*
(Grant NsG-5335)
(NASA-CR-166727; RSL-TR-410-3) Avail: NTIS HC A09/MF A01 CSCL 08L

During the winter of 1979-1980, the University of Kansas Microwave Active Spectrometer systems measured the backscattering properties of snowpacks under varying conditions at four test sites in Colorado. In addition to the radar data over 1-35 GHz, ground-truth measurements of the atmospheric, snow, and soil characteristics were obtained for each radar data set. The test sites, data acquisition procedures, and data that were acquired in this experiment are presented and described. Author

N82-19790# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.
PRECIPITATION ASSESSMENT FROM ENVIRONMENTAL SATELLITE DATA FOR NORTHWEST LIBYA INCLUDING THE GEFARA PLAN
A. vanDijk 1981 50 p refs
(RSC-4) Avail: NTIS HC A04/MF A01

The FAO precipitation assessment technique (satellite imagery combined with rain gage data) was applied to NW Libya to improve precipitation monitoring in this data sparse region. A 21 day period containing a few dry days, a heavy rainstorm, then a few more dry days was chosen. Rain gages reported 3 days of heavy rainfall, but failed to detect 2 further days with rain indicated by satellite data. The FAO rainfall maps appear more reliable than rain gage ones. The application of the technique to the whole of Libya, using Meteosat 2, and 10 reliable, well distributed rain gages, in combination with selected rain gages in South Italy, Tunisia and West Egypt is suggested. Author (ESA)

N82-20586*# Brigham Young Univ., Provo, Utah.
HCMM HYDROLOGICAL ANALYSIS IN UTAH
3 Sep. 1981 37 p refs Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20071. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A from Rockets and Satellites'. HCMM
(E82-10063; NASA-CR-165085; NAS 1.26:165085; QR-2) Avail: NTIS HC A03/MF A01 CSCL 08H

Progress in analysis of Heat Capacity Mapping Mission (HCMM) infrared and visible observations of the hydrology of Utah Lake is reported. Correlation between HCMM intensities converted to temperature and ground truth temperatures was investigated, and a conversion offset value determined. Ground truth surface temperatures minus HCMM temperatures were plotted against several hydrological parameters. Relationships among visible data, thermal data, and algae concentrations were considered, and summer concentrations of predominant algae species determined. Investigations on the effects of varying algae concentrations on evaporation rates are reported. Efforts to develop a model for evaporation estimation are reported. The relationship between air and water surface temperatures was studied and the temperature distribution in different segments of the lake investigated. Indications of the existence of thermal springs are reported. Correlation of HCMM surface temperature data and depth to groundwater were investigated. J.D.H.

N82-20587*# National Oceanic and Atmospheric Administration, Washington, D. C.
EVALUATION OF HCMM SATELLITE DATA FOR ESTUARINE TIDAL CIRCULATION PATTERNS AND THERMAL INERTIA SOIL MOISTURE MEASUREMENTS Final Report
Donald R. Wiesnet, David F. McGinnis, Jr., Principal Investigators, Michael Matson, and John A. Pritchard Jun. 1981 79 p refs Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20071. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(NASA Order S-40229B)
(E82-10064; NASA-CR-165086; NAS 1.26:165086) Avail: NTIS HC A05/MF A01 CSCL 08C

Digital thermal maps of the Cooper River (SC) and the Potomac River estuaries were prepared from heat capacity mapping radiometer (HCMR) tapes. Tidal phases were correctly interpreted and verified. Synoptic surface circulation patterns were charted by location thermal fronts and water mass boundaries within the estuaries. Thermal anomalies were detected adjacent of a conventional power plant on the Potomac. Under optimum conditions, estuaries as small as the Cooper River can be monitored for generalized thermal/tidal circulation patterns by the HCMM-type IR sensors. The HCMM thermal inertia approach to estimating soil moisture at the Luverne (MN) test site was found to be unsatisfactory as a NESS operational satellite technique because of cloud cover interference. Thermal-IR data show similar structure of the Baltimore and Washington heat islands when compared to NOAA AVHHR thermal-IR data. Thermal anomalies from the warm water discharge water of a nuclear power plant were mapped in Lake Anna, Virginia. A.R.H.

N82-20605*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DYNAMIC STUDY OF THE UPPER SAO FRANCISCO RIVER AND THE TRES MARIAS RESERVOIR USING MSS/LANDSAT IMAGES [ESTUDO DINAMICO DO ALTO RICO SAO FRANCISCO ERESERVATORIO DETRES MARIAS, ATRAVES DE IMAGENS MSS/LANDSAT]
Nelson deJesusParada, Principal Investigator and Tania Maria Sausen Jul. 1981 77 p refs In PORTUGUESE Presented at 33rd Reuniao Anual da SBPC, Salvador, Brazil, 8-15 Jun. 1981 Sponsored by NASA ERTS
(E82-10082; NASA-CR-168403; NAS 1.26:168403; INPE-2154-RPE/373) Avail: NTIS HC A05/MF A01 CSCL 08H

The use of LANDSAT multispectral ban scanner imagery to verify the relationship between the behavior of the Tres Marias reservoir and the dynamics of the Sao Francisco River supply basin is described. The dispersion of suspended sediments and their concentration in the surface layers of the water are considered. A five year survey of the region during both dry and rainy seasons was performed. The drainage network was analyzed based on the patterns of dessication, water rises and soil use in the supply basin. Surface layers of the reservoir were tabulated as a function of the levels of gray in the imagery. In situ observations of water depth and reflectance were performed. Ground truth and LANDSAT data were correlated to determine the factors affecting the dynamics of the supply basin. J.D.H.

N82-20617*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS SYSTEMS VERIFICATION AND TRANSFER PROJECT. VOLUME 1: OPERATIONAL APPLICATIONS OF SATELLITE SNOW COVER OBSERVATIONS: EXECUTIVE SUMMARY
Albert Rango Dec. 1981 81 p refs 8 Vol.
(NASA-TP-1822; NAS 1.60:1822; Rept-81F0060-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 05B

Both LANDSAT and NOAA satellite data were used in improving snowmelt runoff forecasts. When the satellite snow cover data were tested in both empirical seasonal runoff estimation and short term modeling approaches, a definite potential for reducing forecast error was evident. A cost benefit analysis run in conjunction with the snow mapping indicated a $36.5 million annual benefit accruing from a one percent improvement in forecast accuracy using the snow cover data for the western United States. The annual cost of employing the system would be $505,000. The snow mapping has proven that satellite snow cover data can be used to reduce snowmelt runoff forecast error in a cost effective manner once all operational satellite data are available within 72 hours after acquisition. Executive summaries of the individual snow mapping projects are presented. J.M.S.

N82-20618*# Geological Survey, Phoenix, Ariz.
APPLICATIONS SYSTEMS VERIFICATION AND TRANSFER PROJECT. VOLUME 2: OPERATIONAL APPLICATIONS OF SATELLITE SNOW-COVER OBSERVATIONS AND DATA-COLLECTION SYSTEMS IN THE ARIZONA TEST SITE
Herbert H. Schumann Dec. 1981 62 p refs 8 Vol.
(NASA-TP-1823; NAS 1.60:1823; Rept-81F0061-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 08L

Ground surveys and aerial observations were used to monitor rapidly changing moisture conditions in the Salt-Verde watershed. Repetitive satellite snow cover observations greatly reduce the necessity for routine aerial snow reconnaissance flights over the mountains. High resolution, multispectral imagery provided by LANDSAT satellite series enabled rapid and accurate mapping of snow-cover distributions for small- to medium-sized subwatersheds; however, the imagery provided only one observation every 9 days of about a third of the watershed. Low resolution imagery acquired by the ITOSa dn SMS/GOES meteorological satellite series provides the daily synoptic observation necessary to monitor the rapid changes in snow-covered area in the entire watershed. Short term runoff volumes can be predicted from daily sequential snow cover observations. J.M.S.

N82-20619*# California State Dept. of Water Resources, Sacramento.
APPLICATIONS SYSTEMS VERIFICATION AND TRANSFER PROJECT. VOLUME 3: OPERATIONAL APPLICATIONS OF SATELLITE SNOW COVER OBSERVATIONS IN CALIFORNIA
A. J Brown and J. F. Hannaford (Sierra Hydrotech, Placerville, Calif.) Dec. 1981 70 p refs 8 Vol.
(Contract NAS5-20831)
(NASA-TP-1824; NAS 1.60:1824; Rept-81F0062-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 08L

Five southern Sierra snowmelt basins and two northern Sierra-Southern Cascade snowmelt basins were used to evaluate the effect on operational water supply forecasting from satellite imagery. Manual photointerpretation techniques were used to obtain SCA and equivalent snow line for the years 1973 to 1979 for the seven test basins using LANDSAT imagery and GOES imagery. The use of SCA was tested operationally in 1977-79. Results indicate the addition of SCA improve the water supply forecasts during the snowmelt phase for these basins where there may be an unusual distribution of snowpack throughout the basin, or where there is a limited amount of real time data available. A high correlation to runoff was obtained when SCA was combined with snow water content data obtained from reporting snow sensors. T.M.

N82-20620*# Soil Conservation Service, Denver, Colo.
APPLICATIONS SYSTEMS VERIFICATION AND TRANSFER PROJECT. VOLUME 4: OPERATIONAL APPLICATIONS OF SATELLITE SNOW COVER OBSERVATIONS. COLORADO FIELD TEST CENTER
Bernard A. Shafer, Charles F. Leaf, Jeris A. Danielson (Colorado State Engineers Office), and George F. Moravec (Colorado State Engineers Office) Dec. 1981 101 p refs 8 Vol.
(NASA-TP-1825; NAS 1.60:1825; Rept-81F0063-Vol-4) Avail: NTIS HC A06/MF A01 CSCL 08L

The study was conducted on six watersheds ranging in size from 277 km to 3460 km in the Rio Grande and Arkansas River basins of southwestern Colorado. Six years of satellite data in the period 1973-78 were analyzed and snowcover maps prepared for all available image dates. Seven snowmapping techniques were explored; the photointerpretative method was selected as the most accurate. Three schemes to forecast snowmelt runoff employing satellite snowcover observations were investigated. They included a conceptual hydrologic model, a statistical model, and a graphical method. A reduction of 10% in the current average forecast error is estimated when snowcover data in snowmelt runoff forecasting is shown to be extremely promising. Inability to obtain repetitive coverage due to the 18 day cycle of LANDSAT, the occurrence of cloud cover and slow image delivery are obstacles to the immediate

implementation of satellite derived snowcover in operational streamflow forecasting programs. T.M.

N82-20621*# Bonneville Power Administration, Portland, Oreg.
APPLICATIONS SYSTEMS VERIFICATION AND TRANSFER PROJECT. VOLUME 5: OPERATIONAL APPLICATIONS OF SATELLITE SNOW-COVER OBSERVATIONS, NORTHWEST UNITED STATES
John P. Dillard Dec. 1981 84 p refs 8 Vol.
(Contract NASA Order S-53877)
(NASA-TP-1826; NAS 1.60:1826; Rept-81F0064-Vol-5) Avail: NTIS HC A05/MF A01 CSCL 08L

The study objective was to develop or modify methods in an operational framework that would allow incorporation of satellite derived snow cover observations for prediction of snowmelt derived runoff. Data were reviewed and verified for five basins in the Pacific Northwest. The data were analyzed for up to a 6-year period ending July 1978, and in all cases cover a low, average, and high snow cover/runoff year. Cloud cover is a major problem in these springtime runoff analyses and have hampered data collection for periods of up to 52 days. Tree cover and terrain are sufficiently dense and rugged to have caused problems. The interpretation of snowlines from satellite data was compared with conventional ground truth data and tested in operational streamflow forecasting models. When the satellite snow-covered area (SCA) data are incorporated in the SSARR (Streamflow Synthesis and Reservoir Regulation) model, there is a definite but minor improvement. T.M.

N82-20622*# National Environmental Satellite Service, Washington, D. C.
APPLICATIONS SYSTEMS VERIFICATION AND TRANSFER PROJECT. VOLUME 6: OPERATIONAL APPLICATIONS OF SATELLITE SNOW-COVER OBSERVATIONS NOAA/NESS SUPPORT STUDY *Final Report, 1 Jan. 1975 - 31 Dec. 1978*
Stanley R. Schneider Dec. 1981 68 p refs 8 Vol.
(NASA Order S-53772)
(NASA-TP-1827; NAS 1.60:1827; Rept-81F0065-Vol-6) Avail: NTIS HC A04/MF A01 CSCL 05B

Geostationary and polar orbiting satellite data from the National Oceanic and Atmospheric Administration were used to operationally provide field hydrologists with basin snowcover percentages for inclusion in runoff models. Data reduction is accomplished thru the use of optical rectification devices and electronic color density slicers. Over two thousand satellite-derived snow maps covering 30 different basins in the western United States were provided to users. Plans for improving snowmapping techniques on computer interactive systems and by all-digital analysis are presented. A description of the newest generation of NOAA polar orbiters, TIROS-N, and its potential for snowmapping is reviewed. Snowcover percentages for all basins determined between November 1974 and July 1978 are presented in tabular format. J.M.S.

N82-20623*# Ecosystems International, Inc., Gambrills, Md.
APPLICATIONS SYSTEMS VERIFICATION AND TRANSFER PROJECT. VOLUME 7: COST/BENEFIT ANALYSIS FOR THE ASVT ON OPERATIONAL APPLICATIONS OF SATELLITE SNOW-COVER OBSERVATIONS
P. Castruccio, H. Loats, D. Lloyd, and P. Newman Dec. 1981 245 p refs 8 Vol.
(Contract NAS5-23729)
(NASA-TP-1828; NAS 1.60:1818; Rept-81F0066-Vol-7) Avail: NTIS HC A11/MF A01 CSCL 08L

The results of the OASSO ASVT's were used to estimate the benefits accruing from the added information available from satellite snowcover area measurement. Estimates of the improvement in runoff prediction due to addition of SATSCAM were made by the Colorado ASVT personnel. The improvement estimate is 6-10%. Data were applied to subregions covering the Western States snow area amended by information from the ASVT and other watershed experts to exclude areas which are not impacted by snowmelt runoff. Benefit models were developed for irrigation and hydroenergy uses. The benefit/cost ratio is 72:1. Since only two major benefit contributors were used and since the forecast improvement estimate does not take into account future satellite capabilities these estimates are considered to be conservative. The large magnitude of the benefit/cost ratio supports the utility and applicability of SATSCAM. T.M.

N82-20624*# Environmental Research and Technology, Inc., Concord, Mass.
APPLICATIONS SYSTEMS VERIFICATION AND TRANSFER PROJECT. VOLUME 8: SATELLITE SNOW MAPPING AND RUNOFF PREDICTION HANDBOOK
Clinton J. Bowley, James C. Barnes, and Albert Rango (NASA. *Goddard Space Flight Center*) Dec. 1981 98 p *refs* 8 Vol.
(Contract NAS5-24410)
(NASA-TP-1829; NAS 1.60:1829; Rept-81F0067-Vol-8) Avail: NTIS HC A05/MF A01 CSCL 08L

The purpose of the handbook is to update the various snowcover interpretation techniques, document the snow mapping techniques used in the various ASVT study areas, and describe the ways snowcover data have been applied to runoff prediction. Through documentation in handbook form, the methodology developed in the Snow Mapping ASVT can be applied to other areas. T.M.

N82-20807*# Morgan State Univ., Baltimore, Md. Dept. of Mathematics and Computer Science.
ASSESSMENT OF THE QUALITY OF GATE AREA RAINFALL DATA FROM A NIMBUS-5 RADIOMETER Final Report
Nathaniel Knox 31 Mar. 1982 18 p refs
(Grant NAG5-14)
(NASA-CR-168512; NAS 1.26:168512) Avail: NTIS HC A02/MF A01 CSCL 04B

The quality of rainfall intensity estimates derived from passive microwave measurements by the Electrically Scanned Microwave Radiometer (ESMR-5) aboard the NIMBUS-5 satellite was evaluated. The microwave measurements used are those coincident with the GARP (Global Atmospheric Research Program) Atlantic Tropical Experiment (GATE). ESMR-5 derived rainfall intensity estimates are compared with hourly averaged GATE radar rainfall measurements. Using the radar measurements as ground truth it is determined that with the transfer curve derived herein the ratio (ESMR-5 derived rain rate)/radar measured rain rate has a mean of approximately 0.62. Author

N82-20822# Digital Programming Services, Inc., Waltham, Mass.
DEVELOPMENT AND APPLICATIONS OF TECHNIQUES TO PROCESS HYDROMETEOR DISTRIBUTION DATA Final Report, 1 May 1978 - 31 Jul. 1981
Lawrence E. Belksy, Fredric B. Kaplan, James P. Lally, D. Keith Roberts, and Terence OToole 31 Jul. 1981 636 p
(Contract F19628-78-C-0131; AF Proj. 627A)
(AD-A109929; AFGL-TR-81-0261) Avail: NTIS HC A99/MF A01 CSCL 04/2

This report summarizes the mathematical procedures used on a variety of standard and non-standard cloud physics data. It includes the complete descriptions and operating instructions for all programs developed under this contract. GRA

N82-21680*# Hydex Corp., Fairfax, Va.
STRATEGIES FOR USING REMOTELY SENSED DATA IN HYDROLOGIC MODELS Final Report
E. L. Peck, T. N. Keefer, and E. R. Johnson, Principal Investigators 31 Jul. 1981 85 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS5-26446; Proj. AgRISTARS)
(E82-10156; NASA-CR-166729; NAS 1.26:166729) Avail: NTIS HC A05/MF A01 CSCL 05B

Present and planned remote sensing capabilities were evaluated. The usefulness of six remote sensing capabilities (soil moisture, land cover, impervious area, areal extent of snow cover, areal extent of frozen ground, and water equivalent of the snow cover) with seven hydrologic models (API, CREAMS, NWSRFS, STORM, STANFORD, SSARR, and NWSRFS Snowmelt) were reviewed. The results indicate remote sensing information has only limited value for use with the hydrologic models in their present form. With minor modifications to the models the usefulness would be enhanced. Specific recommendations are made for incorporating snow covered area measurements in the NWSRFS Snowmelt model. Recommendations are also made for incorporating soil moisture measurements in NWSRFS. Suggestions are made for incorporating snow covered area, soil moisture, and others in STORM and SSARR. General characteristics of a hydrologic model needed to make maximum use of remotely sensed data are discussed. Suggested goals for improvements in remote sensing for use in models are also established. Author

N82-21704# National Academy of Sciences - National Research Council, Washington, D. C.
REMOTE SENSING FOR WATER RESOURCES AND HYDROLOGY: AN ASSESSMENT OF THE CORPS OF ENGINEERS' PROGRAM Final Report
Nov. 1981 53 p refs
(Contract Dacw72-81-M-0342)
(PB82-137142) Avail: NTIS HC A04/MF A01 CSCL 13B

The U.S. Army Corps of Engineers' program of research and development and technology transfer on the application of remote sensing to problems of water resources and hydrology is reviewed. The Corps' current program consists of work units (coastal engineering, flood prediction and management, hydrology, environmental assessment, and development of techniques and equipment). Current research programs are reviewed and recommendations are made. Author (GRA)

N82-21774*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LABORATORY UPWELLED RADIANCE AND REFLECTANCE SPECTRA OF KERR RESERVOIR SEDIMENT WATERS
William G. Witte, Charles H. Whitlock, W. Douglas Morris, and E. A. Gurganus Mar. 1982 22 p refs
(NASA-TP-1993; L-14992; NAS 1.60:1993) Avail: NTIS HC A02/MF A01 CSCL 13B

Reflectance, chromaticity, and several other physical and chemical properties were measured for various water mixtures of bottom sediments taken from two sites at Kerr Reservoir, Virginia. Mixture concentrations ranged from 5 to 1000 ppm by weight of total suspended solids (TSS) in filtered deionized tap water. The two sets of radiance and reflectance spectra obtained were similar in shape and magnitude for comparable values of TSS. Upwelled reflectance was observed to be a nonlinear function of TSS with the degree of curvature a function of wavelength. Sediment from the downstream site contained a greater amount of particulate organic carbon than from the upstream site. No strong conclusions can be made regarding the effects of this difference on the radiance and reflectance spectra. Near-infrared wavelengths appear useful for measuring highly turbid water with concentrations up to 1000 ppm or more. Chromaticity characteristics do not appear useful for monitoring sediment loads above 150 ppm. Author

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07
DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A82-19833 † Optimal methods of computerized image conversion (Ob optimal'nykh sposobakh preobrazovaniia izobrazhenii na EVM). V. I. Krasnov, S. L. Krylov, and B. I. Savel'ev. *Geodeziia i Kartografiia,* Dec. 1981, p. 34-38. In Russian.

It is noted that digital methods of processing images are far more effective than analog methods. Because of the machine time required, however, these methods are less economical. A general model of image conversion using a computer and an input-output device for the images is considered. C.R.

A82-20347 † Diffusion model of cloud cover and its use in the analysis of satellite operations (Diffuzionnaia model' oblachnosti i ee ispol'zovanie pri analize raboty ISZ). V. K. Saul'skii. *Issledovanie Zemli iz Kosmosa,* Nov.-Dec. 1981, p. 73-78. In Russian.

A diffusion model is developed which can be used to analyze the effects of cloud cover on satellite observations of the earth surface. Cloud cover values are modeled as a continuous Markov process of diffusion type which is completely characterized by two parameters: the transport coefficient and the diffusion coefficient. The application of this model to operations involving the remote sensing of earth resources is considered. B.J.

A82-20401 The accuracy potential of the modern bundle block adjustment in aerial photogrammetry. A. Grün (München, Technische Universität, Munich, West Germany). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 45-54. 24 refs.

The use of orthogonal bivariate polynomials as an additional parameter set, together with a gross error detection strategy, are shown to be necessary for self-calibrating bundle block adjustment photogrammetry accuracy. This is illustrated by the processing of data from four test field blocks, gathered by means of three different camera systems, proving empirically that 2.5-micron planimetry and 4.5-micron height accuracies can be achieved for photogrammetric coordinates. The use of dense control and 60/60% overlap, together with the additional parameter set, are demonstrated to be essential for the continuous achievement of such accuracy levels. These results are judged to carry analytical photogrammetry into such new fields of application as network densification and cadastral surveying. O.C.

A82-20402 Analytical triangulation of space photography. M. E. O. Ali (Gendron, Lefebvre, Inc., Laval, Quebec, Canada) and A. J. Brandenberger (Université Laval, Quebec, Canada). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 55-65. 12 refs. Research sponsored by the Department of Energy, Mines and Resources and National Research Council of Canada.

A computer program implementing a mathematical model is used to assess the accuracy of analytical aerial triangulation using Skylab photography combined with high-altitude aircraft photography and Skylab orbital parameters. Two novel bundle adjustment methods are employed: (1) in which the coordinates of the ground control as well as the photo measurements are used as observations in the collinearity condition equations, and (2) in which the camera parameters, control point ground coordinates and the photo measurements are used as observations in the equations. The former method yielded root mean square errors of 53 m in planimetry and 148 m in height. Comparisons of tests to which both bundle adjustment methods were submitted show a significant improvement in planimetric accuracy with the latter method, although this may be due to inherent Skylab mission difficulties. O.C.

A82-20403 Calibration and model reconstruction in analytical close-range stereophotogrammetry. I - Mathematical fundamentals. W. Frobin and E. Hierholzer (Orthopädische Universitätsklinik, Münster, West Germany). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 67-72. 10 refs. Research supported by the Deutsche Forschungsgemeinschaft.

A discussion is presented on the application of the photogrammetric bundle method to close-range problems, with respect to (1) stereophotography, (2) rasterstereography, or the use of a projected grid in stereophotogrammetry, (3) moiré topography, and (4) stereoradiography. After giving the mathematical principles of the method in a form appropriate for application to most close-range problems, a simplified procedure which employs alternating orientation and reconstruction steps is described. In addition, a discussion on the convergence of the solution of the bundle equations and an error analysis are given. O.C.

A82-20404 The location of three-dimensional linear objects by using multiple projections. S. Kondo, R. Ohba, and K. Murata (Hokkaido University, Sapporo, Japan). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 73-79. 10 refs.

A novel method is proposed which determines the least-squares position of a point, a straight line or a curved line by means of plural projections. The method is characterized by the following features: (1) the influence of errors on measurements is minimized, since the result is obtained as the least-squares solution for all data points; (2) the relative positions of data points on the object are unnecessary for every projection; (3) the cost function value at the termination of iterative calculation indicates the variance of the distances between data lines and the least-squares position; (4) the number of calculations increases as more projections and data lines are acquired for higher accuracy; and (5) in the case of a complex object, it is often difficult to select the initial simplex within the domain of the peak containing the minimum cost function value. O.C.

A82-20409 The use of digital multi-date Landsat imagery in terrain classification. H. Schreier, L. M. Lavkulich (British Columbia, University, Vancouver, Canada), and L. C. Goodfellow (Canada Centre for Remote Sensing, Ottawa, Canada). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 111-119. 21 refs. Research supported by the Defence Research Establishment.

A quantitative assessment was made of organic terrain in northern Canada, in order to predict off-road mobility conditions, by using multi-date satellite imagery which provides contrast between vegetation communities and surface materials. A principal component analysis was used to identify the two most important MSS bands for each image, and selected spectral data from two images were then combined and subjected to an unsupervised cluster analysis. The resulting, color-coded images were then related to ground conditions, and were found to be directly useful as thematic mobility maps for operational planning in such environments. O.C.

A82-20410 Techniques for combining Landsat and ancillary data for digital classification improvement. C. F. Hutchinson (Arizona, University, Tucson, AZ). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 123-130. 17 refs. Research supported by the U.S. Geological Survey.

Such ancilliary data as digitized maps and terrain elevation data are combined with Landsat data in order to improve the digital classification in natural resource inventories. The combined data have been used in (1) preclassification scene stratification; (2) postclassification class sorting; and (3) classification modification through increases of the number of observation channels, the modification of prior probabilities, or the addition of a second stage to the classification. The two former uses of the data are found to be efficient, yet unsophisticated due to their reliance on deterministic decision rules. Of the later uses, stratification of the sample used for training by the ancilliary data is found to improve accuracy, as do the altering of prior probabilities and the incorporation of distribution models at the expense of additional sampling. O.C.

A82-20411 Sampling for thematic map accuracy testing. G. H. Rosenfield, K. Fitzpatrick-Lins, and H. S. Ling (U.S. Geological Survey, National Mapping Div., Reston, VA). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 131-137. 13 refs.

The cumulative binomial distribution is used in thematic map accuracy testing to develop (1) the minimum sample size needed to

validate the accuracy for each category with specified confidence, and (2) the critical level, which is used as the criterion for determining whether the identification from remotely sensed data of a thematic category meets a specified accuracy. The algorithm used in map accuracy testing employs a stratified, systematic, unaligned sampling technique based on the map as a whole, and an additional random sample of points for under-represented categories from all points in that category. Such a technique is implemented by a computer program prepared to select the sample from the Geographic Information Retrieval and Analysis System file. The estimated overall accuracy of the map, and the estimated accuracy for each category of the map, are considered, with associated confidence limits. O.C.

A82-20423 * Contrast reduction by the atmosphere and retrieval of nonuniform surface reflectance. Y. Mekler (Tel Aviv University, Tel Aviv, Israel) and Y. J. Kaufman (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD). *Applied Optics,* vol. 21, Jan. 15, 1982, p. 310-316. 21 refs.

A radiative transfer model is developed which gives the upward radiance at nadir for any 1-D Lambertian surface reflectance. This model is used to depict the atmospheric effect on the transmittance of contrast for any 1-D surface reflectance. Here by contrast we mean a general variation of the radiation field across the image. With the aid of this model an inversion algorithm is developed for retrieval of true surface reflectance from high resolution satellite data (e.g., Landsat). This inversion technique can be a useful tool for extraction of surface reflectance from satellite data in the case of a surface reflectance variable in one dimension only (e.g., seashore or near borders of big fields). A sensitivity study of the inversion procedure on the knowledge of atmospheric parameters and sensor calibration was performed. It is shown that this inversion technique is stable even in the presence of errors in the sensor calibration and the atmospheric parameters. The method was applied to Landsat data in two wavelengths. The results show reasonable dependence of the derived surface reflectance on the distance from the seashore.
(Author)

A82-21039 * # Comparison of sigma/deg/ obtained from the conventional definition with sigma/deg/ appearing in the radar equation for randomly rough surfaces. D. M. LeVine (NASA, Goddard Space Flight Center, Greenbelt, MD). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 85-90. 18 refs.

Results from the radar cross section of rough surfaces calculated from a conventional definition and from a direct solution of the radar equation are compared. The purpose is to define conditions under which the conventional solution produces the same cross-section as the radar equation. A randomly rough conduction surface is considered for line sources and corrugated surfaces. Two problems are analyzed: first, a plane wave is assumed to be incident on the surface and the observed scattered fields are computed, and second, the scattered fields received by an antenna colocated with the emitting antenna are used to compute the available power. The fields are assumed to scatter incoherently and the stationary points are assumed to be homogeneously distributed over the surface. The cross sections are found to be equal if the observer is far from the surface compared to the radii of the surface at the specular points. M.S.K.

A82-21040 Maximum likelihood estimation of label imperfection probabilities and its use in the identification of mislabeled patterns. C. B. Chittineni (Conoco, Inc., Exploration Research Div., Ponca City, OK). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 99-111. 18 refs.

The estimation of recognition system performance and of the probabilities of label imperfections as maximum likelihood estimates from the classifier decisions of labeled and unlabeled patterns are considered. The classification of a set of labeled and unlabeled patterns are used to derive the maximum likelihood estimates of classification errors and a priori probabilities. Additionally, expressions for the asymptotic variances of probability of correct classification and proportions are presented. Imperfection in the labels are assumed, and simple models are developed for imperfections in the labels and classification errors. Dependencies between the imperfect, classifier, and true labels, and between the probabilities of label imperfections and the classification accuracies are accounted for. The techniques developed are applicable for processing remotely sensed multispectral data. M.S.K.

A82-21041 Exterior algebraic processing for remotely sensed multispectral and multitemporal images. M. Inamura, H. Toyota, and S. Fujimura (Tokyo, University, Tokyo, Japan). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 112-118. 5 refs. Research supported by the Japan Research Committee of Environmental Remote Sensing.

The application of Grassmann algebra to multispectral, multitemporal image processing is examined. The use of an exterior product, an inner product, and an inner product between two exterior products is introduced, and it is shown that a multispectral image and spectral images or a monochromatic image are representable by a vector image and a scalar image, respectively. The advantages of employing algebraic, as opposed to statistical, image processing are the simplicity of the algorithm because only the statistical mean values are used, and exterior image processing involves the algebraic relationship among spectral vectors or feature vectors. The method is noted to be the equivalent of a normalized correlation method. M.S.K.

A82-21089 Information extraction from remotely sensed data - A user view. J. Townshend (Reading University, Reading, Berks., England) and C. Justice (ESA, European Space Research Institute, Frascati, Italy). *(Remote Sensing Society, Conference on Image Processing - Enhancement or Degradation, University of London, London, England, Nov. 14, 1980.) International Journal of Remote Sensing,* vol. 2, Oct.-Dec. 1981, p. 313-329. 78 refs.

Digital image processing refers to a variety of transformations and manipulations for improving the ability to extract information from imagery. It is often difficult for the user to select the most suitable approach in computer-assisted information extraction. More objective assessments of the relative utility of the different supervised, unsupervised, and hybrid approaches, as well as the individual stages within each of them, is therefore required. The ultimate use of the information extracted from the data is also affected by its compatability with other geographical data planes. Four alternative strategies for incorporating remote sensing data into comprehensive automated geographic information systems are suggested, each of which differ according to flexibility and the quantity of data to be processed and stored. Finally, the success of image analysis and classification methods depends on the relationship between the capabilities of the sensing systems and the character of the phenomena being studied. J.F.

A82-21094 The use of contextual information to improve land cover classification of digital remotely sensed data. C. M. Gurney (Reading, University, Reading, Berks., England). *International Journal of Remote Sensing,* vol. 2, Oct.-Dec. 1981, p. 379-388. 12 refs. Research supported by the Atomic Energy Research Establishment.

Errors frequently occur in land cover classifications which use remotely sensed data. Where the error is assumed to conform to particular spatial patterns, automated contextual correction methods may be applied. Various types of classification errors are described first, and possible contextual correction methods are suggested. Accuracy testing procedures applied both before and after correction are described. The error correction methods were applied to urban:nonurban classifications of four sets of Landsat data of the United Kingdom. The results of linear feature detection were added to the urban classification to reduce the confusion between roads and urban areas. The results were smoothed, and the objects below a given size were removed. Increases in accuracy were obtained which were statistically significant at the 95% confidence level. J.F.

A82-21398 Digital photography techniques (Digitale Aufnahmetechnik). O. Hofmann (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany). *Bildmessung und Luftbildwesen,* vol. 50, Jan. 1, 1982, p. 16-32. 9 refs. In German.

Optoelectronic digital imagery technology has been developed for photographing the earth's surface from the air. The cameras operate according to a push-broom principle with high resolution,

linear semiconductor photodetector arrays. Based on a successful 1978 flight, the Modular Optoelectric Multispectral Scanner (MOMS) was developed, which will be used on the SPAS platform of the 1983 Space Shuttle. Image data are recorded directly on high-density digital tapes, which are later transcribed on computer-compatible tapes for further processing. The image data are produced in graphic form in black-and-white or color by means of a raster plotter. Solutions are still being sought to handle the large data rates and storage requirements as well as to correct the geometric distortions of the scanning lines. J.F.

A82-22146 * Registration of heat capacity mapping mission day and night images. K. Watson, S. Hummer-Miller, and D. L. Sawatzky (U.S. Geological Survey, Denver, CO). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 263-268. 14 refs. NASA Order S-40256-B.

Registration of thermal images is complicated by distinctive differences in the appearance of day and night features needed as control in the registration process. These changes are unlike those that occur between Landsat scenes and pose unique constraints. Experimentation with several potentially promising techniques has led to selection of a fairly simple scheme for registration of data from the experimental thermal satellite HCMM using an affine transformation. Two registration examples are provided. (Author)

A82-22891 # Classification of ice radar imagery. G. Y. Tang (National Taiwan University, Taipei, Republic of China). *Republic of China, National Science Council, Proceedings, Part A: Applied Sciences,* vol. 5, Oct. 1981, p. 287-296. National Science Council of Republic of China Grant No. 70-0404-E002-09; NSF Grant No. ECS-80-06884.

The development of algorithms for computerized radar ice-imagery processing is presented. Initial attempts have involved the establishment of statistical parameters for discerning different ice features from the radar images. Radar imagery is gathered by either side-looking airborne radar (SLAR) or by synthetic aperture side-looking airborne radar (SAR), with coordinates chosen as azimuth (flight path) and range direction, the direction of sensing. SLAR produces a two-dimensional image of the reflectivity distribution of the ground, while higher resolution has allowed SAR applications in satellites. Seasat-1 SAR images are cited as examples for grey level categorization of surface features, and analysis indicates that mean and variance of grey levels serve best for classification. M.S.K.

A82-25139 Multispectral texture. A. Rosenfeld (Maryland, University, College Park, MD), A. Y. Wu (Maryland, University, College Park, MD; American University, Washington, DC), and C.-Y. Wang. *IEEE Transactions on Systems, Man, and Cybernetics,* vol. SMC-12, Jan.-Feb. 1982, p. 79-84. 5 refs. Grant No. AF-AFOSR-77-3271.

Textures in single-band images are often characterized by statistics of the joint distributions of pairs of gray levels for pairs of pixels in given relative positions, or by statistics of absolute gray level differences for such pairs of pixels. Joint distributions of pairs of spectral vectors in multiband images are cumbersome, since for k bands they are 2k-dimensional, but absolute difference distributions are less so, e.g., for two bands they are only two-dimensional. The possibility is discussed of using statistics of absolute difference distributions for characterizing textures in multiband images, with emphasis on the two-band case. (Author)

A82-25454 Increase in correlation accuracy of remote sensing imagery by digital filtering. M. Ehlers (Hannover, Universität, Hanover, West Germany). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Mar. 1982, p. 415-420. 8 refs.

For correlation of remote sensing photographs of Wetlands, a concept for rectification on a common reference image was developed at the University of Hanover. The results of two objective functions after previous filtering are compared to those obtained without filtering. It is shown that the accuracy and efficiency of the objective function at the correlation process is essentially increased by a low pass filter. (Author)

A82-25455 * Modeling misregistration and related effects on multispectral classification. F. C. Billingsley (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Mar. 1982, p. 421-430. Contract No. NAS7-100.

Misregistration is but one of a group of parameters (noise, class separability, spatial transient response, field sizes) affecting the accuracy of multispectral classification. The entire group must be considered simultaneously. Any noise in the measurements (due to the scene, to the sensor, or to the analog/digital conversion) will cause a finite fraction of the measurements to fall outside of the classification limits, even within nominally uniform fields. For field boundaries, where the effects of misregistration are felt, additional pixels will be misclassified due to the mixture of materials in the pixels. Misregistration causes field borders in a given (set of) band(s) to be closer than expected to a given pixel, causing additional pixels to be misclassified. Simplified models of the various effects are used to gain conceptual understanding and to estimate the performance to be expected. (Author)

A82-25456 * Using known map category marginal frequencies to improve estimates of thematic map accuracy. D. H. Card (NASA, Ames Research Center, Moffett Field, CA). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Mar. 1982, p. 431-439. 10 refs.

By means of two simple sampling plans suggested in the accuracy-assessment literature, it is shown how one can use knowledge of map-category relative sizes to improve estimates of various probabilities. The fact that maximum likelihood estimates of cell probabilities for the simple random sampling and map category-stratified sampling were identical has permitted a unified treatment of the contingency-table analysis. A rigorous analysis of the effect of sampling independently within map categories is made possible by results for the stratified case. It is noted that such matters as optimal sample size selection for the achievement of a desired level of precision in various estimators are irrelevant, since the estimators derived are valid irrespective of how sample sizes are chosen. O.C.

A82-26050 A procedure for the interactive tracing of edges and lines by means of digital image processing (Ein Verfahren zur interaktiven Verfolgung von Kanten und Linien mit den Mitteln der Digitalen Bildverarbeitung). B.-S. Schulz (Institut für angewandte Geodäsie, Frankfurt am Main, West Germany). *Bildmessung und Luftbildwesen,* vol. 50, Mar. 1, 1982, p. 69-79. 18 refs. In German.

The considered procedure is partly related to the realization that object boundaries in an aerial photograph can be determined only on the basis of density discontinuities. The method has been developed for the calculation and the tracing of edges. In the study of cartographic objects, a special case involves conditions in which object width and image element size are approximately equal. Such problems can also be solved with the aid of the reported method. The strategy of line tracing is considered, taking into account the utilization of a 3 x 3 matrix. A preprocessing step is employed to close small gaps automatically and to delete inadmissible line connections. With an arbitrary starting point on the line, the line is followed to the end or to a point where an interruption occurs. Aspects of method implementation are illustrated with the aid of specific examples. G.R.

A82-26726 † Methods for the processing of synthetic-aperture radar signals when solving problems of the national economy /Review/ (Sposoby obrabotki signalov radiolokatorov s sintezirovannoi aperturoi pri reshenii narodnokhoziaistvennykh zadach /Obzor/). V. B. Shteinshleiger, A. N. Erkin, P. S. Lifanov, G. S. Misezhnikov, and A. V. Ianovich. *Radiotekhnika i Elektronika,* vol. 27, Feb. 1982, p. 193-213. 34 refs. In Russian.

The paper examines and compares various signal processing methods for synthetic-aperture radar systems used in the remote sensing of earth resources. Attention is given to optical processing, processing using CRTs with memory, and digital and hybrid processing. B.J.

A82-26840 An automatic optimum kernel-size selection technique for edge enhancement. P. Chavez, Jr. (U.S. Geological Survey, Flagstaff, AZ) and B. Bauer (U.S. Geological Survey, EROS Data Center, Sioux Falls, SD). *Remote Sensing of Environment,* vol. 12, Mar. 1982, p. 23-38. 5 refs. Research supported by the U.S.

Geological Survey.

An automatic optimum kernel-size selection technique for edge enhancement is presented, which is a correction for the modulation transfer function of an imaging system to a first order. The horizontal first difference is used to automatically select the optimum kernel size to enhance the edges contained in the image. The technique is easy to implement, works on a one-line-in/one-line-out basis, and the first difference and the subtractive rectangular filter are both efficient and simple. D.L.G.

A82-26841 A relation between Landsat digital numbers, surface reflectance, and the cosine of the solar zenith angle. W. S. Kowalik, S. E. Marsh (Stanford University, Stanford, CA; U.S. Geological Survey, Washington, DC), and R. J. P. Lyon (Stanford University, Stanford, CA). *Remote Sensing of Environment*, vol. 12, Mar. 1982, p. 39-55. 23 refs. Research supported by the U.S. Geological Survey.

A method for estimating the reflectance of ground sites from satellite radiance data is proposed and tested. The method uses the known ground reflectance from several sites and satellite data gathered over a wide range of solar zenith angles. The method was tested on each of 10 different Landsat images using 10 small sites in the Walker Lake, Nevada area. Plots of raw Landsat digital numbers (DNs) versus the cosine of the solar zenith angle (cos Z) for the test areas are linear, and the average correlation coefficients of the data for Landsat bands 4, 5, 6, and 7 are 0.94, 0.93, 0.94, and 0.94, respectively. Ground reflectance values for the 10 sites are proportional to the slope of the DN versus cos Z relation at each site. The slope of the DN versus cos Z relation for seven additional sites in Nevada and California were used to estimate the ground reflectances of those sites. The estimates for nearby sites are in error by an average of 1.2% and more distant sites are in error by 5.1%. The method can successfully estimate the reflectance of sites outside the original scene, but extrapolation of the reflectance estimation equations to other areas may violate assumptions of atmospheric homogeneity. (Author)

A82-27505 † The effectiveness of instrumented visual studies of the earth from space (Ob effektivnosti vizual'no-instrumental'nykh issledovanii zemli iz kosmosa). V. V. Kovalenok, A. D. Koval', and A. A. Tishchenko. In: Scientific lectures on aviation and astronautics 1980. Moscow, Izdatel'stvo Nauka, 1981, p. 39-49. In Russian.

Recommendations are presented on the equipment required for making visual observations of the earth's surface from orbital space stations. Attention is given to the effectiveness of human vision with regard to the interpretation, recognition, and study of various types of earth resources and terrestrial phenomena in a wide range of observation conditions. General criteria are developed for the quantitative assessment of the effectiveness of visual-observation systems. B.J.

A82-27587 # Context dependent modeling. P. R. Beaudet (Business and Technological Systems, Inc., Seabrook, MD). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 145-164. 23 refs.

In connection with remote-sensing operations, the need arises to incorporate a priori knowledge in the interpretation of the digital images in order to gain complete understanding of the data that is present. This need to incorporate a priori knowledge is found in every part of the processing algorithm. As a consequence, context-dependent modeling is much utilized today as a means of incorporating a priori knowledge in the interpretation process. In most of the context-dependent work, the information extraction process is partitioned into a set of parallel feature extraction routines embedded in a decision tree network. The notion of context-dependent modeling, as it applies to processing algorithms, is considered along with the role of a priori knowledge, and data interpretive tools. G.R.

A82-27590 # Operational resampling for correcting images to a geocoded format. D. E. Friedmann (MacDonald, Dettwiler and Associates, Ltd., Richmond, British Columbia, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 195-212. 24 refs. Research supported by the Department of Industry, Trade and Commerce. DITC Project 534-3203.

Accompanying the improved satellite imagery provided in connection with new remote-sensing developments is the increasing compilation of detailed, geographically oriented data bases from disparate sources. Image correction must evolve to cope with the new sources of data. Precision processed images with map accuracies are now available for a variety of remote sensing applications. In connection with a study of the new developments, it becomes apparent that geometric correction must be expanded to yield satellite independent images. These geocoded images are precision images that have been rotated through the spacecraft heading angle so that they are aligned with the output map projection. Attention is given to the theoretical arguments for validating one-dimensional precision processing of imagery data from present and future sensors. It is shown that a radiometrically and geometrically accurate geocoded image can be obtained by a series of three one-dimensional resampling passes. G.R.

A82-27607 # Towards an operational SPOT system - A preliminary assessment. G. Brachet and P. Gonfreville (Centre National d'Etudes Spatiales, Paris, France). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 445-460.

A description is presented of the SPOT system, whose operation is scheduled to begin in 1984 and which comprises both earth observation satellites and ground stations offering the greatest achievable adherence to user requirements. The vertical and oblique viewing capability of the system will minimize the time interval between consecutive observations of the same area. Stereoscopic image pairs will be obtained by oblique observations of a given area during different satellite passes, and the 10-m resolution offered will permit operations on a 1/50,000-scale and even 1/25,000-scale, in some cases. It is expected that renewable resources management will gradually replace the creation of image data banks for mining and oil companies, which will represent the system's principal activity during its first years of existence. O.C.

A82-27623 # Enhancement of Landsat data for Hudson Bay lowlands vegetation. I. L. Johnston and P. J. Howarth (McMaster University, Hamilton, Ontario, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 623-633. 18 refs. Research supported by McMaster University; Natural Sciences and Engineering Research Council of Canada Grant No. A-5586.

The two basic methods of Landsat digital analysis include classification and enhancement. In classification, spectral data are statistically sorted and displayed as different colors or symbols on a CRT monitor or line printer. There are sometimes difficulties related to the assignment of a unique description or to interpretation. In order to overcome these problems, image enhancement has been developed as a second and complementary method of digital analysis. Image enhancement maximizes the visual information presented on the CRT monitor so that subtle details in the image are clearly displayed. The present investigation is concerned with the assessment of the capabilities of three Landsat digital enhancements to differentiate major land cover types in a remote subarctic environment, giving attention to linear contrast stretch, band ratioing, and video filtering. G.R.

A82-27625 # An evaluation of the utility of smaller Landsat resolution elements /Resolution of Landsat resolution/. R. F. Hyde, N. J. Vesper, and I. A. Goldblatt (Butler University, Indianapolis, IN). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 647-652.

The considered project has the objective to make definitive statements on the spatial resolution level requirements or the optimum pixel size for several of the high volume Landsat data user

disciplines. Several issues are examined in anticipation of future and proposed satellite derived smaller pixels (or ground resolution levels). This is accomplished by the construction of a detailed database which combines the two technical philosophies associated with Landsat data analysis and application, with Geographic Information System database development. Aspects of methodology are considered. In connection with a discussion of data base construction, attention is given to design, encoding, and computer generating. Questions of aggregation to various pixel sizes are considered along with the assignment of reflectance values, the classification of each new pixel resolution, and the interpretation of aggregate levels. G.R.

A82-27626 # **The use of digital terrain model in the rectification of satellite-borne imagery.** F. Wong, R. Orth, and D. E. Friedmann (MacDonald, Dettwiler and Associates, Ltd.; Richmond, British Columbia, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 653-662. 8 refs. Research supported by the Industrial Research Assistance Program.

The present investigation is concerned with the precision geometric rectification of satellite-borne imagery, including correction for relief displacement with the use of a digital terrain model. While relief displacement error is small in Multispectral Scanner System (Landsats -1, -2, and -3) imagery, it will become significant in imagery from future sensors due to increased resolution (Thematic Mapper on Landsat-D) and off-nadir pointing capabilities (linear arrays on SPOT). It is shown how the slow varying geometric distortion correction can be separated from the fast varying relief displacement correction. Experiments illustrate that subpixel geometric rectification accuracy can be achieved even in areas of severe high relief provided an accurate digital terrain model is used during the correction process. G.R.

A82-27629 # **An approach to path radiance correction in MSS images.** M. Onitsuka, K. Ohta (National Research Institute for Pollution and Resources, Yatabe, Ibaraki, Japan), N. Okami (Institute of Physical and Chemical Research, Wako, Saitama, Japan), and J. R. Miller (York University, Downsview, Ontario, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 681-689. 10 refs.

Problems related to providing accurate corrections for atmospheric scattering are a major obstacle to the use of remote sensing for determining changes in water quality with time. In the present investigation, published path radiance determinations are used to derive relationships which describe the systematic variation in the path radiance. Empirical equations are derived to relate the path radiance in Landsat bands 4, 5, and 6 to the path radiance in band 7. The algorithms are applied to a number of Landsat images acquired over Japanese coastal waters. G.R.

A82-27636 # **Strategies and uses of small distributed analysis centers as in the natural resource inventory of Venezuela.** R. J. P. Lyon, K. Lanz (Stanford University, Stanford, CA), and R. Lairet (Ministerio del Ambiente y de los Recursos Naturales Renovables, Caracas, Venezuela). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 751-759.

A82-27651 # **Field-by-field multitemporal analysis of aerial scanner data geometrically corrected by means of a sliding model.** R. Jeansoulin, J.-C. Darcos, and G. Rigal (CNRS, Langages et Systèmes Informatiques; Toulouse, Ecole Nationale Supérieure d'Electrotechnique, d'Electronique, d'Informatique et d'Hydraulique, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 929-938. 6 refs. Research supported by the Centre National d'Etudes Spatiales.

Field-by-field multitemporal analysis is the geometrical processing of multitemporal images of a given scene through automatic registration and overlapping, with emphasis on the processing of information lying within the same geographical entity in order to obtain the population distribution function for every date. Two techniques are proposed to this end: (1) the sliding model, in which a sequence of local, simple and independent models of the relative deformation is computed and adjacent local models are joined by sliding processing; and (2) the field-by-field correction method, which is based on the segmentation of intersecting areas into a reference image, and the assessment of the same area at different dates through computation of local relative deformation with the minimum number of nearest neighbors among the registered control points. O.C.

A82-27654 # **Effect of aerosols on optical remotely sensed data.** W. G. Egan (Grumman Aerospace Corp., Research Dept., Bethpage, NY) and G. E. Shaw (Alaska, University, Fairbanks, AK). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 959-973. 23 refs.

It has been found possible to validate and determine certain characteristics of atmospheric aerosols, as well as to typify their effects, in major experimental tests of two complementary aerosol modeling approaches: (1) the Dave (1972) radiative transfer program, applied to the Caribbean area of St. Thomas in 1972, and (2) the constrained linear inversion method, applied to the continental area of Ft. Collins, Colorado, in 1980. The aerosol optical thickness at 0.5-micron wavelength over Ft. Collins was about 0.07, and about 0.12 over St. Thomas. It is concluded that, by using ground-based observations, the Dave model provides detailed angular variation of sky radiance and solar flux to + or - 20% away from the solar aureole, while the constrained linear inversion model furnishes path-averaged optical depth to + or - 3%, and total downwelling diffuse radiation to + or - 1%, as well as aerosol size distribution. O.C.

A82-27655 # **HCMM night-time thermal IR imaging experiment in Michigan.** R. K. Vincent, J. B. Parrish, D. H. Coupland (Geospectra Corp., Ann Arbor, MI), and E. Jaworski (Eastern Michigan University, Ypsilanti, MI). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 975-980, 983, 984. 7 refs.

The Heat Capacity Mapping Mission satellite's 10.5-12.5-micron thermal IR channel obtained a color level-sliced image of Michigan during an August 21, 1978 overpass. Surface water, including most of the Great Lakes, was warmer than the land mass, and two area types in the southern peninsula of Michigan appear unusually cool: (1) forested valley areas with high soil infiltration rates, in the north-central region; and (2) small, flat, swampy areas in Sanilac County associated with peat bogs. Comparison with actual reported temperatures show an underestimation of temperature by the satellite of up to 8 C, perhaps due to atmospheric effects. O.C.

A82-27666 * # **ELAS - A geobased information system that is transferable to several computers.** S. L. Whitley, R. W. Pearson, B. R. Seyfarth, and M. H. Graham (NASA, National Space Technology Laboratories, Earth Resources Laboratory, Bay St. Louis, MS). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1091-1098.

In the early years of remote sensing, emphasis was placed on the processing and analysis of data from a single multispectral sensor, such as the Landsat Multispectral Scanner System (MSS). However, in connection with attempts to use the data for resource management, it was realized that many deficiencies existed in single data sets. A need was established to geographically reference the MSS data and to register with it data from disparate sources. Technological transfer activities have required systems concepts that can be easily transferred to computers of different types in other organizations. ELAS (Earth Resources Laboratory Applications Software), a geographically based information system, was developed to meet the considered needs. ELAS accepts data from a variety of sources. It contains programs to geographically reference the data to the Universal Transverse Mercator grid. One of the primary functions of ELAS is to produce a surface cover map. G.R.

A82-27667 # **Flexible processing of remote sensing data through integration of image processing and geobased information systems.** W. A. Hallada (Computer Sciences Corp., Silver Spring, MD), F. C. Mertz, L. R. Tinney, M. J. Cosentino, and J. E. Estes (California, University, Santa Barbara, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1099-1111. 13 refs.

Integrating image processing and geobased information systems (GBIS) provides the analyst with many new options and opportunities for processing and using remotely sensed data. Even when remote sensing can provide a crucial input to an analysis, it is not uncommon for this input to be only one of many that must be considered. In a similar manner, many types of data (e.g. terrain and soils) can be very useful when deriving products from remotely sensed data. Research to date indicates that a systems concept employing geobased system and image processing technologies provides a flexible means of analyzing remotely sensed data for purposes of preprocessing, stratification, classification, and modeling. This paper presents examples of the use of an image based information system (IBIS) that allows the spatial integration of remotely sensed imagery with other types of geobased data. An automated cluster labeling procedure, an automated land management system, and an automated fire information management system are discussed within this paper. (Author)

A82-27671 # **Interpretation of Heat Capacity Mapping Mission images over Canada.** J. Cihlar (Canada Centre for Remote Sensing, Applications Div., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1141-1152.

The influence of atmospheric and land surface variables on day and night Heat Capacity Mapping Mission (HCMM) thermal infrared data collected over two Canadian sites is analyzed for confirmation of the thermal inertia concept. Visual analysis of many images and digital nighttime apparent land temperature distribution was dominated by the near-surface air temperature and that the effects of typography, wind, and land cover were primarily indirect. In the daytime, surface cover was the most important variable, mainly because of the role of water in relation to cover type. The effect of soil moisture was very weak. Except for the land/water contrast, surface temperature differences were relatively small. Cloud cover was the dominant feature of daytime and nighttime thermal infrared images. (Author)

A82-27677 # **Classification of Landsat MSS data for surface cover of small areas.** Y. J. Chong, A. C. Yeo, and V. K. Vong (National University of Singapore, Singapore). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1219-1225.

Multispectral scanner data acquired by Landsat 1, 2 and 3 have been studied for path 137 row 56 and path 137 row 57. Software has been developed to process the computer compatible tapes on a user terminal of a general purpose mini-computer utilizing only the standard input/output peripherals. Spectral classification of the data is done by identifying clusters in a four-dimensional vector space. An area of the sea in the vicinity of a tidal gauge station is chosen for study, both at high tide and at low tide. When the classified data is compared with a hydrographic map water depth boundaries are clearly discernible, even though the water in the area being influenced by river discharges is not particularly clear. (Author)

A82-27685 # **An analysis of user requirements for operational land satellite data.** G. W. Spann, N. J. Hooper (Metrics, Inc., Atlanta, GA), and D. J. Cotter (NOAA, National Earth Satellite Service, Washington, DC). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1297-1303.

The National Oceanic and Atmospheric Administration/National Earth Satellite Service (NOAA/NESS), as the agency designated to implement and manage the U.S. operational land remote sensing satellite system, conducted a survey in March, 1980, to determine user needs for land satellite data in the context of an operational system. Analysis of the survey responses indicates that the operational requirements of most users can be met by data similar to that which can be provided by the MSS and/or TM instruments developed by NASA in the Landsat program. The analysis further indicates that users emphasize the timely, reliable delivery of data products as the essential element of an operational land satellite system. (Author)

A82-27686 * # **Precision in the evaluation of Landsat autocorrelation - The terrain effect.** R. G. Craig (Kent State University, Kent, OH). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1305-1314. 14 refs. Contract No. NAS5-26111.

The autocorrelation present in Landsat data can be described by a two-parameter model. Presence of this autocorrelation seriously inflates estimates of the variance of a set of pixels. The degree of inflation is always serious but varies markedly according to the values of the parameters phi and Theta. Thus corrections of the effects of the model require precise estimates of these parameters. Two hypotheses are proposed to explain the variation of phi with location. Several lines of evidence are presented which support the idea that phi is induced directly by the autocorrelation structure of the terrain being sensed. It is suggested that use of this relation will allow economical estimates of phi for any scene of interest. (Author)

A82-27688 # **Natural resources inventories by computer-satellite mapping techniques in Chaco State, Argentine Republic, South America.** A. V. Gustin (State Institute of Ecology, Natural Resources and Technology, Resistencia, Chaco, Argentina) and L. L. Ledesma (National Institute of Agro-Technology, Roque Saénz Peña, Chaco, Argentina; Stanford University, San Francisco, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1327-1338. 9 refs. Research supported by the Quebracho Extract National Commission.

Information from satellites Landsat 1 and Landsat 2, launched by NASA in 1972 and 1975, were used to survey natural resources in Chaco State, Argentine. In order to get map representation by a digital system, computer processing was done defining spectral characteristics (Honey curves) which were used as survey patterns in the digital analysis. Results of this procedure are 1:100,000 and 1:25,000 dotprints maps and slides in false color, with band combination (4, 5, 6, 7). The multispectral analysis of Landsat C.C.T. data has shown to be useful for the characterization and correlation (based on field data, frames interpretation and aerial photo interpretation) for surveying and mapping natural resources in this State, because the site spectral values are well segregated by their own natural characteristics. (Author)

A82-27689 * # **Ground level reflectance measurement techniques - An evaluation with emphasis on the importance of spectral calibration.** M. J. Duggin (New York, State University, Syracuse, NY) and W. R. Philipson (Cornell University, Ithaca, NY). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1339-1352. 36 refs. Research supported by the U.S. Department of Agriculture; Grant No. NGL-33-010-171.

The bandpasses, overflight conditions, and sensor geometry that will provide optimum target discrimination in remote-sensing studies can be determined only from spectral reflectance measurements made for various sun-target-sensor geometries, supplemented by model calculations which can be checked against field data. The accurate measurement of ground reflectance properties is critical to the design of future sensors and to the determination of imaging conditions. The current investigation has the objective to review typical methods of measuring spectral reflectance, to point out some of the problems inherent to reflectance measuring techniques, and to present a method of checking measurement accuracy. G.R.

A82-27693 # Application of machine processing of visible and thermal data to the study of the geothermal area of Cerro Prieto, Mexico. A. Jinich, J. L. Farah, M. Garza, C. Velarde, R. Méndez, J. Rosenblueth (Universidad Nacional Autónoma de México, Villa Obregón, Mexico), R. Alvarez, G. García, R. Hernández, and A. López (Comisión Federal de Electricidad, Mexico). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1387-1396. 13 refs. Research supported by the United Nations. UN Project MEX-120-8-004-05-X.

A82-27698 # Visual and digital analysis of H.C.M.M. data over eastern Canada. F. Bonn, M. Bernier, and R. Brochu (Sherbrooke, Université, Sherbrooke, Québec, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1449-1463. 21 refs. Natural Sciences and Engineering Council Grant No. A-6043.

It is pointed out that the Heat Capacity Mapping Mission (HCMM) has generated a great conceptual and research interest due to its theoretical ability to map subsurface features which were up to now invisible to sensors. A satellite equipped with a thermal channel providing a 12 hour coverage at adequate passing times might be of great value to investigators interested in physical aspects of rocks, soils, and water. The present analysis is concerned with two HCMM scenes, which were acquired on June 6th, 1978 over Montreal and Lake Ontario, and on September 19th, 1978 over the St. Lawrence Valley. A visual analysis of the images is considered, taking into account geology and geomorphology, topography and climate, landuse and human activities, and hydrology and water surfaces. Attention is given to day and night images, the temperature difference image, the thermal inertia image, the digital analysis of a subimage, and observed features unique to HCMM. G.R.

A82-27923 # The role of computer graphics in geographic research. F. T. Aldrich (Arizona State University, Tempe, AZ). In: Computer Graphics Symposium, Phoenix, AZ, April 24, 1982, Proceedings. New York, American Institute of Aeronautics and Astronautics, 1982, p. 38-41. 7 refs.

This paper discusses the way in which a geographer views computer graphics and the role this media plays in applied spatial research. A background perspective is presented which gives the scope of geographic research tasks and a discussion of manual cartographic displays, their characteristics and limitations. Advantages of digital production of conventional graphics is presented as well as a documenting of new capabilities available only by utilizing the media of computer graphics. These new capabilities involved the use of whole surface displays using perspective views, stereo perspective, and 'photogrammetric' surfaces. (Author)

A82-28141 † Correlation identification of stellar configurations for purposes of the coordinate referencing of aerial and space images (Korreliatsionnoe otozhdestvlenie zvezdnykh konfiguratsii dlia tselei koordinatnoi priviazki aerokosmicheskikh snimkov). V. K. Zlobin and V. N. Kobzev. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 83-88. 8 refs. In Russian.

Correlation algorithms are proposed for the identification of stellar configurations in the coordinate referencing of aerial and space remote-sensing images. In order to reduce the number of required computations, an image of the correlation-field fragment is constructed, and a search is carried out for the maximum of the cross correlation function of the real image and the reference image. B.J.

A82-28143 † Characteristics of the use of laser-mirror scanners for image processing in cartography and aerial photography (Osobennosti ispol'zovaniia lazernykh zerkal'nykh skanatorov dlia obrabotki izobrazhenii v kartografii i aerofotos'emke). I. M. Kol'tsov, V. P. Mikheev, and B. S. Rozov. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 94-99. In Russian.

A special-purpose laser-mirror scanner for the processing of aerial photographs is described. The system provides for synphase scanning of two photographs per line, whose length varies automatically from 0.5 to 10 mm. The size of the scanning spot varies from 30 to 300 mm, while the rms error of the position of the raster centers is about 3 microns. A schematic diagram of the scanning system is presented, and the basic characteristics of the scanner are given. B.J.

A82-28144 † Construction of digital models of statistically uniform characteristics on the basis of multispectral space imagery (Postroenie tsifrovykh modelei statisticheski odnorodnykh kharakteristik po spektrozonal'nym kosmicheskim materialam). N. P. Lavrova and G. Ia. Globa. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 99-108. In Russian.

The development of digital terrain models on the basis of multispectral remote-sensing data is considered. It is found that partial multispectral images can be subjected to statistical treatment using microphotometer data. Digital models are constructed for a portion of terrain having statistically uniform characteristics. B.J.

A82-28146 † Construction of a mathematical model for the recognition of identical images on a pair of photographs (O postroenii matematicheskoi modeli opoznavaniia identichnykh izobrazhenii na pare snimkov). I. G. Zhurkin. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 111-119. In Russian.

A82-28343 Earth-scanning satellites lead resource hunt. P. Kinnucan. *High Technology,* vol. 2, Mar.-Apr. 1982, p. 53-60.

Technology to be used for the acquisition of satellite imagery for earth resources applications is discussed. Advanced earth resource satellites to be launched in the 1980s by the United States, France and Japan will incorporate technical innovations increasing the value of satellite imagery for the mapping and monitoring of crops, mineral and petroleum deposits and other resources, including the Thematic Mapper to be carried on board the Landsat D satellites, data relay satellites to be used for image transmission to the ground, the pushbroom scanner to be used on the French SPOT satellites to provide high-resolution panchromatic and stereo images, and night and all-weather coverage offered by radar imaging from the Japanese ERS satellites. These technical innovations, however, raise sensitive issues concerning the need for specialized agricultural and geological satellites, the private operation of the Landsat satellites, the restriction of access to satellite data and national defense. A.L.W.

A82-28467 † Improving the quality of aerial photography /Concerning the 'Basic principles of aerial photography'/ (Povyshat' kachestvo aerofotos'emochnykh rabot /K Vypusku osnovnykh polozhenii po aerofotos'emke/). A. G. Vanin and Iu. I. Poletaev. *Geodeziia i Kartografiia,* Feb. 1982, p. 45-48. In Russian.

The paper reviews the contents of the normative document 'Basic principles of aerial photography', issued by the Krasovskii Institute of Geodesy, Cartography, and Aerial Photography. Particular consideration is given to techniques for improving the quality of aerial photography. B.J.

A82-28468 † Classification of systems for digital terrain simulation (K voprosu klassifikatsii sistem tsifrovogo modelirovaniia rel'efa mestnosti). A. S. Vasmut, A. V. Gusev, and Iu. A. Kravchenko. *Geodeziia i Kartografiia,* Feb. 1982, p. 53-57. 6 refs. In Russian.

A classification scheme for digital terrain models is examined. Particular attention is given to the three main classification characteristics: (1) data structures (the makeup and organization of terrain data interrelationships); (2) mathematical methods (i.e., recovery of relief at the required point); and (3) algorithms of data transformation. Interpolation methods for digital terrain models are considered. B.J.

N82-16437*# Wisconsin Univ. - Madison. Environmental Remote Sensing Center.
WETLAND MAPPING FROM DIGITIZED AERIAL PHOTOGRAPHY
F. L. Scarpace, B. K. Quirk, R. W. Kiefer, and S. L. Wynn, Principal Investigators [1982] 31 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(E82-10019; NASA-CR-164816) Avail: NTIS HC A03/MF A01 CSCL 08B

Aerial photographic imagery of the Sheboygan Marsh in Wisconsin was scanned through three different narrow band interference filters centered at .45, .55, and .65 micrometers. The output data was transformed into log exposures and corrected for lens fall-off. The scanned area was approximately 253 hectares, with each pixel representing an area of 6.0 meters square on the ground. Training sets were extracted from the digital file of the imagery using the map generated from the photointerpretation and computer generated character displays from the digital file as first approximations. From these training sets, statistics were generated to be used with an elliptical classifier. The classifier generated a digital file from which color coded thematic representations of the classifications could be produced. A two stage table-look-up elliptical algorithm was used as the classification procedure. The wetland boundary was easily delineated, but there was difficulty in mapping the boundaries of vegetation within the wetland. A.R.H.

N82-16438*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
PARTIALLY PROCESSED MULTISPECTRAL SCANNER LANDSAT HIGH-DENSITY TAPES REFORMATTING SYSTEM (HDT-AM/AMC) DESIGN SPECIFICATIONS
Omar J. Holguin, Principal Investigator Dec. 1980 37 p ERTS
(Contract NAS9-15800)
(E82-10020; NASA-CR-161046; JSC-17101; LEMSCO-15905) Avail: NTIS HC A03/MF A01 CSCL 05B

The data interface formats and communication conventions used by the system (HDTRS) are defined. They are used to retrieve partially processed MSS and return beam vidicon type data. T.M.

N82-16441*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CNPQ/INPE: LANDSAT SYSTEM Progress Report, 1 Jun. 1980 - 30 Apr. 1981
Nelson deJesusParada, Principal Investigator and Marcio Nogueira Barbosa May 1981 26 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(E82-10023; NASA-CR-164814; INPE-2063-RPE/305) Avail: NTIS HC A03/MF A01 CSCL 05B

The current status of the Brazilian LANDSAT facilities is reported. The activities at the Cuiaba tracking and receiving station, and at the electronic processing and photo laboratories are presented. The image data bank is discussed. Operation statistics are given and include: scenes received and recorded, and scenes converted to images; images distributed to users and revenues; CCT's produced to users and revenues; images and CCT's distributed (summary); and LANDSAT data sales/distribution analysis for the year of 1980. The status of the LANDSAT-D project is also reported. T.M.

N82-16450# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SIMPLIFIED ALGORITHM FOR CALCULATING RADIATIVE TRANSFER IN SATELLITE IMAGES [ALGORITMO SIMPLIFICADO PARA CALCULO DE TRANSFERENCIA RADIATIVA EM IMAGENS DE SATELITE]
L. A. V. Dias, A. E. C. Pereira, and G. Camara Jul. 1981 17 p refs In PORTUGUESE; ENGLISH abstract Presented at the 33rd Reuniao Anual da SBPC, 8-15 Jul. 1981, Salvador, Brazil
(INPE-2169-RPE/385) Avail: NTIS HC A02/MF A01

Temporal variations of Earth's atmosphere may cause problems on remote sensing data analysis of satellites, such as LANDSAT, SKYLAB and NIMBUS-7. The apparent radiance of surface features which an orbiting spacecraft measures differs from the intrinsic surface radiance of the object, due to the presence of the intervening atmosphere of Earth. An algorithm for atmospheric correction is presented. J.D.H.

N82-16452*# Texas Univ. at Arlington. Applied Research Labs.
DIGITAL CORRELATION OF DDRS DATA Final Report, 1 Oct. 1980 - 30 Sep. 1981
Carroll R. Griffin and James M. Estes 24 Nov. 1981 42 p refs
(Contract NAS9-16208)
(NASA-CR-167494; ARL-TR-81-51) Avail: NTIS HC A03/MF A01 CSCL 05B

The reduction of digital SAR (synthetic aperture radar) data to radar images for use in remote sensing applications was investigated. The critical software operations are discussed in detail, and suggestions and recommendations are made for improving the algorithms currently being used. J.M.S.

N82-16677# National Weather Service, Fort Worth, Tex. Scientific Services Div.
WEATHER SATELLITE INTERPRETATION: INTRODUCTION TO WEATHER SATELLITE IMAGERY
David L. Carlson Jun. 1981 54 p refs
(PB82-107657; NOAA-TM-NWS-SR-103; NOAA-81081105) Avail: NTIS HC A04/MF A01 CSCL 04B

This manual was designed to be a basic self-study course for the new GOES (Geostationary Operational Environmental Satellite). They may also be referred to as SMS, Synchronous Meteorological Satellite. Five GOES satellites launched by the U.S. and two others launched by Europe and Japan provide global coverage plus backup capability. Content of the manual includes basic operation of the GOES system and detailed explanations of some of the most commonly used GOES photos. The test consists of two chapters, a criterion test at the end of each chapter, and a comprehensive photo interpretation examination. GRA

N82-17570# Inter-American Geodetic Survey, Fort Sam Houston, Tex.
PHOTOGRAMMETRY SOFTWARE. A PACKAGE FOR EVERYONE
James R. Hawk Oct. 1981 59 p
(AD-A108098) Avail: NTIS HC A04/MF A01 CSCL 08/2

An example photogrammetry software is presented for consideration. The system is being implemented throughout Latin America by IAGS. It includes both analytical and semi-analytical adjustments. It is a simplistic yet versatile system which has proven very successful. Author (GRA)

N82-18656 Old Dominion Univ., Norfolk, Va.
USAGE AND LIMITATIONS OF CHARACTERISTIC VECTOR ANALYSIS OF REMOTE SENSING MULTISPECTRAL DATA FOR THE IDENTIFICATION AND QUANTIFICATION OF WATER QUALITY PARAMETERS Ph.D. Thesis
Theodore A. Talay 1981 394 p
Avail: Univ. Microfilms Order No. 8128308

Characteristic vector analysis is investigated to determine how it resolves total radiance signals measured by a remote sensor into eigenvectors and associated scalar coefficients and their relationships to the identification and quantification of the in situ water constituents. Technique operation is checked against a progression of hypothetical test cases and a limited number of laboratory data sets. Under ideal conditions, characteristic vector analysis has the potential of identifying and quantifying individual constituents in water, even when in mixtures, with a minimum of surface truth data. Exact constituent identification, using characteristic vectors, and quantification, by scaling a scalar coefficients, is possible when the study constituents have a linear radiance concentration relationship, superimpose linearly in mixtures, and the measured radiance spectra are devoid of noise and atmospheric effects. As these conditions are relaxed, technique limitations and inexact solutions are encountered. Dissert. Abstr.

N82-18657 Royal Aircraft Establishment, Farnborough (England). Space Dept.
AUTOMATIC RELOCATION OF GROUND CONTROL POINTS IN LANDSAT IMAGERY
A. H. Benny 5 Jun. 1981 37 p refs
(RAE-TR-81071; RAE-Space-598; BR80598) Copyright. Avail: Issuing Activity

A computer program which relocates ground control points (GCP), used in the geometric transformation of satellite pictures is discussed. The GCP's are first located manually on the image and a map. A transformation matrix enables image locations to

be converted to map references. For subsequent images, the identity of a first GCP and an indication (not necessarily precise) of its position in the new image enable a spiral search to locate that GCP and then all the others. Accuracy of + or - 0.4 pixel is obtained for LANDSAT pictures. For similar seasons, proportion relocated approaches 100%. In worst cases (6 months difference between images, with snow in the second) 60% is achieved.
Author (ESA)

N82-19611*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITE EARTH RESOURCES DATA, MODULE U-3
Jan. 1980 13 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Fals, S.D. 57198. ERTS
(E82-10035; NASA-TM-84130) Avail: NTIS HC A02/MF A01 CSCL 05B

Satellite data image products potentially useful in solving Earth resource and environmental problems are described. Sources for satellite data and user information are given. Recommendations for suitability of use of data from each satellite are presented. Satellite sources of Earth resources data are summarized for satellites launched since 1965 and those projected for launch through the late 1980s. The sensors of interest on each satellite, the wavelength or frequency of operation, and the resolution are given. Color ranges are illustrated and compared. The form and utility of aircraft and LANDSAT images are compared. Data from the Gemini-Apollo photography, Skylab, meteorological satellites, the Heat Capacity Mapping Mission, the Coastal Zone Color Scanner, Seasat, LANDSAT, and projected future satellites are briefly described. J.D.H.

N82-19612*# Consiglio Nazionale delle Ricerche, Venice (Italy). Lab. per lo Studio della Dinamica delle Grandi Masse.
LANDSAT IMAGERY OF THE VENETIAN LAGOON: A MULTITEMPORAL ANALYSIS
L. Alberotanza and A. Zandonella, Principal Investigators (Telespazio S.p.A., Rome) 1980 9 p refs Sponsored by NASA ERTS
(E82-10036; NASA-CR-164772) Avail: NTIS HC A02/MF A01 CSCL 08H

The use of LANDSAT multispectral scanner images from 1975 to 1979 to determine pollution dispersion in the central basin of the lagoon under varying tidal conditions is described. Images taken during the late spring and representing both short and long range tidal dynamics were processed for partial haze removal and removal of residual striping. Selected spectral bands were correlated to different types of turbid water. The multitemporal data was calibrated, classified considering sea truth data, and evaluated. The classification differentiated tide diffusion, algae belts, and industrial, agricultural, and urban turbidity distributions. Pollution concentration is derived during the short time interval between inflow and outflow and from the distance between the two lagoon inlets and the industrial zones. Increasing pollution of the lagoon is indicated. J.D.H.

N82-19613*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF UNSUPERVISED CLASSIFICATION PROCEDURES ON LANDSAT MSS DATA FOR AN AREA OF COMPLEX SURFACE CONDITIONS IN BASILICATA, SOUTHERN ITALY
Chris Justice and John Townshend, Principal Investigators Mar. 1981 40 p refs Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux, Falls, S.D. 57198. ERTS
(E82-10038; NASA-TM-82098) Avail: NTIS HC A03/MF A01 CSCL 05B

Two unsupervised classification procedures were applied to ratioed and unratioed LANDSAT multispectral scanner data of an area of spatially complex vegetation and terrain. An objective accuracy assessment was undertaken on each classification and comparison was made of the classification accuracies. The two unsupervised procedures use the same clustering algorithm. By on procedure the entire area is clustered and by the other a representative sample of the area is clustered and the resulting statistics are extrapolated to the remaining area using a maximum likelihood classifier. Explanation is given of the major steps in the classification procedures including image preprocessing; classification; interpretation of cluster classes; and accuracy assessment. Of the four classifications undertaken, the monocluster block approach on the unratioed data gave the highest accuracy of 80% for five coarse cover classes. This accuracy was increased to 84% by applying a 3 x 3 contextual filter to the classified image. A detailed description and partial explanation is provided for the major misclassification. The classification of the unratioed data produced higher pecentage accuracies than for the ratioed data and the monocluster block approach gave higher accuracies than clustering the entire area. The moncluster block approach was additionally the most economical in terms of computing time. Author

N82-19617*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
DELINEATION OF SOIL TEMPERATURE REGIMES FROM HCMM DATA Quarterly Report
Rick L. Day and Gary W. Petersen, Principal Investigators 30 Sep. 1981 3 p Sponsored by NASA HCMM
(E82-10042; NASA-CR-164919) Avail: NTIS HC A02/MF A01 CSCL 08M

Supplementary data including photographs as well as topographic, geologic, and soil maps were obtained and evaluated for ground truth purposes and control point selection. A study area (approximately 450 by 450 pixels) was subset from LANDSAT scene No. 2477-17142. Geometric corrections and scaling were performed. Initial enhancement techniques were initiated to aid control point selection and soils interpretation. The SUBSET program was modified to read HCMM tapes and HCMM data were reformated so that they are compatible with the ORSER system. Initial NMAP products of geometrically corrected and scaled raw data tapes (unregistered) of the study were produced. A.R.H.

N82-19621*# Agricultural Research Service, Weslaco, Tex.
METHODS OF EDITING CLOUD AND ATMOSPHERIC LAYER AFFECTED PIXELS FROM SATELLITE DATA Quarterly Progress Report, 5 Jun. - 5 Sep. 1981
Paul R. Nixon, Principal Investigator, Craig L. Wiegand, Arthur J. Richardson, Michael P. Johnson, and Benjamin G. Goodier Sep. 1981 10 p ERTS
(NASA Order S-75406-B)
(E82-10046; NASA-CR-164923; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 05B

The location and migration of cloud, land and water features were examined in spectral space (reflective VIS vs. emissive IR). Daytime HCMM data showed two distinct types of cloud affected pixels in the south Texas test area. High altitude cirrus and/or cirrostratus and 'subvisible cirrus' (SCi) reflected the same or only slightly more than land features. In the emissive band, the digital counts ranged from 1 to over 75 and overlapped land features. Pixels consisting of cumulus clouds, or of mixed cumulus and landscape, clustered in a different area of spectral space than the high altitude cloud pixels. Cumulus affected pixels were more reflective than land and water pixels. In August the high altitude clouds and SCi were more emissive than similar clouds were in July. Four-channel TIROS-N data were examined with the objective of developing a multispectral screening technique for removing SCi contaminated data. Author

N82-19622*# Miami Univ., Fla. School of Marine and Atmospheric Science.
INVESTIGATIONS OF MEDIUM WAVELENGTH MAGNETIC ANOMALIES IN THE EASTERN PACIFIC USING MAGSAT DATA Interim Report, Apr. - Jun. 1981
Christopher G. A. Harrison, Principal Investigator Jun. 1981 3 p Sponsored by NASA ERTS
(E82-10047; NASA-CR-164924) Avail: NTIS HC A02/MF A01 CSCL 08G

Processing continued on the data set covering the first three months of the mission. Orbits were selected over a specified range of longitude and latitude and those orbits falling within the geographical boundaries were stored on a disk and a listing made. To verify the quality of the data, plots were made showing altitude vs latitude, anomalous field vs latitude, and corrected anomalous field vs latitude. Results of the plotting showed that: (1) data from the first day of the mission are not usable because they are too noisy; (2) some orbits contain spikes, no doubt a processing error on the tape; (3) some orbits contain a 20 deg region in latitude, offset roughly 30 nT from the rest of the anomalous field profiles; and (4) the correlation between the adjacent orbits is poor. Even the new ring current coefficients

provided with a later, corrected set of data tapes did not not yield the desired correlations. A.R.H.

N82-19623*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
INTERACTIVE INITIALIZATION OF HEAT FLUX PARAMETERS FOR NUMERICAL MODELS USING SATELLITE TEMPERATURE MEASUREMENTS Quarterly Report, 1 Jun. - 31 Aug. 1981
Toby N. Carlson, Principal Investigator 31 Aug. 1981 5 p Sponsored by NASA HCMM
(E82-10048; NASA-CR-164925; QR-2) Avail: NTIS HC A02/MF A01 CSCL 08M

Day/night Heat Capacity Mapping Mission image pairs over Kansas and Indiana were used to examine the spatial variation of moisture availability on the mesoscale. Of particular concern was whether patterns of moisture availability and thermal inertia, as well as surface heat fluxes, respond to significant spatial variations in the rainfall pattern. A temperature analysis for the Indiana case is presented. M.G.

N82-19644*# Business and Technological Systems, Inc., Seabrook, Md.
AN INFORMATION ADAPTIVE SYSTEM STUDY REPORT AND DEVELOPMENT PLAN
William S. Ataras, Kenneth Eng, John J. Morone, Paul R. Beaudet, and Roland Chin 9 May 1980 225 p
(Contract NAS5-25668)
(NASA-CR-166768; BTS-FR-80-117) Avail: NTIS HC A10/MF A01 CSCL 05B

The purpose of the information adaptive system (IAS) study was to determine how some selected Earth resource applications may be processed onboard a spacecraft and to provide a detailed preliminary IAS design for these applications. Detailed investigations of a number of applications were conducted with regard to IAS and three were selected for further analysis. Areas of future research and development include algorithmic specifications, system design specifications, and IAS recommended time lines. N.W.

N82-19645*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF FINITE FIELD SIZE ON CLASSIFICATION AND ATMOSPHERIC CORRECTION
Yoram J. Kaufman and Robert S. Fraser Sep. 1981 53 p refs
(NASA-TM-83818) Avail: NTIS HC A04/MF A01 CSCL 20F

The atmospheric effect on the upward radiance of sunlight scattered from the Earth-atmosphere system is strongly influenced by the contrasts between fields and their sizes. For a given atmospheric turbidity, the atmospheric effect on classification of surface features is much stronger for nonuniform surfaces than for uniform surfaces. Therefore, the classification accuracy of agricultural fields and urban areas is dependent not only on the optical characteristics of the atmosphere, but also on the size of the surface do not account for the nonuniformity of the surface have only a slight effect on the classification accuracy in other cases the classification accuracy descreases. The radiances above finite fields were computed to simulate radiances measured by a satellite. A simulation case including 11 agricultural fields and four natural fields (water, soil, savanah, and forest) was used to test the effect of the size of the background reflectance and the optical thickness of the atmosphere on classification accuracy. *It is concluded that new atmospheric correction methods, which* take into account the finite size of the fields, have to be developed to improve significantly the classification accuracy. Author

N82-19649# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
STUDY OF EARTH RESOURCES SATELLITE (ERS) DATA REDUCTION UNIT
C. J. Collins, comp., F. A. C. Burke, comp., J. W. Pengelly, comp., P. Redstone, comp. (Logica Ltd.), C. Burrows, comp. (Logica Ltd.), and N. McEvoy, comp. (Logica Ltd.) Paris ESA Aug. 1981 188 p refs
(Contract ESA-4415/80/NL-PP(SC))
(BAe-TP-7905; ESA-CR(P)-1478) Avail: NTIS HC A09/MF A01

Techniques for reducing onboard, by a factor of 4, the data rate from imaging instruments on Earth resources satellites, especially from the ocean color monitor on ERS 1, were examined. Theoretical analysis and simulation with real images allow algorithms to be defined for implementation assessment. A tradeoff based on performance and engineering criteria shows that spatial resolution degrading unit (SRDU) and a fixed weight spectral transform followed by a Rice Machine (FWST + RM2) *meet reduction criteria within the mass and power constraints.* Costs (two model program) are comparable, the greater complexity of FWST + RM2 being largely offset by more advanced technology in SRDU. Before either option is adopted, further simulation and breadboarding are recommended. Author (ESA)

N82-19654# Engins Matra, Velizy (France). Lab. de Traitement des Images.
DATA RATE REDUCTION. IMPACT OF IMAGE DATA COMPRESSION ON END TO END DATA MANAGEMENT OF A MULTISPECTRAL PAYLOAD
G. E. Lowitz, J. M. Vivier, J. P. Camus, and B. H. Roy *Paris* ESA Jul. 1980 51 p refs
(Contract ESTEC-3749/78)
(Rept-44/130; ESA-CR(P)-1507) Avail: NTIS HC A04/MF A01

Satellite onboard data compression by clustering in the raw channels with a variable number of classes is discussed. The effect on the overall image chain is illustrated by land applications satellite system (LASS) data and LANDSAT ground stations processing and dissemination systems. Image quality, processing costs, software and hardware are considered. Onboard mechanization is efficient and the compression principles benefit user interpretation routines such as classification. Compressed data can be processed efficiently, yielding cost savings on the order of 100 to 1. A 512 X 512 pixel frame, including preprocessing, is treated in 5 min. The compressed imagery can be recognized, zones can be located and cloud cover can be assessed, making high quality quick looks possible. Author (ESA)

N82-19656# Saab-Scania, Linkoping (Sweden).
ON THE ACCURACY OF THERMAL INERTIA MAPPING BY INFRARED IMAGERY
Sune R. J. Axelsson 1981 20 p refs
(SAAB-REPR-AE-10) Avail: NTIS HC A02/MF A01

The influence of different interfering parameters on the estimation of the thermal inertia of the ground from the diurnal variations of the surface, temperature, using thermal infrared and albedo measuring imagery, was investigated. The strong influence of these parameters degrades the accuracy of the analysis and makes the interpretation complex. This influence was studied, starting from an improved analytic model of the surface temperature of a periodically heated ground surface. The errors in albedo and atmospheric heat exchange, and the limited accuracy of sensors and the model used in data processing, dominate the thermal inertia error. Further reductions of the accuracy are due to the translation of the thermal inertia map into user data like soil type, porosity and soil moisture. Upper bounds on the potential thermal inertia mapping accuracy are found by calculating the estimation error when the interfering parameters are known *with specified accuracy.* Author (ESA)

N82-19788# Wisconsin Univ. - Madison. Space Science and Engineering Center.
THE DEVELOPMENT AND TESTING OF METHODS TO INFER MIDLATITUDE PRECIPITATION INTENSITY FROM GEOSYNCHRONOUS SATELLITE INFRARED DATA
John V. Zapotocny, Donald R. Johnson, and Thomas M. Whittaker Hanscom AFB, Mass. AFGL 31 Jul. 1981 90 p refs
(Contract F19628-78-C-0137; AF Proj. 6670)
(AD-A108881; SCIENTIFIC-3; AFGL-TR-81-0252) Avail: NTIS HC A05/MF A01 CSCL 04/2

In an attempt to aid development of simple techniques applicable in middle latitudes, this study addresses the inference of precipitation intensity and its temporal change associated with imbedded convective activity at a location in areas of continuous stratiform precipitation from Geosynchronous Operational Environmental Satellite (GOES) IR digital data. Imbedded convective activity is easily identified in high resolution visible GOES imagery if high cloud layers are not present to obscure the convection. At low Sun angles with the shadowing effect of the convective towers, details of these convective areas are especially enhanced. However, with the need for these methods to be applicable during both daytime and nighttime hours, only the IR 11 micron channel data were used in this study which

was based on several synoptic cases. In each of the cases examined, visible and IR imagery and loops were used to help pinpoint optimum areas for study. GRA

N82-19927# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SELECTION OF ATTRIBUTES APPLIED TO MULTISPECTRAL IMAGES [SELECAO DE ATRIBUTOS APLICADA A IMAGENS MULTISPECTRAIS]
Fernando A. Mitsuo Ii Jan. 1982 92 p refs In PORTUGUESE; ENGLISH summary
(INPE-2303-TDL/072) Avail: NTIS HC A05/MF A01

Classes of Gaussian distribution are defined, given a multispectral scene of 12 channels. The best channels for separating classes are identified using the J-M distance criterion. The quantitative analysis of these interclass separations is also discussed. M.G.

N82-20603*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE LANDSAT SYSTEM OPERATED IN BRAZIL BY CNPQ/INPE - RESULTS OBTAINED IN THE AREA OF MAPPING AND FUTURE PERSPECTIVES [O SISTEMA LANDSAT OPERADO NO BRASIL PELO CNPQ/INPE - RESULTADOS OBTIDOS NA AREA DE CARTOGRAFIA E PERSPECTIVAS FUTURAS]
Nelson deJesusParada, Principal Investigator and Marcio Nogueira Barbosa Jul. 1981 45 p refs In PORTUGUESE; ENGLISH summary Presented at the 10th Congr. Brasileiro de Cartografica, Brasil, 19-24 Jul. 1981 Sponsored by NASA ERTS
(E82-10080; NASA-CR-168401; NAS 1.26:168401; INPE-2191-RPE/003) Avail: NTIS HC A03/MF A01 CSCL 05B

The LANDSAT system, operated in the country by CNPq/INPE since 1973, systematically acquires, produces, and distributes both multispectral and panchromatic images obtained through remote sensing satellites to thousands of researchers and technicians involved in the natural resources survey. To cooperate in the solution of national problems, CNPq/INPE is developing efforts in the area of manipulation of those images with the objective of making them useful as planimetric bases for the simple revision of already published maps or for its utilization as basic material in regions not yet reliability mapped. The results obtained from performed tests are presented and the existing limitations are discussed. The new system purchased to handle data from the next series of LANDSAT as well as from MAPSAT and SPOT which will be in operation within the 80's decade, and are designed not only for natural resources survey but also for the solution of cartographic problems. Author

N82-20604*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AN ALGORITHM FOR SPATIAL HEIRARCHY CLUSTERING [UM ALGORITMO PARA AGREGACAO HIERARQUICA ESPACIAL]
Nelson deJesusParada, Principal Investigator and Flavio Roberto Dias Velasco Jul. 1981 12 p refs In PORTUGUESE; ENGLISH summary ERTS
(E82-10081; NASA-CR-168402; NAS 1.26:168402; INPE-2170-RPE/386) Avail: NTIS HC A02/MF A01 CSCL 05B

A method for utilizing both spectral and spatial redundancy in compacting and preclassifying images is presented. In multispectral satellite images, a high correlation exists between neighboring image points which tend to occupy dense and restricted regions of the feature space. The image is divided into windows of the same size where the clustering is made. The classes obtained in several neighboring windows are clustered, and then again successively clustered until only one region corresponding to the whole image is obtained. By employing this algorithm only a few points are considered in each clustering, thus reducing computational effort. The method is illustrated as applied to LANDSAT images. J.D.H.

N82-20607*# Florida Univ., Gainesville. Climatology Lab.
APPLICATION OF SATELLITE FROST FORECAST TECHNOLOGY TO OTHER PARTS OF THE UNITED STATES, PHASE 2 Final Report
J. David Martsolf, Ellen Chen, C. Terry Morrow, Stuart H. Gage, and Jon F. Bartholic Nov. 1981 265 p refs Prepared in cooperation with Pennsylvania State Univ., University Park and Michigan State Univ., East Lansing Original contains color illustrations
(Contract NAS10-9876)
(NASA-CR-166827) Avail: NTIS HC A12/MF A01 CSCL 02C

Thermal infrared data taken from the GOES satellite over a period of several hours was color enhanced by computer according to temperature. The varying temperatures were then used to assist in frost forecasting. Input from Michigan and Pennsylvania to the cold climate mapping project is emphasized in the report of the second year's activities of a two-year effort.

N82-20608*# Florida Univ., Gainesville.
APPLICATION OF SATELLITE FROST FORECAST TECHNOLOGY TO OTHER PARTS OF THE UNITED STATES, PHASE 2, INTRODUCTION Final Report
In its Appl. of Satellite Frost Forecast Technol. to Other Parts of the U.S., Phase 2 Nov. 1981 31 p

Avail: NTIS HC A12/MF A01 CSCL 02C

The history and status of University of Michigan and University of Pennsylvania involvement in determining if P-model for frost prediction used in Florida is applicable to those geographic locations is reviewed. The possibility of using the S-model to develop a satellite frost forecast system that can recall the distribution of temperatures during previous freezes from a particular area and bring that cold climate climatology to bear on present forecasts is discussed as well as a proposed GOES satellite downlink system to sectionalize the data used in Florida. A.R.H.

N82-20612*# Pennsylvania State Univ., University Park.
THE OFFICE FOR REMOTE SENSING OF EARTH RESOURCES Final Report
In Florida Univ. Appl. of Satellite Frost Forecast Technol. to Other Parts of the U.S., Phase 2 Nov. 1981 6 p refs

Avail: NTIS HC A12/MF A01 CSCL 05B

The main effort of the University of Pennsylvania's office for remote sensing of Earth resources (ORSER) is the processing, analysis, and interpretation of multispectral data, most often supplied by NASA in the form of imagery and digital data. The facilities used for data reduction and image enhancement are described as well as the development of algorithms for producing a computer map showing various environmental and land use characteristics of data points in the analyzed scenes. The application of an (ORSER) capability for statewide monitoring of gypsy moth defoliation is discussed. A.R.H.

N82-20614*# Michigan State Univ., East Lansing.
MSU TEST OF P-MODEL Final Report
In Florida Univ. Appl. of Satellite Frost Forecast Technol. to Other Parts of the U.S., Phase 2 Nov. 1981 8 p refs

Avail: NTIS HC A12/MF A01 CSCL 05B

Results of running key station data (soil, air, and dew point temperatures, net irradiation, and wind direction and speed) from Michigan through the P-model are presented. The details of each of the 55 error calculations are shown in tables. A histogram is included showing errors in degrees Fahrenheit. A.R.H.

N82-20628# Army Engineer Topographic Labs., Fort Belvoir, Va.
COMPUTER-ASSISTED PHOTO INTERPRETATION RESEARCH AT USAETL
George E. Lukes 21 Apr. 1981 14 p refs
(AD-A109366; ETL-R028) Avail: NTIS HC A02/MF A01 CSCL 08/5

A program in computer-assisted photo interpretation research (CAPIR) has been initiated at the U.S. Army Engineer Topographic Laboratories. In a new laboratory, a photo interpreter (PI) analyzing high-resolution, aerial photography interfaces directly to a digital computer and geographic information system (GIS). A modified analytical plotter enables the PI to transmit encoded three dimensional spatial data from the stereomodel to the computer. Computer-generated graphics are displayed in the stereomodel for direct feedback of digital spatial data to the PI. Initial CAPIR capabilities include point positioning, mensuration, stereoscopic area search, GIS creation and playback, and elevation

data extraction. New capabilities under development include stereographic superposition, a digital image workstation, and integration of panoramic Optical Bar Camera photography as a primary GIS data source. This project has been conceived as an evolutionary approach to the digital cartographic feature extraction problem. As a working feature extraction system, the CAPIR laboratory can serve as a testbed for new concepts emerging from image understanding and knowledge-based systems research. GRA

N82-21457*# Business and Technological Systems, Inc., Seabrook, Md.
CONTEXT SENSITIVE FORMULATIONS OF ANTENNA PATTERN CORRECTION AND SIDE LOBE COMPENSATION FOR NOSS/LAMMR REAL TIME PROCESSING Final Report
Roland T. Chin and Paul R. Beaudet 7 Oct. 1981 157 p (Contract NAS5-26541)
(NASA-CR-166789; NAS 1.26:166789; BTS-FR-81-165) Avail: NTIS HC A08/MF A01 CSCL 20N

Large antenna multi-channel microwave radiometer (LAMMR) software specifications were written for LAMMR ground processing. There is a need to determine more computationally-efficient antenna temperature correction methods in compensating side lobe contributions especially near continents, islands and weather fronts. One of the major conclusions was that the antenna pattern corrections (APC) processes did not accomplish the implied goals of compensating for the antenna side lobe influences on brightness temperature. A-priori knowledge of land/water locations was shown to be needed and had to be incorporated in a context sensitive APC process if the artifacts caused by land presence is to be avoided. The high temperatures in land regions can severely bias the lower ocean response. R.J.F.

N82-21458# European Space Agency, Paris (France).
SAR IMAGE QUALITY
Jun. 1981 96 p refs Presented at EARTHNET/EARSel Workshop, Frascati, Italy, 11-12 Dec. 1980
(ESA-SP-172; ISSN-0379-6566) Avail: NTIS HC A05/MF A01; ESA, Paris FF 55 (US $12)

The processing and quality of synthetic aperture radar imagery is considered with particular attention on optimal multilook processing, simulation, beam tracking, speckle filtering, radiometric calibration, digital processing, ocean wave spectra, two-dimensional image spectrum, terrain models, etc.

N82-21474# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
DIRECT DETERMINATION OF THE TWO DIMENSIONAL IMAGE SPECTRUM FROM RAW SYNTHETIC APERTURE RADAR DATA
P. Martin *In* ESA SAR Image Quality Jun. 1981 p 81-87 refs Submitted for publication

Avail: NTIS HC A05/MF A01; ESA, Paris FF 55 (US $12)

An algorithm is described which computes the two-dimensional Fourier transform of a synthetic aperture radar image. This method is intended to replace the whole SAR processing and the two-dimensional Fourier transformation by a specialized processing scheme which, in terms of computational speed and complexity, will be of the order of a single two-dimensional autocorrelation. This processing approach is applied to the estimation of the wave directional spectrum from the raw data of the SAR sensor of SEASAT-1. Author (ESA)

N82-21499# Royal Signals and Radar Establishment, Malvern (England).
THE DESIGN AND IMPLEMENTATION OF AN OPERATIONAL, COMPUTER-BASED WEATHER RADAR SYSTEM
A. P. Ball, J. L. Clarke, M. J. Brien, A. H. Shaw, S. E. Trigg, and T. A. Voller 1979 94 p refs Original contains color illustrations
(RSRE-MEMO-3151; BR71459) Avail: NTIS HC A05/MF A01

A system that provides quantitative rainfall data is described. It consists of an on-site PDP-11/40 computer used to process digitized radar data from a narrow beam, fully steerable radar aerial. The data are collected at several low elevation angles. The radar amplitude signals received are digitized and transferred to the computer by a special purpose radar signal averaging unit (RSAU). After processing, the signals are displayed as a color coded, Cartesian map of instantaneous rainfall rate and distribution on a modified color TV via a special data store. Similar data can be transmitted via the DATEL service to users remote from the radar and to a network center computer where a composited color TV picture of data is displayed. Hardware and software are described in detail. Author (ESA)

N82-21565# Royal Aircraft Establishment, Farnborough (England).
AN INTRODUCTION TO IMAGE PROCESSING AT ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH, ENGLAND
G. J. Davison London HMSO Sep. 1980 26 p refs
(RAE-TR-80107; RAE-SPACE-585; BR76808) Avail: NTIS HC A03/MF A01

Data collection and image processing for the generation of photographic products from SEASAT, LANDSAT, NIMBUS TIROS and METEOSAT 2 are described. The hardware facilities include a Linoscan 204 D composition device driven by a PRIME 200 computer, and a Plessey IDP 3000 interactive image display system. A disk based system enables the user to apply various processing algorithms to standard format data for display. Algorithms are described including: contrast enhancement by applying a mapping function to a set of pixel intensity values, a destriping algorithm which equates the means and variances of the radiance levels from each detector (LANDSAT), four principal components analysis, edge enhancement, and geometric transformations. Collaborative projects using remote sensing data by other government agencies are also mentioned. Author (ESA)

N82-21637*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR UNIV4VEC
Mary Ann Tompkins and Carol A. Sivillo, Principal Investigators Jun. 1981 32 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10085; NASA-CR-161060; JSC-17389;
NAS 1.26:161060; SR-L1-00301; LEMSCO-16676) Avail: NTIS HC A03/MF A01 CSCL 02C

The UNIV4VEC program which is part of the CLSFYG package is described. This program reads a CLASFYG vector parameter file and converts it to a four channel universal formatted file. A.R.H.

N82-21638*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DOCUMENTATION OF PROGRAMS TO IMPLEMENT THE ROBERTSON AND DORAISWAMY/THOMPSON MODELS
D. J Valenziano, Principal Investigator Jun. 1981 96 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10086; NASA-CR-161061;JSC-17400;
NAS 1.26:161061; SR-L1-00717; LEMSCO-16376) Avail: NTIS HC A05/MF A01 CSCL 02C

The software which implements two spring wheat phenology models is described. The main program routines for the Doraiswamy/Thompson crop phenology model and the basic Robertson crop phenology model are DTMAIN and BRMAIN. These routines read meteorological data files and coefficient files, accept the planting date information and other information from the user, and initiate processing. Daily processing for the basic Robertson program consists only of calculation of the basic Robertson increment of crop development. Additional processing in the Doraiswamy/Thompson program includes the calculation of a moisture stress index and correction of the basic increment of development. Output for both consists of listings of the daily results. T.M.

N82-21641*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR PARHIS
Mary Ann Tompkins, Principal Investigator Jun. 1981 122 p

Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10089; NASA-CR-161064; NAS 1.26:161064; SR-L1-00305; JSC-17371; LEMSCO-16650) Avail: NTIS HC A06/MF A01 CSCL 02C

The program is part of the CLASFYG package. It produces histograms of the greenness profile derived parameters alpha, beta, t sub o, and chi squared, which are computed by the CLASFYG program. Alpha is the approximate greenness rise time, beta is the approximate greennss decay time, t sub o is the spectral crop emergence date, and chi squared per degree of freedom is the goodness of fit of the actual data to the computed greenness profile. The program also produces statistical information concerning the parameters. T.M.

N82-21642*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR PARCLS
Mary Ann Tompkins, Principal Investigator Jun. 1981 113 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10090; NASA-CR-161065; NAS 1.26:161065; SR-L1-00302; JSC-17390; LEMSCO-16677) Avail: NTIS HC A06/MF A01 CSCL 02C

The PARCLS program, part of the CLASFYG package, reads a parameter file created by the CLASFYG program and a pure pixel ground truth file in order to create to classification file of three separate crop categories in universal format. A.R.H.

N82-21643*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR MISMAP
P. M. Brown, D. E. Cheng, and M. A. Tompkins, Principal Investigators Jun. 1981 71 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10091; NASA-CR-161066; NAS 1.26:161066; SR-L1-00307; JSC-17231; LEMSCO-16300) Avail: NTIS HC A04/MF A01 CSCL 02C

The MISMAP program, which is part of the CLASFYT package, is described. The program is designed to compare classification values with ground truth values for a segment and produce a comparison map and summary table. A.R.H.

N82-21646*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR SEGMENT MAP (SGMAP) PROGRAM
Mary Ann Tompkins, Principal Investigator Jun. 1981 100 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10094; NASA-CR-161056; NAS 1.26:161056; SR-LI-00306; JSC-17037; LEMSCO-15937) Avail: NTIS HC A05/MF A01 CSCL 02C

The segment map program (SGMAP), which is part of the CLASFYT package, is described in detail. This program is designed to output symbolic maps or numerical dumps from LANDSAT cluster/classification files or aircraft ground truth/processed ground truth files which are in 'universal' format. M.G.

N82-21656*# Research and Data Systems, Inc., Lanham, Md.
DEVELOPMENT OF A SURFACE ISOLATION ESTIMATION TECHNIQUE SUITABLE FOR APPLICATION OF POLAR ORBITING SATELLITE DATA
P. A. Davis and L. M. Penn, Principal Investigators Nov. 1981 77 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(NASA Order C-00741; Proj. AgRISTARS)
(E82-10122; NASA-CR-167473; NAS 1.26:167473; YM-N1-04198; JSC-17784) Avail: NTIS HC A05/MF A01 CSCL 04A

A technique is developed for the estimation of total daily insolation on the basis of data derivable from operational polar-orbiting satellites. Although surface insolation and meteorological observations are used in the development, the algorithm is constrained in application by the infrequent daytime polar-orbiter coverage. Author

N82-21663*# North Carolina State Univ., Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
COMPATIBILITY STUDY OF THE MAGSAT DATA AND AEROMAGNETIC DATA Progress Report
I. J. Won, Principal Investigator Aug. 1981 15 p refs
(Contract NAS5-26157)
(E82-10136; NASA-CR-168521; NAS 1.26:168521) Avail: NTIS HC A02/MF A01 CSCL 05B

The results of (1) an analysis of the fine attitude MAGSAT data covering the continental U.S., (2) analysis of the Project MAGNET U.S. aeromagnetic data in terms of its compatibility with the corresponding MAGSAT data, and finally, (3) analysis of MAGSAT data in the Pacific region and comparison with satellite gravity data are presented. All data reduction procedures are described and the resulting magnetic maps are given. The results indicate a general compatibility between the MAGSAT data and the MAGNET and gravity data. M.G.

N82-21665*# Paris VI Univ. (France).
CONTINUATION OF POTENTIAL FIELD DATA TO A COMMON ALTITUDE
Jean-Louis LeMouel, Principal Investigator and Joel Ducruix 1 Apr. 1981 3 p refs Sponsored by NASA ERTS
(E82-10138; NASA-CR-168523; NAS 1.26:168523) Avail: NTIS HC A02/MF A01 CSCL 05B

It is noted that the distorsions introduced by the variation of distance between the sources and the measurement points can be important enough to create fake anomalies. The average amplitude of the anomalies at MAGSAT altitude is of the order of a few nT. Thus it is necessary to be careful in reducing MAGSAT data to a common elevation. The achievement of the corresponding anomaly map is of primary importance for the study of regional and long wave length anomalies. A method for the continuation of potential fields is described which consists in representing any harmonic function (in particular the anomaly is function of space coordinates) as a sum of elementary harmonic functions; the continuation being achieved by an inverse technique. Tests, made on a synthetic set of data, evaluate the method. M.G.

N82-21666*# Paris VI Univ. (France).
SEPARATION OF INTERNAL AND EXTERNAL FIELDS: A NEW TECHNIQUE OF DATA SCREENING Progress Report
Jean-Louis LeMouel, Principal Investigator, Michel Menvielle, and Joel Ducruix 1 Dec. 1980 5 p ref Sponsored by NASA ERTS
(E82-10139; NASA-CR-168524; NAS 1.26:168524) Avail: NTIS HC A02/MF A01 CSCL 05B

A method for eliminating transient variation from MAGSAT data is described. Instead of using the conventional Kp index, the Km index is used for the rejection of nonquiet data. To build the Km index, the surface of the Earth is divided in eight sectors. Each sector is defined by two or three magnetic observatories and its geographic limits. For each three hourly interval the MAGSAT tracks were drawn on a map showing the location of the station (the crosses), the limits of the sector, and the value of the mean K index inside each sector. No figure in a sector means that the activity level in this sector is lower than 5 nt; in a sector covered with number 1, the activity lies between 5 and 20 nt; 2 stands for any level greater than 20 nT. M.G.

N82-21678*# Agricultural Research Service, Weslaco, Tex.
METHODS OF EDITING CLOUD AND ATMOSPHERIC LAYER AFFECTED PIXELS FROM SATELLITE DATA Quarterly Progress Report, 5 Sep. - 5 Dec. 1981
Paul R. Nixon, Principal Investigator, Craig L. Wiegand, Arthur J. Richardson, and Michael P. Johnson Dec. 1981 6 p ref HCMM
(NASA Order S-75406B)
(E82-10154; NASA-CR-168539; NAS 1.26:168539; PR-4) Avail: NTIS HC A02/MF A01 CSCL 05B

Plotted transects made from south Texas daytime HCMM data show the effect of subvisible cirrus (SCI) clouds in the emissive (IR) band but the effect is unnoticable in the reflective (VIS) band. The depression of satellite indicated temperatures

ws greatest in the center of SCi streamers and tapered off at the edges. Pixels of uncontaminated land and water features in the HCMM test area shared identical VIS and IR digital count combinations with other pixels representing similar features. A minimum of 0.015 percent repeats of identical VIS-IR combinations are characteristic of land and water features in a scene of 30 percent cloud cover. This increases to 0.021 percent of more when the scene is clear. Pixels having shared VIS-IR combinations less than these amounts are considered to be cloud contaminated in the cluster screening method. About twenty percent of SCi was machine indistinguishable from land features in two dimensional spectral space (VIS vs IR). T.M.

N82-21687*# National Aeronautics and Space Administration, Washington, D. C.
OBSERVATION OF THE EARTH BY RADAR
Charles Elachi (French Petroleum Inst.) Feb. 1982 33 p Transl. into ENGLISH from La Recherche (France), v. 12, no. 128, Dec. 1981 p 1366-1375 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by French Petroleum Inst.
(Contract NASw-3542)
(NASA-TM-76830; NAS 1.15:76830) Avail: NTIS HC A03/MF A01 CSCL 17I

Techniques and applications of radar observation from Earth satellites are discussed. Images processing and analysis of these images are discussed. Also discussed is radar imaging from aircraft. Uses of this data include ocean wave analysis, surface water evaluation, and topographic analysis. R.J.F.

N82-21698# Logica Ltd., London (England).
FUTURE EARTHNET DISSEMINATION SYSTEMS (FEDS) STUDY. EXECUTIVE SUMMARY Final Report
M. Macintyre, P. Norris, and P. Scragg Paris ESA Dec. 1980 47 p
(Contract ESA-4241/80/F-FC(SC))
(Rept-3318; ESA-CR(P)-1438) Avail: NTIS HC A03/MF A01

The preparation of Earthnet for the dissemination to users of data from the European remote sensing program is considered. Worldwide plans for remote sensing satellite systems, European and north African user demand, data acquisition subsystems, data processing subsystems, data archiving subsystems and data communications subsystems are covered. Subsystems configurations that would meet these performance requirement are studied. Results are integrated to define overall systems configurations that would meet the performance requirements. Alternate centralized acquires data at four Earth stations and stores it temporarily on magnetic tape. Data are forwarded by satellite and disseminated to users by satellite and terrestrial links. Raw data are stored in a permanent playback archive, on optical disks, at the central site. Author (ESA)

N82-21699# Logica Ltd., London (England).
INTERPRETATION OF REMOTELY SENSED IMAGE DATA AND IMPACT OF CLUSTER COMPRESSION
David J. Stanley Paris ESA Feb. 1981 154 p refs
(Contract ESA-3749/78/NL-HP)
(Rept-44.2866; ESA-CR(P)-1450) Avail: NTIS HC A08/MF A01

Image interpretation techniques are described and related to the needs of application areas. A survey of users and literature shows (1) little correlation between processing techniques and specific applications; (2) most users employ general purpose image analysis algorithms rather than developing special purpose techniques; (3) interpretation methodology frequently involves the use of several preprocessing, enhancement, and classification methods; (4) the majority of operational applications rely on manual photointerpretation; and (5) most digital image interpretation is done with general purpose software packages and/or special hard-wired image analysis systems. Operational users, (a minority), rely heavily on human photointerpretation, especially in geology, and at most use simple linear classifiers or enhancement techniques on interactive image processing systems. The impact of compression is limited because of academic and research user hostility, and decreasing cost of machine processing.
Author (ESA)

N82-21700# European Space Agency, Paris (France).
ATLAS OF METEOSAT IMAGERY
C. A. Brimacombe (ESOC) May 1981 494 p refs In ENGLISH and FRENCH Original contains color illustrations
(ESA-SP-1030; ISSN-0379-6566) Avail: NTIS HC A21/MF A01; ESA, Paris FF 200 Member States, AU, CN, and NO (+20% others)

A selection of the images received from METEOSAT during its first two years of operation is presented. The METEOSAT system is described and characteristics of images as well as image processing are explained. Imagery is examined as to cloud classification, surface features, and mesoscale cloud formations. Synoptic scale cloud patterns, planetary scale cloud systems, and details of tropical cloud systems are also discussed. Miscellaneous aspects of satellite meteorology are included.
Author (ESA)

08
INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A82-21022 **Thermal viewing system for studying the earth's resources.** V. V. Perlov, D. N. Krasnikov, V. P. Sergeev, B. V. Ukhov, and G. I. Iasinskii. *(Optiko-Mekhanicheskaia Promyshlennost', vol. 48, Apr. 1981, p. 27-29.) Soviet Journal of Optical Technology,* vol. 48, Apr. 1981, p. 213-215. 5 refs. Translation.

The paper presents the Vulkan airborne thermal viewing system for remote studies of earth's resources, which operates simultaneously in two spectral bands of 3.8-5.2 microns. The construction and circuit features of the thermal viewer are examined, and further improvements for studying natural resources involving simultaneous radiometric measurements in several spectral channels are discussed. D.L.G.

A82-21027 * **Sigma/deg/ signature of the Amazon rain forest obtained from the Seasat scatterometer.** I. J. Birrer, G. Berthold (University of Kansas Center for Research, Inc., Lawrence, KS), E. M. Bracalente (NASA, Langley Research Center, Hampton, VA), G. J. Dome (Bell Telephone Laboratories, Inc., Holmdel, NJ), and J. Sweet (Kentron Corp., Hampton, VA). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 11-17.

Scatterometer data from Seasat of the Amazon rain forest were examined to determine if the region is suitable to use as a reference for calibration of radars. The consistency of Skylab data viewing the Amazon region prompted the analyses, and the Seasat-A scatterometer system (SASS) gathered data of the same region at varying angles. The instrument employed a 100 W 14.6 GHz signal with the reflected power sampled 61 times during each 1.89 sec measurement period. Doppler filters were used in 15 parallel channels of reception, and represented areas 20 km by 50-70 km. Tests were made of regional and temporal stability of the Amazon area, with five measurement angles averaged at different incidence angles to find the mean deviation, which was found to be less than 0.5 dB. Diurnal effects were confined to early morning, and further tests are recommended to obtain results for an entire year, to develop screening methods for thick clouds and rain, and to determine the deviation more precisely. M.S.K.

A82-21034 **Theoretical and experimental studies of microwave emission signatures of snow.** M. E. Tiuri (Helsinki University of Technology, Esbo, Finland). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 51-57. 11 refs.

Theoretical and experimental studies of the brightness temperature of snow are reported. A snow model was devised, with the dielectric constant for snow determined from the dielectric properties of ice and water. The equivalent scattering particle dielectric constant was calculated from the dielectric constant of snow, and the theory was expanded to consider different homogeneous layers. Radiometric readings at 4.8, 11.6, and 36.8 GHz were taken from a seven meter high tower in a snow field. The brightness temperature decreased rapidly with increasing frequencies, and the brightness temperature of snow covered land was found to be higher in cold weather than that of bare land. M.S.K.

A82-21035 **Towards the definition of optimum sensor specifications for microwave remote sensing of snow.** C. Mätzler, E. Schanda (Bern, Universität, Berne, Switzerland), and W. Good (Eidgenössisches Institut für Schnee- und Lawinenforschung, Davos, Switzerland). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-20, Jan. 1982, p. 57-66. 20 refs.

The inconsistencies in the relationships between microwave data and the water equivalent of the snowcover, and the disappearance of the contrast between snow and snow-free regions when the snow is wet were studied. A relationship between the water equivalent of a dry snow layer and the brightness temperature is discussed in terms of a complete set of snow radiometry data at 4.9, 10.4, 21, and 36 GHz. The combined effects of volume scattering on large crystals is shown to be a function of the water equivalent, which is determined from knowledge of the state of metamorphism. A strong decrease of the reflected wavelengths was found to be due to snow wetness, especially at higher frequencies. Multivariate data analysis was employed to analyze the data set to find the respective discriminant powers in splitting the ground-truth data-points of the changing snow cover. M.S.K.

A82-21082 **Observation of the turbulent structure in the planetary boundary layer with a kytoon-mounted ultrasonic anemometer system.** Y. Ogawa (National Institute for Environmental Studies, Yatabe, Ibaraki, Japan) and T. Ohara (Hokkaido University, Sapporo, Japan). *Boundary-Layer Meteorology,* vol. 22, Jan. 1982, p. 123-131.

The development of a small, lightweight ultrasonic kytoon-mounted anemometer system for transmitting windspeed, momentum, and heat flux data to the ground in digital form by means of optical fibers is reported. The 70 cu m kytoon can lift 20-30 kg, and the weight of the instruments is 10 kg, with an optic fiber 1500 m long capable of carrying one megabyte/sec at 18 cycles/sec on 16 channels. Numerical filters are used to eliminate artificial velocities induced by swinging motion of the sensors, with calibration achieved in wind tunnel studies. Experimental data were gathered at heights of 50, 100, 200, 300, 400, 500, and 700 m, and the standard deviations for the u, v, and w components were found to stabilize at 400 m, and increase with decreasing height below that level. The kytoon-mounted system is suitable for operation in winds below 10 m/sec. M.S.K.

A82-21090 **Image quality control in the Meteosat ground processing system.** M. Jones and N. C. Colombeski (ESA, European Space Research Operations Centre, Darmstadt, West Germany). *International Journal of Remote Sensing,* vol. 2, Oct.-Dec. 1981, p. 331-349. 11 refs.

The approach taken to image quality control in the European Space Agency's Meteosat project is discussed. User requirements, to both instrumental and physical accuracy, on the quality of the meteorological end-products and on the image quality are presented, and the effect of a deterioration in image quality on budget errors is discussed. Methods for evaluating image quality are described, and the implementation of these methods within the Meteosat Ground Computer System is reviewed. It is concluded, that the proper hardware and software must be provided to monitor the quality indicators and to allow for an adequate level of manning. This includes interactive displays permitting near real-time display of image data and key parameters, and facilities for a longer-term view of the evolution of the quality parameters. Image quality control should also be closely coupled with mission control. The radiometric and geometric quality from the F1-model of Meteosat is described as an example. J.F.

A82-21091 **Effects of the atmosphere on the detection of surface changes from Landsat multispectral scanner data.** J. Otterman (U.S. Geological Survey, Reston, VA; Tel Aviv University, Tel Aviv, Israel) and C. J. Robinove (U.S. Geological Survey, Reston, VA). *International Journal of Remote Sensing,* vol. 2, Oct.-Dec. 1981, p. 351-360.

The atmospheric effects of radiometric data recorded in the Landsat multispectral scanner system bands are compiled for cases of representative and ideal atmospheric conditions. These effects are expressed as a difference between the actual spectral reflectivity measured close to the ground and the surface-atmosphere system reflectivity to zenith, derived from satellite data. The resulting formula includes two optical thickness parameters for backscattering and absorption as well as a function for the anisotropy of backscattering from the direct beam to the zenith. The expression is accurate only for an atmosphere of low optical thickness and large areas of uniform reflectivity. It is concluded that in the quantitative monitoring of surface changes from satellites, scattering effects will predominate in some cases (mapping coastal waters), while absorption effects will predominate in others (desert fringe regions). The measurements used for monitoring scattering effects are also shown to differ from those for monitoring absorption effects. J.F.

A82-21399 **Analysis of the direction-dependent radiation behavior in multispectral scanning data (Untersuchung des richtungs-**

abhängigen Strahlungsverhaltens in multispektralen Abtastdaten). B. Pfeiffer (Karlsruhe, Universität, Karlsruhe, West Germany). *Bildmessung und Luftbildwesen,* vol. 50, Jan. 1, 1982, p. 35-47. 7 refs. In German.

The direction-dependent radiation behavior of several natural objects is analyzed, based on multispectral scanning data from a number of different flight altitudes. Results show a significant change in brightness with view angle and wavelength, and a comparison with atmospheric model calculations shows that the increase in directional behavior is caused more by the object itself than by the atmosphere. The position of the sun seemed to have a greater effect in changing the object-reflected signal than did height. The direction-dependence could not be corrected for all classes of objects and wavelengths due to variations in brightness as well as object-dependent color shifts. The application of a modified classification procedure by use of a direction dependent statistic greatly improved the results. J.F.

A82-21434 Recent auroral measurements using a field-widened interferometer spectrometer. A. J. Steed, D. J. Baker, B. Y. Bartschi (Utah State University of Agriculture and Applied Science, Logan, UT), and A. T. Stair, Jr. (USAF, Geophysics Laboratory, Bedford, MA). In: International Conference on Fourier Transform Infrared Spectroscopy, Columbia, SC, June 8-12, 1981, Proceedings. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1981, p. 202-205. 9 refs. USAF-sponsored research.

Questions regarding the evolution of field-widened interferometer (FWI) instruments are briefly considered. The first FWI instrument was designed for visible and near IR applications. In response to the need for a faster drive system for auroral work, a second generation instrument using a gas-lubricated bearing was developed in 1973. A description is presented of the field operating configuration of the second generation system, taking into account also recent auroral results. A third generation rocket-borne version of this instrument has been developed by Haycock et al. (1979). A presented graph shows one 40 second spectral scan of an auroral arc taken with the second generation FWI instrument in Andoya, Norway, on November 11, 1980. The instrument was pointed at the zenith, and a separate dual channel radiometer was co-aligned with the interferometer to provide long-term OH and O2 emission levels. G.R.

A82-22140 Accuracy of the normal case of close-range photogrammetry. Y. I. Abdel-Aziz (University of Petroleum and Minerals, Dhahran, Saudi Arabia). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 207-213. 5 refs.

The photogrammetric technique is used for the three-dimensional recording of historical monuments. In connection with the recording operation, certain problems have to be solved concerning the establishment of the optimum location of the camera relative to the monument. So far, there have been no satisfactory formulas for the determination of the optimum positions of the two camera stations. The main objective of the considered investigation is related to the development of formulas which will make it possible to determine the object accuracy, for any camera setup, right in the field. The new formulas developed express the accuracy of the ground points as a function of the four parameters of external orientation. A description is provided of mathematical and experimental proofs regarding the correctness of the new formulas. G.R.

A82-22141 Calibration and model reconstruction in analytical close-range stereophotogrammetry. II - Special evaluation procedures for rasterstereography and moiré topography. W. Frobin and E. Hierholzer (Orthopädische Universitätsklinik, Münster, West Germany). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 215-220. 8 refs. Research supported by the Deutsche Forschungsgemeinschaft.

It is pointed out that, in the case of rasterstereography and moiré topography, special provisions have to be made when standard photogrammetric procedures are employed. Rasterstereography is a modification of conventional stereophotography, in which one of the two cameras has been replaced by a projector with a regular (cross) raster diapositive. The raster lines are projected onto the surface to be measured and are photographed by the camera. The calibration of a rasterstereographic apparatus is discussed. In cross rasterstereography, there is an overdeterminancy regarding the reconstruction of the surface point. Either vertical or horizontal raster lines may be omitted. Special procedures employed in line rasterstereography are considered. Problems related to the use of moiré topography are also investigated, taking into account the projection method and the shadow method. G.R.

A82-22148 Satellite photos can aid navigation on aerial photo missions. R. J. Myhre (U.S. Forest Service, Fort Collins, CO). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 275-279.

Accurate navigation is important to the success of aerial photo missions. The accuracy of the navigation on these missions depends on the amount of useful information available on the flight maps or photos. If satisfactory maps or aerial photos are not available, current satellite imagery (Landsat photos) can be enlarged for use as navigational aids. This technique has been tested and proven successful on operational aerial photography missions. Aspects of photo mission planning are considered, taking into account aerial photo coverage and satellite photo coverage. Attention is also given to questions regarding Landsat imagery and the two methods employed to enlarge the Landsat image to the desired scale. It is found to be important to select a satellite image which represents the time frame of the anticipated aerial photo mission. G.R.

A82-22397 † Spaceborne photography for the study of earth resources (Kosmicheskaia fotos'emka dlia izucheniia prirodnykh resursov). G. B. Bonin. Leningrad, Izdatel'stvo Nedra, 1980. 320 p. 564 refs. In Russian.

Various theoretical and practical aspects of spaceborne photography in the study of earth resources are reviewed, including problems of photogrammetric image processing. Particular consideration is given to the attitude control and stabilization of remote-sensing satellites; the effect of the atmosphere on the quality and photometric properties of the photographs; subsatellite experiments; and external-orientation elements of space imagery. Photogrammetric measurements on the basis of single images, the transformation of images, and elements of scanner photogrammetry are also discussed. B.J.

A82-22877 * Microwave remote sensing: Active and passive. Volume 1 - Microwave remote sensing fundamentals and radiometry. F. T. Ulaby, R. K. Moore, and A. K. Fung (Kansas, University, Lawrence, KS). Research supported by NASA, NSF, and DOD. Reading, MA, Addison-Wesley Publishing Co. (Remote Sensing, No. 2), 1981. 470 p. 267 refs. $46.50.

The three components of microwave remote sensing (sensor-scene interaction, sensor design, and measurement techniques), and the applications to geoscience are examined. The history of active and passive microwave sensing is reviewed, along with fundamental principles of electromagnetic wave propagation, antennas, and microwave interaction with atmospheric constituents. Radiometric concepts are reviewed, particularly for measurement problems for atmospheric and terrestrial sources of natural radiation. Particular attention is given to the emission by atmospheric gases, clouds, and rain as described by the radiative transfer function. Finally, the operation and performance characteristics of radiometer receivers are discussed, particularly for measurement precision, calibration techniques, and imaging considerations. M.S.K.

A82-23045 * Superconducting tensor gravity gradiometer. H. J. Paik (Maryland, University, College Park, MD). *(International Symposium on Inertial Technology for Surveying and Geodesy, 2nd, Banff, Alberta, Canada, June 1-5, 1981.) Bulletin Géodésique,* vol. 55, no. 4, 1981, p. 370-381. 12 refs. Contract No. NAS8-33822.

The employment of superconductivity and other material properties at cryogenic temperatures to fabricate sensitive, low-drift, gravity gradiometer is described. The device yields a reduction of noise of four orders of magnitude over room temperature gradiometers, and direct summation and subtraction of signals from accelerometers in varying orientations are possible with superconducting circuitry. Additional circuits permit determination of the linear and angular acceleration vectors independent of the measurement of the gravity gradient tensor. A dewar flask capable of maintaining helium in a liquid state for a year's duration is under

development by NASA, and a superconducting tensor gravity gradiometer for the NASA Geodynamics Program is intended for a LEO polar trajectory to measure the harmonic expansion coefficients of the earth's gravity field up to order 300. M.S.K.

A82-24964 Thermal infrared data from the Heat Capacity Mapping Mission. *Remote Sensing of Environment,* vol. 11, Mar. 1981, p. 77-79.

The Heat Capacity Mapping Mission (HCMM) satellite, launched on April 26, 1978, was designed to experimentally evaluate the usefulness of remotely sensed surface temperature measurements for applications in geology, botany, ecology, hydrology and meteorology. The orbital characteristics of the satellite permit repetitive observations of midlatitude regions over the course of the diurnal heating cycle. This type of coverage is optimal for observing the temporal and spatial thermal contrasts within surface materials. HCMM thermal IR measurements can also be used to estimate the apparent thermal inertia of surface cover materials. A nighttime thermal IR image of Utah is examined. O.C.

A82-25460 Satellite photograph interpretation. C. Peebles. *Spaceflight,* vol. 24, Apr. 1982, p. 161-163. 10 refs.

The instrumentation and interpretation of satellite earth surface reconnaissance data are outlined. IR scanners, multispectral photo systems, and digitally returned optical sensor information are soon to be augmented by imaging radar and continuation of the use of the Big Bird satellites for high resolution photographic imaging. The photographs are sometimes scanned visually by using a 60% overlap to provide a stereo view and gain depth information on the observed scene. Human photointerpreters are mentioned as having an encyclopedic knowledge of particular areas of scanning, enabling immediate detection and educated guessing at the function of any change in a repeatedly monitored scene. Comparative covers is a process of historically referencing updated photos to determine increases or decreases in use of areas, or precise visual steps of weapons assembly. M.S.K.

A82-26000 # Ideal phase in estimating the spatial gradient of magnetic daily variations recorded by magnetometer arrays. F. E. M. Lilley and M. N. Sloane (Australian National University, Canberra, Australia). *Journal of Geomagnetism and Geoelectricity,* vol. 33, no. 9, 1981, p. 517-525. 14 refs.

A82-26049 Evaluation of serial photogrammetric camera and aircraft scanner pictures from tidal lands - Digital correlation and classification of multitemporal imagery data (Auswertung von Reihenmesskammer- und Flugzeugabtasteraufnahmen aus Wattgebieten - Digitale Korrelation und Klassifizierung multitemporaler Bilddaten). E. Dennert-Möller and M. Ehlers (Hannover, Universität, Hanover, West Germany). *Bildmessung und Luftbildwesen,* vol. 50, Mar. 1, 1982, p. 59-67. 14 refs. In German.

It has been found that large-scale aerial photographs are particularly suited for the study of the special conditions of the tidal lands at the German coast of the North Sea. Procedures of digital correlation make it possible to establish, for a comparison, relations between imagery obtained with various sensors at different scales and at different times. In the present investigation, photographs obtained with serial photogrammetric cameras, and aircraft scanner imagery are, after image correction, classified on an individual basis, and are compared with each other. A multitemporal picture is finally obtained and classified. The required digital processing operations are performed by making use of interactive image processing equipment and a Cyber 76-14 computer. G.R.

A82-26963 Radiometric calibration of the Coastal Zone Color Scanner on Nimbus 7 - A proposed adjustment. M. Viollier (Lille I, Université, Villeneuve d'Ascq, Nord, France). *Applied Optics,* vol. 21, Mar. 15, 1982, p. 1142-1145. 12 refs. Research supported by the Centre National d'Etudes Spatiales and Ministère de l'Environnement et du Cadre de Vie.

In conjunction with atmospheric effect computations, ground measurements of water reflectances for two very clear days are compared with Coastal Zone Color Scanner satellite data to point out scanner calibration errors. A new set of calibration constants is proposed which standardizes radiances relative to the extraterrestrial solar irradiance. It is emphasized that the suggested modification is theoretically valid only for the June and July, 1979 period of study alone, and for the corresponding electronic gain. It is expected that similar calibration error trends exist for the other gains and periods. O.C.

A82-27576 * International Symposium on Remote Sensing of Environment, 15th, University of Michigan, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volumes 1, 2 & 3. Symposium sponsored by the Environmental Research Institute of Michigan, NOAA, NASA, et al. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981. Vol. 1, 570 p.; vol. 2, 568 p.; vol. 3, 493 p. Price of three volumes, $88.

Developments related to advanced sensors and sensor systems are being examined, taking into account advanced aerospace remote sensing systems for global resource applications, spaceborne radar observation of the earth surface, a concept for an advanced earth resources satellite system, technologies for the multispectral mapping of earth resources, and the use of Landsat images and morphologic analogs in space exploration. Other topics discussed are related to modeling for terrain analysis, digital processing and analysis of remotely sensed data, microwave remote sensing, new discoveries from planetary remote sensing, and data base utilization. Advances in the area of luminescence are also considered along with future plans and prospects concerning the remote sensing of the earth from space. G.R.

A82-27577 * # Advanced aerospace remote sensing systems for global resource applications. J. V. Taranik (NASA, Office of Space and Terrestrial Applications, Washington, DC). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 3-20. 8 refs.

The Landsat program, which was concerned with testing the use of satellite data for global resource observations, has been an unqualified success, and users of Landsat data demand now that repetitive global multispectral data be provided on a routine basis for a wide variety of applications. A review is provided of the current status of NASA's land observation program, new developments in advanced aerospace remote sensing techniques, and issues related to the development and testing of new prototype systems by the U.S. The current Landsat program is considered along with developments in solid-state imaging technology, short wave infrared research using the Space Shuttle, the Shuttle Orbiter camera payload system large format camera, and advanced research in thermal remote sensing. Attention is also given to the potential of imaging radar for global resource observations, and research related to geopotential field mapping. G.R.

A82-27578 * # Spaceborne radar observation of the earth surface. C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 21-31. 9 refs. Contract No. NAS7-100.

Seasat SAR images are being analyzed to determine the potential of spaceborne radars for earth resources and ocean surface observation. Examples are presented for a variety of applications in structural mapping, lithological classification, soil moisture detection, polar ice motion monitoring and ocean features observation. These examples are briefly discussed with emphasis on the future research needed to further the capability of radar sensors, by themselves or in combination with other sensors. A brief discussion is then given on the spaceborne sensors which are required and planned to meet these needs. (Author)

A82-27579 # A concept for an advanced earth resources satellite system. G. T. Keene (Eastman Kodak Co., Rochester, NY). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 33-44. 5 refs.

Attention is given to a study concerned with the definition of a concept for an advanced sensor system to follow the Landsat D series. In this project NASA sought maximum operational reliability and minimum development risk by use of proven mechanisms and available technology, taking into account an employment of visible (VIS), shortwave infrared (SWIR), and thermal infrared (TIR) spectral bands. The TIR section was to be an optional modular unit, and all focal planes would utilize the inherent registration of solid state linear arrays with no moving parts while imaging, and passive thermal control. Attention is given to optics, detectors, thermal control, performance estimates, and recent modifications. G.R.

A82-27580 * # Technologies for the multispectral mapping of earth resources. J. B. Wellman (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 45-64. 16 refs. Contract No. NAS7-100.

The application of solid-state detector array imaging to the remote sensing of the earth as a follow-on to currently planned Landsat missions provides the opportunity to achieve significantly increased performance. First-order advantages to be anticipated are higher sensitivity resulting in greater radiometric accuracies and improved geometric fidelity. The Multispectral Mapper design concept is responsive to a broad range of user needs by incorporating in-flight selection of spectral bands, instantaneous fields of view, and swath width. This versatility is achieved by the use of an imaging spectrometer which permits both spatial and spectral sampling in the image plane using area array detectors. Other improvements over the current Landsat multispectral scanner and Thematic Mapper include higher spatial resolution and inherently precise registration of the spectral bands. The key technologies required in order to realize these improvements include short-wavelength infrared detectors, wide field of view, broad spectral coverage optics, focal plane cooling, and high-speed onboard signal processing. Significant development activities will be required if an advanced remote sensing capability is to be implemented. (Author)

A82-27581 # Mapsat compared to other earth-sensing concepts. A. P. Colvocoresses (U.S. Geological Survey, Reston, VA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 65-72. 10 refs.

The acceptance and use of Landsat products clearly indicates that there is a need for a truly operational earth-sensing system. In December 1980 NASA issued a request for proposal of an MLA (multispectral linear array) Instrument Definition Study. The MLA study calls for two 'short-wave' infrared bands (1.55 to 1.75 micrometers and 2.08 to 2.35 micrometers). However, in connection with cost and complexity problems, it appears unlikely that these bands will be utilized on any operational system during the 1980's. The characteristics of available systems for imaging the earth are discussed. Attention is given to Mapsat which is the result of an effort to define an operational earth-sensing system. Mapsat is based on Landsat technology and will provide global coverage on a continuous basis. Aspects of mapping geometry are considered along with questions of resolution and data transmission, spectral bands, stereoscopic capability, and one-dimensional data processing. G.R.

A82-27583 * # Information expectations from Landsat-D. V. V. Salomonson, D. L. Williams, and J. L. Barker (NASA, Goddard Space Flight Center, Applications Directorate, Greenbelt, MD). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 81-93. 5 refs.

The first satellite of the Landsat-D Project is to be launched in the third quarter of 1982 with a second satellite to be prepared for launch 12 to 15 months later. Both spacecraft are to include the familiar Multispectral Scanner (MSS) and the advanced multispectral scanner called the Thematic Mapper (TM). The ground data processing system for the MSS data is to be ready to produce 200 scenes a day in 1982. The data processing systems for the TM are to be fully operational at the 50 to 100 scenes a day level in early 1985. The fabrication of the system components has proceeded well in recent months, and integration of the total system is under way. The procedures for processing the data and meeting specifications are nearly completed for the MSS and are outlined in detail for the TM. An outline of an investigation program stressing systems performance has been developed for the period 1982 to 1985. (Author)

A82-27589 # Overview of digital processing of SAR data. J. P. Guignard (ESA, Data Handling and Signal Processing Div., Noordwijk, Netherlands). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 179-194. 18 refs.

It is pointed out that before the launch of the Seasat-A spacecraft, the processing of synthetic aperture radar (SAR) data was mainly performed using optical correlators. Seasat offered the first opportunity to develop digital SAR processors. An overview is provided of the Seasat-A SAR digital processors, taking into account the MDA configuration, Communication Research Center processing, the RAE processor, the DFVLR-GSOC processor, the JPL processor, the Bendix SAR processor, the CCRS processors, the Mitsubishi Seasat processor, the Norway Defense Research Establishment processor, and the Nippon Electric Company processor. Attention is also given to algorithms, image quality experiments, and a number of new developments. G.R.

A82-27591 # The logit classifier - A general maximum likelihood discriminant for remote sensing applications. P. F. Maynard and A. H. Strahler (California, University, Santa Barbara, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 213-222. 17 refs.

The most commonly used discriminant function in remote sensing applications is the Bayes maximum likelihood classifier (Bayes MLC). However, in an evaluation study it is found that Bayes MLC with parametric estimation of the probability density functions is not an optimal classifier for many remote sensing applications. It is pointed out that there are several statistically acceptable techniques for classifying nominal data such as the probit, logit, and arctan. However, the logit model has computational advantages since it is a closed (explicit) functional form with convenient curvature properties for numerical optimization. An investigation shows that the logit classifier is both theoretically and experimentally superior to the Bayes MLC with the simulated data and the Landsat Multispectral Scanner System (MSS) data employed in the study. G.R.

A82-27594 * # Simulation and studies of spaceborne synthetic aperture radar image quality with reduced bit rate. F. Li, D. Held, B. Huneycutt, and H. Zebker (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 259-270. 18 refs. Contract No. NAS7-100.

A computer simulation program that is used to study the effects of digitization in spaceborne synthetic aperture radar systems is described. An analytical study of the distortion noise introduced by the digitization process at various gain settings, sampling rates and bit error rates is presented and the results agree well with those obtained from the simulation program. The simulation program is also used to study the spatial frequency response of hard-limiting (quantizing to 1-bit) synthetic aperture radar systems. The implications of these results on synthetic aperture radar system design are discussed. (Author)

A82-27595 # Features of a generalized digital Synthetic Aperture Radar processor. J. R. Bennett, I. G. Cumming, P. R. McConnell, and L. Gutteridge (MacDonald, Dettwiler and Associates, Ltd., Richmond, British Columbia, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 271-290.

A summary of the planned or proposed international Synthetic

Aperture Radar (SAR) activity for the next decade is provided in a table. A large number of primarily Shuttle-based experimental missions carrying SARs are being considered. In terms of SAR processing requirements, this activity translates into a need for modest throughput, highly flexible processors. The required processors will have to be adaptable to SARs of different pulse coding schemes, frequency, antenna length (beam width), swath width, depression angle, altitude, squint angle, polarization, and data rates. Experimental flexibility will be required to process the data from a given SAR configuration in a variety of different ways, taking into account resolution, multilooks, and multisubapertures. A description is presented of a digital processor designed to service the needs of this projected SAR activity. G.R.

A82-27606 # **The Japanese MOS and Los program.** Y. Ishizawa (National Space Development Agency of Japan, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 433-443.

The status of the Japanese Earth Observation Satellite Program and sensor development program is reviewd, with emphasis on the Marine Observation Satellite-1 (MOS-1) to be launched in 1985. Mission objectives of the MOS-1 program are outlined, and the satellite and radiometers are described. Three sensors to be mounted on the satellite are presented, which are to observe visible, near visible, near infrared, infrared, and microwave regions. The MOS-1 is a three-axis stabilized satellite with a cubic body on which the three sensors and bus equipment are mounted. The overall height, including antennas, is about 300 cm, with a length and width of about 146 and 126 cm, respectively. D.L.G.

A82-27628 # **Implementation of the Space Oblique Mercator projection in a production environment.** J. Brooks, R. Kumar, and I. Levine (General Electric Co., Space Div., Lanham, MD). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 671-679. 5 refs.

The Space Oblique Mercator (SOM) projection, first considered by Colvocoresses (1974) is the first known map projection to provide continuous conformal mapping of satellite imagery true to scale along ground track, and accurate to within a few parts in a million. Although SOM was specifically designed for Landsat Imagery, it is also suitable for other near polar satellites. Snyder (1978) obtained a full mathematical derivation of the projection and developed a computer program for it (Snyder's Code). The present investigation has the objective to show that it is possible to incorporate the Snyder code output into Landsat-D Multispectral Scanner System (MSS) processing by means of mostly offline calculations. G.R.

A82-27633 # **Spectritek - A multispectral electron-optic pushbroom camera.** R. F. Lucy (Itek Corp., Optical Systems Div., Lexington, MA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 715-720.

Spectritek is an electro-optic aircraft camera concept designed to provide multispectral imagery for earth resources exploration. The silicon CCD focal plane arrays provide registered imagery in three Landsat color bands. The camera sensitivity meets Landsat-MLA requirements. The data collected is recorded on magnetic tape. After ground processing and calibration the data is stored in a low-cost storage medium for use by earth resources investigators. The camera system provides the wide area coverage of a satellite sensor and the high resolution of an aircraft sensor. Spectritek complements a companion large format stereo film camera (Metritek). Another advantage of the aircraft approach is its ability to update data files rapidly and economically. (Author)

A82-27638 # **Locating prehistoric archaeological sites using Landsat.** I. Wells, J. Custer, and V. Klemas (Delaware, University, Newark, DE). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 771-780. 29 refs. Research supported by the Bureau of Archaeology and Historic Preservation of the State of Delaware.

It has been suggested that computer statistical techniques using Landsat digital imagery classifications can be applied over large areas and a large number of sites to locate areas that have a high probability of containing prehistoric sites. To test this hypothesis, an experiment has been performed on a selected area along the Appoquinimink River in New Castle County, Delaware. The results of the experiment suggest that Landsat data combined possibly with digital terrain data can provide the necessary consistent synoptic analysis of the landscape. B.J.

A82-27642 # **Passive bathymetric measurements in the Bruce Peninsula region of Ontario.** W. C. Weidmark, S. C. Jain (Moniteq, Ltd., Concord, Ontario, Canada), H. H. Zwick (Canada Centre for Remote Sensing, Ottawa, Canada), and J. R. Miller (York University, Downsview, Ontario, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 811-822. 12 refs. Research supported by the Canada Centre for Remote Sensing; Department of Supply and Services Contract No. OSQ-80-00097.

Airborne MSS measurements in the 400-1000 nm wavelength range were performed in the summer of 1980 over the Bruce Peninsula in order to evaluate techniques of computing water depth from MSS imagery. The spectral volume reflectance maps were processed using radiative transfer models to interpret the image in terms of water depth. Theoretical modelling shows that the modification of Hulbert's formulation of the two-flow model to include asymmetric attenuation of upwelling and downwelling radiation results in reflectance values which express accurately the exact Monte Carlo calculations. A value of asymmetry factor can be chosen for any scattering albedo and backscatter probability to ensure a good fit of the two-flow model results to the Monte Carlo calculations. B.J.

A82-27648 # **Utilization of spatial complexity in computer classified Landsat MSS data for multi-factoral thematic mapping.** J. W. Merchant (Kansas, University, Lawrence, KS). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 905-914. 32 refs.

Graphic displays of classified Landsat MSS data commonly exhibit substantial variations in the degree to which pixels of various cover types are fragmented, aggregated and interspersed within a scene. The nature of the spatial distribution of classified pixels, or 'spatial complexity', in a scene is discussed. The components of cover frequency, cover diversity and cover composition are defined and are employed to measure spatial complexity. Regions of similar spatial complexity are delimited in a Kansas test site and are found to be associated with independently defined multi-factoral landscape regions. Such multi-factoral regions are characterized by integrated complexes of physical and cultural phenomena. Potential applications of research results are considered. (Author)

A82-27649 # **Development and implementation of a low cost micro computer system for Landsat analysis and geographic data base application.** N. L. Faust, L. E. Jordon, III, and M. D. Furman (ERDAS, Inc., Atlanta, GA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 915-917.

This paper addresses some of the issues involved in the design and operational use of a low-cost image processing system based on recent advances in micro-computer technology. Also discussed are the integration on the micro system of Landsat image processing and GIS capabilities, with an overview of existing software capabilities such as false color display, training field selection, geometric correction, and both supervised and unsupervised (cluster) classification. Considerations for the use of the system by 'non-computer types' provide the basis for a menu-selection approach using simple keywords. Future directions in the development of the micro system are also mentioned. (Author)

A82-27652 # **Instrumentation for remote reflectance and radiance measurements.** L. Daubner, J. Davies, R. Dick, and S. M. Till (Barringer Research, Ltd., Toronto, Canada). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 939-948. 12 refs.

Reflectance spectroscopy has led to the development of a family of instruments capable of remote sensing applications. The various features in the reflectance spectra of soils, rocks, and other materials are dependent upon their constituent minerals. Attention is given to the Field Reflectance Spectrometer (REFSPEC), which is a self-contained dual beam scanning reflectance spectrometer. The optical train looks alternately at the target of choice and then at the solar radiation. REFSPEC comprises the optical head, a battery pack, a standard reflectance target package, and a digital data logger. An analog output is also provided. Another instrument considered is the Hand Held Ratioing Radiometer (HHRR). This instrument measures the energy reflected by a target scene of interest. Applications for both instruments are related to general studies, agriculture, geobotany, geochemistry, geology, and oceanography. G.R.

A82-27653 # **Orbital performance of a 1.6 micrometer DMSP snow/cloud discrimination sensor.** A. W. Kimball (Westinghouse Electric Corp., Baltimore, MD). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 949-958. USAF-supported research.

A report on the orbital performance of a line array infrared (1.57 + or - 0.6 micron) sensor flown on DMSP satellite F4 in 1979 is given. Instrument characteristics are discussed briefly. Numerical data reduction and normalization methods are described. Samples of orbital data, normalized and compared to data in DMSP visible and thermal infrared channels, are presented. It is concluded that the instrument design performance was essentially as expected and that cloud/snow contrast ratios predicted to lie in the range of three to six were realized in analysis of daylight data over the Northern Hemisphere in December 1979. (Author)

A82-27659 # **University of Dundee satellite image data acquisition and archiving facility.** P. E. Baylis (Dundee, University, Dundee, Scotland). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1017-1024. 10 refs.

The capabilities, operations and equipment of the facility for the reception and archiving of satellite image data maintained by the University of Dundee are presented. The Dundee station receives, records and stores data from the Very High Resolution Radiometer (VHRR) of the ITOS/NOAA satellites, the Advanced Very High Resolution Radiometer (AVHRR) of the Tiros-N/NOAA satellites, the Coastal Zone Color Scanner (CZCS) of the Nimbus 7 satellite, and the Visible and Infra-red Spin Scan Radiometer of the Meteosat satellite. Products available from the archive include hard copy and browse files of VHRR/AVHRR and CZCS images, and computer compatible tapes of AVHRR and CZCS scenes. Station equipment used to carry out the functions of the Dundee station consists of a spun aluminum antenna with computer-driven drive motors for satellite tracking purposes, connected with two front ends, telemetry receivers, a bit conditioner, frame synchronizer, and decommutator, and also includes a video processor and tape transports. A.L.W.

A82-27675 # **The use of wave contrast measurements in the evaluation of SAR/gravity models.** E. S. Kasischke and R. A. Shuchman (Michigan, Environmental Research Institute, Ann Arbor, MI). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1187-1209. 36 refs. Contract No. N00014-76-C-1048.

A new method to measure the detectability of gravity waves imaged by a synthetic aperture radar (SAR) has been developed. This new method is called a peak-to-background ratio (PBR). The PBR was used in studying two different SAR data sets. X- and L-band aircraft SAR data collected over a Lake Michigan test site were used to study the effects of changing SAR processing parameters (telerotation adjustments and integration time) on wave visibility. A second data set was collected by the Seasat L-band SAR over the JASIN test array and was used to correlate PBRs to various wind and wave parameters. Results of this study indicate the peak-to-background ratio is an effective means to correlate SAR/oceanography theory with actual SAR data sets. (Author)

A82-27681 # **A low cost NOAA/TIROS AVHRR receiving station.** W. Carroll (Western Australia Institute of Technology, South Bentley, Australia), R. D. Cargill, and F. R. Honey (Commonwealth Scientific and Industrial Research Organization, Div. of Land Resources Management, Wembley, Australia). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3.
Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1253-1264. 12 refs.

In August 1980, a project was initiated with the objective to build in Australia a facility for real-time reception, processing, and dissemination of data from the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA satellites. Using existing equipment and developing some special purpose hardware and software, the facility cost approximately $5000, excluding labor costs. This facility will provide data for experiments on correlation of sea surface temperatures with fish catches around Australia, for cloud seeding experiments, and for regional geologic, soil moisture, and land system mapping. G.R.

A82-27683 # **Spatial resolution and geometric potential of planned earth satellite missions.** R. Welch (Georgia, University, Athens, GA). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1275-1283. 14 refs.

Evidence to-date indicates that spatial resolutions of satellite sensor systems equivalent to 5 to 10 m IFOV will be required for the compilation of topographic maps at scales larger than 1:250,000, or for the preparation of land use maps depicting Level II and III classes of information. Film and line array cameras planned for use on satellite missions in the 1980's will provide image data meeting accepted accuracy standards for planimetric maps of 1:25,000 to 1:100,000 scale. Contour intervals of approximately 50 to 100 m appear feasible. Contour intervals of this magnitude are normally associated with topographic maps of 1:250,000 scale. (Author)

A82-27706 # **Geometric correction of airborne multispectral scanner images.** M. Kindelan (IBM Scientific Centre, Madrid, Spain), V. Moreno (Instituto Nacional de Técnica Aerospacial, Madrid, Spain), and A. Valverde (Escuela Técnica Superior de Ingenieros de Minas, Madrid, Spain). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1539-1549. 17 refs.

The aim of this paper, is to compare different methods to correct the geometric distortions which are present in Multispectral Scanner Images, and to propose a method based on the orientation parameters which are recorded in flight in the same tape as the image data. This method has the advantage that it may be completed automatically, while their results are comparable or better than those of other methods. (Author)

A82-28127 † **Investigation of earth resources using rocket and space technology (Issledovanie zemnykh resursov pri pomoshchi raketno-kosmicheskoi tekhniki).** V. P. Mishin. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 9-11. In Russian.

Various applications of the remote sensing of earth resources are described, and the basic characteristics of the investigation of resources of land and sea from space are discussed. The features of a long-term remote sensing program are examined. B.J.

A82-28128 † **Structure of hardware and software at a regional center for the automated processing of aerial and space**

remote-sensing images (Struktura tekhnicheskikh i programmnykh sredstv regional'nogo tsentra avtomatizirovannoi obrabotki aerokosmicheskikh izobrazhenii). A. S. Alekseev, V. N. Dement'ev, B. K. Kozhevnikov, N. V. Kul'kov, V. P. Piatkin, R. M. Salavatov, and S. L. Shevelev. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 12-21. 8 refs. In Russian.

The paper describes a multiprocessor system for the processing of multispectral remote-sensing images, which features interactive thematic processing. Hardware and software structures for the system are described, and particular attention is given to the development of problem-oriented languages. B.J.

A82-28129 † The structure and basic parameters of a satellite system for the remote sensing of earth resources (O sostave i osnovnykh parametrakh kosmicheskoi sistemy issledovaniia prirodnykh resursov). A. S. Selivanov. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 22, 23. In Russian.

The characteristics of a remote sensing complex for the study of earth resources are briefly described. Particular attention is given to the characteristics and operation of a multispectral scanner of high and medium resolution. Also included in the complex are side-looking radar, a radar altimeter, and a microwave scanning radiometer. The organization of regional processing centers for the remote sensing data is considered. B.J.

A82-28130 † Experience with a variety of studies of earth resources in the Kalmyk ASSR using space imagery (Opyt kompleksnogo izucheniia prirodnykh resursov Kalmytskoi ASSR na osnove kosmicheskoi informatsii). I. N. El'vartynov and Iu. P. Kienko. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 23-26. In Russian.

Various applications of the remote sensing of earth resources in the Kalmyk ASSR are reviewed. These applications include structural mapping, gas and oil exploration, hydrogeology, soil studies, and the mapping of agricultural lands and pastures. B.J.

A82-28132 † The earth resources program for the long-term orbital station Salyut 6 (Programma IPRZ na dolgovremennoi orbital'noi stantsii 'Saliut-6'). V. V. Arkhipov, A. D. Koval', V. V. Kovalenok, A. A. Tishchenko, and L. A. Ronzhin. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 30-36. In Russian.

A general review is given of the basic features of the remote sensing of earth resources from Salyut 6. Particular attention is given to the development of the earth resources program, preparatory steps towards the implementation of the program, and the acquisition, processing, and application of the data. B.J.

A82-28140 † Complex of units for the storage and automated processing of research data (Kompleks sredstv dlia nakopleniia i avtomatizirovannoi obrabotki dannykh pri nauchnykh issledovaniiakh). N. I. Baklashov, G. M. Solodikhin, and L. V. Sergeev. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 76-82. 5 refs. In Russian.

The paper describes an onboard system for the acquisition, storage, and processing of remote sensing data. Various storage techniques are discussed, and block diagrams of the various elements of the system are presented. B.J.

A82-28142 † Machine implementation of algorithms for the mapping of soil moisture on the basis of microwave-radiometer measurements (Mashinnaia realizatsiia algoritmov kartirovaniia vlazhnosti pochvy po rezul'tatam SVCh-radiometricheskikh izmerenii). N. A. Armand, F. A. Mkrtchian, and A. M. Shutko. *(Vsesoiuznaia Konferentsiia po Problemam Issledovaniia Prirodnykh Resursov Zemli i Mirovogo Okeana, Aviatsionno-Kosmicheskimi Sredstvami, Moscow, USSR, Nov. 1980.) Geodeziia i Aerofotos'emka,* no. 1, 1982, p. 89-94. In Russian.

The paper describes a method for the compilation of soil moisture maps on the basis of microwave remote-sensing data. The technique involves the use of the BENSON graphic device, a general-purpose computer, and an analog-digital converter. The program for the implementation of the proposed algorithm is presented, and it is shown that the program makes it possible to obtain moisture maps of arbitrary gradation. B.J.

A82-28342 Instruments watch for impending earthquakes. B. C. Cole. *High Technology,* vol. 2, Mar.-Apr. 1982, p. 43-47, 50, 51.

The current state of the art of earthquake prediction techniques is discussed. Signs of an imminent earthquake detected upon the analysis of seismic records preceding the Sylmar quake in 1971 are described which have led to the development of more sophisticated instruments and procedures for monitoring seismic velocities and other precursors, including seismometers and seismographs, tiltmeters, linear-strain meters, creep meters, dilatometers, magnetometers, gravimeters, ohmmeters, well monitors, radon monitors and radio telescopes and satellites. Problems with the establishment of a useful earthquake theory on which to base a prediction model are considered, and plans for improving data collection and analysis, particularly from California and the western states, are outlined. The mixed record of previous earthquake predictions in the United States, the Soviet Union and China is noted, and indications of greater confidence in predictions over the next decade as the understanding of earthquake processes grows are pointed out. A.L.W.

A82-28466 † Complex examination of photorectifiers (Kompleksnoe issledovanie fototransformatorov). V. A. Moroz and L. I. Iablonskii. *Geodeziia i Kartografiia,* Feb. 1982, p. 42-44. In Russian.

A method for the complex investigation of photorectifiers is proposed which involves the simultaneous determination of instrumental accuracy and corrections to null points which characterize the operational accuracy of the basic elements of the instruments. This makes possible a more effective adjustment and improves the accuracy of transformation. B.J.

N82-16154*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE MICROWAVE RADIOMETER SPACECRAFT. A DESIGN STUDY: EXECUTIVE SUMMARY
Uriel M. Lovelace *In its* The Microwave Radiometer Spacecraft Dec. 1981 p 1-14 refs

Avail: NTIS HC A11/MF A01 CSCL 22B

A conceptual design was developed for a microwave radiometer spacecraft (MRS) using a large passive reflector, microwave radiometer, and advanced control concepts soil moisture mapping from microwave sensing for global crop forecasting. Mission requirements and tradeoffs were defined, and major subsystems (structural, electromagnetic surface, and attitude control) conceptually designed. An overview of the mission and a summary of the study results are presented. J.M.S.

N82-16155*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MISSION DEFINITION FOR A LARGE-APERTURE MICROWAVE RADIOMETER SPACECRAFT
Lloyd S. Keafer, Jr. *In its* The Microwave Radiometer Spacecraft Dec. 1981 p 17-32 refs

Avail: NTIS HC A11/MF A01 CSCL 22B

An Earth-observation measurements mission is defined for a large-aperture microwave radiometer spacecraft. This mission is defined without regard to any particular spacecraft design concept. Space data application needs, the measurement selection rationale, and broad spacecraft design requirements and constraints are described. The effects of orbital parameters and image quality requirements on the spacecraft and mission performance are discussed. Over the land the primary measurand is soil moisture: over the coastal zones and the oceans important

measurands are salinity, surface temperature, surface winds, oil spill dimensions and ice boundaries; and specific measurement requirements have been selected for each. Near-all-weather operation and good spatial resolution are assured by operating at low microwave frequencies using an extremely large aperture antenna in a low-Earth-orbit contiguous mapping mode. Author

N82-16440*# General Electric Co., Philadelphia, Pa. Space Div.

LANDSAT-2 AND LANDSAT-3 FLIGHT EVALUATION REPORT, 23 JANUARY TO 23 JULY 1980

1 Aug. 1980 241 p ERTS

(Contract NAS5-21808)

(E82-10022; NASA-CR-164392; Doc-80SDS4229) Avail: NTIS HC A11/MF A01 CSCL 05B

Flight performance analyses of LANDSAT 2 and LANDSAT 3 are presented. Spacecraft operations and orbital parameters are summarized for each spacecraft. Data are provided on the performance and operation of the following onboard subsystems: power; attitude control; command/clock; telemetry; orbit adjust; magnetic moment compensation assembly; unified S-band/premodulation processor; electrical interface; thermal; narrowband tape recorders; wideband tape recorders; return beam vidicon; multispace multispectral scanner; and data collection. Orbit reference tables for January 1980 through July 1981 are included. A.R.H.

N82-16444*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

BRAZILIAN REMOTE SENSING ACTIVITIES, CURRENT AND PROSPECTIVE NEEDS

Nelson deJesusParada, Principal Investigator Apr. 1981 55 p Presented at the United Nations Regional Seminar on Remote Sensing Appl. and Satellite Commun. for Education and Develop., Toulouse, 21-25 Apr. 1981 Sponsored by NASA ERTS

(E82-10026; NASA-CR-164811) Avail: NTIS HC A04/MF A01 CSCL 05A

Remote sensing activities began in Brazil in 1968 and are now concentrated in a satellite and a side-looking radar program. The radar program systematically surveys the natural resources of the whole national territory in a level of detail compatible with a 1:1,000,000 scale, focusing on geology, geomorphology, soil, agricultural aptitude, ecology, and potential land use. The satellite program receives, processes, and disseminates remotely sensed data (basically LANDSAT data) and develops methodologies for applying these data for surveying, monitoring and mapping. Special emphasis is given to national priorities, particularly food and energy. Major results obtained and difficulties encountered in the following applications are described: crop forecasting, reforestation, mineral exploration, fishing chart models, land use, sedimentation in reservoirs, and deforestation in the Amazon forest. A decision was made to upgrade existing LANDSAT reception and processing stations to receive and process MSS and thematic data from LANDSAT-D and from SPOT and to construct two satellites for launch in 1987-1990. A.R.H.

N82-16445*# South Dakota State Univ., Brookings. Remote Sensing Inst.

REMOTE SENSING APPLICATIONS TO RESOURCE PROBLEMS IN SOUTH DAKOTA Semiannual Progress Report, 1 Jul. 1980 - 1 Jan. 1981

Victor I. Myers, Principal Investigator, T. Bailey, R. G. Best, J. C. Eidenshink, D. Hause, H. Haivala, F. A. Schmer, M. Wehde, and K. Winks 1 Jan. 1981 102 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS

(Grant NGL-42-003-007)

(E82-10027; NASA-CR-164810; SDSU-RSI-81-03) Avail: NTIS HC A06/MF A01 CSCL 05A

Data obtained from field studies, aerial color infrared photography, and LANDSAT imagery are being used for resources management in South Dakota. The procedures used and results obtained are described for the following applications: (1) detecting Dutch elm disease in the city of Watertown; (2) determining the distribution and abundance of grasshoppers in Corcon County; (3) inventorying sagebrush in Butte County to support sage grouse management; (4) computerized digitization of aerial thermography of the concentration of Canada geese on the Missouri River Reservoir; (5) surveying to determine the diversion of water along the Belle Fourche River from the Keyhole Reservoir in eastern Wyoming to the City of Belle Fourche in western South Dakota; (6) identifying and locating areas of the Lower James River where stream blockages, streambank erosion, and flooding occur; and (7) acquiring and analyzing data on the landcover in the Lake Herman watershed for the national pilot Model Implementation program. A.R.H.

N82-18466# Analysis and Technology, Inc., North Stonington, Conn.

EVALUATION OF TWO AN/APS-94 SIDE-LOOKING AIRBORNE RADAR SYSTEMS IN THE DETECTION OF SEARCH AND RESCUE TARGETS Interim Report, Jan. 1978 - Aug. 1981

S. R. Osmer, N. C. Edwards, Jr., G. L. Hover, and T. J. Mazour Aug. 1981 163 p refs

(Contract DTCG39-80-C-80052)

(AD-A108404; USCG-D-64-81) Avail: NTIS HC A08/MF A01 CSCL 17/9

Side-Looking Airborne Radar (SLAR) detection data were gathered in conjunction with four visual detection experiments designed to improve search planning guidance contained in the National Search and Rescue Manual. HC-130 aircraft, equipped with either the Airborne Oil Surveillance System (AOSS) or SLAR/radar image processor (SLAR/RIP) configuration of the AN/APS-94C or D SLAR, conducted controlled searches for life rafts, small boats, and 41- to 95-foot Coast Guard vessels in Block Island Sound or open ocean. Using a microwave tracking system and SLAR data, the positions of searchers and targets were accurately reconstructed to facilitate the verification of detections on SLAR films or video tape. These data were used to evaluate the effects of environmental and controllable parameters on SLAR detection of the various target types. Target size/composition search altitude, swell height, wind speed, and humidity/precipitation were found to have a significant influence of SLAR detection performance. Upper-bound lateral range curves and sweep widths for SLAR search are included. Real-time performance tests for AN/APS-94D SLAR and system performance tests for new SLARs (AN/APS-131) are recommended. GRA

N82-18481# Thomson-CSF, Meudon-la-Foret (France). Dept. Espace-Satellites.

STUDY OF SYNTHETIC APERTURE RADAR IN 2D - 2FS OPERATION OVER THE OCEAN Final Report

Paris ESA 5 Mar. 1981 25 p

(Contract ESA-4586/81/F-DD(SC))

(ESA-CR(P)-1475) Avail: NTIS HC A02/MF A01

Synthetic aperture radar operation (imaging mode) for the European Remote Sensing program is considered. The 2D - 2FS function consists in operating in a low power mode (100 W RF) for 1.5 sec every 15 sec in order to image patches on the sea surface of 5 km by 5 km every 100 km, with the 5 km squares in the center of the beam. The data stream needs to be buffered such that a continuous (300 kbit/sec) data stream is delivered. The impact of such a mode on hardware, especially in terms of mass and power consumption, was studied. Results show that the 2D - 2FS option requires minor changes. One additional dispersive line and one additional box, containing the added hardware for data handling, are necessary. This represents 7 kg more (with redundancy) for payload. The average power consumption in wave mode becomes 150 W. Author (ESA)

N82-18564# British Aerospace Dynamics Group, Bristol (England). Space and Communications Div.

IMAGING MICROWAVE RADIOMETER. PHASE A STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report

C. R. Francis Paris ESA Jul. 1980 50 p refs Prepared in cooperation with Dornier-Werke G.m.b.H., Friedrichshafen, West Germany, B and W Electronik and Tech. Univ. of Denmark Original contains color illustrations

(Contract ESA-4243/80/F-CG(SC))

(ESS/SS-1006; ESA-CR(P)-1468) Avail: NTIS HC A03/MF A01

An imaging microwave radiometer, a passive microwave instrument proposed for inclusion in the sensor payload of the Coastal Ocean Monitoring Satellite System (COMSS) spacecraft, was studied. The instrument detects microwave radiation at 5 frequencies in the range 6.8 to 36.5 GHz, each at vertical and horizontal polarization, and has an optional facility for measurements at 90 GHz. Results show that the instrument

meets the experiment requirements proposed by ESA and meets the accommodation constraints of the COMSS payload.
Author (ESA)

N82-18672# Research Inst. of National Defence, Linkoeping (Sweden). Huvudavdelning 3.
OBSERVATIONS WITH AN IMAGING 35 GHz RADIOMETER OF TERRAIN IN MALMSLATETT, JULY 1980
Gunnar Stenstroem and Ain Sume Oct. 1981 39 p refs Original contains color illustrations
(FOA-C-30240-E1/E3) Avail: NTIS HC A03/MF A01

Microwave emission of militarily important terrain was studied, using Dicke radiometer measurements around an air traffic control tower. The radiometer has a 60 cm parabolic Cassegrain antenna, controlled through a desk top computer, which also manages the data sampling and recording. The radiometric images were color-coded and presented on-line on a TV monitor. A selected part of the scenery was monitored once every hour in order to examine time variations of the observed antenna temperature and their correlation with day-to-night and meteorological changes. The significance of reflected, cold sky radiation in smooth surfaces (metals, plastics, roads) is demonstrated, resulting in a contrast with the less reflective surroundings. Author (ESA)

N82-18776*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRATOSPHERIC INSTRUMENTS AND ANALYSES
In its The Stratosphere 1981 Jan. 1982 26 p

Avail: NTIS HC A22/MF A01 CSCL 04A

The Instruments are divided into two groups, ground based instruments and satellite-borne instruments. The ground based instruments include a Dobson ozone spectrophotometer, a filter ozonometer, and ozonesondes. The satellite-borne instruments include: a backscatter ultraviolet spectrometer, a high resolution infrared radiation sounder, a infrared interferometer spectrometer, a limb radiance inversion radiometer, and multichannel filter radiometer. A list of investigations using stratospheric satellite data is presented. T.M.

N82-18881# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A MICROCOMPUTER FOR CONTROL OF DATA COLLECTION PLATFORMS [UM MICROCOMPUTADOR PARA CONTROLE DE PLATAFORMAS DE COLETA DE BADOS]
Jose Bianchi Neto and E. W. Bergamini Jun. 1981 12 p refs In PORTUGUESE; ENGLISH summary Presented at the 2nd Natl. Meeting on Automation, Salvador, Bahia, Brazil, Jul. 1981
(INPE-2104-RPE/331) Avail: NTIS HC A02/MF A01

A microcomputer developed for application in an environmental data collection platform performs functions of data control, acquisition and processing of a self timed data collection platform compatible with the GOES (satellite) system. Block diagrams are presented and the data collection platform is described.
Author

N82-19520# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AUTOMATIC ANALYSIS OF MULTISPECTRAL IMAGES
Luciano Vieira Dutra, Ricado Cartaxo Modesto deSouza, Fernando Augusto Mitsuo, II, and Jose Carlos Moreira Aug. 1981 33 p refs In PORTUGUESE; ENGLISH summary
(INPE-2212-MD/009) Avail: NTIS HC A03/MF A01

Some ideas of automatic multispectral image analysis are introduced. Automatic multispectral image analysis plays a central role in numerically oriented remote sensing systems. It presupposes the utilization of electronic equipments, mainly computers and their peripherals, to help people to interpret the information contained in multispectral digital imagery. This necessity derives from the great amount of multispectral data gathered by remote sensors within satellites and airplanes. When the number of channels or spectral bands is increased, the interpretation becomes more complex and subjective. In some cases, for example, in harvest estimation in national or regional level, it is imperative to use computer systems to complete the work within the time required. Automatic analysis also aimes to eliminate subjective factors that appear in the human interpretation, so increasing the global precision. R.J.F.

N82-19647*# Systematics General Corp., Sterling, Va.
GUIDELINES FOR SPACEBORNE MICROWAVE REMOTE SENSORS
Viqui Litman (Applied Media, Inc., Greenbelt, Md.) and John Nicholas Mar. 1982 87 p refs
(Contract NASw-3398)
(NASA-RP-1086) Avail: NTIS HC A05/MF A01 CSCL 14B

A handbook was developed to provide information and support to the spaceborne remote sensing and frequency management communities: to guide sensor developers in the choice of frequencies; to advise regulators on sensor technology needs and sharing potential; to present sharing analysis models and, through example, methods for determining sensor sharing feasibility; to introduce developers to the regulatory process; to create awareness of proper assignment procedures; to present sensor allocations; and to provide guidelines on the use and limitations of allocated bands. Controlling physical factors and user requirements and the regulatory environment are discussed. Sensor frequency allocation achievable performance and usefulness are reviewed. Procedures for national and international registration, the use of non-allocated bands and steps for obtaining new frequency allocations, and procedures for reporting interference are also discussed. M.D.K.

N82-19650# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SATELLITE SCATTEROMETER FEASIBILITY STUDY. VOLUME 1: TECHNICAL RESULTS Final Report
R. Anders, G. Bommas, W. Gieraths, W. Gilg, P. Hans, M. Haimerl, H. Hoelzl, A. Kuehnle, H. Schuessler, P. Stuerzenhofaecker et al Paris ESA Apr. 1981 194 p refs 2 Vol.
(Contract ESA-4367/80/F-DD(SC))
(ESA-CR(P)-1492-Vol-1) Avail: NTIS HC A09/MF A01

A scatterometer for ERS 1 is described. A wind sensor determines vector fields within a 400 km sweep parallel to satellite motion. Individual vectors are extractable from 50 X 50 km cells. Wind speeds between 4 and 24 m/sec are measured with an angular accuracy of + or - 20 deg. A wave sensor handles spectra between 100 and 1000 m wavelength. Measurements are taken with a spacing of 100 km or less along the satellite track. Data are extractable from 5 x 5 km resolution cells. Wind speed and wind direction measurements are derived from Seasat data and of two-dimensional ocean wave spectra measurement are derived from the synthetic aperture radar mode. Author (ESA)

N82-19651# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SATELLITE SCATTEROMETER FEASIBILITY STUDY. VOLUME 2: DATA EXTRACTION ALGORITHM AND ERROR SIMULATION FOR WIND SENSOR Final Report
P. Hans Paris ESA Apr. 1981 100 p ref 2 Vol.
(Contract ESA-4367/80/F-DD(SC))
(ESA-CR(P)-1492-Vol-2) Avail: NTIS HC A05/MF A01

The ERS 1 scatterometer operation was computer simulated to: (1) test the Moore's relationship between the backscattering coefficient sigma deg and wind speed/direction; (2) investigate the influence of statistical errors in the sigma deg measurement on the resultant wind parameters; and (3) investigate antenna configurations with respect to functional performance and hardwear realization. Erroneous a sub zero parameter values in the radar sea return model cause errors mainly in wind speed, while erroneous a sub 2 causes errors in wind direction, and a sub 1 has little effect. The dual beam/dual polarization concept is recommended. Author (ESA)

N82-19652# Spar Aerospace Products Ltd., Toronto (Ontario).
STUDY OF A RADAR ALTIMETER FOR THE EUROPEAN REMOTE SENSING PROGRAM. VOLUME 1: EXECUTIVE SUMMARY
A. Thompson and S. J. Alexander Jun. 1981 90 p Prepared jointly with Dornier-Werke GmbH Friedrichshafen, West Germany
(Contract ESA-4427/80/F-DD(SC))
(Spar-R.1090-Issue-A; ESA-CR(P)-1502) Avail: NTIS HC A05/MF A01

Sea scattering, radar parameter selection, performance characteristics such as acquisition and tracking, and operation in rain and over land were studied in order to design a radar altimeter. Tradeoffs covering the antenna, microwave subsystem, signal processor, and altimeter controller were performed.

A configuration consisting of a full deramp radar pulse compression system operating at 13.7 GHz, with a maximum likelihood estimator tracker/processor is chosen. The design meets the specification in all respects, has better performance and less weight than the Seasat altimeter, yet is fully redundant. A costed development plan completely compatible with the ERS 1 schedule is outlined. Author (ESA)

N82-19653# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
DEVELOPMENT OF A BREADBOARD COOLER FOR INFRARED REMOTE SENSING PAYLOADS, PHASE 1 Final Report
E. G. Overbosch and N. P. Enderberg Paris ESA 14 Mar. 1981 153 p
(Contract ESTEC-4484/80/NL-PP(SC))
(FOK-RV-R-81-064; ESA-CR(P)-1506) Avail: NTIS HC A08/MF A01

A multistage passive cryogenic cooler was designed for the ocean color monitor (OCM) for ERS 1. Mathematical models of thermal and mechanical behavior support the concept of a radiator located in a parabolic reflector. Technologically critical areas of the design are compared with corresponding components in the optical imaging instrument, i.e. the glass reinforced thermal insulation/suspension straps, the suspension system integrated in the cooler, the parabolic reflector, and the cold stage radiator. A set of critical components suitable for both coolers is feasible. A three stage breadboard cooler is described. The multilayer insulation (MLI) radiator cools the MLI support, the first stage cools the paraboloid. The second stage is the cold stage radiating its heat loads by the open faced honeycomb radiator to space. The suspension of the first stage consists of dummies representing the thermal behavior of the corresponding OCM straps. The outside mounting ring is sufficiently stiff to support the cooler, and is used for mounting the cooler in the test chamber. Author (ESA)

N82-20375# European Space Agency, Paris (France).
MRSE: A MICROWAVE REMOTE SENSING EXPERIMENT IN SPACELAB
Marian Werner *In its* On Radio Frequencies in Aerospace (ESA-TT-704) Dec. 1981 p 75-83 Transl. into ENGLISH from "Beitraege zum Kolloq. 'Hochfrequenztech. in der Luft- u. Raumfahrt'", Rept. DFVLR-Mitt-80-10 DFVLR, Oberpfaffenhofen, West Germany, Jun. 1980

Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 21,80

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

N82-20491# Electronics Research Lab., Adelaide (Australia).
PROPOSED DIGITAL CARTRIDGE RECORDING SYSTEM FOR WRELADS
T. R. Adams and D. M. Phillips Aug. 1981 22 p
(AD-A109484; ERL-0210-TM) Avail: NTIS HC A02/MF A01 CSCL 09/2

The present data recording system in WRELADS II uses a hybrid tape recorder. Signal waveforms are recorded in analogue form while system parameters are recorded digitally. The hybrid recording system has several disadvantages that would be overcome by introducing a fully digital recording system. A proposal is described for developing a system to utilize two high-capacity digital cartridge recorders in conjunction with a microprocessor based cartridge controller. GRA

N82-20606*# National Aeronautics and Space Administration, Washington, D. C.
GRADIO: PROJECT PROPOSAL FOR SATELLITE GRADIOMETRY
G. Balmino, F. Barlier, A. Bernard, C. Bouzat, G. Riviera, and J. Runavot Dec. 1981 55 p refs Transl. into ENGLISH of "Gradio: Gradiometrie par Satellite Proposition de Projet" Rept. no. 244 PRT/AMP/AP (France), 8 Sep. 1981 p 1-51 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre National Etudes Spatiales
(Contract NASw-3541)
(NASA-TM-76796; NAS 1.15:76796) Avail: NTIS HC A04/MF A01 CSCL 08B

A gradiometric approach, rather than the more complicated satellite to satellite tracking, is proposed for studying anomalies in the gravitational fields of the Earth and, possibly, other telluric bodies. The first analyses of a gradiometer based on four of ONERA's CACTUS or SUPERCACTUS accelerometers are summarized. it is shown that the obstacles to achieving the required accuracy are not insuperable. The device will be carried in a 1000 kg lens shaped satellite in a heliosynchronous orbit 200 to 300 km in altitude. The first launching is planned for the end of 1987. Author

N82-20630# Naval Ocean Systems Center, San Diego, Calif.
SATELLITE-BORNE NON-DOD SENSORS FOR TERRESTRIAL OBSERVATIONS
H. M. Wight Aug. 1981 66 p refs
(AD-A109486; NOSC/TD-458) Avail: NTIS HC A04/MF A01 CSCL 22/2

This is a summary review that was made of satellite-borne 'non-DoD sensors' used for terrestrial observations. The term non-DoD sensors refers to 'civil' (as contrasted with 'military') remote sensing systems. The civil satellite-borne sensing systems were developed for the most part by NASA and are employed operationally by NOAA/NESS. Author (GRA)

N82-21669*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A MULTIBAND RADIOMETER AND DATA ACQUISITION SYSTEM FOR REMOTE SENSING FIELD RESEARCH
M. E. Bauer, Principal Investigator, B. F. Robinson, D. P. DeWitt, L. F. Silva, and V. C. Vanderbilt Nov. 1981 14 p refs Repr. from from Proc. of the Intern. Arch. of Photogrammetry (West Germany), v. 23(B8) p 783-793 Presented at the 14th Congr. of the Intern. Soc. for Photogrammetry, Hamburg, 13-25 Jul. 1980 Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E82-10142; NASA-CR-167506; NAS 1.26:167506; SR-P1-04201; LARS-071480) Avail: NTIS HC A02/MF A01 CSCL 14B

Specifications are described for a recently developed prototype multispectral data acquisition system which consists of multiband radiometer with 8 bands between 0.4 and 12.5 micrometers and a data recording module to record data from the radometer and ancillary sources. The system is adaptable to helicopter, truck, or tripod platforms, as well as hand-held operation. The general characteristics are: (1) comparatively inexpensive to acquire, maintain and operate; (2) simple to operate and calibrate; (3) complete with data hardware and software; and (4) well documented for use by researchers. The instrument system is to be commercially available and can be utilized by many researchers to obtain large numbers of accurate, calibrated spectral measurements. It can be a key element in improving and advancing the capability for field research in remote sensing. A.R.H.

N82-21703# Tennessee Valley Authority, Chattanooga.
NATIONAL HIGH-ALTITUDE PHOTOGRAPHY (NHAP) OF THE TENNESSEE VALLEY REGION, VOLUME 1, NO. 1
31 Oct. 1981 19 p
(PB82-130899; TVA/ONR/NRO-82/3) Avail: NTIS HC A02/MF A01 CSCL 08B

The capabilities and activities of the photogrammetry and remote sensing section of the mapping services branch are described. The uses of aerial photography are briefly described. Plans for upgrading of services and equipment are discussed.
GRA

N82-21808# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
OZONE MEASUREMENTS TO 48Km WITH CHEMILUMINESCENT OZONE DETECTORS Annual Progress Report
J. M. Rosen and D. J. Hofman Jan. 1982 9 p refs
(Contract N00014-76-C-0170)
(AD-A110342; AP-70) Avail: NTIS HC A02/MF A01 CSCL 07/1

An inflight ozone calibrator was tested both in a laboratory environmental chamber and on a balloon flight. The results demonstrate the need for an inflight calibrator and also indicate that there may be a serious and previously unobserved tempera-

ture sensitivity problem with one of the primary ozone detectors. Author (GRA)

N82-21826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CLOUD TOP SCANNING RADIOMETER (CTS): USER'S GUIDE

K. S. Brown Nov. 1981 30 p refs

(NASA-TM-83887; NAS 1.15:83887) Avail: NTIS HC A03/MF A01 CSCL 04B

The CTS maps the Earth's surface with a resolution of 0.1 km from an altitude of 18km with 60km side-to-side coverage of the field. It has three spectral channels. The 0.625 micrometer centered visual channel detects reflectance to within 1 percent. The 6.75 micrometer centered water vapor channel detects changes in temperature of less than one degree Kelvin at 175 K. The 11.5 micrometer centered infrared window channel detects changes of less one half degree Kelvin at 175 K. The data can be converted graphically into three display images of the scene. Values for scene temperature and albedo are calculated from calibration equations. The equations were derived from in-situ and laboratory measurements. Intercomparisons of the flight data temperatures with ground based and other remote sensor results established the certainty of the derived temperature values to within 3 K over a wide temperature range (180 to 320 K). The system performance, calibration, and operation is successful and the engineering information describing this system should prove useful to scientists and potential users of the data. T.M.

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GENERAL

Includes economic analysis.

A82-20412 **Landsat classification accuracy assessment procedures.** R. A. Mead (Virginia Polytechnic Institute and State University, Blacksburg, VA) and J. Szajgin (Technicolor Graphic Services, Inc., Sioux Falls, SD). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Jan. 1982, p. 139-141.

At the November 12-14, 1980 conference on Landsat classification accuracy assessment procedures, attention was given to sampling procedures, statistical analysis techniques, and examples of projects concerned with accuracy assessment as well as the associated costs, logistical problems, and value of accuracy data to the remote sensing and resource management fields. It was commented during the proceedings that national standards for reporting thematic map accuracy have not been established, so that potential users of Landsat classifications often do not know the relative accuracies achievable in the identification of land-cover types. Moreover, Landsat classification accuracy assessments are often made with inadequate reference data, such as maps, photointerpretations or visits to the field. These reference data should be distributed throughout the scene in such a way that all cover types and transition zones between them are adequately represented. O.C.

A82-21280 **The Landsat program - Moving ahead.** A. Chiaviello. *Satellite Communications,* vol. 6, Feb. 1982, p. 34-36.

The operations and accomplishments of Landsats 1-3 are reviewed, and attention is given to the capabilities and uses of Landsat D. Landsats 1-3 fly at a 510 mi altitude in polar orbits, taking photographs of 115 by 115 km areas of the earth surface for transmittance to cover 100 countries. False color composites are developed with color coding for vegetation, water, cities, and highways. Multispectral data on minerals and oil locations, population estimates, crop yield estimates, and for disaster warnings have been gathered, along with data for resources planning and environmental monitoring. The Landsat-D satellite will carry a Thematic Mapper besides the Multispectral Scanner in a 435 mi altitude orbit and transmit at X-band and S-band frequencies. The Thematic Mapper will have 30 m resolution and the whole package will generate 800 images/day. M.S.K.

A82-21875 **Remote sensing for natural resources: An international view of problems, promises and accomplishments.** Moscow, ID, University of Idaho, 1980. 527 p.

Aspects of remote sensing which were discussed included historical uses of remote sensing and reports on current applications in forestry, in international assistance programs, for spatial classification of multisource data types for lithologic mapping in Southwestern Idaho, and for rangeland sensing. Interactive roles between remote sensing and management information/mapping systems in resource inventories were discussed, along with Landsat contributions to national and regional resource inventories, techniques for obtaining multiresource information from remote sensing and ancillary data sources for resources in Costa Rica, and computer analysis of remote sensing data. Consideration was given to applications of remote sensing to pest control, in identifying wind energy sites, for crops identification, and for mapping world forests and nonrenewable resources. M.S.K.

A82-22149 **An intelligent earth sensing information system.** T. H. Fay (Southern Mississippi, University, Hattiesburg, MS), J. Nazemetz (Oklahoma State University, Stillwater, OK), D. M. Sandford (Rutgers University, New Brunswick, NJ), V. Taneja (Western Illinois University, Macomb, IL), and P. Walsh (Fairleigh Dickinson University, Teaneck, NJ). *Photogrammetric Engineering and Remote Sensing,* vol. 48, Feb. 1982, p. 281-286. 9 refs.

By the year 2000, problems related to the expected increase in the world population will require for their solution a highly effective widespread management of earth resources with the aid of remote earth sensing. The cost of operating an earth sensing system can be greatly reduced through the use of artificial intelligence techniques to achieve goal oriented data gathering, information extraction using a world model, and direct user interfacing. A technology feasibility study was conducted to investigate the use of advanced and intelligent automation in space. The concept of an ambitious earth resource monitoring system directed toward future needs was developed as a result of this study. A proposal is made for the extensive use of artificial intelligence techniques within an autonomous satellite system to acquire and interpret data required by future users at as low a cost as possible. G.R.

A82-24343 # **Remote sensing and international law.** C. Q. Christol (Southern California, University, Los Angeles, CA). In: Annals of air and space law. Volume 5. Toronto, Carswell Co., Ltd.; Paris, Editions A. Pedone, 1980, p. 375-426. 90 refs.

Legal aspects of spaceborne remote sensing are reviewed, with consideration given to a definition of remote sensing, a functional approach to remote sensing, the emergence of contending positions on remote sensing, and the range of legal viewpoints in 1980. It is concluded that it has become increasingly evident during the COPUOS negotiations relating to the space-based remote sensing of the earth and its natural resources that substantial obstacles lie in the way of acceptance of fundamental principles concerning this matter. B.J.

A82-26123 **Some problems concerning the effective use of remote sensing (Zu einigen Problemen der effektiven Nutzung der Erdfernerkundung).** P. Bormann (Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, Potsdam, East Germany). *Gerlands Beiträge zur Geophysik,* vol. 91, no. 1, 1982, p. 13-24. 13 refs. In German.

The paper investigates a number of problems in remote sensing relating to data aquisition, information extraction, and the utilization of information, in an effort to increase its effectiveness. Emphasis is on the conception of suitable remote sensing systems; the importance of accessibility, continuity, and timelessness of data; and the acceptability and feasibility of a remote sensing system as related to the scientific-technical, economical, infrastructural and environmental conditions of a given country. The assessment of cost benefits of remote sensing is discussed, and information extraction and integration of results into traditional disciplines, information systems and decision making are considered. D.L.G.

A82-27169 **Imaging the earth. I - The troubled first decade of Landsat.** M. M. Waldrop. *Science,* vol. 215, Mar. 26, 1982, p. 1600-1603.

The coming launching of Landsat-D in July 1982 follows a decade of problems between NASA and users of Landsat data. The users wanted the continued use on Landsat-D of the multispectral scanner that had been aboard previous Landsats, since they had made heavy investments in computers, software and trained personnel to process the data obtained through that scanner. NASA, however, had planned to replace the scanner with a thematic mapper that advances the 80-meter resolution of the MSS to 30 meters and senses in not four spectral bands but seven. Users also wanted a far higher map production rate from NASA. Although it appeared that Landsat-D might go into orbit without the thematic mapper, the problems were finally resolved as NASA achieved high-volume map output and decided to put both the MSS and the mapper into orbit. C.D.

A82-27501 **Scientific lectures on aviation and astronautics 1980 (Nauchnye chteniia po aviatsii i kosmonavtike 1980 g.).** Edited by A. Iu. Ishlinskii. Moscow, Izdatel'stvo Nauka, 1981. 336 p. In Russian.

Papers from the 1979 and 1980 Gagarin Lectures on Aviation and Astronautics are presented. Attention is given to such topics as directional solidification in conditions of weightlessness, scientific-technical and organizational problems of cosmonaut training, the remote sensing of earth resources, the ballistic-navigational support for the Salyut 6-Soyuz-Progress complex, and the automation of the thermal-stress analysis of flight vehicles. Also considered are the development of spacecraft power supply systems, space biomedical

studies, method for the design of flight-vehicle control systems, problems of space-flight mechanics, and the development of life support systems. B.J.

A82-27506 † **Present and future studies of natural resources and the environment from space (Kosmicheskoe prirodovedenie segodnia i zavtra).** Iu. P. Kienko. In: Scientific lectures on aviation and astronautics 1980. Moscow, Izdatel'stvo Nauka, 1981, p. 50-56. In Russian.

The advantages of space data on natural resources, as compared with conventional sources of such data, are described. Current trends in remote sensing technology are reviewed, and examples are presented illustrating the application of remote sensing data to solve various scientific and economic problems. B.J.

A82-27543 † **Development of cooperation between CMEA member countries in the development and utilization of space-based systems for the remote sensing of earth resources and the environment (Razvitie sotrudnichestva stran-chlenov SEV v oblasti sozdaniia i ispol'zovaniia kosmicheskikh sistem issledovaniia prirodnykh resursov i okruzhaiushchei sredy).** B. A. Chumachenko, V. V. Marchenko, Iu. A. Tiurin, and E. P. Vlasov. In: Problems of space studies. Moscow, Mezhdunarodnyi Tsentr Nauchnoi i Tekhnicheskoi Informatsii, 1981, p. 13-22. 10 refs. In Russian.

The development of remote sensing systems for geological services is examined with reference to cooperation between CMEA member countries. Attention is given to the organization of the sequential processing and complex integration of space and ground data in relation to the prediction of earth resources on the basis of a problem-oriented man-machine system. The Region system, dedicated to geological prediction, is considered as an example of such a system. B.J.

A82-27669 # **Earth sensing from space - Commercial and international aspects.** A. W. Frutkin (Burroughs Corp., Pacific Canada Div., Detroit, MI). In: International Symposium on Remote Sensing of Environment, 15th, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volume 3. Ann Arbor, MI, Environmental Research Institute of Michigan, 1981, p. 1121-1126.

A critical evaluation is conducted of problems and promises related to earth sensing operations from space, taking into account developments occurring during the last two or three years. In a quick survey of the fundamental elements of the present situation, it is found that there were no changes with respect to the space segment during the last two years. Neither has there been any great increase in the use of the data during the same period. Attention is also given to the absence of substantial changes regarding the price of data, the transfer of responsibility for a future operational system to NOAA, national programs in France and Japan, and the absence of a real provision for continuity beyond Landsats D/D-prime. All hope and planning for the future seem to be a function of legislation to be proposed for a private sector follow-on to Landsats D/D-prime. After an investigation of the envisaged private-sector solution, it is concluded that the primary role should be played by government. G.R.

N82-17792# National Oceanic and Atmospheric Administration, Washington, D. C. National Earth Satellite Service.
PUBLICATIONS AND REPORTS ON CONTRACTS AND GRANTS, 1980 Final Report
Nancy A. Everson May 1981 19 p refs
(PB82-103219; NOAA-TM-NESS-115; NOAA-81072202) Avail: NTIS HC A02/MF A01 CSCL 04B

This bibliography cites the titles and authors of 122 articles and reports published by or for the National Earth Satellite Service (NESS). The first section includes publications by NESS staff members and the second section includes final reports on contracts and grants sponsored by NESS. GRA

N82-18669# Eurospace, Paris (France).
EXAMINATION OF THE OPERATIONAL PROSPECTS FOR REMOTE SENSING Final Report [EXAMEN DES PERSPECTIVES OPERATIONNELLES DE LA TELEDETECTION]
Eleonora Ambrosetti Paris ESA Dec. 1980 305 p refs In FRENCH
(Contract ESA-4080/79/F-FC(SC))
(ESA-CR(P)-1476) Avail: NTIS HC A14/MF A01

European remote sensing activities are reviewed while development and utilization trends are identified. Existing and planned satellite systems are described. Remote sensing applications are listed by country in the European Economic Community. Cartography, geology, agriculture, silviculture, and land and water resources management are mentioned among other user disciplines. Applications are summarized in three categories: terrestrial, maritime, and coastal. Although maritime and coastal uses of remote sensing data are less well developed than terrestrial applications, economic, social and political benefits which can be accrued by Europe are sure to provide a strong incentive to continuing development. Author (ESA)

N82-19627*# Public Technology, Inc., Washington, D. C.
REMOTE SENSING PROCUREMENT PACKAGE: A MANAGEMENT REPORT FOR STATE AND LOCAL GOVERNMENTS
Jun. 1981 21 p ERTS
(Contract NAS13-129)
(E82-10052; NASA-CR-168633) Avail: NTIS HC A02/MF A01 CSCL 05B

An overview of the remote sensing procurement process is presented for chief executives, senior administrators, and other local and state officials responsible for purchasing remote sensing products, services, or equipment. Guidelines are provided for planning, organizing, staffing, and implementing such a procurement project. Other sections of the four-volume package are described and their benefits examined. A.R.H.

N82-20626# Inter-American Geodetic Survey, Fort Sam Houston, Tex.
REMOTE SENSING IN LATIN AMERICA: TECHNOLOGY AND MARKETS FOR THE 1980'S
Lawrence J. Jungman Aug. 1981 16 p refs
(AD-A108784) Avail: NTIS HC A02/MF A01 CSCL 22/2

A review is made on the impact of satellite derived remote sensing data in Latin America. Data availability has generated a phenomenal growth in the user community in Latin America, and new sensor systems planned and proposed are viewed as a further impetus to an increased market in the Americas. The international institutionalization of remote sensing interests in the area is an indicator submitted as a viable force in the continued, future market and transfer of technology. The availability of required training and funding for special projects by these institutions is reviewed. Proposals are made for special training to prepare for increased digital and cartographic applications that will be required in the expanded users market of the 1980s. GRA

N82-21660*# Washington Univ., St. Louis, Mo. Center for Development Technology.
PROGRAM ON STIMULATING OPERATIONAL PRIVATE SECTOR USE OF EARTH OBSERVATION SATELLITE INFORMATION Final Report, 1 Nov. 1979 - 15 Jan. 1981
Lester F. Eastwood, Jr., Jerry Foshage, Guillermo Gomez, Becky Kirkpatrick, Barry Konig, and Robert Stein, Principal Investigators 15 Jan. 1981 216 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Contract NASw-3331)
(E82-10131; NASA-CR-168515; NAS 1.26:168515) Avail: NTIS HC A10/MF A01 CSCL 05B

Ideas for new businesses specializing in using remote sensing and computerized spatial data systems were developd. Each such business serves as an 'information middleman', buying raw satellite or aircraft imagery, processing these data, combining them in a computer system with customer-specific information, and marketing the resulting information products. Examples of the businesses the project designed are: (1) an agricultural facility site evaluation firm; (2) a mass media grocery price and supply analyst and forecaster; (3) a management service for privately held woodlots; (4) a brokerage for insulation and roofing contractors, based on infrared imagery; (5) an expanded real estate information service. In addition, more than twenty-five other commercially attractive ideas in agribusiness, forestry, mining, real estate, urban planning and redevelopment, and consumer information were created. The commercial feasibility of the five business was assessed. This assessment included market surveys, revenue projections, cost analyses, and profitability studies. The results show that there are large and enthusiastic markets willing to pay for the services these businesses offer, and that the businesses could operate profitably. M.G.

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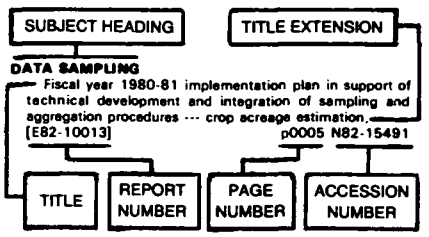

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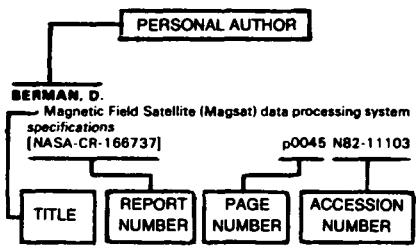

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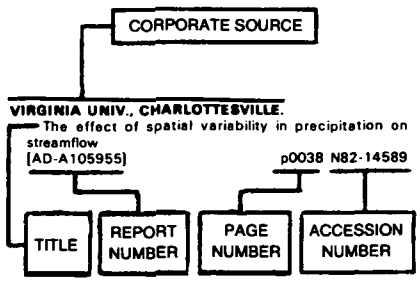

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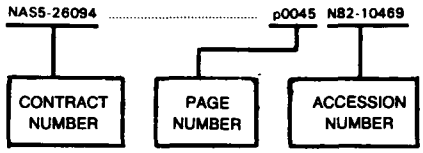

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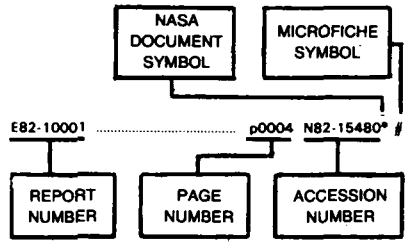

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