



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:

IAA (A-10000 Series)

A81-10001 – A81-19672

STAR (N-10000 Series)

N81-10001 – N81-15967

EARTH RESOURCES

**A Continuing Bibliography
With Indexes
Issue 29**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between January 1 and March 31, 1981 in

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

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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 instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 308 reports, articles, and other documents announced between January 1 and March 31, 1981 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

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

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

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

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

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

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After the abstract section, there are five indexes:

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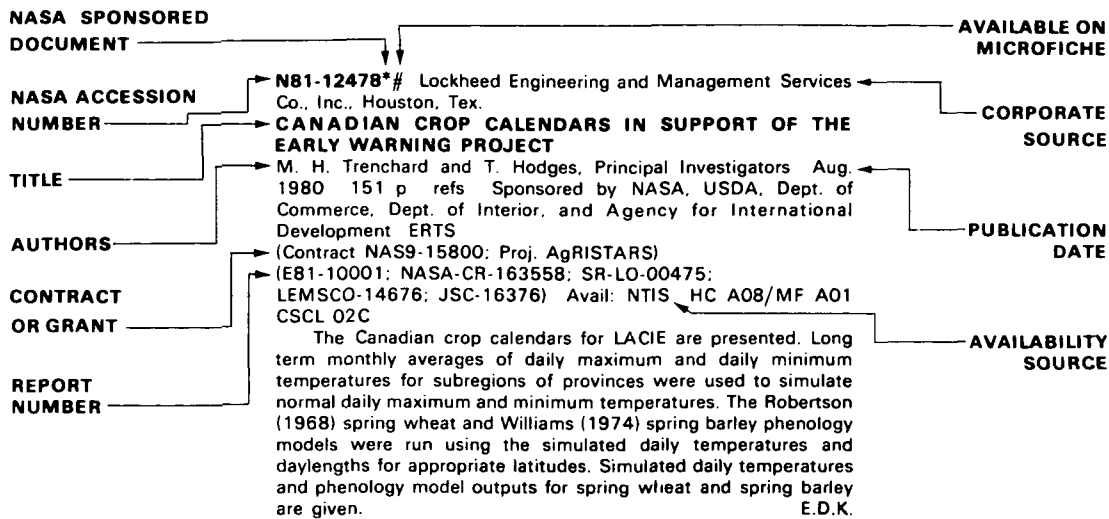
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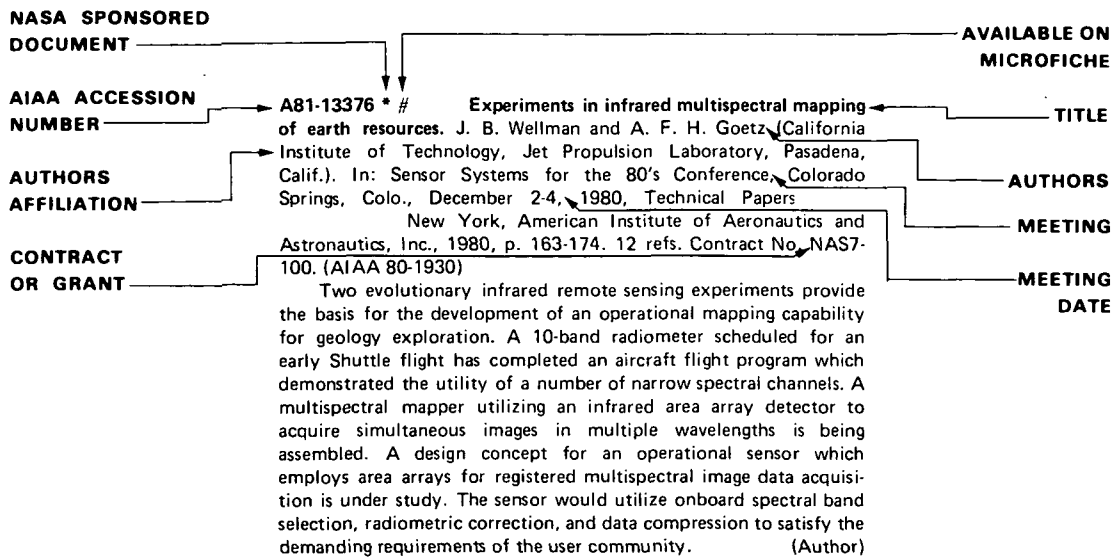
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EARTH RESOURCES

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APRIL 1981

01

AGRICULTURE AND FORESTRY

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

A81-10025 # Geodetic aerial-photography surveying intended for farming purposes (Aerofotogeodezicheskie izyskaniia v sel'skom khoziaistve). A. A. Fostikov, B. Sh. Al'tshuler, R. M. Plotkin, and N. V. Sukhot'ko. Moscow, Izdatel'stvo Nedra, 1980. 320 p. 84 refs. In Russian.

The book deals with the application of aerial-photography surveying and interpretation for agricultural purposes. Various techniques used in preparing, correcting, and renewing agricultural maps and charts are examined, along with the instruments employed. Progress made in this field over the past few years is noted and some examples are presented. V.P.

A81-11972 * L-band radar sensing of soil moisture. A. T. C. Chang, V. V. Salomonson (NASA, Goddard Space Flight Center, Earth Survey Applications Div., Greenbelt, Md.), S. G. Atwater, J. E. Estes, D. S. Simonett (California, University, Santa Barbara, Calif.), and M. L. Bryan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Transactions on Geoscience and Remote Sensing*, vol. GE-18, Oct. 1980, p. 303-310. 8 refs. Contract No. NAS7-100.

The objectives of the experiment were to assess the performance of an L-band, 25-cm wavelength imaging synthetic aperture radar (SAR) for soil moisture determination, and to study the temporal variability of radar returns from a number of agricultural fields. A series of overflights was accomplished during March 1977 over an agricultural test site in Kern County, Calif. Soil moisture samples were collected from bare fields at nine sites at depths of 0-2, 2-5, 5-15, and 15-30 cm. These gravimetric measurements were converted to percent of field capacity for correlation to the radar return signal. The initial signal film was optically correlated and scanned to produce image data numbers. These numbers were then converted to relative return power by linear interpolation of the noise power wedge which was introduced in 5-dB steps into the original signal film before and after each data run. Results of correlations between the relative return power and percent of field capacity demonstrate that the relative return power from this imaging radar system is responsive to the amount of soil moisture in bare fields. The signal returned from dry and wet fields where furrowing is parallel to the radar beam differs by about 15 dB. Before this technique can be

operationally employed; adequate calibration of the radar system is required to insure comparability of data both from area to area within a single flight and between different flights. (Author)

A81-11974 * Effect of texture on microwave emission from soils. T. J. Schmugge (NASA, Goddard Space Flight Center, Hydrological Sciences Branch, Greenbelt, Md.). *IEEE Transactions on Geoscience and Remote Sensing*, vol. GE-18, Oct. 1980, p. 353-361. 21 refs.

The intensity brightness temperature, T(B), of the microwave emission from the soil is determined primarily by its dielectric properties. The large difference between the dielectric constant of water and that of dry soil produces a strong dependence of the soil's dielectric constant on its moisture content. This dependence is effected by the texture of the soil because the water molecules close to the particle surface are tightly bound and do not contribute significantly to the dielectric properties. Since this surface area is a function of the particle size distribution (soil texture), being larger for clay soils with small particles, and smaller for sandy soils with larger particles, the dielectric properties will depend on soil texture. This dependence has been demonstrated by laboratory measurements of the dielectric constant for soils which are briefly summarized. The dependence of the microwave emission on texture is demonstrated by measurements of T(B) from an aircraft platform for a wide range of soil textures. It is concluded that the effect of soil texture differences on the observed T(B) values can be normalized by expressing the soil moisture values as a percentage of field capacity for the soil. (Author)

A81-12082 Aerial photo and Landsat image use in forest inventory in China. Y.-C. Fang (Nanking College of Forestry, Nanking, Communist China). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Nov. 1980, p. 1421-1424.

The use of aerial photographs and Landsat images in the compilation of forest inventories in China is discussed. Aerial photography of forest resources began in China in 1953 at scales of 1:25,000 and 1:14,000, and photomaps were obtained by radial triangulation for the entire country. Since 1953, the use of aerial photography has led to the technological development of forest survey techniques, with the inclusion of stratified sampling of aerial photographs, photointerpretation and field surveys based on regression analysis, and digitized volumetric tables. In addition, a continuous forest inventory system has been established. The application of Landsat MSS imagery to forest inventories has recently begun, with the measurement of total land and forest areas and the compilation of maps of forest type distributions. A.L.W.

A81-12699 The ITC multispectral camera system with respect to crop prognosis in winter-wheat. R. Graham (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal*, no. 2, 1980, p. 235-254. 7 refs.

A three-camera multispectral (70 mm) system is described with reference to its use for crop prognosis (winter wheat). Photometric calibration, film sensitometry, spectrally designated ground truth,

01 AGRICULTURE AND FORESTRY

and microdensitometry combine to enable objective analysis of the primary data. The effects and magnitude of haze are determined at three operational altitudes. B.J.

A81-12700 Visual interpretation of multitemporal Landsat data for inventories of natural resources - A north Indian case study. F. W. Hilwig (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal*, no. 2, 1980, p. 297-327. 20 refs.

A method is designed in which optimal use can be made of static and dynamic image interpretation elements. Static elements, such as drainage pattern, alignments, and landform, are not particularly season-dependent, but are influenced by image quality and cloud cover. Dynamic elements such as drainage condition (reflected in the status of moisture, vegetation, and agricultural land use) are season-dependent. The image interpretation methodology is demonstrated in an example of multispectral and multitemporal Landsat image interpretation for a physiographic soil survey in northern India. B.J.

A81-13937 * Radiometric resolution for monitoring vegetation - how many bits are needed. C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). *International Journal of Remote Sensing*, vol. 1, July-Sept. 1980, p. 241-254. 8 refs.

The number of radiometric quantizing levels required for satellite monitoring of vegetation resources was evaluated by using in situ collected spectral reflectance data, an atmospheric radiative transfer simulation model, and a satellite sensor simulation model. Reflectance data were converted to radiance data, passed through a model atmosphere to an altitude of 706 km, and subsequently quantized at 16, 32, 64, 128, 256 and 512 digital count levels for Thematic Mapper bands TM3 (0.63-0.69 microns) and TM4 (0.76-0.90 microns). The simulated digital count data were regressed against in situ biological data to quantify the relationship between quantizing levels. Results of the analysis demonstrated that solar zenith angle has an effect on the quantization equivalent change in reflectance, that 256 quantizing levels gave a 1-3% improvement per channel over 64 quantizing levels, and that 256 quantizing levels gave a 1% improvement per channel over 128 quantizing levels. No improvements were found for 256 versus 512 quantizing levels.

(Author)

A81-14078 # Application of Meteosat images for ecological studies of desert plants. E. Brinckmann, D. J. von Willert, D. Thomas (Bayreuth, Universität, Bayreuth, West Germany), and K.-G. Lenhart (ESA, European Space Operations Centre, Darmstadt, West Germany). *ESA Bulletin*, no. 20, Nov. 1979, p. 20-23.

The application of Meteosat images to the study of the survival mechanisms of desert plants is illustrated for the case of the succulents (Mesembryanthemaceae) of the arid Richtersveld region of South Africa. Ground data concerning the climate and the concentration of malic acid, which is used to store CO₂ acquired at night for daytime photosynthesis, in the succulent stems of *Psilocaulon* shrubs are presented which reveal malate formation to be high on nights of high relative humidity and low temperature. Climatic data is shown to be correlated with Meteosat cloud images, which reveal dense cloud cover during a day when malate decomposition was found to be below normal. The Meteosat data thus provide information on the daily distributions of cloud cover which can be used in the explanation of the survival and distribution of the Mesembryanthemaceae, although dew formation and actual precipitation levels can not yet be obtained from the imagery. A.L.W.

A81-15057 # Identification of some agricultural crops from their spectral reflectance (Opyt raspoznavaniia nekotorykh sel'skokhoziaistvennykh kul'tur po ikh spektram otrazheniia). K. Ia. Kondrat'ev (Glavnaia Geofizicheskaiia Observatoriia, Leningrad,

USSR) and P. P. Fedchenko (Gosudarstvennyi Komitet SSSR po gidrometeorologii i kontroliu Prirodnoi Sredy, Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennoi Meteorologii, Obninsk, USSR). *Issledovanie Zemli iz Kosmosa*, Sept.-Oct. 1980, p. 50-55. In Russian.

The experiment described revealed the feasibility, in principle, of identifying some crops from their spectral brightness coefficients measured from a helicopter flying at heights of 50 to 70 m. Measurements were made under clear and partially clear conditions at solar elevations of at least 40 degrees, during various stages of crop growth. The spectral brightness coefficients of wheat, rye, oats, and barley crops are tabulated. V.P.

A81-15300 # Experience with stereotopographic photography of a forest landscape in the 1:10,000 scales (Iz opyta stereotopograficheskoi s'emki zalesennoi mestnosti v masshtabe 1:10,000). E. S. Osipuk. *Geodeziia i Kartografiia*, Sept. 1980, p. 31-36. In Russian.

It is shown that the stereotopographic method applied to spring-time aerial photographs provides adequate accuracy in 1:10,000 mapping of flat territories covered with deciduous and mixed forest types, but not areas completely covered with fir trees. In the latter case, a combinational method should be employed. V.P.

A81-15652 Remote sensing application in agriculture and hydrology. Edited by G. Frayse (Commission of the European Communities, Joint Research Centre, Ispra, Italy). Rotterdam, A. A. Balkema, 1980. 509 p. \$75.

Remote sensing applications in agriculture and hydrology are considered. Particular topics discussed include basic problems concerning the reflectance and emittance properties of vegetation, computer-aided analysis techniques for the mapping of surface features, radar applications in agriculture, and agricultural applications of satellite data collection systems. The computer-aided analysis of satellite and aircraft MSS data for mapping snow cover and water resources, the use of radar and satellite in rainfall monitoring, and hydrologic basin models are also examined. P.T.H.

A81-15653 Agricultural statistics analysis of the main requirements - Conventional and new methodologies. G. Thiede (Commission of the European Communities, Statistical Office, Luxembourg). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 9-15. 6 refs.

Three topics regarding the application of remote sensing to agriculture are discussed: (1) which areas are suitable for remote sensing applications and which are not; (2) the requirements and problems of agricultural statistical analysis under European conditions; and (3) statistical surveys based on aerial photography which has already been conducted in Europe. The following areas of study are mentioned as being most suitable for remote sensing applications: agricultural weather data, land use statistics, cultivated-area statistics, statistics on the progress of crops and harvest predictions, forestry statistics, and fishery statistics. The requirements and problems of agricultural statistical analysis that are discussed include harmonization, level of detailed breakdown, data accuracy, speed, form of data output, and costs. Some aerial photographic surveys in Europe are briefly discussed, including surveys of citrus plantations, fruit plantations, olive groves, hop growing, and forest areas. P.T.H.

A81-15654 Survey of photointerpretation techniques in agricultural inventories - Identification of crops, discrimination of species, biomass evaluation ECC: Typical results. G. M. Lechi (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 17-24. 12 refs.

Classic photointerpretation in agriculture is performed by the following means: black and white aerial photographs, color aerial

photographs, IR color or black and white aerial photographs, multispectral photographs, and satellite images. Classic photo-interpretation techniques are reviewed, and attention is given to such applications as agricultural land use mapping, land-use change, population distribution, and land-use potential. Automatic photo-interpretation techniques are also considered; both supervised and unsupervised classifications are described. As an illustration, the application of advanced photointerpretation techniques to biomass evaluation is examined. P.T.H.

A81-15655 **Survey of remote sensing techniques in forestry.** G. Hildebrandt (Freiburg, Universität, Freiburg im Breisgau, West Germany). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 25-36. 40 refs.

The application of remote sensing techniques to forest inventory management and mapping is discussed with reference to the development of thematic maps from aerial photographs and to timber volumes estimation for forestry planning. Remote sensing for forest inventories of large areas is described with emphasis on the use of the following techniques: Landsat MSS, airborne MSS, radar imagery, and ultra-small-scale IR color aerial photographs. Finally, remote sensing for forest protection is reviewed with attention given to the discovery, delimitation, and quantification of forest damage; and to thermal imaging for forest fire surveillance. P.T.H.

A81-15656 **Application of photointerpretation technique to the classification of agricultural soils, choice of the sensor, use of the results.** C. M. Girard (Institut National Agronomique Paris-Grignon, Paris, France). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 37-51.

The use of photointerpretation techniques for soil mapping and arable layer utilization is described. Consideration is given to directly detected characteristics (e.g., water content, chemical composition, organic matter content, etc.) and deduced characteristics (i.e., vegetation, morphology, and human influence). The choice of the sensor is discussed with regard to types of emulsions, date, and scale. The use of photointerpretation for soil mapping is described in detail, and photointerpretation examples are presented. Finally, the interpretation of multispectral imagery is considered, with attention given to an example involving Landsat imagery. P.T.H.

A81-15657 **Significance of spectral reflectance for natural surfaces.** Ch. C. Goillot (Institut National de la Recherche Agronomique, Versailles, Yvelines, France). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 53-68. 22 refs.

The basic principles and applications of spectral reflectance in the remote sensing of the earth's surface are reviewed. It is noted that the study of vegetation reflectance involves four different and complementary points of view: the reflectance of plant parts; the reflectance of sets (canopies); the nature and state of the plants; and the structure and texture of sets. Composite reflectance is discussed, and reflectance is considered as a state variable. It is suggested that the plan of an agricultural remote sensing mission using reflectance properties should take into account: (1) the choice of spectral bands, (2) choice of spectral bandwidth according to its information content, (3) optimal irradiance conditions, and (4) sensitive periods in the vegetative cycles of the plants. P.T.H.

A81-15658 **Basic problems in the reflectance and emittance properties of vegetation.** C. De Carolis and P. Amodeo (Milano, Università, Milan, Italy). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 69-79. 25 refs.

Factors which affect the spectral response of vegetation are very important in agricultural applications of remote sensing. A detailed review of the following factors is presented: maturity, pigmentation, sun exposure, phyllotaxis, pubescence, turgidity, nutritional status, the internal structure of leaves, and diseases. Particular consideration

is given to the effect of diseases on the reflectance and emittance properties of vegetation; attention is given to the effects of trophic, auxonic, vascular, lytic, and epiphytic diseases. P.T.H.

A81-15659 **Agricultural information systems for Europe.** A. B. Park (General Electric Co., Beltsville, Md.). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 81-109.

The characteristics and capabilities of a satellite-data-based agricultural information system applicable to any or all European countries are described. The system uses Landsat and meteorological-satellite data with various types of collateral data. System outputs are both visual and statistical, presenting acreage, yield, and production information by crop and by geographical area. A series of three crop production systems has been defined based on the extent of Landsat and other data sources utilized: (1) the Landsat Crop Production Prediction System, (2) the Landsat + Collateral Crop Production Prediction System, and (3) the Landsat + Collateral + Meteorological Crop Production Prediction System. The latter system represents the present state-of-the-art. P.T.H.

A81-15661 **Thermal infra-red remote sensing principles and applications.** F. Becker (Strasbourg I, Université, Strasbourg, France). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 153-213. 90 refs.

The general principles of thermal infrared remote sensing and the general problems associated with the realization of experiments and their interpretation are reviewed. The use of spectral emissivity as a tool for analyzing bare soil and vegetation is discussed, and attention is given to the use of surface temperature in the analysis of bare soil and vegetation, the composition of underlayers, and heat and mass transfer between the ground and the atmosphere. Methods of experiment design for obtaining suitable measurement conditions are described. P.T.H.

A81-15662 **Survey of radar applications in agriculture.** G. P. De Loor (Centrale Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, Fysisch Laboratorium TNO, The Hague, Netherlands). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 215-232. 21 refs.

Radar is discussed as a remote sensing tool for the inventory and monitoring of natural vegetation, crops, and soils. It is shown that side-looking airborne radar has great potential for classification, yield forecasting, and monitoring; this radar tool satisfies all existing observational criteria. The radar return parameter is found to be the best classifier. The high accuracy required for the determination of the return parameter (high dynamic resolution) requires a tradeoff between dynamic and spatial resolution. The operational organization of this type of remote-sensing radar system is described. P.T.H.

A81-15663 **Survey of methods for the determination of soil moisture content by remote sensing methods.** J. R. Hardy (Reading, University, Reading, Berks., England). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 233-247. 15 refs.

The use of visible, infrared (reflective and thermal), and microwave remote sensing methods for the determination of soil moisture content is discussed. There is as yet no operational method of determining soil moisture for large areas from remotely sensed data; all work reported is in the experimental or research stage. The most likely area for the development of soil moisture measurement by remote sensing is in the thermal infrared, by thermal inertia methods. Since visible and reflective infrared measurements are already available (e.g., Landsat), they must be explored to their fullest potential. Passive microwave may be a possible method, but is beset by resolution problems. Radar seems to be ruled out for the present on account of the cost of aircraft surveys and the nonavailability of spaceborne sensors. P.T.H.

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A81-15665 **Satellite data collection system - Agricultural application.** M. Taillade-Carriere (Centre National d'Etudes Spatiales, Toulouse, France). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 269-284. 12 refs.

Past and present satellite data collection systems are reviewed, with attention given to the IRLS (the Interrogation, Recording, and Location System), the RAMS (the Random Access Measurement System) developed for Landsat, ordered systems with self time capability, and the earth coverage of the main systems (i.e., GOES, NOAA/ARGOS, Landsat low orbit, and Nimbus RAMS low orbit). The characteristics of two major data collection systems are compared: a geosynchronous system (2 operational GOES and METEOSAT, GMS, and GOES I) and a low polar orbit system (8 TIROS-N NOAA/ARGOS satellites). Applications to agricultural data collection are considered; crop production, forest resources, and forest fire monitoring is discussed. A specific GOES application example is presented. P.T.H.

A81-15666 **Applications of remote sensing to agriculture development in tropical countries.** R. A. Pacheco (United Nations, Food and Agriculture Organization, Rome, Italy). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 299-308. 23 refs.

Remote sensing offers the possibility of monitoring agricultural resources for rapid and continuous assessment of plant, soil, and water resources. This paper considers the role of remote sensing in agriculture development in tropical countries, and presents a brief analysis of the problems of utilization of remote sensing data. The technology of aerial photography, side-looking airborne radar, and orbital multispectral photography is considered, and several FAO case studies relevant to agriculture development and monitoring are discussed (including tropical forest cover monitoring, desert locust survey, flood monitoring, and soil survey). Particular attention is given to the use of Landsat imagery in tropical countries. P.T.H.

A81-15667 **Agreste project - Experience gained in data processing, main results on rice, poplar and beech inventories.** J. Dejace and J. Mégier (Commission of the European Communities, Joint Research Centre, Ispra, Italy). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 309-325. 9 refs.

The Agreste Project is sponsored by the European Communities to study the range of applications of remote sensing to agriculture and forestry under European conditions, particularly in France and Italy. The data used are mainly from Landsat 1 and Landsat 2; data from airborne scanners are also used, but to a minor extent. One of the main objectives of Agreste is to study the feasibility of performing inventories of irrigated crops such as rice, planted forests such as poplars, and natural-growth forests such as beeches by computer-aided analysis of Landsat digital data. This paper deals with the processing of data from inventory studies performed over northern Italy. P.T.H.

A81-16341 * **Evaluation of several schemes for classification of remotely sensed data.** M. Hixson, D. Scholz, N. Fuhs (Purdue University, West Lafayette, Ind.), and T. Akiyama. *Photogrammetric Engineering and Remote Sensing*, vol. 46, Dec. 1980, p. 1547-1553. 12 refs. Contract No. NAS9-15466.

Various numerical analysis schemes for the classification of remotely sensed data are evaluated with respect to their capabilities for crop identification. A per point Gaussian maximum likelihood classifier, per point sum-of-normal-densities classifier, per point linear classifier, per point Gaussian maximum likelihood decision tree classifier and a texture-sensitive per field Gaussian maximum likelihood classifier were applied to seven sets of Landsat MSS data on several crop types and regions. The results of the implementation of the classifiers indicate that, given a representative set of training statistics, the choice of classification algorithm of the differentiation of corn and soybeans from one another and from other crop types made relatively little difference in accuracy, whereas the use of a

different training method affected the accuracy significantly. In addition, the linear classifier is found to be the easiest for the analyst to use and to cost least in computer time per classification. A.L.W.

A81-16343 * **Vegetation reflectance measurements as a function of solar zenith angle.** D. S. Kimes (NASA, Goddard Space Flight Center, Greenbelt, Md.), J. A. Smith, and K. J. Ranson (Colorado State University, Fort Collins, Colo.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Dec. 1980, p. 1563-1573. 40 refs. U.S. Department of Agriculture Contract No. 16-741-CA; Grant No. DAAG29-78-G-0045.

An understanding of the behavior of vegetation canopy reflectance as a function of solar zenith angle is important to several remote sensing applications. Spectral hemispherical-conical reflectances of a nadir looking sensor were taken throughout the day of a lodgepole pine and two grass canopies. Mathematical simulations of both a spectral hemispherical-conical reflectance factor and a spectral bi-hemispherical reflectance were performed for two theoretical canopies of contrasting geometric structure. These results and results from literature studies showed a great amount of variability of vegetation canopy reflectances as a function of solar zenith angle. Explanations for this variability are discussed and recommendations for future measurements are proposed. (Author)

A81-16344 * **Landsat for practical forest type mapping - A test case.** E. Bryant (NASA, Goddard Institute for Space Studies, New York, N.Y.; Dartmouth College, Hanover, N.H.), A. G. Dodge, Jr. (New Hampshire, University, Durham, N.H.), and S. D. Warren (Seven Islands Land Co., Bangor, Me.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Dec. 1980, p. 1575-1584. 25 refs. Grant No. NSG-5014.

Computer classified Landsat maps are compared with a recent conventional inventory of forest lands in northern Maine. Over the 196,000 hectare area mapped, estimates of the areas of softwood, mixed wood and hardwood forest obtained by a supervised classification of the Landsat data and a standard inventory based on aerial photointerpretation, probability proportional to prediction, field sampling and a standard forest measurement program are found to agree to within 5%. The cost of the Landsat maps is estimated to be \$0.065/hectare. It is concluded that satellite techniques are worth developing for forest inventories, although they are not yet refined enough to be incorporated into current practical inventories. A.L.W.

A81-16345 **Forest site index mapping and modeling.** C. H. Tom (Science Applications, Inc., Golden, Colo.) and L. D. Miller (Texas A & M University, College Station, Tex.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Dec. 1980, p. 1585-1596. 15 refs.

Forest site productivity refers to the timber-growing capacity of wildlands, and is commonly designated by a site index number which relates tree species height to age. Landscape modeling was used to merge a single summer Landsat scene of four MSS bands and six MSS band ratios with nine ancillary map variables, including topographic elevation, slope, aspect, solar radiation, four MSS insolation band ratios, and photointerpreted vegetation type, to predict and map forest site productivity with a supervised nonparametric classifier. Flexibility of data input and analysis with landscape modeling indicated that further site classification accuracy gains and/or cost reductions were possible. However, the real value of such a unified, multivariate data base lies not in just a single-purpose function, but in its applicability to a wide range of resource management, planning, and research areas. (Author)

A81-18268 **Future requirements on earth observation sensors for crop production forecasting.** P. Hartl. *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-72*. 14 p. 14 refs.

The author discusses the present situation in crop production forecasting which is quite different in the developed and developing countries. He reviews then the results of some experiments, especially those of LACIE and discusses the needs for further

developments in the sensor techniques. Whereas he concludes that in the optical region the flexibility must be improved to meet the requirements of the sampling methods he states for the microwave technology that the development must urgently be accelerated in general to meet the needs for all weather systems. (Author)

A81-19526 * Radiative transfer theory for passive microwave remote sensing of a two-layer random medium with cylindrical structures. S. L. Chuang, J. A. Kong (MIT, Cambridge, Mass.), and L. Tsang (Texas A & M University, College Station, Tex.). *Journal of Applied Physics*, vol. 51, Nov. 1980, p. 5588-5593. NSF Grant No. ENG-78-23145; Contracts No. F19628-80-C-0052; No. NAG5-16.

A model of the vegetation layer as a two-layer random medium with a small correlation length l sub ρ in the horizontal direction, and a large correlation length l sub z in the vertical direction, is presented for fields with cylindrical structures. As l sub z approaches infinity, closed form solutions are derived for the brightness temperatures; the kernels in the scattering terms of the radiative transfer equations result in delta functions showing that forward scattering is dominant over all other directions. The results are compared with the Gaussian quadrature method data for numerical solution of the radiative transfer equations. A.T.

N81-10647# World Meteorological Organization, Geneva (Switzerland).

THE ROLE OF AGROMETEOROLOGY IN AGRICULTURAL DEVELOPMENT AND INVESTMENT PROJECTS

1980 96 p refs
(WMO-536; TN-168; ISBN-92-63-10536-7) Avail: NTIS HC A05/MF A01

General information is given on the importance, the availability and the general use of meteorological data services and information. The discussion covers livestock and forestry as well as field and plantation crops under both irrigated and nonirrigated conditions. The components of agrometeorological information are identified, with emphasis on the correct interpretation of climate data. Sources of agrometeorological information are given. Author (ESA)

N81-12478*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

CANADIAN CROP CALENDARS IN SUPPORT OF THE EARLY WARNING PROJECT

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

(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10001; NASA-CR-163558; SR-LO-00475;
LEMSCO-14676; JSC-16376) Avail: NTIS HC A08/MF A01
CSCL 02C

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

N81-12479*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

AS-BUILT DESIGN SPECIFICATION FOR PROPORTION ESTIMATE SOFTWARE SUBSYSTEM

S. O'Brien, Principal Investigator Jul. 1980 81 p ERTS
(Contract NAS9-15800)
(E81-10002; NASA-CR-163560; LEMSCO-15353; JSC-16807)
Avail: NTIS HC A05/MF A01 CSCL 05B

The Proportion Estimate Processor evaluates four estimation techniques in order to get an improved estimate of the proportion

of a scene that is planted in a selected crop. The four techniques to be evaluated were provided by the techniques development section and are: (1) random sampling; (2) proportional allocation, relative count estimate; (3) proportional allocation, Bayesian estimate; and (4) sequential Bayesian allocation. The user is given two options for computation of the estimated mean square error. These are referred to as the cluster calculation option and the segment calculation option. The software for the Proportion Estimate Processor is operational on the IBM 3031 computer. E.D.K.

N81-12480*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

HOUSTON AREA MULTICROP INSPECTION TRIPS

E. W. Dunham, Principal Investigator Jul. 1980 49 p refs
Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10003; NASA-CR-163557; FC-LO-00437;
LEMSCO-14584; JSC-16351) Avail: NTIS HC A03/MF A01
CSCL 02C

The phenology of crops such as corn, cotton, soybeans, sorghum, sunflowers, and rice and their observed signatures on LANDSAT imagery was studied. This was accomplished by photographing the various crops in segments 275 and 276 located in Wharton County, Texas and comparing those photographs with LANDSAT imagery of the same dates. These comparisons gave insight as to why a particular crop growth stage appeared as a definite signature on LANDSAT and how the percentage of ground cover of various crops affected the signatures on LANDSAT imagery. Numerous crop growth stages could not be directly compared due to cloud cover during several LANDSAT overpasses. E.D.K.

N81-12481*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Apr. - 30 Jun. 1980

R. P. Mroczynski, Principal Investigator and D. Freeman 18 Jul. 1980 20 p ERTS
(Contract NAS9-15325)

(E81-10004; NASA-CR-163553; LARS-CR-071880) Avail: NTIS HC A02/MF A01 CSCL 02F

Remote sensing technology providing St. Regis with an independent operational system and having LANDSAT data as a significant and viable contributor was documented and transferred. Primary emphasis was placed on documenting developmental LARSYS (LARSYS DV) software modules. Timelines and a short description of the software documentation process is given. E.D.K.

N81-12483*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

PROPORTION ESTIMATION USING PRIOR CLUSTER PURITIES

G. R. Terrell, Principal Investigator Jul. 1980 17 p refs
Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10006; NASA-CR-160776; SR-LO-00465;
LEMSCO-15163; JSC-16754) Avail: NTIS HC A02/MF A01
CSCL 05B

The prior distribution of CLASSY component purities is studied, and this information incorporated into maximum likelihood crop proportion estimators. The method is tested on Transition Year spring small grain segments. Author

N81-12489*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

CROP CALENDARS FOR THE US, USSR, AND CANADA IN SUPPORT OF THE EARLY WARNING PROJECT

T. Hodges, M. L. Sestak, and M. H. Trenchard, Principal Investigators Jul. 1980 35 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for

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International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10012; NASA-CR-163555; SR-LO-00450;
LEMSCO-14673; JSC-16359) Avail: NTIS HC A03/MF A01
CSCL 02C

New crop calendars are produced for U.S. regions where several years of periodic growth stage observations are available on a CRD basis. Preexisting crop calendars from the LACIE are also collected as are U.S. crop calendars currently being created for the Foreign Commodities Production Forecast project. For the U.S.S.R. and Canada, no new crop calendars are created because no new data are available. Instead, LACIE crop calendars are compared against simulated normal daily temperatures and against the Robertson wheat and Williams barley phenology models run on the simulated normal temperatures. Severe inconsistencies are noted and discussed. For the U.S.S.R., spring and fall planting dates can probably be estimated accurately from satellite or meteorological data. For the starter model problem, the Feyerherm spring wheat model is recommended for spring planted small grains, and the results of an analysis are presented. For fall planted small grains, use of normal planting dates supplemented by spectral observation of an early stage is recommended. The importance of nonmeteorological factors as they pertain to meteorological factors in determining fall planting is discussed. Crop calendar data available at the Johnson Space Center for the U.S., U.S.S.R., Canada, and other countries are inventoried. Author

N81-12490*# Oregon State Univ., Corvallis. Environmental Remote Sensing Applications Lab.

EIGHTH YEAR PROJECTS AND ACTIVITIES OF THE ENVIRONMENTAL REMOTE SENSING APPLICATIONS LABORATORY (ERSAL) Annual Progress Report. 1 Apr. 1979 - 31 Mar. 1980

Anthony J. Lewis, Dennis L. Isaacson, and Barry J. Schrupf, Principal Investigators 31 Mar. 1980 93 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 Original contains color illustrations ERTS
(Grant NGL-38-002-053)

(E81-10013; NASA-CR-163533) Avail: NTIS
HC A05/MF A01 CSCL 05A

Projects completed for the NASA Office of University Affairs include the application of remote sensing data in support of rehabilitation of wild fire damaged areas and the use of LANDSAT 3 return beam vidicon in forestry mapping applications. Continuing projects for that office include monitoring western Oregon timber clearcut; detecting and monitoring wheat disease; land use monitoring for tax assessment in Umatilla, Lake, and Morrow Counties; and the use of Oregon Air National Guard thermal infrared scanning data. Projects funded through other agencies include the remote sensing inventory of elk in the Blue Mountains; the estimation of burned agricultural acreage in the Willamette Valley; a resource inventory of Deschutes County; and hosting a LANDSAT digital workshop. A.R.H.

N81-12491*# Oregon State Univ., Corvallis. **THE APPLICATION OF REMOTELY SENSED DATA IN SUPPORT OF EMERGENCY REHABILITATION OF WILD-FIRE-DAMAGE AREAS**

Dennis L. Isaacson, H. Gregory Smith, and Cassandra J. Alexander, Principal Investigators 9 May 1980 44 p refs Original contains color illustrations ERTS
(Grant NGL-38-002-053)

(E81-10014; NASA-CR-163534; ERSAL-80-1) Avail: NTIS
HC A03/MF A01 CSCL 05B

The depth, texture, and water holding capacity of the soil before the fire in the Bridge Creek area of Deschutes National Forest (1979) were determined from available aerial photography and LANDSAT MSS digital data. Three days after the fire was out, complete coverage of the burned area was acquired on 35 mm color infrared film from a near vertical or low oblique perspective. These photographs were used in assessing the condition of vegetation, and in predicting the likelihood of survival. Negatives from vertical natural photography obtained during the same flight were used to produce 3R prints from which large scale mosaics

of the entire burned area were obtained. LANDSAT MSS data obtained on the day the fire was under control were used to evaluate vegetative vigor (by calculating a band 7/band 5 ratio value for each spectral class) and to determine the boundary between altered and unaltered land. A.R.H.

N81-12496*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

EFFECTS OF MANAGEMENT PRACTICES ON REFLECTANCE OF SPRING WHEAT CANOPIES

C. S. T. Daughtry, M. E. Bauer, D. W. Crecelius, and M. M. Hixson, Principal Investigators May 1980 23 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15466; NAS9-14970; Proj. AgRISTARS)

(E81-10019; NASA-CR-163507; SR-PO-00458;

LARS-TR-051580) Avail: NTIS HC A02/MF A01 CSCL 02C

The effects of available soil moisture, planting date, nitrogen fertilization, and cultivar on reflectance of spring wheat (*Triticum aestivum* L.) canopies were investigated. Spectral measurements were acquired on eight dates throughout the growing season, along with measurements of crop maturity stage, leaf area index, biomass, plant height, percent soil cover, and soil moisture. Planting date and available soil moisture were the primary agronomic factors which affected reflectance of spring wheat canopies from tillering to maturity. Comparisons of treatments indicated that during the seedling and tillering stages planting date was associated with 36 percent and 85 percent of variation in red and near infrared reflectances, respectively. As the wheat headed and matured, less of the variation in reflectance was associated with planting date and more with available soil moisture. By mid July, soil moisture accounted for 73 percent and 69 percent of the variation in reflectance in red and near infrared bands, respectively. Differences in spectral reflectance among treatments were attributed to changes in leaf area index, biomass, and percent soil cover. Cultivar and N fertilization rate were associated with very little of the variation in the reflectance of these canopies. A.R.H.

N81-12499*# Canada Centre for Remote Sensing, Ottawa (Ontario).

HCMM/SOIL MOISTURE EXPERIMENT Progress Report

Josef Cihlar, Principal Investigator 31 Aug. 1980 7 p refs Sponsored by NASA HCMM

(E81-10022; NASA-CR-163504) Avail: NTIS
HC A02/MF A01 CSCL 08M

Progress in the compilation and analysis of airborne and ground data to determine the relationship between the maximum surface minus maximum air temperature differential (ΔT_{sa}) and available water (PAW) is reported. Also, results of an analysis of HCMM images to determine the effect of cloud cover on the availability of HCMM-type data are presented. An inverse relationship between ΔT_{sa} and PAW is indicated along with stable ΔT_{sa} vs. PAW distributions for fully developed canopies. Large variations, both geographical and diurnal, in the cloud cover images are reported. The average monthly daytime cloud cover fluctuated between 40 and 60 percent. J.M.S.

N81-12504*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

AN ASSESSMENT OF LANDSAT DATA ACQUISITION HISTORY ON IDENTIFICATION AND AREA ESTIMATION OF CORN AND SOYBEANS

Marilyn M. Hixson, Marvin E. Bauer, and Donna K. Scholz, Principal Investigators (EROS Data Center) 1980 6 p refs Repr. from Machine Process. of Remotely Sensed Data, Jun. 1980 p 72-77 Presented at the Machine Process. of Remotely Sensed Data Symp., 1980 ERTS

(Contract NAS9-15466)

(E81-10027; NASA-CR-163445) Avail: NTIS
HC A02/MF A01 CSCL 02C

Multitemporally registered LANDSAT MSS data from four acquisitions during the 1978 growing season were used in classification of eight sample segments in Iowa and Indiana. The results illustrate that use of LANDSAT acquisition when

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corn has tasseled is critical, as this is the optimum time for separation of corn and soybeans. An early season acquisition when the summer crops appear as bare soil can be beneficial in reducing the confusion between these two crops and other cover types. A subset of one visible and one infrared band from each date was found to produce results not significantly different from the use of all bands. Selection of a subset of these bands may also be feasible for multitemporal analysis. A.R.H.

N81-12509*# Minnesota Univ., St. Paul. Dept. of Soil Science.

A PROJECT TO EVALUATE MOISTURE STRESS IN CORN AND SOYBEAN AREAS OF WESTERN AND SOUTHWESTERN MINNESOTA

R. H. Rust and Pierre Robert, Principal Investigators *In* Minnesota Univ. A Study of Minn. Land and Water Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p 88-106 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A07/MF A01 CSCL 02C

Remote sensing techniques, particularly LANDSAT data, were used to assess soil moisture stress through crop signature in southwestern Minnesota. Related objectives were: localization of droughty, well drained, and poorly drained soils; detection of stress from hail, wind, and disease damage; and the use of remote sensing data for agricultural management. Since the amount and distribution of precipitation were adequate during the 1977 and 1978 growing seasons, no significant stress occurred. Crop conditions were very favorable. As a result, crop signatures were too uniform to reflect soilscape variations and crop condition changes. In 1979 precipitation was again adequate to excess, particularly in June and August. In some cases, poorly drained sites especially, stress conditions developed as a result of excess of water and could be identified on color infrared photographs. E.D.K.

N81-12511*# South Dakota State Univ., Brookings. Remote Sensing Inst.

REMOTE SENSING APPLICATIONS TO RESOURCE PROBLEMS IN SOUTH DAKOTA Annual Progress Report, 1 Jul. 1979 - 30 Jun. 1980

Victor I. Myers, Principal Investigator, R. G. Best, K. J. Dalsted, M. E. DeVries, J. C. Eidenshink, R. Fowler, J. L. Heilman, and F. A. Schmer 30 Jun. 1980 165 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 (Grant NGL-42-003-007)

(E81-10029; NASA-CR-163529; SD SU-RSI-80-06) Avail: NTIS HC A08/MF A01 CSCL 08B

Cooperative projects between RSI and numerous South Dakota agencies have provided a means of incorporating remote sensing techniques into operational programs. Eight projects discussed in detail are: (1) detection of high moisture zones near interstate 90; (2) thermal infrared census of Canada geese in South Dakota; (3) dutch elm disease detection in urban environment; (4) a feasibility study for monitoring effective precipitation in South Dakota using TIROS-N; (5) open and abandoned dump sites in Spink county; (6) the influence of soil reflectance on LANDSAT signatures of crops; (7) A model implementation program for Lake Herman watershed; and (8) the Six-Mile Creek investigation follow-on. E.D.K.

N81-12513*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

SUPPLEMENTAL US/CANADA WHEAT AND BARLEY EXPLORATORY EXPERIMENT IMPLEMENTATION PLAN: EVALUATION OF A PROCEDURE 1A TECHNOLOGY Interim Report

Jun. 1980 44 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10031; NASA-CR-160777; FC-LO-00609; LEMSCO-15042; JSC-16364) Avail: NTIS HC A03/MF A01 CSCL 02C

A plan is presented for a supplemental experiment to evaluate a sample allocation technique for selecting picture elements from remotely sensed multispectral imagery for labeling in connection with a new crop proportion estimation technique. The method of evaluating an improved allocation and proportion estimation technique is also provided. A.R.H.

N81-12514*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ILLUSTRATION OF YEAR-TO-YEAR VARIATION IN WHEAT SPECTRAL PROFILE CROP GROWTH CURVES

Pete Gonzalez and Clay Jones, Principal Investigators Aug. 1980 37 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Proj. AgRISTARS)

(E81-10032; NASA-TM-82199; SR-JO-00489; JSC-16817) Avail: NTIS HC A03/MF A01 CSCL 02C

Data previously compiled on the year to year variability of spectral profile crop growth parameters for spring and winter wheat in Kansas, Oklahoma, and the Dakotas were used with a profile model to develop graphs illustrating spectral profile crop growth curves for a number of years and a number of spring and winter wheat segments. These curves show the apparent variability in spectral profiles for wheat from one year to another within the same segment and from one segment to another within the same year. A.R.H.

N81-12515*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

MINIMUM VARIANCE GEOGRAPHIC SAMPLING

G. R. Terrell, Principal Investigator Jul. 1980 12 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS)

(E81-10033; NASA-CR-163556; SR-LO-00467; LEMSCO-15179; JSC-16370) Avail: NTIS HC A02/MF A01 CSCL 08F

Resource inventories require samples with geographical scatter, sometimes not as widely spaced as would be hoped. A simple model of correlation over distances is used to create a minimum variance unbiased estimate population means. The fitting procedure is illustrated from data used to estimate Missouri corn acreage. A.R.H.

N81-12516*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

ESTIMATION OF WITHIN-STRATUM VARIANCE FOR SAMPLE ALLOCATION: FOREIGN COMMODITY PRODUCTION FORECASTING

R. S. Chhikara and Charles R. Perry, Jr., Principal Investigators (NASA, Johnson Space Center) Jul. 1980 49 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS)

(E81-10034; NASA-CR-163554; FC-LO-00428; LEMSCO-14067; JSC-16343) Avail: NTIS HC A03/MF A01 CSCL 02C

The problem of determining the stratum variances required for an optimum sample allocation for remotely sensed crop surveys is investigated with emphasis on an approach based on the concept of stratum variance as a function of the sampling unit size. A methodology using the existing and easily available information of historical statistics is developed for obtaining initial estimates of stratum variances. The procedure is applied to variance for wheat in the U.S. Great Plains and is evaluated based on the numerical results obtained. It is shown that the proposed technique is viable and performs satisfactorily with the use of a conservative value (smaller than the expected value)

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for the field size and with the use of crop statistics from the small political division level. Author

N81-12517*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

STRATUM VARIANCE ESTIMATION FOR SAMPLE ALLOCATION IN CROP SURVEYS

Charles R. Perry, Jr. (NASA Johnson Space Center) and Raj S. Chhikara, Principal Investigators Jul. 1980 20 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency of the Am. Statist. Assoc., Surv. Res. Methods Sect., Houston, Tex., 11-14 Aug. 1980 ERTS (Contract NAS9-15800; Proj. AgRISTARS) (E81-10035; NASA-CR-163552; FC-JO-00468; JSC-16371) Avail: NTIS HC A02/MF A01 CSCL 02C

The problem of determining stratum variances needed in achieving an optimum sample allocation for crop surveys by remote sensing is investigated by considering an approach based on the concept of stratum variance as a function of the sampling unit size. A methodology using the existing and easily available information of historical crop statistics is developed for obtaining initial estimates of stratum variances. The procedure is applied to estimate stratum variances for wheat in the U.S. Great Plains and is evaluated based on the numerical results thus obtained. It is shown that the proposed technique is viable and performs satisfactorily, with the use of a conservative value for the field size and the crop statistics from the small political subdivision level, when the estimated stratum variances were compared to those obtained using the LANDSAT data. Author

N81-12519*# National Aeronautics and Space Administration, Earth Resources Labs., Bay St. Louis, Miss.

MULTISTAGE VARIABLE PROBABILITY FOREST VOLUME INVENTORY

James E. Anderson, Principal Investigator Mar. 1979 31 p refs ERTS (E81-10037; NASA-TM-82198; ERL-179) Avail: NTIS HC A03/MF A01 CSCL 02F

The net board foot volume (Scribner log rule) of the standing Ponderosa pine timber on the Defiance Unit of the Navajo Nation's forested land was estimated using a multistage forest volume inventory scheme with variable sample selection probabilities. The inventory designed to accomplish this task required that both LANDSAT MSS digital data and aircraft acquired data be used to locate one acre ground plots, which were subsequently visited by ground teams conducting detailed tree measurements using an optical dendrometer. The dendrometer measurements were then punched on computer input cards and were entered in a computer program developed by the U.S. Forest Service. The resulting individual tree volume estimates were then expanded through the use of a statistically defined equation to produce the volume estimate for the entire area which includes 192,026 acres and is approximately a 44% the total forested area of the Navajo Nation. A.R.H.

N81-12522*# Institut National de la Recherche Agronomique, Versailles (France), Station de Bioclimatologie.

A STUDY OF RADIOMETRIC SURFACE TEMPERATURES: THEIR FLUCTUATIONS, DISTRIBUTION AND MEANING

A. Perrier, B. Itier, P. Boissard, Principal Investigators, C. Goillot, P. Belluomo, and P. Valery Ispra, Italy Joint Research Center of the European Communities Feb. 1980 36 p In FRENCH; ENGLISH summary Sponsored by NASA HCMM (Proj. TELLUS) (E81-10040; NASA-CR-163544; Newsletter-13) Avail: NTIS HC A03/MF A01 CSCL 05B

A consecutive night and day flight and measurements on the ground, were made in the region of Voves, south of Chartres. The statistical analysis of the thermal scanner data permitted the establishment of criteria for the homogeneity of surfaces. These criteria were used in defining the surface temperature values which are most representative for use in an energy balance approach to evapotranspiration (day) and heat balance (night). For a number of maize fields that airborne thermal scanner data permitted a detailed energy analysis of different fields of a same

crop to be carried out. Such a detailed analysis was not necessary for a calculation of crop evapotranspiration which could be evaluated from the mean temperature of the crop surface. A differential analysis day night is of interest for enhancing the contrast between types of surfaces, as well as for a better definition of the daily energy balance. It should be stressed that, for a homogeneous region, a study such as the present one, could be carried out on a relatively small part of the total surface, as the results for a surface of 2.5 x 2 sq km were not significantly different from those obtained from a surface three times larger. A.R.H.

N81-12535# Institut National de la Recherche Agronomique, Avignon (France), Centre de Recherches Agronomiques d'Avignon.

CONTRIBUTION TO AGRONOMICAL APPLICATIONS OF REMOTE SENSING: ANALYSIS OF THE RELATIONS BETWEEN THE STRUCTURE OF A VEGETATION COVER-AGE, ITS PHYSIOLOGICAL STATE, AND RADIOMETRIC DATA [CONTRIBUTION A L'UTILISATION AGRONOMIQUE DE LA TELEDETECTION; ANALYSE DES RELATIONS ENTRE LA STRUCTURE D'UN COUVERT VEGETAL SON ETAT PHYSIOLOGIQUE, ET LES DONNEES RADIOMETRIQUES]

Frederic Baret and Martine Huet Sep. 1979 133 p refs In FRENCH

Avail: NTIS HC A07/MF A01

Quantitative relations between reflectance measurements and the physiological state of plants were studied. The biological aspects of wheat growth are recalled. The measurement of the spectral characteristics of the light reflected by leaves is described together with the parameters most representative of the plant's state. The radiometric measurement techniques employed are presented together with the factors to be taken into consideration (Sun's altitude, cloud covering, wind and optical characteristics of the soil). Theoretical models are employed. The results given concern varieties of wheat and barely. The usefulness of the technique is demonstrated. Author (ESA)

N81-12541# National Technical Information Service, Springfield, Va.

REMOTE SENSING OF AGRICULTURAL RESOURCES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Oct. 1973 - Sep. 1980

Audrey S. Hundemann Oct. 1980 270 p Supersedes NTIS/PS-79/0993; NTIS/PS-78/0969 (PB80-814981; NTIS/PS-79/0993; NTIS/PS-78/0969) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 02C

Results of agricultural resources surveys using remote sensing techniques for crop identification, acreage measurement, land mapping, and forest density studies are discussed. A few abstracts pertain to identification of plant diseases and insect pests and fishery resources assessment. GRA

N81-13388# European Space Agency, Paris (France).

SATELLITE REMOTE SENSING APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY [TELEDETECTION PAR SATELLITE APPLICATIONS EN AGROCLIMATOLOGIE ET AGROMETEOROLOGIE]

Apr. 1980 141 p refs Partly in FRENCH and ENGLISH Presented at ESA/UN Food and Agr. Organ./WMO Conf., Rome, 1-12 Oct. 1979

(ESA-SP-1022) Avail: NTIS HC A07/MF A01

The applications of several satellite observation systems to crop identification, crop field evaluation, soil water balance and Earth resources evaluation are described. Other methods using agrometeorological data, and some observed methodological difficulties are discussed.

N81-13390# Food and Agriculture Organization of the United Nations, Rome (Italy), Centre de Teledetection.

GENERAL VIEW OF REMOTE SENSING APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY [VUE GENERALE DE L'EMPLOI DE LA TELEDETECTION DANS L'AGROCLIMATOLOGIE ET L'AGROMETEOROLOGIE]

John A. Howard *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 5-9 *In* FRENCH

Avail: NTIS HC A07/MF A01

A summary of remote sensing history is presented. The present situation and trends are discussed, with a detailed examination of satellite remote sensing programs such as LANDSAT C, LANDSAT D, SPOT, Soyuz-Salyut, SEASAT, TIROS-N, NOAA-6 and GOES. The meteorological parameters of interest in remote sensing are listed. Author (ESA)

N81-13392# Institut National de la Recherche Agronomique, Paris (France).

THE APPLICATIONS OF REMOTE SENSING TO AGRICULTURE [APPLICATIONS DE LA TELEDETECTION A L'AGRICULTURE]

C. C. Goillot *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 17-26 refs *In* FRENCH

Avail: NTIS HC A07/MF A01

The principles of soil surface characterization by remote sensing are reviewed and its applications to agriculture discussed. The differences in reflectance presented by soil surface and crop types are shown as a function of radiation wavelength, and the techniques used are described, including IR photography and multiband scanning. Applications to different disciplines such as cartography, soil science, crop inventory, crop growth, and crop disease are examined. Author (ESA)

N81-13393# Institut National de la Recherche Agronomique, Avignon (France). Station de Bioclimatologie.

APPLICATIONS OF REMOTE SENSING IN THE INFRARED TO THE DETERMINATION OF THE EVAPORATION AND THE HUMIDITY OF SOIL [APPLICATION DE LA TELEDETECTION DANS L'INFRAROUGE THERMIQUE A LA DETERMINATION DE L'EVAPORATION ET DE L'HUMIDITE DU SOL]

B. Seguin *In* ESA Satellite Remote Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 27-37 refs *In* FRENCH

Avail: NTIS HC A07/MF A01

The theoretical basis of remote sensing of soil humidity is discussed, including the surface energy balance, the analysis of microclimate in the proximity of the soil, and the determination of the surface temperature. Practical methods for the application of infrared thermography to the estimation of evaporation are examined and the conclusion is drawn that the technique is already pre-operational and that the satellites equipped with IR sensors (NOAA, TIROS N, HCMM, LANDSAT D) should be operational in a few years. Author (ESA)

N81-13398# Centre National d'Etudes Spatiales, Toulouse (France).

RADIOMETRIC PROBLEMS IN AGRICULTURAL REMOTE SENSING [PROBLEMES RADIOMETRIQUES EN TELEDETECTION AGRICOLE]

G. Saint *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 87-99 *In* FRENCH

Avail: NTIS HC A07/MF A01

A model describing the directional reflectance of a vegetative canopy is discussed, exposing the problems related to the characterization of different crops. The utilization of the 1976 LANDSAT images for the study of the agriculture in the Landes region is described in detail. Different crops and varieties could be identified and a good correlation with yield of corn crops could be established. Suggestions for developmental work are given. Author (ESA)

N81-13399# Centre National d'Etudes Spatiales, Toulouse (France).

SPOT: PROBE SYSTEM FOR EARTH OBSERVATION [SPOT: SYSTEME PROBATOIRE A'OBSERVATION DE LA TERRE]

M. Cazenave *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 101-103 *In* FRENCH

Avail: NTIS HC A07/MF A01

The characteristics of the SPOT missions are described. The objectives include crop inventories, agricultural resources, crop identification, catastrophe evaluation, spontaneous vegetation studies, and urbanization effects. The characteristics of the high resolution visible radiation radiometer are detailed. The first SPOT mission is described, including orbital characteristics and the access frequency for a given region. Author (ESA)

N81-13400# Food and Agriculture Organization of the United Nations, Rome (Italy).

CROP SURVEILLANCE BASED ON AGROMETEOROLOGICAL DATA [SURVEILLANCE DES CULTURES BASEE SUR DES INFORMATIONS AGROMETEOROLOGIQUES]

G. F. Popov *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 105-113 *In* FRENCH

Avail: NTIS HC A07/MF A01

The principles of a method for crop surveillance and crop forecasting based upon agrometeorological data in use by 15 countries, are explained. Cumulative water balances are determined in successive 10 day periods for each crop and several parameters are deduced from this basic information. The results show a direct relationship between the calculated index and the crop yield. The experience obtained in Africa by the Food and Agricultural Organization using this method is described. Author (ESA)

N81-13414*# Joint Research Centre of the European Communities, Ispra (Italy).

HCMM SATELLITE FOLLOW-ON INVESTIGATION NO. 25. SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST (TELLUS PROJECT) Progress Report, 31 Apr. - 31 Aug. 1980

31 Aug. 1980 48 p refs Sponsored by NASA HCMM (Proj. TELLUS)

(E81-10057; NASA-CR-163765; PR-3) Avail: NTIS HC A03/MF A01 CSCL 08M

A simple procedure to evaluate actual evaporation was derived by linearizing the surface energy balance equation, using Taylor's expansion. The original multidimensional hypersurface could be reduced to a linear relationship between evaporation and surface temperature or to a surface relationship involving evaporation, surface temperature and albedo. This procedure permits a rapid sensitivity analysis of the surface energy balance equation as well as a speedy mapping of evaporation from remotely sensed surface temperatures and albedo. Comparison with experimental data yielded promising results. The validity of evapotranspiration and soil moisture models in semiarid conditions was tested. Wheat was the crop chosen for a continuous measurement campaign made in the south of Italy. Radiometric, micrometeorologic, agronomic and soil data were collected for processing and interpretation. E.D.K.

N81-13415*# Joint Research Centre of the European Communities, Ispra (Italy).

THE JOINT MEASURING CAMPAIGN 1979 IN RUTHE (WEST GERMANY) DESCRIPTION AND PRELIMINARY DATA

R. R. vanderPloeg, G. Tassone, and J. vonHoyningen-Huene. Principal Investigators 1979 252 p refs Sponsored by NASA HCMM

(Proj. TELLUS) (E81-10058; NASA-CR-163766) Avail: NTIS HC A12/MF A01 CSCL 08B

The measurements and observations performed as part of the TELLUS project on soil moisture and heat budget evaluations of selected areas in the vicinity of Ruthe, West Germany are presented and discussed. The main lines of investigation include evapotranspiration and moisture content in bare soils covered by vegetation, interactions between natural phenomena and

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mesoscale heat budget, and man made changes and their impact on regional heat budget. M.G.

N81-13416*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

AN APPLICATION EXAMPLE OF THE LANDSAT DATA TO THE STUDY OF THE RELATIONSHIP BETWEEN THE TOPOGRAPHY AND PASTURE QUALITY IN AREAS OF PARAGOMINAS [EXEMPLO DE APLICACAO DE DADOS DO SISTEMA LANDSAT, NO ESTUDO DAS RELACOES ENTRE COMPARTIMENTACAO TOPOGRAFICA E QUALIDADE DE PASTAGENS NO MUNICIPIO DE PARAGOMINAS (PA)]

Nelson deJesusParada, Principal Investigator, Armando P. dosSantos, Evelyn Marcia Leao deMoraesNovo, and Valdete Duarte Jun. 1980 76 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color illustrations ERTS

(E81-10059; NASA-CR-163767; INPE-1756-RPE/145) Avail: NTIS HC A05/MF A01 CSCL 02C

The relationship between pasture quality and geomorphology was verified by applying visual and automatic interpretation techniques to LANDSAT data. The results show that LANDSAT data is useful to point out better areas to settle pastures. Author

N81-13420*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

JOINT MICROWAVE AND INFRARED STUDIES FOR SOIL MOISTURE DETERMINATION

E. G. Njoku, J. P. Schieldge, and A. B. Kahle, Principal Investigators 15 Sep. 1980 129 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, Agency for International Development ERTS

(Contract NAS7-100; Proj. AgRISTARS)

(E81-10064; NASA-CR-163771; SM-YO-00495; JPL-80-57) Avail: NTIS HC A07/MF A01 CSCL 02C

The feasibility of using a combined microwave-thermal infrared system to determine soil moisture content is addressed. Of particular concern are bare soils. The theoretical basis for microwave emission from soils and the transport of heat and moisture in soils is presented. Also, a description is given of the results of two field experiments held during vernal months in the San Joaquin Valley of California. M.G.

N81-13421*# Texas A&M Univ., College Station. Remote Sensing Center.

DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report, Apr. - Jul. 1980

W. D. Rosenthal, J. C. Harlan, and Bruce J. Blanchard, Principal Investigators Jul. 1980 14 p HCMM (Contract NAS5-24383)

(E81-10065; NASA-CR-163772; PR-3712-10) Avail: NTIS HC A02/MF A01 CSCL 02C

Heat capacity mapping mission data were obtained for use in enhancing estimates of soil moisture content. Day/day thermal IR difference between data from August 31 and October 17 were analyzed. Atmospheric correction on HCMM pass dates using the RADTRA model were calculated. Differences between corrections using lake temperatures and calculated temperatures were small. R.C.T.

N81-13424*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

STUDY OF THE CERRADO VEGETATION IN THE FEDERAL DISTRICT AREA FROM ORBITAL DATA M.S. Thesis [ESTUDO DA VEGETACAO DE CERRADO NA AREA DO DISTRITO FEDERAL, A PARTIR DE DADOS ORBITAIS]

Nelson deJesusParada, Principal Investigator, Hideyo Aoki, and Joao Roberto dosSantos May 1980 51 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10068; NASA-CR-163775; INPE-1730-TDL/026) Avail: NTIS HC A08/MF A01 CSCL 02F

The physiognomic units of cerrado in the area of Distrito Federal (DF) were studied through the visual and automatic analysis of products provided by Multispectral Scanning System (MSS) of LANDSAT. The visual analysis of the multispectral images in black and white, at the 1:250,000 scale, was made based on the texture and tonal patterns. The automatic analysis of the compatible computer tapes (CCT) was made by means of IMAGE-100 system. The following conclusions were obtained: (1) the delimitation of cerrado vegetation forms can be made by the visual and automatic analysis; (2) in the visual analysis, the principal parameter used to discriminate the cerrado forms was the tonal pattern, independently of the year's seasons, and the channel 5 gave better information; (3) in the automatic analysis, the data of the four channels of MSS can be used in the discrimination of the cerrado forms; and (4) in the automatic analysis, the four channels combination possibilities gave more information in the separation of cerrado units when soil types were considered. E.D.K.

N81-13426*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

NORMAL CROP CALENDARS. VOLUME 2: THE SPRING WHEAT STATES OF MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA

William L. West, III, Principal Investigator Aug. 1980 24 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS)

(E81-10070; NASA-CR-160867; SR-LO-00485; LEMSCO-15034; JSC-16814) Avail: NTIS HC A02/MF A01 CSCL 02C

The state crop calendars for the principal spring wheat producing states within the United States are presented. These crop calendars are an update of those produced for the large area crop inventory experiment multilabeling task during 1978 and are compiled for the foreign commodity production forecasting (FCPF) project of the agriculture and resources inventory surveys through aerospace remote sensing program. R.C.T.

N81-13427*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

PRELIMINARY EVALUATION OF THE ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN CROP CALENDAR SHIFT ALGORITHM FOR ESTIMATION OF SPRING WHEAT DEVELOPMENT STAGE

D. E. Phinney, Principal Investigator Sep. 1980 20 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS) (E81-10071; NASA-CR-160865; SR-LO-00476; LEMSCO-15115; JSC-16377) Avail: NTIS HC A02/MF A01 CSCL 02C

An algorithm for estimating spectral crop calendar shifts of spring small grains was applied to 1978 spring wheat fields. The algorithm provides estimates of the date of peak spectral response by maximizing the cross correlation between a reference profile and the observed multitemporal pattern of Kauth-Thomas greenness for a field. A methodology was developed for estimation of crop development stage from the date of peak spectral response. Evaluation studies showed that the algorithm provided stable estimates with no geographical bias. Crop development stage estimates had a root mean square error near 10 days. The algorithm was recommended for comparative testing against other models which are candidates for use in AgRISTARS experiments. E.D.K.

N81-13430*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EROS TO UNIVERSAL TAPE CONVERSION PROCESSOR S. O. O'Brien, Principal Investigator Sep. 1980 11 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS) (E81-10074; NASA-CR-160869; EW-LO-00705; LEMSCO-15357; JSC-16382) Avail: NTIS HC A02/MF A01 CSCL 05B

The function of the EROS processor is to allow a user to select a specific area from a full frame LANDSAT image which is written on tape in the EROS format. The area of interest is read from the EROS formatted tape and converted to the JSC Universal format and written onto another tape. This tape can then be read by the IMDACS processing system and normal analysis can be performed. Author

N81-13431*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

NORMAL CROP CALENDARS. VOLUME 1: ASSEMBLY AND APPLICATION OF HISTORICAL CROP DATA TO A STANDARD PRODUCT

William L. West, III, Principal Investigator Aug. 1980 21 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS) (E81-10075; NASA-CR-160868; SR-LO-00484; LEMSCO-15033; JSC-16813) Avail: NTIS HC A02/MF A01 CSCL 02C

The approach used in the collection, collation, and compilation of normal crop calendar for the foreign commodity production forecasting (FCPF) project of the AgRISTARS program is described. A.R.H.

N81-13432*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EVALUATION OF RESULTS OF US CORN AND SOYBEANS EXPLORATORY EXPERIMENT: CLASSIFICATION PROCEDURES VERIFICATION TEST

J. G. Carnes and J. E. Baird, Principal Investigators Sep. 1980 39 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AGRISTARS) (E81-10076; NASA-CR-160873; FC-LO-00423; LEMSCO-14386; JSC-16339) Avail: NTIS HC A03/MF A01 CSCL 02C

The classification procedure utilized in making crop proportion estimates for corn and soybeans using remotely sensed data was evaluated. The procedure was derived during the transition year of the Large Area Crop Inventory Experiment. Analysis of variance techniques were applied to classifications performed by 3 groups of analysts who processed 25 segments selected from 4 agrophysical units (APU's). Group and APU effects were assessed to determine factors which affected the quality of the classifications. The classification results were studied to determine the effectiveness of the procedure in producing corn and soybeans proportion estimates. A.R.H.

N81-13441# Battelle Inst., Frankfurt am Main (West Germany). **INVESTIGATION INTO A METHODOLOGY OF ESTABLISHING AN AREAL TERRAIN DATA BASE, PHASE 3 Final Report**

P. Jessel, W. Koeppel, and K. J. Melzer Dec. 1979 139 p refs

(Contract DAJA37-79-C-0242) (AD-A090333; BF-R-64.058-2; FR-2) Avail: NTIS HC A07/MF A01 CSCL 02/6

This volume contains a compilation of vegetation field data, statistical stand table data and current forestry inventory data for a selected area of the FRG within two 1:50,000 scale quadrangle sheets Lauterbach (L 5322) and Hunfeld (L 5324). The data were used for assessing the applicability of existing analysis is presented of how projects performed and of the institutional conditions associated with their success or failure. DOE

N81-15422*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SURVEYING THE AREA OF DEFORESTATION OF THE AMAZON BY LANDSAT SATELLITE IMAGERY [LEVANTAMENTO DE AREAS DE DESMATAMENTO NA AMAZONIA LEGAL ATRAVES DE IMAGENS DO SATELITE LANDSAT]

Nelson deJesusParada, Principal Investigator, Antonio T. Tardin, Armando P. dosSantos, David Chung Liang Lee, Fernando C. SoaresMaia, Francisco J. Mendonca, Getulio V. Assuncao, Jose E. Rodrigues, Myrian deMouraAbdon, and Rene A. Novaes Jan. 1979 13 p refs In PORTUGUESE Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E81-10049; NASA-CR-163759; INPE-1411-NTE/142) Avail: NTIS HC A02/MF A01 CSCL 08F

LANDSAT imagery was used to determine the amount of deforestation in a study area comprising 55 million hectares of the Amazon region. Results show that more than 4 million hectares were deforested. Maps and pictures of the deforested area in relation to the total area of the Amazon are included. Transl. by A.R.H.

N81-15428# National Physical Research Lab., Pretoria (South Africa).

PREPARATION OF A FORESTRY MAP OF SOUTH AFRICA USING LANDSAT DATA. PHASE 1: FEASIBILITY STUDY

O. G. Malan, D. W. vanderZel, and A. J. Brink Feb. 1980 47 p refs Original contains color illustrations (CSIR-FIS-207; ISBN-0-7988-1764-X) Avail: NTIS HC A03/MF A01

The results of a feasibility study to generate such a forestry map of South Africa from LANDSAT data by computer classification are presented. In view of the highly reliable results obtained, even at a scale of 1:50,000, a continuation of the study is recommended. J.M.S.

N81-15664# Marine Biological Lab., Woods Hole, Mass. **CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM. MEASUREMENT OF CHANGES IN TERRESTRIAL CARBON USING REMOTE SENSING**

G. M. Woodwell, (ed.) Sep. 1980 32 p refs Conf. Held at Woods Hole, Mass., May 1979 Sponsored by DOE (CONF-7905176) Avail: NTIS HC A03/MF A01

A program was developed, based on satellite imagery, supplemented by aerial photography, for measuring changes in the area of forests on a global basis. Such changes affect the atmospheric concentration of CO₂. Suggestions for research and development in imaging techniques are presented and include uses of synthetic aperture radar, side looking airborne radar, and other forms of aerial photography. T.M.

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02

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

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

A81-10716 Sanitary landfill site selection by remote sensing. B. E. Ruth, J. D. Degner, and H. K. Brooks (Florida, University, Gainesville, Fla.). (*American Society of Civil Engineers, Annual Convention and Exposition, Atlanta, Ga., Oct. 22-26, 1979.*) *ASCE, Transportation Engineering Journal*, vol. 106, Nov. 1980, p. 661-673. 5 refs.

The use of remote sensing techniques to evaluate the soils, geology, and hydrologic characteristics for selection of potential sanitary landfill sites is discussed with reference to a study involving Landsat imagery and the IMAGE 100 system. The importance of image selection, training site selection, and verification of the results of analysis for the generation of accurate classification schemes is pointed out. The need for using different forms of imagery and analysis methods with reliable ground truth data is demonstrated. Classification problems associated with the results of human activities that altered drainage and vegetation are examined. V.L.

A81-12084 Land-use change analysis using sequential aerial photography and computer techniques. P. O. Adeniyi (Lagos, University, Lagos, Nigeria). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Nov. 1980, p. 1447-1464. 15 refs. Research supported by the University of Lagos and University of Waterloo.

The utility of combined remote sensing and computer techniques in the analysis of changes in urban land use is examined for the case of Lagos, Nigeria. Sequential black-and-white aerial photographs taken of Lagos in 1962 and 1974 were interpreted to identify land-use types and construct base land use maps which were verified in the field. The land-use data were then input into the computer by 100-sq m grid cell, the Land Use Change Detection and Analysis Program was employed to determine the areas of land occupied by each land-use type at each time, the magnitude and types of changes and the locations of each change. A computer mapping program was then used to illustrate the spatial pattern of land-use changes. The land-use statistics and maps produced can be used as a basis for further analysis and as a data bank for urban planning. A.L.W.

A81-13680 Evidence of transport of hazy air masses from satellite imagery. W. A. Lyons (MESOMET, Inc., Chicago, Ill.). In: *Aerosols: Anthropogenic and natural, sources and transport; Proceedings of the Conference, New York, N.Y., January 9-12, 1979.* New York, New York Academy of Sciences, 1980, p. 418-433. 22 refs. U.S. Environmental Protection Agency Contract No. 68-02-3000.

Some observations of major aerosol events in the atmosphere by meteorological satellites are reviewed. The events included a massive plume of smoke from a Hawaiian volcanic eruption, dust plumes originating from the Sahara Desert and the central U.S., smoke from a small forest fire, and sulfate aerosol-hazes. It is concluded that the routine detection and tracking of synoptic-scale pollution episodes, along with quantitative measurements of their intensity, are entirely feasible with existing spacecraft and data analysis systems. F.G.M.

A81-13942 * Seasat SAR identification of dry climate urban land cover. F. M. Henderson (New York, State University, Albany, N.Y.) and S. W. Wharton (NASA, Goddard Space Flight Center, Greenbelt, Md.). *International Journal of Remote Sensing*, vol. 1, July-Sept. 1980, p. 293-304. 5 refs.

Digitally processed Seasat synthetic aperture radar (SAR) imagery of the Denver, Colorado area was examined to assess its potential for mapping urban land cover and the compatibility of SAR derived classes with those described in the U.S. Geological Survey classification system. The entire scene was interpreted to generate a small-scale land cover map. In addition, six subscene enlargements representative of urban land cover categories extant in the area were used as test sites for detailed analysis of land cover types. Two distinct approaches were employed and compared in examining the imagery - a visual interpretation of black-and-white positive transparencies and an automated-machine/visual interpretation. The latter used the Image 100 interactive image analysis system to generate land cover classes by density level slicing of the image frequency histogram. (Author)

A81-14277 * Airborne surveys of USA urban areas at 121.5/243 MHz. R. E. Taylor (NASA, Goddard Space Flight Center, Greenbelt, Md.) and J. S. Hill (EMXX Corp., Springfield, Va.). In: *International Symposium on Electromagnetic Compatibility, 21st, San Diego, Calif., October 9-11, 1979, Proceedings.*

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 245-251. 7 refs.

In situ, aircraft flight measurements were made in 1976 and 1977 by NASA of the radio-frequency environment over USA urban areas within the emergency distress search and rescue frequency bands at 121.5 and 243.0 MHz. This paper analyzes test results reported previously for USA East Coast and Midwest flight surveys; presented also are test results obtained in May 1977 for the USA West Coast during the NASA, ASSESS-II, Space Shuttle/Spacelab simulation aircraft flights. The USA West Coast flight include data at 121.5/243 MHz during an extensive series of aircraft passes for the Los Angeles urban area. The USA East Coast/Midwest measurements show correlation with population count. (Author)

A81-15055 # Means of using aerial and space photographs for evaluating and forecasting anthropoecological processes (Puti primeneniia aerokosmicheskikh snimkov dlia otsenki i prognozirovaniia antropoekologicheskikh protsessov). V. P. Kaznacheev (Akademiia Meditsinskikh Nauk SSSR, Novosibirsk, USSR) and A. I. Melua (Nauchno-Issledovatel'skii i Proektnyi Institut po Razrabotke General'nykh Planov i Proektov Zastroiki Gorodov, Leningrad, USSR). *Issledovanie Zemli iz Kosmosa*, Sept.-Oct. 1980, p. 30-39. 7 refs. In Russian.

An attempt is made to establish a relationship between the parameters of the ambient medium and the state of health of the human population on the basis of published data, concerning vegetative damage and alternation caused by air and solid pollutants, detected from satellite imagery. A theoretical model for predicting the population's state of health is proposed. V.P.

A81-16006 A radar clutter model - Average scattering coefficients of land, snow, and ice. R. K. Moore, K. A. Soofi, and S. M. Purduski (Kansas, University, Lawrence, Kan.). (*Institute of Electrical and Electronics Engineers and International Union of Radio Science, National Radio Science Meeting, Seattle, Wash., June 18-22, 1979.*) *IEEE Transactions on Aerospace and Electronic Systems*, vol. 16, Nov. 1980, p. 783-799. 40 refs. Contract No. F30602-75-C-0121.

Data from Skylab and the University of Kansas microwave spectrometers have been used to develop an empirical model for the average scattering coefficient for general North American terrain during the summer months, for snow-covered terrain, and for sea ice. The models result in standard errors of estimate, for the large averages involved, that are in most cases under 1 dB and in every case under 2 dB. V.L.

A81-19294 Wavelength-modulated derivative spectrometer capable of an automatic analyser of environmental air pollutants. T. Izumi (Anritsu Electric Co., Ltd., Atsugi, Japan) and K. Nakamura

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(National Research Institute for Pollution and Resources, Tsukuba, Ibaraki, Japan). *Journal of Physics E - Scientific Instruments*, vol. 14, Jan. 1981, p. 105-112. 5 refs.

In order to make simultaneous and continuous measurements of the three kinds of environmental air pollutants, SO₂, NO and NO₂, with a high sensitivity and stability, a wavelength-modulated derivative spectrometer is investigated. Much attention is paid to the construction of the optical system, wavelength-modulator, and the multipass cell of the spectrometer, and the performance is investigated. The limits of identification for each measuring object are 15 PPB for SO₂, 13 PPB for NO, and 8 PPB for NO₂, for instantaneous measurement, the values being consistent with those calculated. For the measurement of the integrated value over one hour, the limits of identification are 5 PPB for SO₂, 3 PPB for NO, and 4 PPB for NO₂. Tight correlations are observed between data obtained by the spectrometer and by two other analyzers which are based on the flame-photometric detection, and the chemiluminescence method.

(Author)

N81-10486*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RADAR DETECTION OF SURFACE OIL ACCUMULATIONS

John E. Estes, Peggy O'Neill (California Univ., Santa Barbara), and Michael Wilson (California Univ., Santa Barbara) *In its Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980* p 275-292 refs

Avail: NTIS HC A22/MF A01 CSCL 13B

The United States Coast Guard is developing AIREYE, an all weather, day/night airborne surveillance system, for installation aboard future medium range surveillance aircraft. As part of this program, a series of controlled tests were conducted off southern California to evaluate the oil slick detection capabilities of two Motorola developed, side looking radars. The systems, a real aperture AN/APS-94D and a synthetic aperture coherent on receive (COR) were flown over the Santa Barbara Channel on May 19, 1976. Targets imaged during the coincident overflights included natural oil seepage, simulated oil spills, oil production platforms, piers, mooring buoys, commercial boats and barges at other targets. Based on an analysis of imagery from the coincident radar runs, COR provides better detection of natural and man made oil slicks, whereas the AN/APS-94D consistently exhibited higher surface target detection results. This and other tests have shown that active microwave systems have considerable potential for aiding in the detection and analysis of surface oil accumulations. E.D.K.

N81-10512*# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO URBAN REGIONAL PLANNING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980

Audrey S. Hundemann Aug. 1980 74 p Supersedes NTIS/PS-79/0843; NTIS/PS-78/0790 (PB80-813116; NTIS/PS-79/0843; NTIS/PS-78/0790) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 13B

Urban and regional planning using aerial photography and satellite remote sensing methods is discussed. Abstracts cover the use of remote sensing in land use mapping, traffic surveys and urban transportation planning, and taking inventories of natural resources for urban planning. Abstracts dealing with land use and residential quality associated with and acting as an influence on health and physical well being are included. GRA

N81-10587*# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980

Audrey S. Hundemann Aug. 1980 192 p Supersedes NTIS/PS-79/0842; NTIS/PS-78/0789 (PB80-813140; NTIS/PS-79/0842; NTIS/PS-78/0789) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 13B

Application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarine problems. GRA

N81-11092*# Committee on Commerce, Science, and Transportation (U. S. Senate).

CIVIL REMOTE SENSING SATELLITE SYSTEM

Washington GPO 1980 241 p refs Hearings before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., 26 Jun. and 24 Jul. 1980 (GPO-66-554) Avail: Subcommittee on Science, Technology, and Space

Land remote sensing satellite systems are discussed, with emphasis on LANDSAT D and LANDSAT D PRIME. The transitional program to convert the land remote sensing satellite system to civil operation is detailed. Discussions of users requirement and methods of data acquisition are included. S.F.

N81-12484*# State Univ. Coll. of New York at Oneonta.

EVALUATION OF THREE TECHNIQUES FOR CLASSIFYING URBAN LAND COVER PATTERNS USING LANDSAT MSS DATA

Paul R. Baumann, Principal Investigator Bay St. Louis, Miss. NASA, Earth Resources Lab. Jan. 1979 41 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E81-10007; NASA-CR-163511; Rept-178) Avail: NTIS HC A03/MF A01 CSCL 08B

Three computer quantitative techniques for determining urban land cover patterns are evaluated. The techniques examined deal with the selection of training samples by an automated process, the overlaying of two scenes from different seasons of the year, and the use of individual pixels as training points. Evaluation is based on the number and type of land cover classes generated and the marks obtained from an accuracy test. New Orleans, Louisiana and its environs form the study area. Author

N81-12502*# Pennsylvania State Univ., University Park. Dept. of Meteorology.

APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report

Toby N. Carlson, Principal Investigator 1 Sep. 1980 5 p HCMM (Contract NAS5-24264) (E81-10025; NASA-CR-163503; QR-11) Avail: NTIS HC A02/MF A01 CSCL 13B

The first analyses of the Washington, D.C. area was completed in which a method was employed to determine the surface energy balance, moisture availability, and thermal inertia. Further analyses of the Clarksville, Tennessee area during project STATE were completed. To test a newly operational interactive system, a temperature study of the Central Pennsylvania Barrens was performed. J.M.S.

N81-13387*# National Aeronautics and Space Administration, Washington, D. C.

HEAT BALANCE OF THE EARTH

M. I. Budyko, T. G. Berlyand, N. A. Yefimova, L. I. Zubenok, and L. A. Strokina Apr. 1980 55 p refs Transl. into ENGLISH of the mono. "Teplotovoy Balans Zemli" Leningrad, Gidrometeoizdat, 1978 41 p Original language document announced as A78-46579 Transl. by Scientific Translation Service, Santa Barbara, Calif.

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(Contract NASw-3198)

(NASA-TM-75826) Avail: NTIS HC A04/MF A01 CSCL 08E

Results of improved calculations of the heat balance components of Earth's surface are reported for yearly average conditions. The technique used to determine the heat-balance components from land- and sea-based actinometric observations as well as from satellite data on the radiation balance of the Earth-atmosphere system is described, with special attention given to short-wavelength solar radiation on the continents, effective radiation from the land surface, the radiation balance of the ocean surface, heat expended by both evaporation from the ocean surface, and turbulent heat transfer between the ocean surface and the atmosphere. World maps of heat-balance components show yearly average values of total radiation, radiation balance, heat expended by evaporation, the turbulent heat flow between Earth's surface and atmosphere, and heat transfer between the ocean surface and underlying waters. The global surface heat balance is estimated along with global values of the various components and the heat-balance components for different latitude zones.

Author

N81-13434* Mississippi State Univ., Mississippi State. **APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 May - 31 Oct. 1980**

W. Frank Miller, Bradley D. Carter, Jimmy L. Solomon, Sidney G. Williams, John S. Powers, and Jon R. Clark, Principal Investigators 1 Nov. 1980 63 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Grant NGR-25-001-054)

(E81-10078; NASA-CR-163776; SAPR-14) Avail: NTIS HC A04/MF A01 CSCL 08B

Progress is reported in the following areas: remote sensing applications to land use planning Lowndes County, applications of LANDSAT data to strip mine inventory and reclamation, white tailed deer habitat evaluation using LANDSAT data, remote sensing data analysis support system, and discrimination of unique forest habitats in potential lignite areas of Mississippi. Other projects discussed include LANDSAT change discrimination in gravel operations, environmental impact modeling for highway corridors, and discrimination of fresh water wetlands for inventory and monitoring.

E.D.K.

N81-13435* Pennsylvania State Univ., University Park. Dept. of Meteorology.

REMOTE ESTIMATION OF THE SURFACE CHARACTERISTICS AND ENERGY BALANCE OVER AN URBAN-RURAL AREA AND THE EFFECTS OF SURFACE HEAT FLUX ON PLUME SPREAD AND CONCENTRATION M.S. Thesis

Donald Charles DiCristofaro, Principal Investigator Nov. 1980 122 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 Center A for Rockets and Satellites'. HCMM

(Contract NASS-24264; Grants EPA-R-806048; EPA-R-805640)

(E81-10082; NASA-CR-163780) Avail: NTIS HC A07/MF A01 CSCL 13B

A one dimensional boundary layer model was used in conjunction with satellite derived infrared surface temperatures to deduce values of moisture availability, thermal inertia, heat and evaporative fluxes. The Penn State satellite image display system, a sophisticated image display facility, was used to remotely sense these various parameters for three cases: St. Louis, Missouri; the Land Between the Lakes, Kentucky; and Clarksville, Tennessee. The urban centers displayed the maximum daytime surface temperatures which correspond to the minimum values of moisture availability. The urban center of St. Louis and the bodies of water displayed the maximum nighttime surface temperatures which correspond to the maximum thermal inertia values. It is shown that moisture availability and thermal inertia are very

much responsible for the formation of important temperature variations over the urban rural complex.

R.C.T.

N81-14388* New Mexico Univ., Albuquerque. Technology Application Center.

REMOTE SENSING APPLIED TO POLLUTION MONITORING. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jun. 1980

Gerald F. Zollars Jun. 1980 61 p Supersedes NTIS/PS-79/0732 Sponsored by NASA and NTIS

(NASA-CR-163830; PB80-815632; NTIS/PS-79/0732) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 13B

Citations from the international literature describe the use of remote sensors to aid in the monitoring of air and water pollution. Use of lasers, optical radar systems, aerial photography, and satellite observations are included.

GRA

N81-14505* National Physical Lab., Teddington (England). Div. of Quantum Metrology.

MONITORING POLLUTANT GASES FROM SPACE USING PASSIVE MICROWAVE TECHNIQUES

J. E. Harries Feb. 1980 51 p refs

(NPL-QU-59) Avail: NTIS HC A04/MF A01

The application of passive microwave sensing techniques from space to the study of pollutant concentrations in the lowest layers of the troposphere is discussed. The essentials of radiative transfer theory are introduced and the spectroscopy of the atmosphere at millimeter wavelengths, the intensity of pollutant spectral lines and, the problem of detectability of these lines against the background radiation emitted by the Earth's surface are treated. It is shown that, despite the intrinsic power of microwave techniques, a number of significant problems exist, including the extreme weakness of many of the pollutant lines (making ultra-low receiver noise levels an important goal); uncertainties in the nature of the continuum absorption at these wavelengths; and the effects of heavy rain and thick clouds. Some suggestions for further work are given.

A.R.H.

N81-14514* SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.

DEVELOPMENT OF AN AIRBORNE LIDAR FOR CHARACTERIZING PARTICLE DISTRIBUTION IN THE ATMOSPHERE Final Report

E. E. Uthe, W. L. Jimison, and N. B. Nielsen Sep. 1980 45 p refs

(EPRI Proj. 1308-2)

(EPRI-EA-1538) Avail: NTIS HC A03/MF A01

The ALPHA-1 (Airborne Lidar Plume and Haze Analyzer) was designed to observe smoke plume and atmospheric boundary layer particles over large areas. A data processing system was designed for both real time facsimile (grayscale) display and magnetic tape recording. Multiple microcomputers were used to optimize processing capabilities within the power weight and size constraints of medium sized twin engine aircraft. A one week field program was conducted to evaluate ALPHA-1 performance and reliability. The system successfully observed boundary layer structure over the Los Angeles area and the downwind structure of particulate plumes from power plants. The data show the importance of terrain features in establishing particle distributions over urban areas and downwind of large power plants.

DOE

N81-14598* National Hurricane Center, Coral Gables, Fla. **ANNUAL DATA AND VERIFICATION TABULATION ATLANTIC TROPICAL CYCLONES 1979**

Paul J. Hebert Jun. 1980 84 p refs

(PB80-226301; NOAA-TM-NWS-NHC-13; NOAA-80073103; AR-6) Avail: NTIS HC A05/MF A01 CSCL 04B

Tropical cyclone warning lead times for U.S. land-falling storms are given. A summary of the best track, initial position, and forecast positions for named storms is presented. Other data include supplementary vortex messages, aerial reconnaissance summaries, daily GEOS-2 satellite photographs, and selected radar photographs of hurricanes Bob, David, and Frederic.

T.M.

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

N81-15427*# California Univ., Berkeley. Social Sciences Group.

SOCIAL ISSUES AND IMPLICATIONS OF REMOTE SENSING APPLICATIONS: PARADIGMS OF TECHNOLOGY TRANSFER Semiannual Status Report

Ida R. Hoos 31 Dec. 1980 54 p refs

(Grant NsG-7522)

(NASA-CR-163856) Avail: NTIS HC A04/MF A01 CSCL 05K

The transfer of technology from one federal agency to another was observed in the case of the move of LANDSAT to NOAA. An array of unanticipated consequences was found that have important impacts on both the process and outcome of the transfer. When the process was studied from viewpoint of the ultimate recipient, a set of expectations and perceptions were found that figure more in a final assessment than do the attributes of the technology being transferred. The question of how to link a technology with a community of potential users was studied in detail. T.M.

N81-15631# California Univ., Livermore. Lawrence Livermore Lab. Atmospheric and Geophysical Sciences Div.

DETERMINATION OF TOTAL OZONE FROM DMSP MULTICHANNEL FILTER RADIOMETER MEASUREMENTS

F. M. Luther and R. L. Weichel Sep. 1980 9 p Presented at the Quadrennial Intern. Ozone Symp., Boulder, Colo., 4-9 Aug. 1980

(Contract W-7405-eng-48)

(UCRL-84069; CONF-800869-2)

Avail: NTIS

HC A02/MF A01

Total ozone amounts are determined from sets of radiance measurements using an empirical relationship that is developed using linear regression analysis. Total ozone is modeled as a linear combination of terms involving functions of the MFR radiances for four channels (1, 3, 7 and 16) and the secant of the zenith angle. The ozone retrieval methodology is described schematically. The ozone retrieval model is developed through regression analysis using sets of simulated MFR radiances derived from detailed radiative transfer calculations. The MFR total ozone data are compared with independent ground based Dobson measurements in order to evaluate the ozone retrieval methodology. Comparisons were made where the MFR and Dobson measurements are within 300 km and 300 minutes of each other. Percentages are computed with respect to the Dobson values. The MFR data were processed using a preliminary methodology, and the data will be reprocessed in the near future. DOE

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A81-13343 * Geomagnetic field mapping from a satellite - Spatial power spectra of the geomagnetic field at various satellite altitudes relative to natural noise sources and instrument noise. M. G. McLeod and P. J. Coleman, Jr. (California, University, Los Angeles, Calif.). *Physics of the Earth and Planetary Interiors*, vol. 23, Oct. 1980, p. 222-231. 15 refs. Contract No. NAS8-32571; Grants No. NGR-05-007-351; No. NGL-05-007-004.

A81-15299 # Effectiveness of using multispectral aerial photography for topographic interpretation (Effektivnost' izpol'zovaniia mnogozonal'nykh aerofotosnimkov pri topograficheskom deshifirovani). O. V. Portnova, G. V. Lazarev, N. B. Moskalenko, and N. G. Barabanova. *Geodeziia i Kartografiia*, Sept. 1980, p. 26-31. In Russian.

The paper deals with a study of the effectiveness of multispectral photography in simplifying and improving the interpretation of aerial photographs under field conditions. It is shown that some versions of multispectral photography, applied to specific seasonal and other conditions, resulted in substantial time and cost savings in the preparation of 1:100,000 and 1:10,000 scale maps. V.P.

A81-16491 * Magsat scientific investigations. R. A. Langel (NASA, Goddard Space Flight Center, Geophysics Branch, Greenbelt, Md.). *Johns Hopkins APL Technical Digest*, vol. 1, July-Sept. 1980, p. 214-227. 27 refs.

The nature of the geomagnetic field and of presatellite and early satellite measurements is described. The objectives of each investigation in the areas of geomagnetic modeling, crustal magnetic anomaly studies, investigations of the inner earth, and studies of external current systems are presented, along with some early results from Magsat. (Author)

A81-16589 The earth's variable rotation: Geophysical causes and consequences. K. Lambeck (Australian National University, Canberra, Australia). Research supported by the Université de Paris VI, Université de Paris VII, Institut National d'Astronomie et de Géophysique, DGRST, CNES, and Australian National University. Cambridge and New York, Cambridge University Press, 1980. 458 p. 691 refs. \$77.50.

The book examines physical properties of the earth, rotational dynamics, excitation functions, and the astronomical evidence of earth's rotation. Also covered are ocean and atmospheric tides, seasonal variations in atmospheric pressure, oceans and winds, the excitation of the Chandler wobble, decade fluctuations in the core-mantle, earthquakes, tidal dissipation, and paleorotation. A.T.

A81-17746 General features of the magnetic field of the equatorial electrojet measured by the POGO satellites. C. A. Onwumehili and C. E. Agu (University of Nigeria, Nsukka, Nigeria). *Planetary and Space Science*, vol. 28, Dec. 1980, p. 1125-1130. 16 refs. Research sponsored by the Institute of Management and Technology.

Magnetic field data of the equatorial electrojet observed by POGO satellites from 1967 to 1970 were investigated by comparing

the position of the electrojet axis with the position of the dip equator on the earth's surface. No significant latitudinal shift of the electrojet from the dip equator was observed; however, unexpected instances in which the field increases with altitude were found, including the oscillation of the magnitude of the equatorial electrojet signature with maxima at 460 and 635 km and minima at 580 and 725 km. It was concluded that the model developed shows that a field oscillating with altitude can be also caused by a single complicated system of current without additional current layers.

A.T.

A81-18143 * Global gravity field to degree and order 30 from Geos 3 satellite altimetry and other data. E. M. Gaposchkin (Smithsonian Astrophysical Observatory, Cambridge, Mass.). *Journal of Geophysical Research*, vol. 85, Dec. 10, 1980, p. 7221-7234. 33 refs. Contract No. NAS6-2449.

A model of the geopotential field in spherical harmonics to degree and order 30 is obtained from Geos 3 satellite to sea surface altimetry data, terrestrial gravity measurements and satellite perturbation analysis. A general perturbation solution is employed for the calculation of the orbits of 10 satellites based on satellite laser ranging data, and 1 deg x 1 deg surface gravity data are used to compute 550 km x 550 km block anomalies by means of autocovariance analysis. Altimeter-determined sea-surface heights, which are taken as the geoid, are averaged for each 1 deg x 1 deg ocean surface area and treated by autocovariance analysis to obtain 550 x 550 km block undulations. Observation and normal equations are formed from the altimeter and surface gravity data, which together cover 1635 out of 1654 possible surface elements, and are combined with the available satellite-derived normal equations to obtain a solution for the spherical harmonics coefficients. In addition, a value of 6,378,138.23 + or - 1.3 m is obtained for the earth's semimajor axis. A.L.W.

N81-10508# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

A STUDY ON THE DETERMINATION OF THE KOOTWIJK-WETZELL BASELINE FROM SATELLITE LASER RANGING AT THESE STATIONS

K. F. Wakker and B. A. C. Ambrosius Jan. 1980 28 p refs Presented at 2nd Meeting of the Lageos Working Group, Greenbelt, Md., Feb. 1980 (VTH-LR-295) Avail: NTIS HC A03/MF A01

Results are presented of a preliminary study to determine the Kootwijk-Wetzell baseline and the Wetzell coordinates from satellite laser ranging. Five different estimates were obtained, based on three single arc, one two arc and one four arc solutions. The arcs were formed from 32 passes of four satellites over only the Kootwijk and Wetzell ranging stations during the period July 11 to August 24, 1978. Special attention was paid to the effects of the orbit station geometry, the number of passes, and the distribution of the passes over a time span. Author (ESA)

N81-11027# Naval Surface Weapons Center, Dahlgren, Va. APPLICATION OF NAVSTAR GPS GEODETIC RECEIVER TO GEODESY AND GEOPHYSICS Final Report

Richard J. Anderle Sep. 1980 26 p refs (AD-A090003; NSWC/TR-80-282) Avail: NTIS HC A03/MF A01 CSCL 17/7

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

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N81-12493*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. **STUDIES RELATED TO MAGSAT Progress Report, period ending Sep. 1980**

David P. Stern, Principal Investigator Sep. 1980 3 p refs ERTS
(E81-10016; NASA-TM-82225) Avail: NTIS HC A02/MF A01 CSCL 08G

Two models of the geomagnetic field, derived from Magsat data were compared. One model came from a data set including both the magnitude and the direction of the field. The other resembles earlier POGO models by using only the field magnitude observed from space. The comparison confirmed predictions that such models contain large spurious components of a harmonic nature structure. After the spurious terms in the second model were estimated, they were subtracted. It was noticed that other spurious effects, of smaller amplitude, still existed. While the primary Backus effect tends to introduce significant errors in low-order harmonic terms, these secondary effects are mainly significant in the higher harmonics, since they decay rather slowly with increasing harmonic order, and may, therefore, mask the natural decrease of such terms. FORTRAN programs were developed for the IBM 1800 in order to transform the given magnetic field models into dipole coordinates, and to compare the coefficients of the expansions. A program was also coded in BASIC (for an HP 9830) deriving the d sequences of higher order spurious terms. A.R.H.

N81-12527*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. **MAGSAT VECTOR MAGNETOMETER CALIBRATION USING MAGSAT GEOMAGNETIC FIELD MEASUREMENTS**

E. R. Lancaster, Timothy Jennings, Martha Morrissey, and Robert Langel Nov. 1980 75 p refs
(NASA-TM-82046) Avail: NTIS HC A04/MF A01 CSCL 14B

From the time of its launch on Oct. 30, 1979 into a nearly polar, Sun synchronous orbit, until it reentered the Earth's atmosphere on June 11, 1980, Magsat measured and transmitted more than three complete sets of global magnetic field data. The data obtained from the mission will be used primarily to compute a currently accurate model of the Earth's main magnetic field, to update and refine world and regional magnetic charts, and to develop a global scalar and vector crustal magnetic anomaly map. The in-flight calibration procedure used for 39 vector magnetometer system parameters is described as well as results obtained from some data sets and the numerical studies designed to evaluate the results. A.R.H.

N81-12531# Army Engineer Topographic Labs., Fort Belvoir, Va.

DETECTION OF SIGNAL SIGNATURES OF CARTOGRAPHIC FEATURES

Pi-Fuay Chen and William W. Muller Jun. 1980 15 p refs (AD-A090375) Avail: NTIS HC A02/MF A01 CSCL 08/2

Currently photo interpretation and terrain image identification for military applications is performed manually. This work is time consuming and costly. The work described below is a first step to aiding or semi-automating some of these labor intensive tasks. A semi-automated technique for extracting a selected set of cartographic features such as, road intersections, straight line roads, and rectangular objects from aerial photographs was recently developed at the U.S. Army Engineer Topographic Laboratories (USAETL) using the Walsh transform. The discrete function (Walsh) transform was chosen because of its simplicity (Walsh functions are only two-valued) resulting in simple implementation, and because Walsh functions conform to the selected set of the cartographic features. Since the Walsh transform coefficients were produced by using Walsh functions having alternate magnitudes (either -1 or +1) at different sequences, the Walsh transform coefficients are also decomposed spectral components of the signal signature of the input aerial photographic images. The technique was investigated in two

ways as follows: (1) using a 32 by 32 element solid state sensor array to convert aerial imagery into an electronic signal which was processed in a minicomputer to yield Walsh transforms of the image, and (2) a prototype image spectrum analyzer (PISA) was developed which utilizes a large size plasma discharge device (8.5 by 8.5 inch illuminating area with 512 electrodes each in both x and y directions) to generate two dimensional Walsh function patterns, and produce 512 by 512 Walsh coefficients in 14 seconds. GRA

N81-13418*# Tokyo Univ. (Japan). Geophysics Research Lab.

[STUDYING INTERNAL AND EXTERNAL MAGNETIC FIELDS IN JAPAN USING MAGSAT DATA] Progress Report, 15 Jul. - 15 Nov. 1980

Naoshi Fukushima, Principal Investigators, H. Maeda, T. Yukutake, M. Tanaka, S. Oshima, K. Ogawa, M. Kawamura, Y. Miyazaki, S. Uyeda, K. Kobayashi et al 28 Nov. 1980 7 p ERTS
(E81-10062; NASA-CR-163769; PR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

Examination of the total intensity data of CHRONIT on a few paths over Japan and its neighboring sea shows MAGSAT is extremely useful for studying the local magnetic anomaly. In high latitudes, the signatures of field aligned currents are clearly recognized. These include (1) the persistent basic pattern of current flow; (2) the more intense currents in the summer hemisphere than in the winter hemisphere; (3) more fluctuations in current intensities in summer dawn hours; and (4) apparent dawn-dusk asymmetry in the field-aligned current intensity between the north and south polar regions. A.R.H.

N81-13439*# Energy, Mines and Resources Canada, Ottawa (Ontario). Geomagnetic Service.

THE REDUCTION, VERIFICATION AND INTERPRETATION OF MAGSAT MAGNETIC DATA OVER CANADA Progress Report

R. L. Coles, G. Jansen vanBeek, G. V. Haines, E. Dawson, and J. K. Walker, Principal Investigators Nov. 1980 16 p refs ERTS

(E81-10086; NASA-CR-163786) Avail: NTIS HC A02/MF A01 CSCL 05B

The primary concern of this investigation is to detect and study variations in the magnetic field originating in the solid Earth, as measured by Magsat. Most of this field originates in the core, but an important part of the field is of lithospheric origin. Magnetic anomalies of lithospheric origin are weak at Magsat altitudes (20 to 30 nT at most), and they can easily be masked by much larger effects caused by field aligned and other currents at high latitudes. Most of Canada lies under the influence of ionospheric currents in the auroral zone and polar cap. Therefore, before Magsat data had become available, but after the October 30, 1979 launch, criteria were developed for selecting times when subsets of potentially usable Magsat data could be expected. Subsequently, as Magsat data became available, these criteria were applied. E.D.K.

N81-14373# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

ESTIMATION ON THE WETTZELL COORDINATES FROM SATELLITE LASER RANGING AT KOOTWIJK, SAN FERNANDO AND WETTZELL

K. F. Wakker and B. A. C. Ambrosius Mar. 1980 25 p refs Presented at the EROS Plenary Meeting, Grasse, France, 15-17 Apr. 1980
(VTH-LR-296) Avail: NTIS HC A02/MF A01

Various estimates were obtained, based on single arc and two arc solutions. The arcs were formed from 58 passes of three satellites over the Kootwijk, San Fernando and Wettzell stations during the period July 11 to August 4, 1978. The results are compared with other existing solutions. Author

N81-15419 Ohio State Univ., Columbus. **GEODETIC POSITIONING USING A GLOBAL POSITIONING SYSTEM OF SATELLITES Ph.D. Thesis**

Patrick James Fell 1980 298 p

Avail: Univ. Microfilms Order No. 8100146

A summary of the proposals for geodetic positioning and baseline determination is given which includes a description of measurement techniques and comments on rank deficiency and error sources. An analysis of variance comparison of range, Doppler, and interferometric time delay to determine their relative geometric strength for baseline determination is included. An analytic examination of the effect of a priori constraints on positioning using simultaneous observations from two stations is presented. Dynamic point positioning and baseline determination using range and Doppler was examined in detail. Models for the error sources influencing dynamic positioning were developed. Included is a discussion of atomic clock stability and range and Doppler observation error statistics based on random correlated atomic clock error were derived. Criteria for establishing observation schedules for optimum geometric strength for positioning solutions were examined. Results of geodetic positioning simulation studies are presented. Dissert. Abstr.

NATIONAL REPORT OF THE FEDERAL REPUBLIC OF GERMANY ON GEODETIC ACTIVITIES PERFORMED DURING THE PERIOD 1975 - 1978 [LANDESBERICHT DER BUNDESREPUBLIK DEUTSCHLAND UEBER DIE IN DEN JAHREN 1975 BIS 1978 AUSGEFUEHRTEN GEOAET- ISCHEN ARBEITEN]

1979 171 p refs In GERMAN; ENGLISH summary Presented at 17th Gen. Meeting of the Intern. Union for Geodesy and Geophys., Canberra, Australia, 1979 Original contains color illustrations (Ser-B-244; ISBN-3-7696-8538-5; ISSN-0065-5317) Avail: NTIS HC A08/MF A01

Various topics relating to geodesy are discussed including: the geodetic position network, geodetic astronomy, satellite observations, physical geodesy, and gravimetry. Earth tidal movements and crustal movements are also discussed.

N81-15429# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORTS, NUMBER 78 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN]

1979 91 p refs In GERMAN; ENGLISH summary Original contains color illustrations (ISSN-0469-4236) Avail: NTIS HC A05/MF A01

Various digital image processing techniques are surveyed with emphasis on application to computer-assisted thematic mapping. Cost effectiveness is considered as well as the application areas of regional planning, ocean surface mapping, terrain mapping, and geological mapping.

N81-15430# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

AUTOMATIC RECOGNITION OF OBJECT CHANGES IN MASS IMAGE DATA [AUTOMATISIERTS ERKENNEN VON OBJEKTVERAENDERUNGEN IN MULTITEMPORALEN BILDDATEN]

Wolfgang M. Goepfert *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 78 1979 p 5-23 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A05/MF A01

Digital image processing techniques are discussed in terms of time and cost savings as well as improved accuracy. Radiometric and geometric image processing procedures necessary for mass image comparisons are described including examples and a wide range of possible applications. J.M.S.

N81-15431# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

THE MAKING OF AERIAL MAPS AT THE TIME OF RISING TIDE IN TIDAL FLAT AREAS [DIE HERSTELLUNG VON LUFTBILDKARTEN VON WATTGEBIETEN]

Guenter Hake *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 78 1979 p 25-32 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A05/MF A01

The clearly visible water lines from a series of infrared aerial photographs taken at the time of rising tide in tidal flat areas are digitized and transformed into contours by allocation of the individual altitude values. The cartographic combination of the contour representation with the rectified aerial photographs from the time of the lowest water level results in a valuable photomap. Changes in altitude and volume can be presented or alternatively calculated from later repeated photographs. J.M.S.

N81-15617# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

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04 GEOLOGY AND MINERAL RESOURCES

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

A81-10157 **Aerial photo studies of linears in a glacial landscape of southwestern Michigan.** R. Erhart and R. Priced (Western Michigan University, Kalamazoo, Mich.). *Remote Sensing Quarterly*, vol. 2, Apr. 1980, p. 24-28.

An aerial photographic study of geological linears of the earth's surface in a glacial environment of southwestern Michigan is presented. The study was undertaken in Kalamazoo County, a region overlain by glacial drift due to two distinct glacial lobes, and involved the mapping of linears apparent on county photomosaic indexes and aerial photographs. The linears are found to exhibit two distinct preferred orientations and to be concentrated in two areas. The change in linear orientation is observed to occur despite a constancy in the strike of the bedrock and near the approximate boundary between the two glacial lobes of the Pleistocene, thus indicating that the majority of linears in Kalamazoo County formed independent of structural controls and instead may be a product of glacial processes.

A.L.W.

A81-13349 **Air-photo interpretation of glacial stratigraphy and the engineering assessment of terrain in southern Saskatchewan /Canada/.** E. K. Sauer (Saskatchewan, University, Saskatoon, Canada). *Photogrammetria*, vol. 35, Oct. 1980, p. 207-232. 27 refs.

A81-15051 # **Application of satellite photographs to the study of the distribution of mineral resources in the southern Transural region (Ispol'zovanie kosmicheskikh snimkov pri izuchenii zakonornosti razmeshcheniia poleznykh iskopaemykh v luzhnom Zaural'e).** A. V. Pertsov and G. V. Gal'perov (Vsesoiuznoe Aerogeologicheskoe Nauchno-Proizvodstvennoe Ob'edinenie Aerogeologii, Laboratoriia Aerometodov, Leningrad, USSR). *Issledovanie Zemli iz Kosmosa*, Sept.-Oct. 1980, p. 5-9. 19 refs. In Russian.

A81-15052 # **Deep-seated structure of the earth's crust from space imagery - Using the eastern Azov region as an example (Glubinnaiia struktura zemnoi kory po kosmicheskim izobrazheniiam - Na primere Vostochnogo Priazov'ia).** S. S. Bystrevskaia (Akademiia Nauk Ukrainskoi SSR, Institut Geokhimii i Fiziki Mineralov, Kiev, Ukrainian SSR) and N. N. Shatalov (Akademiia Nauk Ukrainskoi SSR, Institut Geologicheskikh Nauk, Kiev, Ukrainian SSR). *Issledovanie Zemli iz Kosmosa*, Sept.-Oct. 1980, p. 10-16. 16 refs. In Russian.

Using the eastern Azov region as an example, it is shown how the deep-seated structure of the crystalline basement can be recognized on regional satellite photographs of the primary rock area below the Mesocenozoic deposits. Complex interpretation of satellite imagery and routine geological-geophysical information provides evidence for major dome-shaped structure.

V.P.

A81-15053 # **Geological interpretation of the Kozhzero ring structure recognized on satellite photographs /Eastern Karelia/ (Opyt geologicheskoi interpretatsii Kozhozerskoi kol'tsevoi struktury, otdeshifirovannoi po kosmicheskim snimkam /Vostochnaia Kareliia/).** V. M. Moralev and E. N. Terekhov (Akademiia Nauk SSSR, Institut Litofery, Moscow, USSR). *Issledovanie Zemli iz Kosmosa*, Sept.-Oct. 1980, p. 17-21. 6 refs. In Russian.

A81-15054 # **Northern Pleistocene structural features from space and high-altitude photographs (Struktura Severnogo pleistotsena po dannym kosmicheskikh i vysotnykh s'emok).** V. I. Astakhov (Vsesoiuznoe Aerogeologicheskoe Nauchno-Proizvodstvennoe Ob'edinenie Aerogeologii, Laboratoriia Aerometodov, Leningrad, USSR). *Issledovanie Zemli iz Kosmosa*, Sept.-Oct. 1980, p. 22-29. 15 refs. In Russian.

In the present paper, new information on the Pleistocene structure in the northern region of West Siberia and the Pechora basin is obtained from space and high-altitude imagery of various scales. The northern Pleistocene grey-clay sequence is recognized as a continental drift formation containing interlayers of interglacial deposits. Some characteristic features of this formation are examined.

V.P.

A81-15492 * **Evaluation of multispectral middle infrared aircraft images for lithologic mapping in the East Tintic Mountains, Utah.** A. B. Kahle (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.) and L. C. Rowan (U.S. Geological Survey, Reston, Va.). *Geology*, vol. 8, May 1980, p. 234-239. 23 refs. Contract No. NAS7-100.

Six channels of multispectral middle infrared (8 to 14 micron) aircraft scanner data were acquired over the East Tintic mining district, Utah. This area has high relief and moderate vegetation and consists mainly of Tertiary silicic igneous rocks and Paleozoic quartzite and carbonate rocks that have been locally hydrothermally altered. These digital-image data were computer processed to create a color-composite image based on principal component transformations. Color differences in this image are related to the spectral differences in the surface material and allow discrimination of several rock types, depending primarily on their silica content. When combined with a visible and near infrared color-composite image from a previous flight, with limited field checking, it is possible to discriminate quartzite, carbonate rocks, quartz latitic and quartz monzonitic rocks, latitic and monzonitic rocks, silicified altered rocks, argillized altered rocks, and vegetation.

(Author)

A81-18043 * **Lineament and polygon patterns on Europa.** D. C. Pieri (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div., Pasadena, Calif.). *Nature*, vol. 289, Jan. 8, 1981, p. 17-21. 29 refs.

A classification scheme is presented for the lineaments and associated polygonal patterns observed on the surface of Europa, and the frequency distribution of the polygons is discussed in terms of the stress-relief fracturing of the surface. The lineaments are divided on the basis of albedo, morphology, orientation and characteristic geometry into eight groups based on Voyager 2 images taken at a best resolution of 4 km. The lineaments in turn define a system of polygons varying in size from small reticulate patterns the limit of resolution to 1,000,000 sq km individuals. Preliminary analysis of polygon side frequency distributions reveals a class of polygons with statistics similar to those found in complex terrestrial terrains, particularly in areas of well-oriented stresses, a class with similar statistics around the antijovian point, and a class with a distribution similar to those seen in terrestrial tensional fracture patterns. Speculations concerning the processes giving rise to the lineament patterns are presented.

A.L.W.

A81-18226 **Oil fields of foredeeps as seen from space.** V. D. Skariatin (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-A-02*. 12 p.

Preliminary results of studying large oil- and gas-bearing regions and subregions by space images are given in this report. Newly revealed structural elements of the earth's crust are analyzed. An attempt is made to find the correlation between the location of lineaments and deposits of oil and gas, using data about the front foredeeps of the Alpine fold belt.

(Author)

04 GEOLOGY AND MINERAL RESOURCES

A81-18227 The application of space imagery to geological investigations in the USSR. A. L. Stavtsev (Ob'edinenie Aero-geologii, Moscow, USSR). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-A-04.* 5 p.

The paper deals with some domestic applications of TV-, photo-scanner and photographic satellite images. Attention is given to such applications as geological mapping, search for mineral deposits, and the solution of hydrogeological, engineering, and environmental conservation problems. V.P.

A81-18261 Some new data on the tectonic activity in the Montenegro coastal region /Yugoslavia/ based on the Landsat imagery. M. Oluic (Industroprojekt, Zagreb, Yugoslavia), D. Cvijanovic, and E. Prelogovic (Zagreb, Sveuciliste, Zagreb, Yugoslavia). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-61.* 14 p. 5 refs.

Seismic and neotectonic activity in the Montenegro coastal region of Yugoslavia, site of the catastrophic earthquake of April 15, 1979 and the boundary between the Adriatic basin and the Dinaric Mountains, is interpreted based on Landsat imagery. The imagery for the continental area of the coastal region reveals several ruptural deformations of considerable length running in the northwest-southeast direction, with transverse and diagonal intersections as well. Rings-shaped structures of various sizes are also observed with diameters from 5 to 50 km, and are attributed to igneous or diapiric and tectonic activities. Based on the observed fault zones and ring structures, a model is presented of seismotectonic processes caused by the predominantly northward tectonic motion. A.L.W.

N81-10472*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RADAR GEOLOGY: AN ASSESSMENT REPORT OF THE RADAR GEOLOGY WORKSHOP

1 Sep. 1980 515 p refs Workshop held in Snowmass, Colo., 16-20 Jul. 1979 Original contains color illustrations (Contract NAS7-100)
(NASA-CR-163638; JPL-Pub-80-61) Avail.: NTIS HC A22/MF A01 CSCL 08G

The application of imaging radar to geologic problems is assessed. The general topics for consideration were: technique development; engineering environmental; mapping; and exploration.

N81-10473*# Arkansas Univ., Fayetteville. Dept. of Geology. **HISTORICAL SKETCH: RADAR GEOLOGY**
H. MacDonald *In JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 23-38* refs

Avail: NTIS HC A22/MF A01 CSCL 08G

A chronological assessment is given of the broad spectra of technology associated with radar geology. Particular attention is given to the most recent developments made in the areas of microwave Earth resources applications and geologic remote sensing from aircraft and satellite. The significance of space derived radar in geologic investigations is discussed and the scientific basis for exploiting the sensitivity of radar signals to various aspects of geologic terrain is given. R.C.T.

N81-10474*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RADAR GEOLOGY: TECHNOLOGY AND PROGRAM OVERVIEW

Frank T. Barath *In its Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 38-41*

Avail: NTIS HC A22/MF A01 CSCL 08G

The state-of-the-art of active microwave remote sensors (altimeters, scatterometers and imagers) used in geologic applications is assessed and the ongoing radar geology activities within NASA, government agencies, industry, universities and foreign organizations is summarized. Plans for radar geology

research and development and space flight missions are also outlined. R.C.T.

N81-10475*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SIMULATION OF ORBITAL RADAR IMAGES

R. S. Saunders, J. C. Holtzman (Kansas Univ., Lawrence), and Charles Elachi *In its Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 45-63* refs

Avail: NTIS HC A22/MF A01 CSCL 171

The operating parameters for spaceborne synthetic aperture imaging radar systems was addressed in the cost effective manner by using simulation techniques. The use of airborne images, Seasat images; and computer simulation were the first computer simulation of spaceborne radar imagery was analyzed for system definition studies. Analysis of the simulation indicates that incidence angles as small as 30 are useful for general terrain geomorphologic analysis. R.C.T.

N81-10476*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

EXPRESSION OF SAN ANDREAS FAULT ON SEASAT RADAR IMAGE

Floyd F. Sabins, Jr. (Chevron Oil Field Research Co.), R. Blom, and Charles Elachi *In its Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 64-74* refs

Avail: NTIS HC A22/MF A01 CSCL 08G

A Seasat image (23.5 cm wavelength) of the Durmid Hills in southern California, the San Andreas Fault was analyzed. It is shown that a prominent southeast trending tonal lineament exists that is bright on the southwest side and dark on the northeast side. The cause of the contrasting signatures on opposite sides of the lineament was determined and the geologic significance of the lineament was evaluated. R.C.T.

N81-10477*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ANALYSIS OF SEASAT ORBITAL RADAR IMAGERY FOR GEOLOGIC MAPPING IN THE APPALACHIAN VALLEY AND RIDGE PROVINCE, TENNESSEE-KENTUCKY-VIRGINIA

J. P. Ford *In its Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 75-113* refs

Avail: NTIS HC A22/MF A01 CSCL 08B

The terrain-surface features of the Appalachian Valley and Ridge province were analyzed using Seasat synthetic aperture radar imagery. Particular attention was given to determining the efficiency and capability of this microwave imaging system for geologic mapping. R.C.T.

N81-10478*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RADAR IMAGING OF VOLCANIC FIELDS AND SAND DUNE FIELDS: IMPLICATIONS FOR VOIR

Charles Elachi, R. Blom, M. Daily, T. Farr, and R. S. Saunders *In its Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 114-150* refs

Avail: NTIS HC A22/MF A01 CSCL 08B

A number of volcanic fields and sand dune fields in the western part of North America were studied using aircraft and Seasat synthetic aperture radar images and LANDSAT images. The capability of radars with different characteristics (i.e., frequency, polarization and look angles was assessed to identify and map different volcanic features, lava flows and sand dune types. It was concluded that: (1) volcanic features which have a relatively large topographic expression (i.e., cinder cones, collapse craters, calderas, etc.) are easily identified; (2) lava flows of different ages can be identified, particularly on the L-band images; and (3) sand dunes are clearly observed and their extent and large scale geometric characteristics determined, provided the proper imaging geometry exists. R.C.T.

N81-10479*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ROCK TYPE DISCRIMINATION AND STRUCTURAL ANALYSIS WITH LANDSAT AND SEASAT DATA: SAN RAFAEL SWELL, UTAH

H. E. Stewart, R. Blom, M. Abrams, and M. Daily *In its* Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 151-167 refs Original contains color illustrations

Avail: NTIS HC A22/MF A01 CSCL 08B

Satellite synthetic aperture radar (SAR) images is evaluated in terms of its geologic applications. The benchmark to which the SAR images are compared is LANDSAT, used both for structural and lithologic interpretations. R.C.T.

N81-10481*# Texas A&M Univ., College Station. Remote Sensing Center.

REALISTIC EARTH/LAND RADAR MODELS

Andrew J. Blanchard *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 200-222 refs

Avail: NTIS HC A22/MF A01 CSCL 08B

A series of models which attempt to describe more accurately the physical geometry of Earth/land targets is presented. Theoretical calculations are included to illustrate model behavior. Variations with respect to various systems and target parameters are included. R.C.T.

N81-10483# Michigan Univ., Ann Arbor.

MULTICHANNEL SAR IN GEOLOGIC INTERPRETATION: AN APPRAISAL

Philip L. Jackson *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 233-250 refs

Avail: NTIS HC A22/MF A01 CSCL 08G

The use of multichannel synthetic aperture radar in geologic applications is discussed. Isolated illustrations are presented which indicate wide diversity of multichannel returns, which appear to be highly diagnostic of vegetation and lithology. R.C.T.

N81-10485*# Alaska Univ., Fairbanks. Geology/Geophysics Program.

APPLICATIONS OF RADAR IMAGERY TO ARCTIC AND SUBARCTIC PROBLEMS

P. Jan Cannon *In* JPL Radar Geol.: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 265-274 ref

Avail: NTIS HC A22/MF A01 CSCL 08G

Radar imagery provides year around data acquisition of areas in the Arctic and the Subarctic. The foremost factor influencing the choice of radar imagery as the major data source was the demand for neotric data. The weather is so adverse in parts of Alaska that radar imagery was the only remote sensing technique which could meet the demand. The major map products derived from radar imagery are landform maps and lineament maps. These maps are used to make environmental assessments of areas and to reconstruct the geomorphic history of certain regions or features. Since radar imagery provides information, about geologic structure and geomorphic features, it can be used to determine the relationship which exists between geologic structure and geomorphology. Important geologic information related to surface roughness can be obtained through a dry snow cover. Radar imagery is the only remote sensing technique which can provide information needed about sea ice through a cloud cover and dry snow, during strong wind conditions, and throughout the Arctic night. E.D.K.

N81-10490*# Kansas Univ., Lawrence. Remote Sensing Lab.

A NEW LOOK AT TOGO THROUGH THE EYES OF A SLAR

Louis F. Dellwig *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 351-364 refs Sponsored in part by Mobil Foundation, Inc.

Avail: NTIS HC A22/MF A01 CSCL 08B

Imaging of Togo in 1977 with SLAR provided the data required for the production of map controlled radar mosaics at a scale of 1:200,000 with 95 percent of all control points at that scale within + or - 4.0 millimeters of true positions. The mosaics served as the base for the generation of a revised geologic map of Togo. Aided by two looks, numerous revisions resulted, not only with the addition of previously unknown structural features, a revision of age relationships, and the refinement of unit boundaries, but also with the repositioning of rock units and the reorientation of major faults. E.D.K.

N81-10491*# GeoSpectra Corp., Ann Arbor, Mich. **THE USE OF RADAR AND LANDSAT DATA FOR MINERAL AND PETROLEUM EXPLORATION IN THE LOS ANDES REGION, VENEZUELA**

Robert K. Vincent *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 367-384 refs

Avail: NTIS HC A22/MF A01 CSCL 08G

A geological study of a 27,500 sq km area in the Los Andes region of northwestern Venezuela was performed which employed both X-band radar mosaics and computer processed Landsat images. The 3.12 cm wavelength radar data were collected with horizontal-horizontal polarization and 10 meter spatial resolution by an Aeroservices SAR system at an altitude of 12,000 meters. The radar images increased the number of observable suspected fractures by 27 percent over what could be mapped by LANDSAT alone, owing mostly to the cloud cover penetration capabilities of radar. The approximate eight fold greater spatial resolution of the radar images made possible the identification of shorter, narrower fractures than could be detected with LANDSAT data alone, resulting in the discovery of a low relief anticline that could not be observed in LANDSAT data. Exploration targets for petroleum, copper, and uranium were identified for further geophysical work. Author

N81-10492*# Conoco, Inc., Ponca City, Okla. Exploration Research Div.

GEOLOGICAL MAPPING IN THE AMAZON JUNGLE: A CHALLENGE TO SIDE-LOOKING RADAR

Aderbal C. Correa *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 385-416 refs

Avail: NTIS HC A22/MF A01 CSCL 08G

A brief outline of the physical environment and vegetation characteristics peculiar to the Amazon Jungle is given to provide the background for the discussion of energy target interaction models. Examples of radar images of the central part of the jungle are used to illustrate a common approach to geologic mapping in this environment. During the initial phase of interpretation, the interaction phenomenon is evaluated and textural and tonal characteristics of the radar image are observed. Field checking of selected areas is the next phase of a geologic mapping program. Reinterpretation of radar images and auxiliary data (aerial photographs, Landsat images, and field data) is the last phase of geologic mapping. E.D.K.

N81-10493*# Bureau de Recherches Geologiques et Minieres, Orleans (France). Office of Geologic and Mining Research.

SIDE-LOOKING AIRBORNE RADAR IMAGE INTERPRETATION AND GEOLOGICAL MAPPING: PROBLEMS AND RESULTS

Jean-Yves Scanvic and E. H. Soubari *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 417-438 refs

Avail: NTIS HC A22/MF A01 CSCL 08B

Geological experiments and surveys conducted by BRGM and GDTA members to evaluate interest in SLAR image interpretation are summarized. Two surveys were selected for presentation: Les Vans (Massif central, France) and Guyana (South America). They have permitted a comparison between different

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types of SLAR: Goodyear, Motorola, JPL, and Vigie in term of lithological and structural applications. On the Les Vans test site conclusions reached concern radiometry, which is better on L-band imagery, polarization, HV being more useful than HH for geological mapping in an L-band system, wavelength and illuminations. Over Guyana, the use of Goodyear X-band SLAR enables satisfactory geological and structural mapping under heavy equatorial forest with cloud cover conditions. A differential program was developed for fracture filtering and image enhancement with a coherent light laser, and significant results were obtained. E.D.K.

N81-10494*# Woodward-Clyde Consultants, Orange, Calif.
THE EVALUATION OF 3cm-WAVELENGTH RADAR FOR MAPPING SURFACE DEPOSITS IN THE BRISTOL LAKE/GRANITE MOUNTAIN AREA, MOJAVE DESERT, CALIFORNIA

Ray Sugiura and Floyd F. Sabins, Jr. (Chevron Oil Field Research Co.) *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 439-456 refs

Avail: NTIS HC A22/MF A01 CSCL 08B

Surface deposits in the Bristol Lake/Granite Mountains area, Mojave Desert, California were mapped using high resolution 3 cm wavelength radar images. The surface deposits range from silt to boulders in size and were separated into six radar-rock units on the basis of radar return signatures (brightness and texture) and geomorphic expression. Field reconnaissance of the six units showed that the brightness of the radar signatures on the images correlates with the surface roughness of each unit. Two major radar signatures anomalies were noted during the study. A dark radar signature for the large sand ridges in the Kelso Dunes area and a distinct northwest trending contrast boundary between bright and dark radar signatures in the Bristol Dry Lake area. Field reconnaissance of the two areas indicated that near surface moisture may be the cause of dark signatures. Dune areas with little to no vegetation produce a dark signature, whereas areas with sparse to moderate vegetation produce an intermediate to dark signature. E.D.K.

N81-10495*# Phillips Petroleum Co., Bartlesville, Okla.
RADAR, AN OPTIMUM REMOTE-SENSING TOOL FOR DETAILED PLATE TECTONIC ANALYSIS AND ITS APPLICATION TO HYDROCARBON EXPLORATION (AN EXAMPLE IN IRIAN JAYA INDONESIA)

Claude M. Froidevaux *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 457-501 refs Original contains color illustrations

Avail: NTIS HC A22/MF A01 CSCL 08G

Geometric, geomorphic, and structural information derived from the examination of radar imagery and combined with geologic and geophysical evidences strongly indicates that Salawati Island was attached to the Irian Jaya mainland during the time of Miocene lower Pliocene reef development, and that it was separated in middle Pliocene to Pleistocene time, opening the Sele Strait rift zone. The island moved 17.5 km southwestward after an initial counterclockwise rotation of 13 deg. The rift zone is subsequent to the creation of the large left lateral Sorong fault zone that is part of the transitional area separating the westward-moving Pacific plate from the relatively stable Australian plate. The motion was triggered during a widespread magmatic intrusion of the Sorong fault zone, when the basalt infiltrated a right lateral fault system in the area of the present Sele Strait. E.D.K.

N81-10496*# Hunting Geology and Geophysics Ltd., Elstree (England).
FRACTURE TRACE EXPRESSION AND ANALYSIS IN RADAR IMAGERY OF RAIN FOREST TERRAIN (PERU)

Peter H. A. Martin-Kaye, J. W. Norman (Imperial Coll. of Science and Technology), and M. J. Skidmore (National Coal Board, London) *In* JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980 p 502-507 refs

Avail: NTIS HC A22/MF A01 CSCL 02F

Mapping of minor lineaments from radar imagery of the rain forest in southeast Peru is biased due to the selective suppression of some topography which results from the observation geometry of the imaging radar system and the varied perception of lineaments on the imagery by different interpreters. Team analysis of the imagery compensates for several of the sources of bias, and results in the clear recognition of differing regimes within the regional fracture field in the study area.

Author

N81-10513# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO GEOLOGY AND MINERALOGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1973 - Jul. 1980

Audrey S. Hundemann Aug. 1980 192 p Supersedes NTIS/PS-79/0844; NTIS/PS-78/0791 (PB80-813124; NTIS/PS-79/0844; NTIS/PS-78/0791) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 08G

The use of LANDSAT satellites (formerly Earth Resources Technology Satellites (ERTS)) and other remote sensing methods in geological and mineralogical applications is discussed. Abstracts cover rock and soil mapping, terrain analysis, direct and indirect mineral exploration, fault tectonics, and general geologic studies of various countries. A few abstracts pertain to equipment and techniques used in the studies. GRA

N81-11437*# Arkansas Univ., Fayetteville.
EVALUATION OF AIRCRAFT MICROWAVE DATA FOR LOCATING ZONES FOR WELL STIMULATION AND ENHANCED GAS RECOVERY Final Report

H. MacDonald, W. Waite, C. Elachi, R. Babcock, R. Konig, J. Gattis, M. Borengasser, and D. Tolman Jan. 1980 130 p refs

(Contract JPL-955048)

(NASA-CR-163710) Avail: NTIS HC A07/MF A01 CSCL 08G

Imaging radar was evaluated as an adjunct to conventional petroleum exploration techniques, especially linear mapping. Linear features were mapped from several remote sensor data sources including stereo photography, enhanced LANDSAT imagery, SLAR radar imagery, enhanced SAR radar imagery, and SAR radar/LANDSAT combinations. Linear feature maps were compared with surface joint data, subsurface and geophysical data, and gas production in the Arkansas part of the Arkoma basin. The best LANDSAT enhanced product for linear detection was found to be a winter scene, band 7, uniform distribution stretch. Of the individual SAR data products, the VH (cross polarized) SAR radar mosaic provides for detection of most linears; however, none of the SAR enhancements is significantly better than the others. Radar/LANDSAT merges may provide better linear detection than a single sensor mapping mode, but because of operator variability, the results are inconclusive. Radar/LANDSAT combinations appear promising as an optimum linear mapping technique, if the advantages and disadvantages of each remote sensor are considered. Author

N81-11596*# California Inst. of Tech., Pasadena. Geological and Planetary Sciences Div.

AN AIRBORNE SYSTEM FOR DETECTION OF VOLCANIC SURFACE DEFORMATIONS

Jonathan Lunine 20 Aug. 1980 21 p refs Sponsored by NASA Prepared for Lunar and Planetary Inst., Houston, Tex. Avail: NTIS HC A02/MF A01 CSCL 08K

A technique is proposed for measuring volcanic deformation on the order of centimeters per day to centimeters per year. An airborne multifrequency pulsed radar, tracking passive ground reflectors spaced at 1 kilometer intervals over a 50 square kilometer area is employed. Identification of targets is accomplished by Doppler and range resolution techniques, with final relative position measurements accomplished by phase comparison of multifrequency signals. Atmospheric path length errors are corrected by an airborne refractometer, meteorological instruments, or other refractive index measuring devices.

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Anticipated system accuracy is 1-2 cm, with measuring times on the order of minutes. Potential problems exist in the high intrinsic data assimilation rate required of the system to overcome ground backscatter noise. S.F.

N81-12495*# Stanford Univ., Calif. Dept. of Applied Earth Sciences.

GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A (HEAT CAPACITY MAPPING MISSION) Quarterly Report, 1 Apr. - 30 Jun. 1980

Ronald J. P. Lyon and A. E. Prelat, Principal Investigators 30 Jun. 1980 1 p HCMM

(Contract NAS5-24232)

(E81-10018; NASA-CR-163510) Avail: NTIS HC A02/MF A01 CSCL 08B

Further digital processing of HCMM digital data was performed to extract the temperature from the day/night passes to calculate the apparent delta T in the Yerington, Nevada mine area. Further processing is needed to observe the atmospheric effect. Author

N81-12500*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

STRUCTURAL MAPPING FROM MSS-LANDSAT IMAGERY: A PROPOSED METHODOLOGY FOR INTERNATIONAL GEOLOGICAL CORRELATION STUDIES

Nelson deJesusParada, Principal Investigator, Edison Crepani, and Paulo Roberto Martini Jun. 1980 10 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980 Sponsored by NASA ERTS

(E81-10023; NASA-CR-163574; INPE-1787-RPE/159) Avail: NTIS HC A02/MF A01 CSCL 08B

A methodology is proposed for international geological correlation studies based on LANDSAT-MSS imagery. Bullard's model of continental fit and compatible structural trends between Northeast Brazil and the West African counterpart. Six extensive lineaments in the Brazilian study area are mapped and discussed according to their regional behavior and in relation to the adjacent continental margin. Among the first conclusions, correlations were found between the Sobral Pedro II Lineament and the megafaults that surround the West African craton; and the Pernambuco Lineament with the Ngaurandere Linemanet in Cameroon. Ongoing research to complete the methodological stages includes the mapping of the West African structural framework, reconstruction of the pre-drift puzzle, and an analysis of the counterpart correlations. Author

N81-12508*# Geological Survey, Minneapolis, Minn.

SYNERGISTIC RELATIONSHIPS AMONG REMOTE-SENSING AND GEOPHYSICAL MEDIA: GEOLOGICAL AND HYDROLOGICAL APPLICATIONS

Joseph E. Goebel, Matt Walton, and Lawrence G. Batten, Principal Investigators In Minnesota Univ. A Study of Minn. Land and Water Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p 44-87 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A07/MF A01 CSCL 08G

The synergistic relationships among LANDSAT imagery, Skylab photographs, and aerial photographs were useful for establishing areas of near surface bedrock. Lineaments were located on LANDSAT imagery and aerial photographs during 1978 and near surface water tables were to be located during 1980. Both of these subjects can be identified by remote sensing methods more reliably than individual outcrops, which are small and occur in a wide variety of environments with a wide range of responses. Bedrock outcrops themselves could not be resolved by any of the data sources used, nor did any combination of data sources specifically identify rock at the ground surface. The data sources could not simply be combined mathematically to produce a visual image of probable areas of near surface bedrock.

Outcrops and near surface bedrock had to be verified visually at the site. Despite these drawbacks, a procedure for locating areas of near surface bedrock within which actual surface outcrops may occur was developed. E.D.K.

N81-12526*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

A PHYSICAL BASIS FOR REMOTE ROCK MAPPING OF IGNEOUS ROCKS USING SPECTRAL VARIATIONS IN THERMAL INFRARED EMITTANCE

Louis S. Walter and Mark L. Labovitz Oct. 1980 30 p refs (NASA-TM-82019) Avail: NTIS HC A03/MF A01 CSCL 08G

Results of a theoretical investigation of the relation between spectral features in the 8-12 micrometer region and rock type are presented. Data on compositions of a suite of rocks and measurements of their spectral intensities in 8.2-10.9 and 9.4-12.1 micrometer bands published by Vincent (1973) were subjected to various quantitative procedures. There was no consistent direct relationship between rock group names and the relative spectral intensities. However, there is such a relationship between the Thornton-Tuttle (1960) Differentiation Index and the relative spectral intensities. This relationship is explicable on the basis of the change in average Si-O bond length which is a function of the degree of polymerization of the SiO₄ tetrahedra of the silicate minerals in the igneous rocks. Author

N81-13403*# Milan Univ. (Italy). Instituto di Geofisica.

A SIMULATION MODEL OF TEMPERATURE TRANSITORY ON ROCKS HAVING DIFFERENT THERMAL INERTIA. ANALYSIS OF THE THEORETICAL CAPACITY OF ROCK DISCRIMINATION BY REMOTE SENSING DATA Progress Report

R. Cassinis, Principal Investigator and Nicola Tosi Oct. 1980 36 p refs Sponsored by NASA HCMM

(E81-10042; NASA-CR-163752; PR-3) Avail: NTIS HC A03/MF A01 CSCL 08G

The possibility of identifying ground surface material by measuring the surface temperature at two different and significant times of the day was investigated for the case of hypothetical island whose rocky surface contained no vegetation and consisted of dolomite, clay, and granite. The thermal dynamics of the soil surface during a day in which atmospheric conditions were average for a latitude of about 40 deg to 50 deg were numerically simulated. The line of separation between zones of different materials was delineated by the range of temperature variation. Results show that the difference between maximum and minimum value of the temperature of ground surface during the day is linked to the thermal inertia value of the material of which the rock is formed. A.R.H.

N81-13406*# 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, 1 Jul. - 30 Sep. 1980

John F. Herrmance, Principal Investigator 20 Oct. 1980 13 p ERTS

(Contract NAS5-26138)

(E81-10046; NASA-CR-163756; QPR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

The applicability of electromagnetic deep sounding experiments using natural sources in the magnetosphere by incorporating Magsat data with other geophysical data was evaluated. Magsat satellite data, ground based magnetic observations, appropriate reference field models, and other satellite data was analyzed. The optimal combination of observations which lead first to a global and then to a regional characterization of the conductivity of the Earth's upper mantle is sought. E.D.K.

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N81-13408*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

APPLICATION OF REMOTE SENSING TO THE GEOLOGICAL STUDY OF THE ALKALINE COMPLEX REGION OF ITATIAIA [APLICACAO DE SENSORIAMENTO REMOTO AO ESTUDO GEOLOGIA NA REGIAO DO COMPLEXO ALCALINO DE ITATIAIA]

Nelson deJesusParada, Principal Investigator and Jose Eduardo Rodrigues Aug. 1980 9 p refs In PORTUGUESE; ENGLISH summary Presented at the 32nd Reuniao Anual da Soc. Brasil. para o Progr. da Ciencia (SBPC), Rio de Janeiro, 6-12 Jul. 1980 Sponsored by NASA ERTS (E81-10048; NASA-CR-163758) Avail: NTIS HC A02/MF A01 CSCL 08G

The methodology of remote sensing applied to geological study in a complex area was evaluated. Itatiaia was selected as a test area, which covers the alkaline massives and its precambrian basement. LANDSAT-MSS and radar mosaic of the RADAMBRASIL Project were used for photointerpretation. Previous geological works were consulted and many discrepancies in the distribution of stratigraphic units were found. Moreover, structural lineaments and talus deposits were clearly delineated.

M.G.

N81-13409*# London Univ. (England).

HCMM IMAGERY FOR THE DISCRIMINATION OF ROCK TYPES, THE DETECTION OF GEOTHERMAL ENERGY SOURCES AND THE ASSESSMENT OF SOIL MOISTURE CONTENT IN WESTERN QUEENSLAND AND ADJACENT PARTS OF NEW SOUTH WALES AND SOUTH AUSTRALIA

Progress Report

Monica M. Cole, Principal Investigator 30 Apr. 1980 4 p Sponsored by NASA HCMM (E81-10050; NASA-CR-163760) Avail: NTIS HC A02/MF A01 CSCL 05B

Only photographic prints and negative films of day-visible, day-IR and night-IR imagery were received. For northwest Queensland, only five day-visible and day-IR frames of acceptable quality were received. A master-grid was established over these frames within which selected grid sections are being enlarged photographically for the identification of stream courses and geological features permitting an interpretation of the imagery relative to ground truth information. The imagery is also being scanned and digitized using a Joyce-Loebl microdensitometer for classification purposes. For areas for which good quality HCMM imagery is available, valuable information is obtained on ephemeral and seasonal drainage systems. The day-IR cover is particularly helpful.

A.R.H.

N81-13411*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SOME ASPECTS OF GEOLOGICAL INFORMATION CONTAINED IN LANDSAT IMAGES [ALGUNS ASPECTOS DAS INFORMACOES GEOLOGICAS CONTIDAS EM IMAGENS LANDSAT]

Nelson deJesusParada, Principal Investigator, Chan Chiang Liu, Icaro Vitorello, and Paulo Roberto Meneses Jul. 1980 16 p refs In PORTUGUESE; ENGLISH summary Presented at the 31st Congr. Brasil de Geol. da Soc. Brasil. de Geol., Camboriu, Santa Catarina, 19-25 Oct. 1980 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E81-10053; NASA-CR-163763; INPE-1822-RPE/188) Avail: NTIS HC A02/MF A01 CSCL 08G

The characteristics of MSS images and methods of interpretation are analyzed from a geological point of view. The supportive role of LANDSAT data are illustrated in several examples of surface expressions of geological features, such as synclines and anticlines, spectral characteristics of lithologic units, and circular impact structures.

E.D.K.

N81-13419*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jul. - Sep. 1980

Helen N. Paley and Anne B. Kahle, Principal Investigators Oct. 1980 5 p HCMM (Contract NAS7-100) (E81-10063; NASA-CR-163770) Avail: NTIS HC A02/MF A01 CSCL 08B

During the July to September 1980 quarter the final tapes were received completing the order and preliminary processing was done. Thermal Inertia images for each of the three test sites, Death Valley and Pisgah Crater, California and Goldfield, Nevada were created using registered HCMM day/night pairs and the JPL model. A comprehensive study and analysis of the geologic application of all acquired HCMM data is in progress.

E.D.K.

N81-13584 Purdue Univ., Lafayette, Ind. **LITHOSPHERIC INTERPRETATION AND MODELING OF SATELLITE ELEVATION GRAVITY AND MAGNETIC ANOMALY DATA** Ph.D. Thesis

Ralph Robert Benedikt vonFrese 1980 180 p Avail: Univ. Microfilms Order No. 8027347

To facilitate geologic interpretation of satellite elevation potential field data analysis techniques are developed and verified in the spherical domain that are commensurate with conventional flat Earth methods of potential field interpretation. A powerful approach to the spherical Earth problem relates potential field anomalies to a distribution of equivalent point sources by least squares matrix inversion. Linear transformation of the equivalent source field lead to corresponding geoidal anomalies, pseudoanomalies, vector anomaly components, spatial derivatives, continuations, and differential magnetic pole reductions. The procedures and results of this investigation provide a comprehensive approach to the lithospheric analysis of potential field anomalies in the spherical domain and, hence, have widespread application in the analysis and design of satellite gravity and magnetic surveys for geological investigation.

Dissert. Abstr.

N81-15756# Los Alamos Scientific Lab., N. Mex. **PERCENTILE ESTIMATION USING THE NORMAL AND LOGNORMAL PROBABILITY DISTRIBUTION**

Thomas R. Bement 1980 13 p refs Presented at Am. Statist. Meeting (Contract W-7405-eng-36) (LA-UR-80-1542; CONF-800820-1) Avail: NTIS HC A02/MF A01

Implicitly or explicitly percentile estimation is an important aspect of the analysis of aerial radiometric survey data. Standard deviation maps are produced for quadrangles which are surveyed as part of the National Uranium Resource Evaluation. These maps show where variables differ from their mean values by more than one, two or three standard deviations. Data may or may not be log-transformed prior to analysis. These maps have specific percentile interpretations only when proper distributional assumptions are met. Monte Carlo results are presented which show the consequences of estimating percentiles by 1) assuming normality when the data are from a lognormal distribution, and 2) assuming lognormality when the data are from a normal distribution.

Author

N81-15907*# National Aeronautics and Space Administration, Washington, D. C.

REPORTS OF PLANETARY GEOLOGY PROGRAM, 1980 Henry E. Holt, comp. and Elisabeth C. Kisters, comp. Dec. 1980 544 p refs (NASA-TM-82385) Avail: NTIS HC A23/MF A01 CSCL 09B

This is a compilation of abstracts of reports which summarize work conducted in the Planetary Geology Program. Each report reflects significant accomplishments within the area of the author's funded grant or contract.

E.D.K.

OCEANOGRAPHY AND MARINE RESOURCES

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

A81-11976 On the stability of a fluid with specialized density stratification. II - Mixed baroclinic-barotropic instability with application to the Northeast Pacific. D. G. Wright (British Columbia, University, Vancouver, Canada). *Journal of Physical Oceanography*, vol. 10, Sept. 1980, p. 1307-1322. 39 refs. National Research Council of Canada Grant No. A-5201; NSF Grant No. OCE-77-22887.

Low-frequency motions (less than about 0.25 cpd) have recently been observed in Juan de Fuca Strait. A three-layer model developed previously is used to show that some of this activity may be due to an instability (baroclinic) of the mean current to low-frequency quasi-geostrophic disturbances. Satellite infrared imagery and hydrographic maps show eddies in the deep ocean just beyond the continental slope in the northeast Pacific. The eddies are aligned in the north-south direction paralleling the continental slope region and have a wavelength of approximately 100 km. A modification of the three-layer model is used to study the stability of the current system in this area. It is found that for typical vertical and horizontal shears associated with this current system the most unstable waves have properties in agreement with observations. (Author)

A81-12917 Phytoplankton patchiness indicates the fluctuation spectrum of mesoscale oceanic structure. J. F. R. Gower, K. L. Denman (Institute of Ocean Sciences, Sidney, British Columbia, Canada), and R. J. Holyer (U.S. Navy, Oceanography Div., Bay Saint Louis, Miss.). *Nature*, vol. 288, Nov. 13, 1980, p. 157-159. 26 refs.

Satellite imagery revealing phytoplankton distributions controlled by mesoscale ocean structures is presented. The imagery was obtained for a 180 x 250 km area of ocean south of Iceland by spectral band 4 of the Landsat multispectral band scanner. The image shows swirls and eddies of increased reflectance in the green which show a structure characteristic of mesoscale turbulence as observed in satellite thermal imagery, and are interpreted as representing the distribution of phytoplankton biomass or plankton-derived detritus. Results of a phytoplankton survey tow are presented which confirm the presence of high phytoplankton productivity in the area. A two-dimensional power spectral analysis of the image is then performed which results in a power spectral law index of -2.9, which is consistent with the phytoplankton distribution being controlled by advection in variable ocean currents and thus indicates the usefulness of plankton reflectance as a tracer of eddy motion. A.L.W.

A81-13193 The design of a satellite-based system for coastal oceans monitoring. H. M. Mooney (British Aerospace, Dynamics Group, Bristol, England). *British Interplanetary Society, Journal (Space Technology)*, vol. 33, Dec. 1980, p. 433-439.

The design of a Coastal Oceans Monitoring Satellite System (COMSS) and the proposed European program for its utilization are reviewed. The COMSS will be used for fields of industrial exploration and exploitation, environmental monitoring and scientific research. The main performance requirements and characteristics of selected sensors are discussed along with the requirements of coastal and ocean imagery. Aspects of the COMSS space unit which are emphasized include (1) the 1800 watt solar array and battery capacities with operation of a synthetic aperture radar, (2) a fine attitude measurement capability based on utilizing two star scanners, mounted on the support structure of the ocean color monitor, (3) the digitization of all data on-board the spacecraft, (4) an image data transmitter capable of transmitting all data on a simultaneous basis,

and (5) an orbital altitude of 650 km. Basic functions of the COMSS ground unit, such as data reception and archiving, on-line preprocessing, generation and dissemination of image products, and mission and satellite control are discussed in relation to the organization needed for their implementation. A.C.W.

A81-13360 * # Assessment of space sensors for ocean pollution monitoring. U. R. Alvarado, K. Tomiyasu, and R. L. Gulatsi (General Electric Co., Space Systems Div., Valley Forge, Pa.). In: Sensor Systems for the 80's Conference, Colorado Springs, Colo., December 2-4, 1980, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 61-64. NASA-sponsored research. (AIAA 80-1927)

Several passive and active microwave, as well as passive optical remote sensors, applicable to the monitoring of oil spills and waste discharges at sea, are considered. The discussed types of measurements relate to: (1) spatial distribution and properties of the pollutant, and (2) oceanic parameters needed to predict the movement of the pollutants and their impact upon land. The sensors, operating from satellite platforms at 700-900 km altitudes, are found to be useful in mapping the spread of oil in major oil spills and in addition, can be effective in producing wind and ocean parameters as inputs to oil trajectory and dispersion models. These capabilities can be used in countermeasures. S.S.

A81-13371 * # Passive microwave sensing of coastal area waters. B. M. Kendall (NASA, Langley Research Center, Hampton, Va.). In: Sensor Systems for the 80's Conference, Colorado Springs, Colo., December 2-4, 1980, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 128-135. 6 refs. (AIAA 80-1953)

A technique to remotely measure sea-surface temperature and salinity was demonstrated during the 1970's with a dual-frequency microwave radiometer system developed at the NASA Langley Research Center. Accuracies in temperature of 1 C and 1 part per thousand in salinity were obtained using state-of-the-art radiometers. Several aircraft programs for the measurement of coastal area waters demonstrating the application of the microwave radiometer system are discussed. Improvements of the microwave radiometer system during the 1980's and the design and development of new radiometer systems at other frequencies are outlined and related to potential applications. (Author)

A81-13849 A comparison of ship and satellite measurements of sea surface temperatures off the Pacific coast of Canada. S. Tabata and J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada). *Journal of Geophysical Research*, vol. 85, Nov. 20, 1980, p. 6636-6648. 22 refs.

A comparison of ship and satellite measurements of sea surface temperatures indicates that a simple linear regression appears to be sufficient to relate the two sets of data obtained from a limited area and over a limited period to within a standard error of 0.5 C. A comparison of the distributions of sea surface temperatures based on continuous shipborne measurements along the cruise track and on satellite data indicated that many similar features were present in both sets of data. Some features, such as oceanic fronts and relative maxima and minima of temperatures along cruise tracks, are reproduced in the satellite data. The difference in the features depicted in the two sets of data over the continental shelf is attributed to actual changes in the features rather than to the difference in the methods of the two sets of measurements. Some of the well-defined features present in the satellite data can be related to characteristic coastal circulation pattern, upwelling, vertical mixing, and instabilities in the flow. (Author)

A81-13938 Coastal definition using Landsat data. A. H. Benny (Royal Aircraft Establishment, Farnborough, Hants., England). *International Journal of Remote Sensing*, vol. 1, July-Sept. 1980, p. 255-260.

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An automated technique is described, for extracting land-water boundaries from Landsat MSS images by means of 'density contour-threading' of the band 7 data. The resulting coastlines, etc. can then be transformed to fit any map projection - in particular the British National Grid - with the aid of selected ground control points.

(Author)

A81-13939 **Seasat and Jasin.** T. D. Allan and T. H. Guymer (Institute of Oceanographic Sciences, Wormley, Surrey, England). *International Journal of Remote Sensing*, vol. 1, July-Sept. 1980, p. 261-267. 5 refs. Research supported by the Department of Industry of England.

Microwave measurements on board Seasat during its 3 months of operation allow estimation of several important oceanographic and meteorological quantities to be made, including surface wind and wave fields. Since it was an experimental system comparison with conventional data is required. This note briefly reviews the measurements and describes some preliminary work in which high-quality data from the Joint Air-Sea Interaction experiment have been used to assist in the validation of each of the sensors. (Author)

A81-14087 # **Some research uses of Meteosat and early results.** M. Fea (ESA, Meteosat Data Management Dept., Darmstadt, West Germany). *ESA Bulletin*, vol. 21, Feb. 1980, p. 32-37.

An overview is presented of some of the possible applications of Meteosat data to meteorological, oceanological, ecological and climatological research. The technical characteristics of the systems for Meteosat-1, which was launched in 1977, and Meteosat-2, which is due to be launched in 1980, are reviewed, including satellite sensors and data transmission and processing. Attention is then given to applications of the data in synoptic meteorology, numerical weather prediction, climatology and radiation budget studies, hydrological studies, hydrometeorological research for agriculture, and ecological studies. Studies performed to validate satellite meteorological products, particularly those for cloud motion vectors and sea surface temperatures, are indicated, and their potential as training exercises is noted. A.L.W.

A81-14088 # **Operational production of sea-surface temperatures from Meteosat image data.** L. Fusco, R. Lunnon, B. Mason, and C. Tomassini (ESA, Meteosat Data Management Dept., Darmstadt, West Germany). *ESA Bulletin*, vol. 21, Feb. 1980, p. 38-43.

The procedures used in the conversion of Meteosat infrared radiance measurements into sea surface temperatures are discussed. The automatic processing of the data, which is comprised of a multispectral analysis of segmented data, the identification of the sources of radiation and the correction of raw radiance values, is examined, and the manual editing of the results, which is undertaken by trained meteorologists using an interactive computer system in order to delete from the data set any anomalous results obtained by the automatic processing, is presented. Results of a comparison of Meteosat sea surface temperatures with shipboard measurements are discussed, and a mean bias error of 1.07 C obtained is attributed to an occasional identification of cloud with sea surface and an error in the absolute calibration of the radiometer. A.L.W.

A81-14140 **Remote sensing of the sea-surface by dekametric radar.** E. D. R. Shearman (Birmingham, University, Birmingham, England). *Radio and Electronic Engineer*, vol. 50, Nov.-Dec. 1980, p. 611-623. 32 refs. Research supported by the Ministry of Defence, Royal Signals and Radar Establishment, and Science Research Council.

The use of shore-based dekametric-wave radar in the remote sensing of ocean wave energy and surface currents is discussed. The evolution of dekametric radar remote sensing of the sea surface is traced from the original observation of Bragg resonant scattering by Crombie (1955) to its present applications in measurements of surface wind direction and speed, wave-height and direction spectra and surface currents, with emphasis placed on the role of the Doppler spectrum of the radar echoes. The generation and spectral

properties of wind-driven waves and swell on the sea surface are discussed, and the scattering of dekametric radio waves by the sea is examined. Experimental and signal processing techniques used in ground-wave and sky-wave radar surveys of the Celtic Sea and the Rockall Bank area of the North Atlantic respectively, are presented, and results of the experiments are indicated. Finally, work in progress on improved narrow-beam and interferometer radars and methods for Doppler spectrum inversion is reviewed. V.P.

A81-15249 * **The Marineland Experiment - An overview.** O. H. Shemdin (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *EOS*, vol. 61, Sept. 16, 1980, p. 625, 626. 8 refs. Research supported by the University of Florida, Environmental Research Institute of Michigan, City University of New York, University of Miami, U.S. Geological Survey, U.S. Navy, U.S. Army, NOAA, NASA, and NSF.

The Marineland Experiment was conducted in the Atlantic shelf region offshore of Marineland, Fla., during Dec. 1975. The objectives were: (1) to investigate the mechanisms of wave imaging by the synthetic aperture radar and (2) to investigate wave transformations at the western boundary of the Gulf Stream and across the continental shelf to the edge of the surf zone. Three aircraft, two equipped with synthetic aperture radars and one with a real aperture system, participated; three instrumented sites in 10-m, 20-m, and 60-m water depths were incorporated as surface truth. This review presents the mesoscale aspects of the Marineland Experiment and summarizes the salient results. (Author)

A81-15477 * **Detection of tides on the Patagonian shelf by the SEASAT satellite radar altimeter - An initial comparison.** M. E. Parke (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Deep-Sea Research*, vol. 27A, 1980, p. 297-300. 6 refs. Contract No. NAS7-100.

The detection of tides on the Patagonian shelf off Argentina by the SEASAT satellite radar altimeter is reported. The satellite data was obtained during two passes of the satellite over the shelf on August 1 and August 4, 1978, and compared with empirical estimates of the tidal elevation along the satellite ground tracks based on coastal tide gage data, an estimate of tidal variation over the shelf, and the tidal prediction equations of Shureman (1958). Good agreement was observed between the satellite data of sea surface height with respect to a standard ellipsoid and the empirical estimate for the near-shore pass, with agreement degraded slightly for the pass further off shore. It is concluded that the generally good agreement found demonstrates the applicability of satellite radar altimeter data to the determination of tides and that small length scale fluctuations in the geoid are minor along the two ground tracks. A.L.W.

A81-17202 # **Progress toward a practical skywave sea-state radar.** T. M. Georges (NOAA, Wave Propagation Laboratory, Boulder, Colo.). *IEEE Transactions on Antennas and Propagation*, vol. AP-28, Nov. 1980, p. 751-761. 56 refs.

Recent advances in propagation modeling, ionospheric diagnostics, and signal processing have helped overcome the limitations the ionosphere imposes in sea-state measurements with HF skywave radar. Wind-direction fields in tropical storms can be routinely mapped under most ionospheric conditions, but waveheight and wave-spectrum extraction is more sensitive to ionospheric distortions and requires care in signal processing and in selecting an ionospheric path. Spot measurements with a high-resolution radar have verified its ability to measure (in order of increasing difficulty) wind-direction fields, rms waveheight, and the scalar ocean-wave spectrum at ranges up to 300 km using one ionospheric hop. Although such a radar can in principle map these quantities over millions of square kilometers of an ocean area, the time required to do so under various ionospheric conditions remains to be determined. A minimum objective of one map of rms waveheight per day seems attainable. (Author)

A81-18259 Meteorological and oceanographic applications of Bhaskara Samir data. B. S. Gohil, T. A. Hariharan, P. C. Pandey, and A. K. Sharma (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-58.* 15 p. 13 refs.

Data from the passive microwave radiometers at the frequencies 19.35 GHz and 22.235 GHz onboard the Indian Satellite Bhaskara have been used to derive meteorological and oceanographic parameters such as, total water vapor and liquid water contents, horizontal moisture gradient, rainfall rate and surface winds. The methods used to derive these parameters and some of the results obtained are presented. (Author)

A81-18263 Observations of tidal-exchange phenomena in Landsat data and its hydrodynamical consideration. S. Onishi, T. Nishimura (Tokyo, University, Noda, Chiba, Japan), and S. Tanaka (Remote-Sensing Technology Center of Japan, Tokyo, Japan). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-63.* 15 p. 6 refs.

The stability of density fronts in coastal zones and the mechanisms of tidal exchange through narrow straits are investigated based on the imposition of Landsat imagery over its corresponding topographic map. Observations of Toyama Bay and Tokai Offshore reveal that a steep bottom slope along the coastline acts to stabilize the frontal waves and inhibit bay water exchange, while in Sado Strait a mild bottom slope is found to destabilize the frontal wave and accelerate water exchange. In the case of Naruto Strait, a large-scale vortex pair is observed within the steep strait as a result of the amalgamation of vorticity exfoliated at the edge of the coastline, and is found to accelerate tidal exchange through the strait. A.L.W.

A81-18265 Application of remotely sensed data to the detection of sea surface phenomena. H. Ochiai (Toba Merchant Marine College, Toba, Mie, Japan) and K. Tsuchiya (National Space Development Agency of Japan, Tokyo, Japan). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-65.* 13 p. 10 refs.

Investigations in Japan of sea surface phenomena carried out with airborne-MSS, Landsat-MSS, Landsat RBV cameras, and the Geostationary Meteorological Satellite (GMS) are analyzed. Specifications of the airborne-MSS are given (JSCAN-AT-12M, MSS-BG-1, MSS-BG-1A). It is found that the thermal IR band is the most effective for studying oil slicks. Landsat-MSS is used in studying water circulation in Suruga Bay. The results of applying remote sensing to oceanic fronts, river effluents, and sea ice are also discussed. Landsat RBV imagery is found to be more effective than GMS imagery in analyzing the spatial distribution of sea ice. C.R.

N81-10280# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie. **THE EFFECT OF TURBIDITY ON REMOTE SENSING OF OCEAN COLOR**

G. Metzger and E. Raschke. In AGARD Propagation Effects in Space/Earth Paths Aug. 1980 6 p refs

Avail: NTIS HC A22/MF A01

Accurate correction for the atmospheric effects on the backscattered radiation of multispectral satellite measurements is described. A one dimensional radiative transfer model for the atmosphere-ocean system is presented. T.M.

N81-10510# Research Inst. of National Defence, Stockholm (Sweden).

APPLICATIONS OF REMOTE SENSING TO OCEANOGRAPHY AND SEA ICE

Ragnar Thoren 1980 70 p refs Presented at 14th Congr. of the Intern. Soc. of Photogrammetry on Oceanog. and Sea Ice, Hamburg, 13-26 Jul. 1980

(FOA-B-60001-M7) Avail: NTIS HC A04/MF A01

The program of an interdisciplinary arctic expedition for scientific studies is described. Included among the subjects to be studied are: ice conditions; ice-ocean interaction in the marginal ice zone; radar measurements of backscatter from September sea ice; and glacial extent and climatic variations. The problem of navigation hazards due to icebergs and the ice surveillance by advanced remote sensors are discussed. The possibility of under-ice navigation is summarized with respect to remote sensor developments. Author (ESA)

N81-11621# Washington Univ., Seattle. Applied Physics Lab.

ACOUSTICS AND PROPERTIES OF THE OCEAN:

M. Schulkin Sep. 1980 51 p refs Presented at the Plenary Session of Oceans 1980, Seattle, Sep. 1980

(Contract N00014-77-C-0309)

(AD-A090054: APL-UW-TN-9-80)

Avail: NTIS

HC A04/MF A01 CSCL 08/10

Acoustical techniques are being used to determine properties of the ocean for scientific and engineering applications. This paper reports on existing concepts and problems in the application of acoustics to oceanic chemistry, geology, biology and dynamics which can be treated in the next decade. By using different regions of the acoustic spectrum and different acoustic path configurations, information can be obtained concerning such topics as climate and weather, fisheries, ocean pollution, bathymetry and currents. These subjects were discussed in the recent NOAA Workshop on Ocean Acoustic Remote Sensing (Seattle, January 1980). GRA

N81-11622# Naval Postgraduate School, Monterey, Calif. **RELATIONSHIPS BETWEEN SEA SURFACE TEMPERATURE AND NUTRIENTS IN SATELLITE DETECTED OCEAN FRONTS** M.S. Thesis

John Woepfel Conrad Mar. 1980 115 p refs

(AD-A089930) Avail: NTIS HC A06/MF A01 CSCL 17/5

Satellite IR images of the California coast off Point Sur reveal recurrent surface features which appear to be 'thermal discontinuities' associated with aperiodic upwelling events. Some of these have associated 'chemical fronts' and increased biological activity. Satellite IR imagery was used to locate 'discontinuities' and with in situ monitoring the development of three features were studied. Interrelationships between sea surface temperature nutrients and microplanktonic biomass were investigated. Nutrient ratios, satellite imagery, wind stress data and correlations between nutrients and temperature were used to develop an estimate of 'age' within a simplified upwelling 'life cycle' model. The features range in scale from tens to hundreds of kilometers. Two upwelling features exhibited very strong correlations between nutrient and temperature but a third feature had considerable nutrient variability. This suggests a considerable impact from the dynamic and biological processes. The technique of coupling satellite imagery and in situ monitoring was found to be a feasible method to provide real time inferences of the nutrient structure associated with an upwelled thermal feature. GRA

N81-12296*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN ANALYSIS OF SHORT PULSE AND DUAL FREQUENCY RADAR TECHNIQUES FOR MEASURING OCEAN WAVE SPECTRA FROM SATELLITES

Frederick C. Jackson Oct. 1980 58 p refs Submitted for publication

(NASA-TM-82011) Avail: NTIS HC A04/MF A01 CSCL 171

Scanning beam microwave radars were used to measure ocean wave directional spectra from satellites. In principle, surface wave spectral resolution in wave number can be obtained using either short pulse (SP) or dual frequency (DF) techniques: in either case, directional resolution obtains naturally as a consequence of a Bragg-like wave front matching. A four frequency moment characterization of backscatter from the near vertical using physical optics in the high frequency limit was applied to.

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an analysis of the SP and DF measurement techniques. The intrinsic electromagnetic modulation spectrum was to the first order in wave steepness proportional to the large wave directional slope spectrum. Harmonic distortion was small and was a minimum near 10 deg incidence. NonGaussian wave statistics can have an effect comparable to that in the second order of scattering from a normally distributed sea surface. The SP technique is superior to the DF technique in terms of measurement signal to noise ratio and contrast ratio. Author

N81-12486*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.

SHORELINE AS A CONTROLLING FACTOR IN COMMERCIAL SHRIMP PRODUCTION

Kenneth H. Faller, Principal Investigator Dec. 1978 46 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E81-10009; NASA-TM-82186) Avail: NTIS HC A03/MF A01 CSCL 08A

An ecological model was developed that relates marsh detritus export and shrimp production, based on the hypothesis that the shoreline is a controlling factor in the production of shrimp through regulation of detritus export from the marsh. LANDSAT data were used to develop measurements of shoreline length and area of marsh having more than 5.0 km shoreline/sq km for the coast of Louisiana, demonstrating the capability of remote sensing to provide important geographic information. These factors were combined with published tidal ranges and salinities to develop a mathematical model that predicted shrimp production for nine geographic units of the Louisiana coast, as indicated by the long term average commercial shrimp yield. The mathematical model relating these parameters and the shrimp production is consistent with an energy flow model describing the interaction of detritus producing marshlands with shrimp nursery grounds and inshore shrimping areas. The analysis supports the basic hypothesis and further raises the possibility of applications to coastal zone management requirements. Author

N81-12501*# Lille Univ. (France). Lab. d'Optique Atmospherique.

SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE

P. Y. Deschamps, M. Crepon (Museum d'Histoire Naturelle, Paris), J. M. Monget (Ecole des Mines, Valbonne, France), F. Verger, Principal Investigators (Ecole Normale Superieure, Montrouge, France), R. Frouin, J. Cassanet (Ecole Normale Superieure, Montrouge, France), and L. Wald (Ecole des Mines, Valbonne, France) Apr. 1980 48 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 (E81-10024; NASA-CR-163441; PR-3) Avail: NTIS HC A03/MF A01 CSCL 08C

The various thermal gradients in the coastal zones of France were mapped with regard to natural phenomena and man made thermal effluents. The mesoscale thermal features of the English Channel, the Bay of Biscay, and the northwestern Mediterranean Sea were also studied. The evolution of the thermal gradients generated by the main estuaries of the French coastal zones was investigated along with the modeling of diurnal heating of the sea surface and its influence on the oceanic surface layers. J.M.S.

N81-12718# National Technical Information Service, Springfield, Va.

THE GULF STREAM. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980

Audrey S. Hundemann Aug. 1980 212 p Supersedes NTIS/PS-79/0903; NTIS/PS-78/0844 (PB80-814098; NTIS/PS-79/0903; NTIS/PS-78/0844) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 08C

Abstracts dealing primarily with the Gulf Stream's currents,

salinity, temperature and transport properties are presented. A few abstracts pertain to oceanographic equipment used in the studies. Remote sensing studies are included. GRA

N81-13404*# Royal Australian Navy Research Lab., Edgecliff. HEAT CAPACITY MAPPING MISSION Progress Report, period ending 31 Aug. 1980

C. S. Nilsson, J. C. Andrews, P. Scully-Power (Naval Underwater Systems Center, New London, Conn.), S. Ball (Weapons Systems Research Lab., Salisbury, Australia), G. Speechley, and A. R. Latham, Principal Investigators Sep. 1980 41 p 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 (E81-10043; NASA-CR-163753) Avail: NTIS HC A03/MF A01 CSCL 08B

The Tasman Front was delineated by airborne expendable bathythermograph survey; and an Heat Capacity Mapping Mission (HCMM) IR image on the same day shows the same principal features as determined from ground-truth. It is clear that digital enhancement of HCMM images is necessary to map ocean surface temperatures and when done, the Tasman Front and other oceanographic features can be mapped by this method, even through considerable scattered cloud cover. M.G.

N81-13410*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

APPLICATION OF REMOTE SENSING TECHNIQUES TO HYDROGRAPHY WITH EMPHASIS ON BATHYMETRY M.S. Thesis [APLICACAO DE TECNICA DE SENSORES REMOTOS NA HIDROGRAFIA, COM ENFASE A BATIMETRIA]

Nelson deJesusParada, Principal Investigator and Domingos Sergio Meireles Jan. 1980 240 p refs In PORTUGUESE Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E81-10052; NASA-CR-163762; INPE-1673-TDL/013) Avail: NTIS HC A11/MF A01 CSCL 08H

Remote sensing techniques are utilized for the determination of hydrographic characteristics, with emphasis in bathymetry. Two sensor systems were utilized: the Metric Camera Wild RC-10 and the Multispectral Scanner of LANDSAT Satellite (MSS-LANDSAT). From photographs of the metric camera, data of photographic density of points with known depth are obtained. A correlation between the variables density x depth is calculated through a regression straight line. From this line, the depth of points with known photographic density is determined. The LANDSAT MSS images are interpreted automatically in the Iterative Multispectral Analysis System (I-100) with the obtention of point subareas with the same gray level. With some simplifications done, it is assumed that the depth of a point is directly related with its gray level. Subareas with points of the same depth are then determined and isobathymetric curves are drawn. The coast line is obtained through the sensor systems already mentioned. Advantages and limitations of the techniques and of the sensor systems utilized are discussed and the results are compared with ground truth. E.D.K.

N81-13436*# Lille Univ. (France). Lab. D'Optique Atmospherique.

SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE Progress Report

P. Y. Deschamps, F. Verger (Ecole Normale Superieure, Montrouge, France), J. M. Monget (Ecole des Mines, Valbonne, France), M. Crepon, Principal Investigators (Museum d'Histoire Naturelle, Paris), R. Frouin, J. Cassanet (Ecole Normale Superieure, Monbonne, France), and L. Wald (Ecole des Mines, Valbonne, France) Aug. 1980 94 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 (E81-10083; NASA-CR-163781; PR-4) Avail: NTIS HC A05/MF A01 CSCL 08J

The results of an investigation to map the various thermal gradients in the coastal zones of France are presented. Particular emphasis is given to the natural phenomena and man made thermal effluents. It is shown that a close correlation exist between wind speed direction and the offshore width of the effluent.

R.C.T.

N81-13440# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Ocean Science and Technology Lab.

EASTERN ARCTIC SURSAT SAR ICE EXPERIMENT. RADAR SIGNATURES OF SEA ICE FEATURES

R. D. Ketchum, Jr. and L. Dennis Farmer Aug. 1980 43 p refs

(AD-A090629; NORDA-TN-68) Avail: NTIS HC A03/MF A01 CSCL 17/9

Evaluation of X- and L-band steep angle synthetic aperture radar (SAR) sea ice imagery taken in Baffin Bay and Davis Strait in April 1979 has shown that description and discrimination of first season ice types can be difficult because of ambiguous radar returns. Ambiguous returns seen on X-band radar imagery are attributed to snow cover. The data have indicated that changes in snow properties due to melting and refreezing cause development of a highly reflective medium to the 3 cm X-band radar. The 25 cm L-band radar is not noticeably affected by the observed phenomena, thus correlation of coincident X- and L-band imagery often resolves interpretation ambiguities on the X-band imagery caused by the snow effects. The data suggest that L-band radar energy often penetrates the ice and that subsurface returns are received. These returns also produce ambiguities in interpretation. Apparent smooth surfaces do not show this effect, but rough surfaces which have widely different roughness densities may produce apparently equal backscatter of L-band radar. Ice ridge identification and discrimination was often poor due to the obscuring effects of background clutter associated with the above-suggested backscattering phenomena. Small ridge sizes versus system resolution and steep angles of incidence also reduce ridge identification capabilities. Some icebergs produced time-delayed L-band signals, indicating internal reflections within the iceberg. Iceberg/water interface reflections rather than volume scattering are indicated. L-band radar cannot be depended upon for iceberg identification, since icebergs may be only partially imaged or not imaged at all by this frequency.

GRA

N81-13442# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

RADAR SCATTEROMETER MEASUREMENTS OF SEA ICE: THE SURSAT EXPERIMENT

C. V. Delker, R. G. Onstott, and R. K. Moore Aug. 1980 99 p refs

(Contract N00014-76-C-1105; NR Proj. 307-383) (AD-A091239; CRINC/RSL-TR-331-17) Avail: NTIS HC A05/MF A01 CSCL 17/9

The radar backscatter properties of sea ice were measured using both a surface-based and a helicopter-borne scatterometer system. Thick first-year sea ice, thin first-year sea ice, brackish sea ice, and fresh-water inland lake ice were investigated. These ice sites were located off or near the Canadian coast at Tuktoyaktuk, N.W.T., Canada. This paper describes the field experiment, documents the sensors used, and presents the result obtained. Measurements in the 8-18 GHz region verify the ability of radar to distinguish between the different ice types. For angles of incidence greater than 40 degrees VV polarization and 9 GHz frequency appear to provide the best discrimination capability. A strong correlation between radar scattering cross-section and the salinity of ice was observed. Higher salinity ice types produced higher scattering coefficients. Effects of snow cover on lake ice were also investigated. Removal of the snow cover produced significantly lower scattering coefficients which demonstrates the importance of snow cover as a parameter in the radar backscatter return mechanisms of ice.

GRA

N81-13614# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.

OCEAN REMOTE SENSING USING LASER

Howard R. Gordon May 1980 208 p refs Presented at Inst. of Ocean Sci. Symp., Patricia Bay, British Columbia, Canada, 22 Jun. 1978

(PB80-223282; NOAA-TM-ERL-PMEL-18; NOAA-80070710) Avail: NTIS HC A10/MF A01 CSCL 08J

A one-day symposium was organized to bring together investigators actively studying problems associated with the applications and limitations of lasers to the remote sensing of ocean properties. Eight papers are presented.

GRA

N81-14152*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

A MULTIFREQUENCY EVALUATION OF ACTIVE AND PASSIVE MICROWAVE SENSORS FOR OIL SPILL DETECTION AND ASSESSMENT

Richard G. Fenner, Stephen C. Reid, and Charles H. Solie /n its The 11th Space Simulation Conf. 1980 p 163-187 refs Prepared in cooperation with Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

Avail: NTIS HC A19/MF A01 CSCL 14B

An evaluation is given of how active and passive microwave sensors can best be used in oil spill detection and assessment. Radar backscatter curves taken over oil spills are presented and their effect on synthetic aperture radar (SAR) imagery are discussed. Plots of microwave radiometric brightness variations over oil spills are presented and discussed. Recommendations as to how to select the best combination of frequency, viewing angle, and sensor type for evaluation of various aspects of oil spills are also discussed.

R.C.T.

N81-14370# Royal Netherlands Meteorological Inst., De Bilt. **METEOROLOGICAL AND OCEANOGRAPHIC OBSERVATIONS ON BOARD NETHERLANDS LIGHT VESSELS AND THE LIGHT PLATFORM GOEREE IN THE NORTH SEA**

1980 157 p In DUTCH and ENGLISH (KNMI-141-27) Avail: NTIS HC A08/MF A01; Roy. Neth. Meteorol. Inst., De Bilt FL 17.50

Parameters for observation included precipitation, cloud cover, atmospheric turbulence, and wind measurements. Also included were sea states, waterwave energy, and surface temperatures for the North Sea.

T.M.

N81-14374# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.

THE ABILITY OF PASSIVE MICROWAVE SYSTEMS TO DETECT SEA ICE

Martti Tiuri and Martti Hallikainen 1979 13 p refs Presented at WMO Workshop on Remote Sensing of Sea Ice, 1978

(REPT-S-113; ISBN-951-751-702-5) Avail: NTIS HC A02/MF A01

The large difference in the brightness temperature of the open sea and that of the ice covered sea, microwave radiometers are useful in detecting the extent of sea ice. At UHF and lower microwave frequencies sea ice can be considered to consist of homogeneous horizontal layers with smooth surfaces. The exact calculation of brightness temperature is then possible. In the case of the salinity sea ice or thin normal sea ice, the dependence of the brightness temperature on the ice thickness can be applied to the thickness measurement. The accuracy of the method depends on how well the salinity and the surface temperature of ice are known. The drawback of passive systems is their sensitivity to interference caused by many existing radio transmitters as experienced during helicopter reconnaissance over the Gulf of Bothnia in the Baltic.

A.R.H.

N81-14376# Naval Research Lab., Washington, D. C. **EXPERIMENTAL SEA SLICKS IN THE MARSEN (MARITIME REMOTE SENSING) EXERCISE Interim Report**

William D. Garrett and William R. Barger 30 Oct. 1980 22 p refs

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(RR03103)

(AD-A091850: NRL-8454) Avail: NTIS HC A02/MF A01 CACL 07/3

Experimental slicks with various surface properties were generated in the North Sea as part of the MARSEN (Maritime Remote Sensing) exercise. The one-molecule thick slicks, as large as 2.3 square kilometers in area, were formed from nontoxic, organic substances and allowed to drift through the area observed by sensors mounted on the research platform Nordsee. The slicks were also generated in coordination with overflights of aircraft equipped with remote sensing instrumentation. Because of the numerous effects of surface films on air-sea interfacial processes, these experiments were designed to enhance the understanding of energy exchange between wind and water and of the interactions between capillary and gravity waves. In addition, information was obtained on the influence of sea surface films on the interpretation of signals received by remote sensing systems. Criteria for the selection of film-forming material for experimental slicks and various techniques for slick generation are discussed. Physical processes modified by natural and man-made surface films are reviewed, along with the resulting impacts of such modifications of the air-water interface on remotely sensed signals. The characteristics of the MARSEN surface films will be described as well as preliminary results from the remote systems which sensed the slicks. GRA

N81-14601*# EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.

CATALOG OF SEA STATE AND WIND SPEED IN THE SOUTH ATLANTIC BIGHT

J. D. McMillan Jan. 1980 134 p refs

(Contract NAS6-2639)

(NASA-CR-156872) Avail: NTIS HC A07/MF A01 CACL 08C

The GEOS 3 significant waveheight and ground wind speed estimation algorithms are derived and then applied to all GEOS 3 data in the South Atlantic Bight. The investigation area is divided into five geographical sectors and significant waveheight and wind speed histograms are presented in each sector by month and by season. In the discussion of the histograms, definite seasonal trends are identified and examined. Author

N81-15423*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ESTIMATING THE CHLOROPHYLL CONTENT IN THE WATERS OF GUANABARA BAY FROM THE LANDSAT MULTISPECTRAL SCANNING DIGITAL DATA [ESTIMATIVAS DE TEOR EM CLOROFILLA A NAS AGUAS DA BAIJA DE GUANABARA, A PARTIR DE DADOS DIGITAIS DO SISTEMA MSS DO LANDSAT]

Nelson deJesusParada, Principal Investigator, Juan Jose Verdesio Bentancurt, B. Renato Herz, and Luis B. Molion Jun. 1980 12 p refs In PORTUGUESE Sponsored by NASA ERTS (E81-10051; NASA-CR-163761; INPE-1810-RPE/178) Avail: NTIS HC, A02/MF A01 CACL 08H

Detection of water quality in Guanabara Bay using multispectral scanning digital data taken from LANDSAT satellites was examined. To test these processes, an empirical (statistical) approach was chosen to observe the degree of relationship between LANDSAT data and the in situ data taken simultaneously. The linear and nonlinear regression analyses were taken from among those developed by INPE in 1978. Results indicate that the major regression was in the number six MSS band, atmospheric effects, which indicated a correction coefficient of 0.99 and an average error of 6.59 micrograms liter. This error was similar to that obtained in the laboratory. The chlorophyll content was between 0 and 100 micrograms/liter, as taken from the MSS of LANDSAT. A.R.H.

N81-15425*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

CORRECTIONS OF ANOMALOUS TIME DEPENDENT SHIFTS IN THE BRIGHTNESS TEMPERATURE FROM THE NIMBUS 5 ESMR

J. C. Comiso and H. J. Zwally Nov. 1980 23 p refs (NASA-TM-82055) Avail: NTIS HC A02/MF A01 CACL 05B

Temporal variations of the brightness temperature of selected regions representing ocean, sea ice, and ice sheets were studied. Shifts that could not be ascribed to geophysical effects were found to occur during the same periods in the various regions. The procedures employed to correct for these shifts are described. Author

HYDROLOGY AND WATER MANAGEMENT

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

A81-10158 Flood analysis and remote sensing. L. A. Eyre (University of the West Indies, Kingston, Jamaica). *Remote Sensing Quarterly*, vol. 2, Apr. 1980, p. 29-46. 6 refs.

The flood disaster of June 12, 1979 in western Jamaica is investigated based on remote sensing as well as standard meteorological data. NOAA weather satellite imagery, hand-drawn cartographic facsimiles of radarscope-generated imagery, verbal reports and summaries of radar imagery, hemispheric and regional synoptic weather charts, statistical data and Landsat color-infrared composites are used to analyze the meteorological conditions in the seven weeks preceding the disaster, which were marked by abnormally high rainfall in the area due to overall disturbed conditions throughout the Caribbean, the intense precipitation on June 12th brought about by a tropical depression, and the lakes and bodies of water remaining on July 19, more than a month after the flood. (Author)

A81-13263 The burst of the 1978 Indian summer monsoon as seen from Meteosat. D. Cadet and M. Desbois (CNRS, Laboratoire de Météorologie Dynamique, Palaiseau, Essonne, France). *Monthly Weather Review*, vol. 108, Oct. 1980, p. 1697-1701. 8 refs.

Low-level wind fields over the western Indian Ocean west of 65 deg E have been determined from the analysis of Meteosat images from 10 to 22 May 1978 (one field every two days). The data show the abrupt change in the low-level airflow circulation which takes place over the western Indian Ocean during the burst of the monsoon. The burst of the monsoon along the African coast is characterized by the sudden establishment of the Somali low-level jet and associated strong cross-equatorial flow. This modification which augurs the beginning of the monsoon season over India is closely related to the first rainfalls over the southern part of the western coast of India which occur with a lag of 3-4 days. (Author)

A81-13941 Suspended sediment dynamics from repetitive Landsat data. I. L. Thomas (Department of Scientific and Industrial Research, Physics and Engineering Laboratory, Lower Hutt, New Zealand). *International Journal of Remote Sensing*, vol. 1, July-Sept. 1980, p. 285-292. 7 refs.

Repetitive Landsat computer compatible tape data were used to monitor the motion of non-uniformly distributed suspended sediments in a New Zealand tidal basin. The movement of such suspended sediment was followed using all four multispectral scanner (MSS) bands with non-uniformly distributed suspended sediment being differentiated from bottom features by the data from two satellite overpasses. As part of this study penetration depths of 45-50 plus or minus 5 cm and 10-15 plus or minus 5 cm were found for channels MSS 5 and MSS 6 over the sediment-laden tidal inlet. The difference in penetration depths within each MSS band was ascribed to differing concentrations of uniformly distributed suspended sediments between the two overpasses. (Author)

A81-15668 Snowcover monitoring from satellite data under European conditions. H. Haefner (Zürich, Universität, Zurich, Switzerland). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 339-372. 28 refs.

Snow-cover mapping by satellite technique is reviewed with particular reference to European needs regarding water management and runoff forecasting. Attention is given to such topics as the

spectral properties of snow, ground truth, and data interpretation (e.g., analog processing, and digital processing). Some examples of snow-cover mapping in the Alps are presented, including the areal extent under different relief and illumination conditions, the exact location of the transition zone, the separation of snow and clouds, and the delineation of watersheds. The examples show that the areal extent of the snow cover and an exact delineation of its transition zone can be obtained from satellite data by an automated procedure with high accuracy for areas of arbitrary irregular shape. The cloud problem, however, cannot be overcome with optical scanner devices. F.G.M.

A81-15669 Computer-aided analysis of satellite and aircraft MSS data for mapping snow-cover and water resources. R. M. Hoffer (Purdue University, West Lafayette, Ind.). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 373-388. 22 refs.

There are several aspects of remote sensing which have application in mapping the extent and condition of snow-cover and surface water resources. The mapping of snow cover using satellite MSS data and computer-aided analysis techniques is described, with attention given to the mapping of snow cover using Landsat data, snow/cloud differentiation using Landsat data, snow/cloud differentiation using Skylab data, and the mapping of snow cover using Skylab and topographic data. The mapping of water resources using satellite MSS data is also considered; attention is given to the areal extent of water bodies; the definition of water conditions with Landsat data, and water temperature mapping using Skylab data and using aircraft MSS data. F.G.M.

A81-15672 Watershed and river channel characteristics, and their use in a mathematical model to predict flood hydrographs. E. M. Morris, K. Blyth, and R. T. Clarke (Institute of Hydrology, Wallingford, Berks., England). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 431-446. 24 refs.

Studies of the land phase of the hydrological cycle and of how it is affected by human activity constitute the research program of the U.K. Institute of Hydrology. Of particular interest to the Institute is the effect of alternative land uses on the quantity and distribution in time of streamflow from river basins. The Plynlimon study was established in 1969 for the hydrological comparison of two adjacent river basins, one of which is under a hill pasture of relatively low productivity, while the other is planted with coniferous forest. This paper describes the Plynlimon study and considers the applications of remote sensing methods to watershed modeling, including delineation of watershed boundaries, division of catchment into slope elements, determination of mean slope of slope elements, determination of roughness parameters for each slope element, and land use classification. F.G.M.

A81-15673 Hydrologic basin models. J. Martinec (Eidgenössisches Institut für Schnee- und Lawinenforschung, Weissfluh, Switzerland). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 447-459. 12 refs.

Different types of runoff models are described, including deterministic, parametric, and probabilistic models; an example of a general simulation model is also presented. The application of hydrologic basin models to the monitoring of the seasonal snow cover is discussed, with emphasis on the role of snow and ice in the hydrologic cycle, and the changing areal extent of the snow cover. The use of hydrologic models for the evaluation of remote sensing (e.g., Landsat) data and for the computation of snowmelt runoff is also considered. P.T.H.

A81-15674 Satellite data collection systems - Hydrologic application. M. Taillade-Carriere (Centre National d'Etudes Spatiales, Toulouse, France). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 461-470. 16 refs.

06 HYDROLOGY AND WATER MANAGEMENT

Various aspects of the development of satellite remote sensing systems for the collection of hydrologic data are described. Attention is given to major hydrologic data collection sites in the United States, the types of hydrologic parameters; and data collection hydrologic stations. As an example, the use of the TIROS N-ARGOS low orbit system for hydrologic data collection is considered. Experience is described with two users of hydrologic data collection, the U.S. Geological Survey and the Canadian Applied Hydrology Division of the Department of the Environment. The Landsat program has demonstrated that the polar orbiting satellites can be used to relay hydrologic data from any part of Canada to a user without difficulty and at low cost. P.T.H.

A81-15675 Optical properties of water-applications of remote sensing to water quality determination. B. Sturm (Commission of the European Communities, Joint Research Centre, Ispra, Italy). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 471-495. 44 refs.

A specific problem of optical oceanography is addressed: the manner in which downwelling light from the sun and sky interacts with natural water bodies and how the upwelling light can be used to obtain information about the quality and quantity of organic and inorganic matter suspended in the water. The following topics are discussed: the main optical properties of water; scattering and absorption in pure water; scattering and absorption in natural water; the reflection and refraction of global radiation incident on a water surface; and the theory of radiative transfer in water. The application of water optics to the remote sensing of water quality is then described, with reference to Landsat MSS data. F.G.M.

A81-15813 Satellites as aid to water resource managers. D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider (NOAA, National Environmental Satellite Service, Washington, D.C.), and C. P. Berg (NOAA, Washington, D.C.). (*American Society of Civil Engineers, Convention and Exposition and Continuing Education Program, Boston, Mass., Apr. 2-6, 1979.*) *American Society of Civil Engineers, Water Resources Planning and Management Division, Journal*, Mar. 1980, p. 1-19. 17 refs.

The use of satellites to provide a synoptic and integrated data source for assessing and evaluating water resource problems is examined. Applications discussed include snow surveillance, monitoring river ice breakup, flood mapping and monitoring, and precipitation estimates from convective systems. Specific examples are presented to demonstrate the usefulness of satellite derived data. V.L.

A81-17919 Airborne organic contaminants in the Great Lakes ecosystem. S. J. Eisenreich (Minnesota, University, Minneapolis, Minn.), B. B. Looney, and J. D. Thornton. *Environmental Science and Technology*, vol. 15, Jan. 1981, p. 30-38. 42 refs. Research supported by the International Joint Commission and U.S. Environmental Protection Agency.

Available data are reviewed relative to airborne organic pollutants, including atmospheric removal processes, trace organic concentrations, and deposition to the Great Lakes, with emphasis on polychlorinated biphenils (PCBs). It is shown that atmospheric deposition represents the principal source to the upper lakes, and a significant source to the lower lakes. The PCB concentration in air, precipitation, water, and biota are highest in the upper lakes and result from many factors, including source strength, meteorological patterns, and lake susceptibility. V.L.

N81-10511# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO HYDROLOGY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980

Audrey S. Hundemann Aug. 1980 230 p Supersedes

NTIS/PS-79/0845; NTIS/PS-78/0792 Updates NTIS/PS-76/0500

(PB80-813132: NTIS/PS-79/0845; NTIS/PS-76/0500) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 08H

The use of aerial and satellite imagery in hydrologic studies, including water resources planning and management, is discussed. The abstracts cover remote sensing studies of water quality, soil moisture, floodplain delineation, ice cover, and determination of snow depth and water equivalent. This updated bibliography contains 225 citations, 15 of which are new entries to the previous edition. GRA

N81-12485*# Tennessee Valley Authority, Chattanooga. Div. of Environmental Planning.

TROPIC CLASSIFICATION OF TENNESSEE VALLEY AREA RESERVOIRS DERIVED FROM LANDSAT MULTISPECTRAL SCANNER DATA

Dennis L. Meinert, Donald L. Malone, Alan W. Voss, Principal Investigators, and Frank L. Scarpace (Wisconsin Univ. - Madison) [1980] 73 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10008; NASA-CR-163528) Avail: NTIS HC A04/MF A01 CSCL 08H

LANDSAT MSS data from four different dates were extracted from computer tapes using a semiautomated digital data handling and analysis system. Reservoirs were extracted from the surrounding land matrix by using a Band 7 density level slice of 3; and descriptive statistics to include mean, variance, and ratio between bands for each of the four bands were calculated. Significant correlations (> 0.80) were identified between the MSS statistics and many trophic indicators from ground truth water quality data collected at 35 reservoirs in the greater Tennessee Valley region. Regression models were developed which gave significant estimates of each reservoir's trophic state as defined by its trophic state index and explained in all four LANDSAT frames at least 85 percent of the variability in the data. To illustrate the spatial variations within reservoirs as well as the relative variations between reservoirs, a table look up elliptical classification was used in conjunction with each reservoir's trophic state index to classify each reservoir on a pixel by pixel basis and produce color coded thematic representations. A.R.H.

N81-12505*# Minnesota Univ., Minneapolis. Space Science Center.

A STUDY OF MINNESOTA LAND AND WATER RESOURCES USING REMOTE SENSING. VOLUME 13 Progress Report, 1 Jan. - 31 Dec. 1979

1 Jan. 1980 140 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Grant NGL-24-005-263) (E81-10028; NASA-CR-163530) Avail: NTIS HC A07/MF A01 CSCL 08B

Progress in the use of LANDSAT data to classify wetlands in the Upper Mississippi River Valley and efforts to evaluate stress in corn and soybean crops are described. Satellite remote sensing data was used to measure particle concentrations in Lake Superior and several different kinds of remote sensing data were synergistically combined in order to identify near surface bedrock in Minnesota. Data analysis techniques which separate those activities requiring extensive computing from those involving a great deal of user interaction were developed to allow the latter to be done in the user's office or in the field.

N81-12506*# Minnesota Univ., St. Paul. Remote Sensing Lab.

LANDSAT APPLICATIONS TO WETLANDS CLASSIFICATION IN THE UPPER MISSISSIPPI RIVER VALLEY Ph.D. Thesis. Final Report

Thomas M. Lillesand and Lee F. Werth, Principal Investigators /n Minnesota Univ. A Study of Minn. Land and Water Resources

Using Remote Sensing, Vol. 13 1 Jan. 1980 p 5-29 refs
Original contains color imagery. Original photography may be
purchased from the EROS Data Center, Sioux Falls, S.D. 57198
ERTS

Avail: NTIS HC A07/MF A01 CSCL 08B

A 25% improvement in average classification accuracy was realized by processing double-date vs. single-date data. Under the spectrally and spatially complex site conditions characterizing the geographical area used, further improvement in wetland classification accuracy is apparently precluded by the spectral and spatial resolution restrictions of the LANDSAT MSS. Full scene analysis of scanning densitometer data extracted from scale infrared photography failed to permit discrimination of many wetland and nonwetland cover types. When classification of photographic data was limited to wetland areas only, much more detailed and accurate classification could be made. The integration of conventional image interpretation (to simply delineate wetland boundaries) and machine assisted classification (to discriminate among cover types present within the wetland areas) appears to warrant further research to study the feasibility and cost of extending this methodology over a large area using LANDSAT and/or small scale photography. E.D.K.

N81-12510*# Minnesota Univ., Duluth. Dept. of Physics.
MEASUREMENT OF SUSPENDED SOLIDS IN LAKES AND OCEANS USING SATELLITE REMOTE SENSING DATA
Michael Sydor, Principal Investigator In Minnesota Univ. A Study of Minn. Land and Water Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p 107-137 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A07/MF A01 CSCL 13B

Using satellite remote sensing data to measure low concentrations of suspended solids in lakes and oceans requires careful evaluation of background signals from the atmosphere and the water surface. Typical background corrections for Lake Superior are presented and the spectral distribution of the residual radiance from three major categories of turbidity in the lake are determined. The results indicate that for large bodies of water, some general information on atmospheric scattering, water clarity, and the optical properties of suspended solids allows estimates of concentrations of suspended solids to within + or - 0.5 mg/L without using real time ground truth data. Under calibrated conditions the threshold detection level is 0.3 mg/L for the fine particulates dispersed throughout the lake and 1 mg/L for the highly light absorbing effluent from rivers. Comparisons of the minimum reflectance over the open lake areas with reflection from the highly absorbing tannin water from rivers provides a check on the clarity of the atmosphere and the excessive background scatter from the water surface. E.D.K.

N81-12529*# National Academy of Sciences - National Research Council, Washington, D. C. Space Applications Board.
REMOTE SENSING FOR WATER RESOURCES AND HYDROLOGY. RECOMMENDED RESEARCH EMPHASIS FOR THE 1980'S
1980 30 p refs
(Grant NSR-09-012-106)
(NASA-CR-163791) Avail: NTIS HC A03/MF A01 CSCL 08H

The problems and the areas of activity that the Panel believes should be emphasized in work on remote sensing for water resources and hydrology in the 1980's are set forth. The Panel deals only with those activities and problems in water resources and hydrology that the Panel considers important, and where, in the Panel's opinion, application of current remote sensing capability or advancements in remote sensing capability can help meet urgent problems and provide large returns in practical benefits. L.F.M.

N81-13401 Oregon State Univ., Corvallis.
AN INVESTIGATION INTO MODELING SNOW COVER ELEMENTS AT CRATER LAKE NATIONAL PARK AND SURROUNDING ENVIRONS AS AN IMPROVED GROUND

TRUTH METHOD FOR SATELLITE SNOW OBSERVATIONS
Ph.D. Thesis

William L. Hamilton 1980 119 p

Avail: Univ. Microfilms Order No. 8027840

A mountain snow cover model capable of generating snow cover data at a scale useful as ground truth for operational satellite snow cover observations was developed to aid in streamflow forecasts for hydroelectric and irrigation reservoirs in the Pacific Northwest. Both the physiography (topography and vegetation) and snow climate of the study area were analyzed. In order to take into account the effects of the dynamic snow climate and physiography upon snow cover conditions, multiple regression analysis was used. Snow depth, snow water equivalent values, and the physiographic elements of slope, aspect, elevation, percentage of forest canopy cover, and regional aspect were recorded for each snow core site. The physiographic elements were regressed against the snow core data to produce snow model equations. The model has a combined spatial, annual, and long term resolution. Current studies are being conducted to couple dynamic snow meteorology and LANDSAT digital data to the model to increase its accuracy and reduce its dependency on snow core data. Also, output of the model can be used for studies on snow cover effect upon wildlife movement and survival and the determination of source regions of relative runoff from snow melt. Dissert. Abstr.

N81-13405*# Environmental Research and Technology, Inc., Concord, Mass.

INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, Jul. - Oct. 1980

James C. Barnes, Principal Investigator Oct. 1980 5 p HCMM

(Contract NAS4-24316)

(E81-10045; NASA-CR-163755; QPR-12) Avail: NTIS HC A02/MF A01 CSCL 08L

All heat capacity mapping mission (HCMM) data needed for the investigation were received, including the imagery and CCT's for the April 1979 day/night registered data set for the Sierras study area. Three sets of excellent data for the Sierras study were received. Analysis of the earlier two sets (late May and mid July 1978) was completed. Initial examination of the latest imagery received indicates that the April 1979 data are the best quality HCMM day/night registered data of the three data sets. The thermal inertia imagery is particularly outstanding, appearing to contain much more detail and information than the earlier thermal inertia images. R.C.T.

N81-13412*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF THE ORIGIN OF AUFEIS FEED-WATER ON THE ARCTIC SLOPE OF ALASKA

Dorothy K. Hall and Charles Roswell, Principal Investigator (Maryland Univ., College Park) Aug. 1980 45 p refs Submitted for publication Original contains imagery. Original photography may be purchased for the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10054; NASA-TM-81992) Avail: NTIS HC A03/MF A01 CSCL 08H

The origin of water feeding large aufeis fields (overflow river ice) on the Arctic Slope of Alaska is analyzed. Field measurements of two large aufeis fields on the eastern Arctic Slope were taken during July of 1978 and 1979. Measurements of aufeis extent and distribution were made using LANDSAT Multispectral Scanner Subsystem (MSS) satellite data from 1973 through 1979. In addition, ice cores were analyzed in the laboratory. Results of the field and laboratory studies indicate that the water derived from aufeis melt water has a chemical composition different from the adjacent upstream river water. Large aufeis fields are found in association with springs and faults thus indicating a subterranean origin of the feed water. In addition, the maximum extent of large aufeis fields was not found to follow meteorological patterns which would only be expected if the origin of the feed water were local. It is concluded that extent of large aufeis in a given river channel on the Arctic Slope is controlled by dis-

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charge from reservoirs of groundwater. It seems probable that precipitation passes into limestone aquifers in the Brooks Range, through an interconnecting system of subterranean fractures in calcareous rocks and ultimately discharges into alluvial sediments on the coastal plain to form auefis. It is speculated that only small auefis patches are affected by local meteorological parameters in the months just prior to auefis formation. E.D.K.

N81-13423*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

TRES MARIAS RESERVOIR, MINAS GERAIS STATE: STUDY OF THE DISPERSION OF SUSPENDED SEDIMENTS IN SURFACE WATERS USING ORBITAL IMAGES

Nelson deJesusParada, Principal Investigator and Tania Maria Sausen Jun. 1980 16 p Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980 Sponsored by NASA. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10067; NASA-CR-163774; INPE-1788-RPE/160) Avail: NTIS HC A02/MF A01 CSCL 08H

Computer compatible tapes from LANDSAT were used to compartmentalize the Tres Marias reservoir according to respective grey level spectral response. Interactive and automatic, supervised classification, was executed from the IMAGE-100 system. From the simple correlation analysis and graphic representation, it is shown that grey tone levels are inversely proportional to Secchi Depth values. It is further shown that the most favorable period to conduct an analysis of this type is during the rainy season.

R.C.T.

N81-15600# Environmental Protection Agency, Las Vegas, Nev. **LANDSAT ESTUARINE WATER QUALITY ASSESSMENT OF SILVICULTURE AND DREDGING ACTIVITIES**

John M. Hill Aug. 1980 130 p refs

(PB81-107989; EPA-600/4-80-043) Avail: NTIS HC A07/MF A01 CSCL 13B

The application of LANDSAT multispectral scanning to estuarine water quality is described, with specific reference to dredging and silviculture practices. Water quality data collected biweekly since 1972 in the Apalachicola Bay, Florida, and LANDSAT data covering the same geographical area were used as data base. LANDSAT can provide temporal cause and effect information relating to landuse changes and water quality. GRA

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A81-12083 **A method of assessing accuracy of a digital classification.** B. K. Quirk and F. L. Scarpace (Wisconsin, University, Madison, Wis.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Nov. 1980, p. 1427-1431. 16 refs.

A procedure was developed for verifying the accuracy of land-cover classifications produced by computer. The procedure involved marking pixels in a computer file, creating a film product which could be placed in a color additive viewer, and performing a manual photo interpretation of the pixels. A program was then used to compare the results of the manual photo interpretation of the pixels with their computer classified counterparts, which resulted in a confusion matrix. (Author)

A81-13365 # **A conceptual ground processing system for operational land remote sensing satellites.** P. F. Holkenbrink, D. E. Ulmer, G. H. Landis, and B. P. Bauer (U.S. Geological Survey, EROS Data Center, Sioux Falls, S. Dak.). In: Sensor Systems for the 80's Conference, Colorado Springs, Colo., December 2-4, 1980, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 93-97. (AIAA 80-1940)

A nonexperimental, or "operational," land remote-sensing satellite system will become a reality during this decade. The spatial resolution and number of spectral bands of such a system could exceed those of the current Landsat systems and result in a data stream as large as 10 to the 12th bits per day, transmitted at rates as high as 150 million bits per second. The ground processing equipment required to support such an operational remote-sensing system must be flexible enough to archive the data, generate products, and provide the timely distribution of products from a volume of data an order of magnitude larger than that handled by current ground processing systems. More importantly, the new ground processing system must expand the services and products provided to the user of operational remotely-sensed data. A conceptual design of a system to provide these capabilities has been developed which is centered around an optical mass memory and multiple access stations for data entry, product generation, and product distribution. (Author)

A81-13379 * # **The massively parallel processor.** D. H. Schaefer, J. R. Fischer, and K. R. Wallgren (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Sensor Systems for the 80's Conference, Colorado Springs, Colo., December 2-4, 1980, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 187-190. (AIAA 80-1909)

Future sensor systems will utilize massively parallel computing systems for rapid analysis of two-dimensional data. The Goddard Space Flight Center has an ongoing program to develop these systems. A single-instruction multiple data computer known as the Massively Parallel Processor (MPP) is being fabricated for NASA by the Goodyear Aerospace Corporation. This processor contains 16,384 processing elements arranged in a 128 x 128 array. The MPP will be capable of adding more than 6 billion 8-bit numbers per second. Multiplication of eight-bit numbers can occur at a rate of 2 billion per second. Delivery of the MPP to Goddard Space Flight Center is scheduled for 1983. (Author)

A81-14137 **Computer processing of multi-layer imagery data.** T. Orhaug, S. I. Akersten (Forsvarets Forskningsanstalt, Linköping, Sweden), and J. Larsson (Kungl. Tekniska Hogskolan, Stockholm, Sweden). *Radio and Electronic Engineer*, vol. 50,

Nov.-Dec. 1980, p. 575-584. 16 refs. Research supported by the Swedish Board for Space Activities.

The technique and methodology of computer-aided image processing has become a valuable tool for handling, processing and analyzing multispectral imagery data acquired from sensors in aircraft and satellites. The paper describes the rationale for performing computer processing and discusses types and kinds of operations used; it also describes a software system for performing various tasks in computer-aided image processing. A supervised classification program system for pixelwise (or objectwise) multilayer classification uses an algorithm which performs class assignment in a linearly transformed space. Examples of pilot and application studies of various problems in environmental monitoring and land use are also given; forest monitoring is considered to be an important application in Sweden. The importance of incorporating nonspectral (topographic) data for increased classification accuracy of detecting clear-cut areas is demonstrated. (Author)

A81-15056 # **Interpretation of contemporary Allay Valley landscapes from Soyuz-22 photographs (Interpretatsiia sovremennykh landshaftov Alaiskoi doliny po kosmicheskim snirkam s 'Soiuz-22').** V. P. Burov and E. V. Glushko (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Issledovanie Zemli iz Kosmosa*, Sept.-Oct. 1980, p. 40-49. 6 refs. In Russian.

A81-15484 * **A clear-sky spectral solar radiation model for snow-covered mountainous terrain.** J. Dozier (California, University, Santa Barbara, Calif.). *Water Resources Research*, vol. 16, Aug. 1980, p. 709-718. 52 refs. Research supported by the University of California; Grants No. NOAA-04-8-MO; No. NsG-5155; No. NsG-5262.

A clear-sky spectral solar radiation model for direct and diffuse fluxes, combined with topographic calculations from digital terrain data, computes either incident, net, or reflected solar radiation at any point on a snow surface in mountainous terrain. The radiation may be integrated over any wavelength range from 250 to 5000 nm, or over any time step. Atmospheric attenuation parameters are ozone, water vapor, the Angstrom turbidity coefficient and exponent, and the absorptance to reflectance ratio of the atmospheric aerosols. The model derives these, from measurements which may contain both systematic and random errors, by finding the least squares solution to an overdetermined set of nonlinear equations. For calculations over a specified area, it employs table look-up procedures, so that computation speed for the spectral model approaches that for a lumped model. Thus it may be useful as part of a snow surface energy budget calculation over a drainage basin. (Author)

A81-15660 **Computer-aided analysis techniques for mapping earth surface features.** R. M. Hoffer (Purdue University, West Lafayette, Ind.). In: Remote sensing application in agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 133-152. 14 refs.

Since the primary data collection system on Landsat-1 is a four-band multispectral scanner, there has recently been considerably increased interest in computer-aided analysis techniques for processing this data. Several new capabilities for handling this type of data have been developed, offering considerable potential for meeting agricultural inventory and land use mapping needs. This paper describes basic and newly developed techniques for working with MSS data obtained by aircraft or satellite. Current procedures for digital processing and analysis of data from multispectral scanner systems involve five principal areas of activity: data reformatting and preprocessing, definition of training statistics, computer classification of data, information display and tabulation, and evaluation of results. These five areas are discussed in detail. P.T.H.

A81-15664 **The acquisition of ground data for surveys based on remotely sensed data.** J. R. Hardy (Reading, University, Reading, Berks., England). In: Remote sensing application in

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agriculture and hydrology. Rotterdam, A. A. Balkema, 1980, p. 249-255. 20 refs.

Ground truth methods are described. Consideration is given to information required before ground data collection, scale in ground data collection, multilevel data collection, the time dimension in ground data collection, the map base for ground truth, the sampling strategy, accuracy assessment, and the data to be collected. It is noted that the nature of ground data collection must vary for every project according to various factors. It is difficult to suggest any standardized scheme of ground data collection which could meet the requirements of a variety of institutions and programs. P.T.H.

A81-17977 Autonomous navigation using passively sensed terrain images. O. Firschein and M. J. Hannah (Lockheed Signal Processing Laboratory, Palo Alto, Calif.). *Lockheed Horizons*, Winter 1980-1981, p. 26-34.

The possibility of using passively sensed terrain images as the basis for an autonomous navigation system in subsonic vehicles flying at low altitudes is of interest for unmanned flight applications. Through a TV camera or mosaic of light-sensitive semiconductor devices, the image scene is converted into a number which is stored in a computer and can then be used by the 'Navigation Expert' (a computer program being developed at Lockheed's Signal Processing Laboratory) to make decisions and control the vehicle's flight. The Navigation Expert coordinates several subsystems including the Instruments Subsystem (IS), a Dead Reckoning System (DRS), a Ground Velocity Subsystem (GVS), a Visual Bootstrapping Subsystem (VBS), and a Landmarks Subsystem (LS). Further research is necessary before an automatic navigation system based on images can become operational. B.R.K.

A81-18272 Technical diagnostics techniques in assessment of anthropogenic environmental changes from space observations. V. V. Bugrovskii, L. I. Liutov, E. G. Mellina (Institute of Control Sciences, Moscow, USSR), and E. B. Dudin (International Research Institute of Management Sciences, Moscow, USSR). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-84*. 14 p. 6 refs.

High-speed decoding and interpretation of the large amounts of data produced by remote sensing and satellite photography require the use of computers. However, these tasks preclude the use of pattern recognition, rendering man-machine methods a viable, if partial, solution to the problem. The man-machine technique presented employs a relative-brightness algorithm to interpret variations in tonal density caused by anthropogenic elements of the landscape, and a reference-line algorithm to identify complex shapes and their boundaries. It is found that natural, high-contrast objects are easily and accurately detected by the computer, whereas formations of lower contrast and anthropogenic disruptions require the participation of a researcher. R.S.

N81-10480*# Geological Survey, Flagstaff, Ariz.
TERRAIN-ANALYSIS PROCEDURES FOR MODELING RADAR BACKSCATTER

Gerald G. Schaber, Graydon L. Berlin, and Richard J. Pike (Geological Survey, Menlo Park, Calif.) *In JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980* p 168-199 refs

(NASA Order W-12388; NASA Order W-13276; NASA Order W-13130; NASA Order W-13709)

Avail: NTIS HC A22/MF A01 CSCL 08B

Procedures developed to obtain both raw measured and surface roughness statistics for radar backscatter modeling are described. A comprehensive and highly flexible software package for terrain analysis is introduced. R.C.T.

N81-10482*# Texas A&M Univ., College Station. Remote Sensing Center.

SOME CONFUSION FACTORS IN RADAR IMAGE INTERPRETATION

Bruce J. Blanchard *In JPL Radar Geol: An Assessment Rept.*

of the Radar Geol. Workshop 1 Sep. 1980 p 223-232

Avail: NTIS HC A22/MF A01 CSCL 08G

Geologic interpretation of radar imagery for land use applications is discussed with reference to its dependence on classification of the radar return into categories related to some training area within the image. It is shown that such interpretation relies on the assumption that surface characteristics of areas with similar returns are truly similar. It is further shown that this may not always be true over water surfaces due to the influence of system parameters on the radar return. In imagery over land, both system parameters and scene parameters may lead to ambiguous returns which can ultimately lead to misinterpretation. R.C.T.

N81-10488*# Technische Hochschule, Graz (Austria). Inst. for National Surveying and Photogrammetry.

APPLICATION OF IMAGING RADAR TO MAPPING

Franz W. Leberl *In JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980* p 307-335 refs

Avail: NTIS HC A22/MF A01 CSCL 08B

The present state of radar mapping is reviewed. Emphasis is on radargrammetric mapping with single images, stereo pairs, and block adjustment. Applications to thematic mapping are also addressed. Examples presented concern radar mosaicking, sea ice study and extraterrestrial mapping. E.D.K.

N81-10489*# Goodyear Aerospace Corp., Litchfield Park, Ariz.
STEREO RADAR FOR MAPPING AND INTERPRETATION

L. Graham *In JPL Radar Geol: An Assessment Rept. of the Radar Geol. Workshop 1 Sep. 1980* p 336-350 ref

Avail: NTIS HC A22/MF A01 CSCL 08B

The use of terrain imaging radar to extract elevation information by stereo viewing and measurement is discussed. Either a three dimensional visual model or elevation measurements may be obtained by simultaneous viewing or differential measurement of images obtained by a side-looking radar from two different flightpaths. Expressions describing radar image geometry, model vertical exaggeration, and stereo measurement accuracy are derived. The dependence of the exaggeration and accuracy on system parameters and key system errors is derived, discussed, and illustrated by application to several airborne and spaceborne systems and system concepts, and the results of some preliminary measurements of imagery from two airborne and one spaceborne system are given. E.D.K.

N81-10507# Societe Nationale Industrielle Aerospatiale, Cannes (France).

USE OF COLOR TECHNIQUES FOR IMAGE AND EXPERIMENTAL DATA PROCESSING [ETUDES DES TECHNIQUES DE COULEUR POUR LE TRAITEMENT DES DONNEES IMAGES ET EXPERIMENTALES]

Michel Albuissou (Ecole Nationale Supérieure des Mines, Sophia-Antipolis, France), Roselyne Dupre, Guy Lebegue, and Jean-Marie Monget (Ecole Nationale Supérieure des Mines, Sophia-Antipolis, France) Oct. 1979 253 p refs *In FRENCH* Original contains color illustrations (Contract ESOC-3583/79)

(ESA-CR(P)-1294) Avail: NTIS HC A12/MF A01

Methods, algorithms and instruments allowing the use of color techniques for the processing of information incoming from satellites are described. Various methods of optical data processing are surveyed and applied to LANDSAT satellite images, METEOSAT satellite telemetry measurement, and GEOS satellite experimental data. Color treatment material presently available on the market is examined. The main characteristics of a simplified system for color data processing are outlined.

Author (ESA)

N81-11436*# Arizona Univ., Tucson. Optical Sciences Center.

FEASIBILITY STUDY CONSISTING OF A REVIEW OF

CONTOUR GENERATION METHODS FROM STEREOGRAMS

Cheol-Jung Kim and James C. Wyant Aug. 1980 23 p refs
(Contract JPL-955667)
(NASA-CR-163716) Avail: NTIS HC A02/MF A01 CSCL 14E

A review of techniques for obtaining contour information from stereo pairs is given. Photogrammetric principles including a description of stereoscopic vision are presented. The use of conventional contour generation methods, such as the photogrammetric plotting technique, electronic correlator, and digital correlator are described. Coherent optical techniques for contour generation are discussed and compared to the electronic correlator. The optical techniques are divided into two categories: (1) image plane operation and (2) frequency plane operation. The description of image plane correlators are further divided into three categories: (1) image to image correlator, (2) interferometric correlator, and (3) positive negative transparencies. The frequency plane correlators are divided into two categories: (1) correlation of Fourier transforms, and (2) filtering techniques. Author

N81-11438*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

NASA WALLOPS FLIGHT CENTER GEOS-3 ALTIMETER DATA PROCESSING REPORT

H. R. Stanley and R. E. Dwyer (Computer Sciences Corp., Wallops Island, Va.) Nov. 1980 131 p refs Supersedes NASA-TM-X-69357
(NASA-RP-1066) Avail: NTIS HC A07/MF A01 CSCL 17I

The procedures used to process the GEOS-3 radar altimeter data from raw telemetry data to a final user data product are described. In addition, the radar altimeter hardware design and operating parameters are presented to aid the altimeter user in understanding the altimeter data. Author

N81-11439*# Texas A&M Univ., College Station. Remote Sensing Center.

THE SOFTWARE SYSTEM DEVELOPMENT FOR THE TAMU REAL-TIME FAN BEAM SCATTEROMETER DATA PROCESSORS Final Report

Billy V. Clark and B. Randall Jean Aug. 1980 262 p refs
(Contract NAS9-15311)
(NASA-CR-160880; RSC-3556-2) Avail: NTIS HC A12/MF A01 CSCL 08B

A software package was designed and written to process in real-time any one quadrature channel pair of radar scatterometer signals form the NASA L- or C-Band radar scatterometer systems. The software was successfully tested in the C-Band processor breadboard hardware using recorded radar and NERDAS (NASA Earth Resources Data Annotation System) signals as the input data sources. The processor development program and the overall processor theory of operation and design are described. The real-time processor software system is documented and the results of the laboratory software tests, and recommendations for the efficient application of the data processing capabilities are presented. A.R.H.

N81-11443# Los Alamos Scientific Lab., N. Mex.

STATISTICAL TECHNIQUES APPLIED TO AERIAL RADIO-METRIC SURVEYS (STAARS): PERCENTILE ESTIMATION WITH THE NORMAL AND LOGNORMAL DISTRIBUTIONS

Thomas R. Bement and Frederick L. Pirkle Jun. 1980 28 p refs Prepared in cooperation with Bendix Field Engineering Corp., Grand Junction, Colo.
(Contracts DE-AC13-76GJ-01664; W-7405-eng-36)
(GJBX-123-80) Avail: NTIS HC A03/MF A01

Because of the prominence of percentile estimation in the analysis of NURE aerial radiometric data, a study was conducted to compare two methods of estimating percentiles. The two methods of estimation considered are (1) the normal distribution assumption method and (2) the lognormal distribution assumption method. An error made by assuming the data are from a normal population, when in fact the population is lognormal, causes problems primarily when estimating tail percentiles. When estimating upper percentiles, the error of assuming

lognormality, when the data are really normal, has more serious consequences than does the error of assuming normality, when the data are lognormal. When estimating lower tail percentiles, the error of failing to perform a log-transformation has more serious consequences than does the error of transforming. DOE

N81-11689*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

PURE PIXEL CLASSIFICATION SOFTWARE

O. A. Wehmanen Jul. 1980 53 p refs
(Contract NAS9-15800)
(NASA-CR-160872; JSC-16783; LEMSCO-15309) Avail: NTIS HC A04/MF A01 CSCL 09B

Programs are described which permit classification runs with the LARSYS software to be made on images which have the ground truth field boundaries removed. Author

N81-12482*# Freiburg Univ. (West Germany). Geographisches Institut.

IMAGE PROCESSING OF HCMM-SATELLITE THERMAL IMAGES FOR SUPERPOSITION WITH OTHER SATELLITE IMAGERY AND TOPOGRAPHIC AND THEMATIC MAPS

H. Gossmann and P. Haberaecker, Principal Investigators (DFVLR, Oberpfaffenhofen, West Germany) Ispra, Italy Joint Research Centre of the European Communities Jan. 1980 42 p refs Sponsored by NASA and Deutsche Forschungsgemeinschaft 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'; nondomestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E81-10005; NASA-CR-163545) Avail: NTIS HC A03/MF A01 CSCL 05B

The southwestern part of Central Europe between Basal and Frankfurt was used in a study to determine the accuracy with which a regionally bounded HCMM scene could be rectified with respect to a preassigned coordinate system. The scale to which excerpts from HCMM data can be sensibly enlarged and the question of how large natural structures must be in order to be identified in a satellite thermal image with the given resolution were also examined. Relief and forest and population distribution maps and a land use map derived from LANDSAT data were digitalized and adapted to a common reference system and then combined in a single multichannel data system. The control points for geometrical rectification were determined using the coordinates of the reference system. The multichannel scene was evaluated in several different manners such as the correlation of surface temperature and relief, surface temperature and land use, or surface temperature and built up areas. A.R.H.

N81-12487*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 2: USER REFERENCE MANUAL

P. J. Aucoin, J. Stewart, and M. F. McKay, Principal Investigators Jun. 1980 404 p refs ERTS
(Contract NAS9-15800)
(E81-10010; NASA-CR-163562; LEMSCO-12564-Vol-2-Rev-A; JSC-13821-Vol-2-Rev-A) Avail: NTIS HC A18/MF A01 CSCL 05B

This document presents instructions for analysts who use the EOD-LARSYS as programmed on the Purdue University IBM 370/148 (recently replaced by the IBM 3031) computer. It presents sample applications, control cards, and error messages for all processors in the system and gives detailed descriptions of the mathematical procedures and information needed to execute the system and obtain the desired output. EOD-LARSYS is the JSC version of an integrated batch system for analysis of multispectral scanner imagery data. The data included is designed for use with the as built documentation (volume 3) and the program listings (volume 4). The system is operational from remote

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terminals at Johnson Space Center under the virtual machine/
conversational monitor system environment. Author

N81-12488*# Lockheed Engineering and Management Services
Co., Inc., Houston, Tex. Systems and Services Div.

AS-BUILT DESIGN SPECIFICATION FOR P1A SOFTWARE SYSTEM MODIFIED DISPLAY SUBSYSTEM

C. L. Horton and A. S. Story, Principal Investigators Jun. 1980
352 p Sponsored by NASA, USDA, Dept. of Commerce, Dept.
of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10011; NASA-CR-163561; LEMSCO-15151; JSC-16750)
Avail: NTIS HC A16/MF A01 CSCL 05B

This document contains the design of the proportional estimate
processor which was written to satisfy the software requirement
of Part A of the P1A experiment. The purposes of the project
are: (1) to select the dots to be labelled; (2) to create tables of
green numbers and brightness values for all selected dots per
acquisition; (3) to create scatter plots of green numbers vs
brightness for each acquisition for all selected dots. If labels
have been provided then scatter plots of only categories of interest
can be optionally produced; and (4) to produce trajectory plots
of green number vs brightness at differing acquisition times for
each dot. These plots need to be in the same order as the list
of selected dots. When labels are provided only plots of dots of
categories of interest are to be produced. Author

N81-12494*# Wisconsin Univ., Madison. Inst. for Environmental
Studies.

FOR MULTIDISCIPLINARY RESEARCH ON THE APPLICA- TION OF REMOTE SENSING TO WATER RESOURCES PROBLEMS Progress Report, Aug. 1978 - Jul. 1979

Ralph W. Kiefer, Principal Investigator Jul. 1979 50 p refs
Original contains color imagery. Original photography may be
purchased from the EROS Data Center, Sioux Falls, S.D. 57198
ERTS

(Grant NGL-50-002-127)

(E81-10017; NASA-CR-163527) Avail: NTIS
HC A03/MF A01 CSCL 08H

Research on the application of remote sensing to problems
of water resources was concentrated on sediments and associated
nonpoint source pollutants in lakes. Further transfer of the
technology of remote sensing and the refinement of equipment
and programs for thermal scanning and the digital analysis of
images were also addressed. J.M.S.

N81-12497*# Agricultural Research Service, Phoenix, Ariz.
Water Conservation Lab.

HEAT CAPACITY MAPPING MISSION (HCMM) Quarterly Progress Report, 1 Feb. - 30 Apr. 1980

Ray D. Jackson, Principal Investigator 30 Apr. 1980 1 p
HCMM

(NASA Order S-40255-B)

(E81-10020; NASA-CR-163506) Avail: NTIS
HC A02/MF A01 CSCL 08H

Tapes for day and night passes on May 16 and May 20,
1978 and a day pass on May 3, 1980 were processed. Results
indicate that it is extremely difficult to locate a field of 9 pixel
size and temperature data from the HCMM are consistently lower
than temperatures measured with a scanner flown at low altitudes.
The temperature differences between the satellite and aircraft
data appear to be temperature dependent, being smaller at
lower temperatures. Three data points are [in the format (airc,
HCMM)] (12,9), (30,23), and (39,30). The linear equation for
these three points is $T_{sub HCMM} = 0.778 T_{sub airc} - 0.33$.

J.M.S.

N81-12498*# Agricultural Research Service, Phoenix, Ariz.
Water Conservation Lab.

HEAT CAPACITY MAPPING MISSION (HCMM) Quarterly Progress Report, 1 Nov. 1979 - 31 Jan. 1980

Ray D. Jackson, Principal Investigator 31 Jan. 1980 1 p
HCMM

(NASA Order S-40255-B)

(E81-10021; NASA-CR-163505) Avail: NTIS
HC A02/MF A01 CSCL 08H

Progress in the processing of CCT's for both day and night
passes for May 16 and 20, 1978 and a day pass on May 3,
1980 is reported. J.M.S.

N81-12503*# Business and Technological Systems, Inc.,
Seabrook, Md.

EQUIVALENT SOURCE MODELING OF THE MAIN FIELD USING MAGSAT DATA Quarterly Report, 1 Apr. - 30 Jun. 1980

30 Jun. 1980 4 p ERTS

(Contract NAS5-26047)

(E81-10026; NASA-CR-163502; QR-2) Avail: NTIS
HC A02/MF A01 CSCL 08F

Progress is reported on software development for equivalent
dipole source modeling of the main magnetic field. This includes
a spatial statistical output capability, a subroutine to compute
the equivalent spherical harmonic representation from the dipole
distribution, and capability to plot the global locations of the
dipoles and the values of the source magnetization. J.M.S.

N81-12507*# Minnesota Univ., St. Paul. Remote Sensing
Lab.

DEVELOPMENT OF ALTERNATIVE DATA ANALYSIS TECHNIQUES FOR IMPROVING THE ACCURACY AND SPECIFICITY OF NATURAL RESOURCE INVENTORIES MADE WITH DIGITAL REMOTE SENSING DATA Progress Report, 1 Jul. - 31 Dec. 1979

Thomas M. Lillesand and Douglas E. Meisner, Principal Investi-
gators In Minnesota Univ. A Study of Minn. Land and Water
Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p
30-43 ERTS

Avail: NTIS HC A07/MF A01 CSCL 05B

An investigation was conducted into ways to improve the
involvement of state and local user personnel in the digital image
analysis process by isolating those elements of the analysis process
which require extensive involvement by field personnel and
providing means for performing those activities apart from a
computer facility. In this way, the analysis procedure can be
converted from a centralized activity focused on a computer
facility to a distributed activity in which users can interact with
the data at the field office level or in the field itself. A general
image processing software was developed on the University of
Minnesota computer system (Control Data Cyber models 172 and
74). The use of color hardcopy image data as a primary medium
in supervised training procedures was investigated and digital
display equipment and a coordinate digitizer were procured.

E.D.K.

N81-12512*# National Aeronautics and Space Administration,
Earth Resources Lab., Slidell, La.

A METHOD FOR THE PROCESSING AND ANALYSIS OF DIGITAL TERRAIN ELEVATION DATA

Bobby G. Junkin, Principal Investigator Jan. 1979 85 p refs
Original contains color illustrations ERTS

(E81-10030; NASA-TM-82187; ERL-177) Avail: NTIS
HC A05/MF A01 CSCL 05B

A method is presented for the processing and analysis of
digital topography data that can subsequently be entered in an
interactive data base in the form of slope, slope length, elevation,
and aspect angle. A discussion of the data source and specific
descriptions of the data processing software programs are
included. In addition, the mathematical considerations involved
in the registration of raw digitized coordinate points to the
UTM coordinate system are presented. Scale factor considerations
are also included. Results of the processing and analysis are
illustrated using the Shiprock and Gallup Quadrangle test data.

E.D.K.

N81-12518*# Minnesota Univ., Minneapolis.

REMOTE SENSING AND IMAGE INTERPRETATION

Thomas M. Lillesand and Ralph W. Kiefer, Principal Investigators
(Wisconsin Univ. - Madison) New York John Wiley and Sons

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1979 658 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E81-10036; NASA-CR-163531; LC-78-27846; ISBN-0-471-02609-3) Avail: NTIS HC A99/MF A01 CSCL 14E

A textbook prepared primarily for use in introductory courses in remote sensing is presented. Topics covered include concepts and foundations of remote sensing; elements of photographic systems; introduction to airphoto interpretation; airphoto interpretation for terrain evaluation; photogrammetry; radiometric characteristics of aerial photographs; aerial thermography; multispectral scanning and spectral pattern recognition; microwave sensing; and remote sensing from space. A.R.H.

N81-12520*# Purdue Univ., Lafayette, Ind. Applications of Remote Sensing Lab.

CONTEXTUAL CLASSIFICATION OF MULTISPECTRAL IMAGE DATA: APPROXIMATE ALGORITHM

James C. Tilton, Principal Investigator Aug. 1980 18 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS (Contract NAS9-15466; Proj. AgRISTARS) (E81-10038; NASA-CR-163551; SR-PO-00491; LARS-TR-081580) Avail: NTIS HC A02/MF A01 CSCL 02C

An approximation to a classification algorithm incorporating spatial context information in a general, statistical manner is presented which is computationally less intensive. Classifications that are nearly as accurate are produced. J.M.S.

N81-12521*# Institut National de la Recherche Agronomique, Avignon (France).

THE EVALUATION OF EVAPORATION BY INFRARED THERMOGRAPHY: A CRITICAL ANALYSIS OF THE MEASUREMENTS ON THE CRAU TEST SITE

B. Seguin, V. Petit (Centre d'Informatique Geologique, Fontainebleau, France), R. Devillard, P. Reich, and G. Thouy, Principal Investigators Ispra, Italy Joint Research Centre of the European Communities Jun. 1980 15 p refs In ENGLISH and FRENCH Sponsored by NASA HCMM (Proj. TELLUS)

(E81-10039; NASA-CR-163546; Newsletter-16) Avail: NTIS HC A02/MF A01 CSCL 05B

Evapotranspiration was calculated for both the dry and irrigated zone by four methods which were compared with the energy balance method serving as a reference. Two methods did not involve the surface temperature. They are $ETR(n) = R(n)$, liable to be valid under wet conditions and $ET(eq) = (\Delta/\Delta + \gamma) R(n)$ i.e. the first term of Penman's equation, adapted to moderately dry conditions. The methods using surface temperature were the combined energy balance aerodynamic approach and a simplified approach proposed by Jackson et al. Tests show the surface temperature methods give relatively satisfactory results both in the dry and wet zone, with a precision of 10% to 15% compared with the reference method. As was to be expected, $ET(eq)$ gave satisfactory results only in the dry zone and $ET(Rn)$ in the irrigated zone. Thermography increased the precision in the estimate of ET relative to the most suitable classical method by 5% to 8% and is equally suitable for both dry and wet conditions. The Jackson method does not require extensive ground measurements and the evaluation of the surface roughness. A.R.H.

N81-12539# Royal Aircraft Establishment, Farnborough (England).

A CARTOGRAPHIC COMPUTER DATA FORMAT AND ASSOCIATED PROGRAMS

A. H. Benny London HMSO Mar. 1980 67 p refs (RAE-TR-80037; RAE-Space-578; BR74346) Avail: NTIS HC A04/MF A01

A map data format is described in detail, together with a suite of computer programs and subroutines for handling such data files. This format is used for storage of LANDSAT multispectral images. A map data file consists of a header record followed by a number of features, each feature consisting of

either one coordinate value (to represent a single location, or a string of coordinates (to represent a line). Programs are described to create, alter, transform, and display map files. Author (ESA)

N81-12669*# Ohio State Univ., Columbus. ACCURACY OF THE DETERMINATION OF MEAN ANOMALIES AND MEAN GEOID UNDULATIONS FROM A SATELLITE GRAVITY FIELD MAPPING MISSION

Christopher Jekeli and Richard H. Rapp Aug. 1980 22 p refs

(Grant NGR-36-008-161)

(Rept-307) Avail: NTIS HC A02/MF A01 CSCL 08G

Improved knowledge of the Earth's gravity field was obtained from new and improved satellite measurements such as satellite to satellite tracking and gradiometry. This improvement was examined by estimating the accuracy of the determination of mean anomalies and mean undulations in various size blocks based on an assumed mission. In this report the accuracy is considered through a commission error due to measurement noise propagation and a truncation error due to unobservable higher degree terms in the geopotential. To do this the spectrum of the measurement was related to the spectrum of the disturbing potential of the Earth's gravity field. Equations were derived for a low-low (radial or horizontal separation) mission and a gradiometer mission. For a low-low mission of six month's duration, at an altitude of 160 km, with a data noise of plus or minus 1 micrometers sec for a four second integration time, we would expect to determine 1 deg x 1 deg mean anomalies to an accuracy of plus or minus 2.3 mgals and 1 deg x 1 deg mean geoid undulations to plus or minus 4.3 cm. A very fast Fortran program is available to study various mission configurations and block sizes. Author

N81-13402*# Centro Studi ed Applicazioni in Tecnologie Avanzate, Bari (Italy).

SCALE EFFECTS: HCMM DATA SIMULATION. USAGE OF FILTERING TECHNIQUES FOR SCALING-UP SIMULATIONS

V. DiGennaro, Principal Investigator [1980] 63 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'; nondomestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM

(E81-10041; NASA-CR-163751) Avail: NTIS HC A04/MF A01 CSCL 08B

Image reduction used to simulate increase in altitude of an acquisition platform is equivalent to data smoothing, and can be achieved either by neighborhood averaging or by filtering techniques. The averaging approach is limited for accurate simulation. A filtering method is described which was based on the hypothesis that all changes due to altitude increase can be represented by a point spread function. Determination of the scale function and factor are discussed as well as implementation of the filtering. Filtering can be either in the spatial or frequency domain. In the spatial domain, filtering consists of the convolution of the image with the weights mask, and then of the declination of the points according to the appropriate scale factor. A simulation of an aircraft day image in the infrared channel is examined. A.R.H.

N81-13407*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

PRELIMINARY ANALYSIS OF THE POTENTIAL OF LANDSAT IMAGERY TO STUDY DESERTIFICATION

Nelson deJesusParada, Principal Investigator, Magda Adelaide Lombardo, and Vitor Celso deCarvalho Jun. 1980 10 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980 Sponsored by NASA ERTS

(E81-10047; NASA-CR-163757; INPE-1789-RPE/161) Avail: NTIS HC A02/MF A01 CSCL 05B

The use of LANDSAT imagery to define and delimit areas under process of desertification was investigated. Imagery for

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two different years (1973 and 1978) and two different seasons (dry and rainy seasons in 1976), were used to identify terrain morphology and vegetation cover. The analysis of LANDSAT interpretation, combined with geological and soil information obtained from published literature, allowed the identification of eleven ecological units which were classified corresponding to the degree of the Xique-Xique region of Rio Sao Francisco.

A.R.H.

N81-13413*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

APPLICATION OF DIGITAL TERRAIN DATA TO QUANTIFY AND REDUCE THE TOPOGRAPHIC EFFECT ON LANDSAT DATA

C. O. Justice, S. W. Wharton, and B. N. Holben, Principal Investigators Aug. 1980 35 p refs Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 (E81-10055; NASA-TM-81988) Avail: NTIS HC A03/MF A01 CSCL 05B

Integration of LANDSAT multispectral scanner (MSS) data with 30 m U.S. Geological Survey (USGS) digital terrain data was undertaken to quantify and reduce the topographic effect on imagery of a forested mountain ridge test site in central Pennsylvania. High Sun angle imagery revealed variation of as much as 21 pixel values in data for slopes of different angles and aspects with uniform surface cover. Large topographic effects were apparent in MSS 4 and 5 was due to a combination of high absorption by the forest cover and the MSS quantization. Four methods for reducing the topographic effect were compared. Band ratioing of MSS 6/5 and MSS 7/5 did not eliminate the topographic effect because of the lack of variation in MSS 4 and 5 radiances. The three radiance models examined to reduce the topographic effect required integration of the digital terrain data. Two Lambertian models increased the variation in the LANDSAT radiances. The nonLambertian model considerably reduced (86 per cent) the topographic effect in the LANDSAT data. The study demonstrates that high quality digital terrain data, as provided by the USGS digital elevation model data, can be used to enhance the utility of multispectral satellite data.

Author

N81-13417*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

TAPE MERGE/COPY PROCESSOR

S. O. OBrien, Principal Investigator Sep. 1980 11 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS) (E81-10060; NASA-CR-162863; EW-LO-00704; LEMSCO-15356; JSC-16381) Avail: NTIS HC A02/MF A01 CSCL 05B

The TAPMRG processor merges or copies data files from one or more tapes onto a single output tape.

Author

N81-13425*# Houston Univ., Tex. Dept. of Mathematics.

NUMERICAL TRIALS OF HISSE

Charles Peters and Frank Kampe, Principal Investigators 5 Aug. 1980 28 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-14689; Proj. AgRISTARS) (E81-10069; NASA-CR-160881; SR-HO-00477) Avail: NTIS HC A03/MF A01 CSCL 02C

The mathematical description and implementation of the statistical estimation procedure known as the Houston integrated spatial/spectral estimator (HISSE) is discussed. HISSE is based on a normal mixture model and is designed to take advantage of spectral and spatial information of LANDSAT data pixels, utilizing the initial classification and clustering information provided by the AMOEBA algorithm. The HISSE calculates parametric estimates of class proportions which reduce the error inherent in estimates derived from typical classify and count procedures common to nonparametric clustering algorithms. It also singles out spatial groupings of pixels which are most suitable for labeling classes. These calculations are designed to aid the analyst/

interpreter in labeling patches with a crop class label. Finally, HISSE's initial performance on an actual LANDSAT agricultural ground truth data set is reported.

E.D.K.

N81-13428*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

LIMITED AREA COVERAGE/HIGH RESOLUTION PICTURE TRANSMISSION (LAC/HRPT) TAPE IJ GRID PIXEL EXTRACTION PROCESSOR USER'S MANUAL

S. O. OBrien, Principal Investigator Sep. 1980 14 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS) (E81-10072; NASA-CR-160866; EW-LO-00702; LEMSCO-15326; JSC-16374) Avail: NTIS HC A02/MF A01 CSCL 05B

The program, LACREG, extracted all pixels that are contained in a specific IJ grid section. The pixels, along with a header record are stored in a disk file defined by the user. The program will extract up to 99 IJ grid sections.

Author

N81-13429*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

LIMITED AREA COVERAGE/HIGH RESOLUTION PICTURE TRANSMISSION (LAC/HRPT) DATA VEGETATIVE INDEX CALCULATION PROCESSOR USER'S MANUAL

S. O. OBrien, Principal Investigator Sep. 1980 14 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS) (E81-10073; NASA-CR-160870; EW-LO-00703; LEMSCO-15327; JSC-16375) Avail: NTIS HC A02/MF A01 CSCL 08F

The program, LACVIN, calculates vegetative indexes numbers on limited area coverage/high resolution picture transmission data for selected IJ grid sections. The IJ grid sections were previously extracted from the full resolution data tapes and stored on disk files.

Author

N81-13433*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

LIMITED AREA COVERAGE/HIGH RESOLUTION PICTURE TRANSMISSION, LAC/HRPT TAPE CONVERSION PROCESSOR USER'S MANUAL

S. O. OBrien, Principal Investigator Sep. 1980 14 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS (Contract NAS9-15800; Proj. AgRISTARS) (E81-10077; NASA-CR-160871; EW-LO-00701; LEMSCO-15325; JSC-16373) Avail: NTIS HC A02/MF A01 CSCL 05B

The program, LACSEG, converts LAC/HRPT data tapes to the CSC defined Universal format. The Universal formatted data tape is then processed the normal way by the FAS IMDACS system.

Author

N81-13437*# Business and Technological Systems, Inc., Seabrook, Md.

GEOMAGNETIC FIELD MODELING BY OPTIMAL RECURSIVE FILTERING Quarterly Report, 11 Jul. - 30 Sep. 1980

30 Sep. 1980 4 p ERTS (Contract NAS5-26250) (E81-10084; NASA-CR-163782; QR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

Data sets selected for mini-batches and the software modifications required for processing these sets are described. Initial analysis was performed on minibatch field model recovery. Studies are being performed to examine the convergence of the solutions and the maximum expansion order the data will support in the constant and secular terms.

E.D.K.

N81-13438*# Herzberg Inst. of Astronomy, Ottawa (Ontario). Inst. of Astrophysics.

STUDIES OF HIGH LATITUDE CURRENT SYSTEMS USING

MAGSAT VECTOR DATA Triennial Progress Report, 1 Jul. - 15 Nov. 1980

J. Ronald Burrows, T. J. Hughes, D. D. Wallis, and Margaret D. Wilson, Principal Investigators 1 Dec. 1980 16 p Sponsored by NASA ERTS

(E81-10085; NASA-CR-163785; PR-1) Avail: NTIS HC A02/MF A01 CSCL 04A

Disturbance fields caused by global external current systems are analyzed in order to gain an improved understanding of the physical processes which control high latitude current systems and to increase the confidence level in the identification of internal field levels. The basic approach is to: (1) categorize the vector data by those physical parameters important for investigation of external current systems; (2) map the disturbances for appropriate conditions; (3) model the currents which might cause the mapped disturbances; and (4) correlate results with data from other sources. It is concluded that the Magsat data set appears to have remarkably high precision and quality and should permit major advances to be made in modeling current distribution at high latitudes in the ionosphere and magnetosphere. E.D.K.

N81-14372*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SEASAT VIEWS NORTH AMERICA, THE CARIBBEAN, AND WESTERN EUROPE WITH IMAGING RADAR

J. P. Ford, R. G. Blom, M. L. Bryan, M. I. Daily, T. H. Dixon, C. Elachi, and E. C. Xenos 1 Nov. 1980 135 p refs (Contract NAS7-100)

(NASA-CR-163825; JPL-Pub-80-67) Avail: NTIS HC A07/MF A01 CSCL 17I

Forty-one digitally correlated Seasat synthetic-aperture radar images of land areas in North America, the Caribbean, and Western Europe are presented to demonstrate this microwave orbital imagery. The characteristics of the radar images, the types of information that can be extracted from them, and certain of their inherent distortions are briefly described. Each atlas scene covers an area of 90 X 90 kilometers, with the exception of the one that is the Nation's Capital. The scenes are grouped according to salient features of geology, hydrology and water resources, urban landcover, or agriculture. Each radar image is accompanied by a corresponding image in the optical or near-infrared range, or by a simple sketch map to illustrate features of interest. Characteristics of the Seasat radar imaging system are outlined. Author

N81-14381# George Washington Univ., Washington, D.C. Dept. of Electrical Engineering and Computer Science.

ANALYSIS AND DEVELOPMENT OF IMAGE STATISTICS AND REDUNDANCY REMOVAL Final Report, 15 Sep. 1979 - 14 Sep. 1980

Murray H. Loew, Raymond L. Pickholtz, Lee Goldman, Fred Hill, and Fred Lawler Sep. 1980 162 p refs (Contract DAAK70-79-C-0147)

(AD-A091600; GWU-EE-CS-80-09) Avail: NTIS HC A08/MF A01 CSCL 09/2

The goal of classifying objects of cartographic interest in aerial photographs was approached using techniques from pattern recognition and image processing. Bridge and airport images were chosen as the initial objects of interest and segments of photographs containing them were digitized for the data base. Edge-detection and Hough transform algorithms identified structures as candidate bridges; additional decision logic (using global contrast and other attributes) further reduced the set. Results indicate the feasibility and low computational cost of the approach. Additional results in discrete medial-axis transformation are presented, as are methods for encoding the two kinds of images. The characteristics of the two kinds of targets are so distinctive that encoding promises substantial efficiencies. GRA

N81-15426*# National Aeronautics and Space Administration, Washington, D. C.

INTERPRETATION OF SATELLITE IMAGES OF THE REPUBLIC OF NIGER Final Report

F. Bender and D. Bannert Jan. 1981 86 p refs Transl. into ENGLISH of "Interpretation d'Images de Satellite en Republique du Niger" BMZ Proj. Rept. 7521373 Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hanover, West Germany, 20 Apr. 1979 p 1-124 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76476; BMZ-7521373) Avail: NTIS HC A05/MF A01 CSCL 05B

Interpretations of LANDSAT pictures were carried out for an area located in the west of the Niger Republic in the geological, hydrogeological and pedological sectors. Checking of the extent of vegetation and use of the soils and effects of desertification for the purpose of yearly map making was carried out. The proposed control of land use may be optimized by the direct reception of LANDSAT data by the receiving station planned for Ouagadougou. Since that station will not be operating before 1983, the establishment of a mobile reception station in the Republic of Niger to enable the installation of the required control system is advised. Author

N81-15651# National Environmental Satellite Service, Washington, D. C.

NATIONAL ENVIRONMENTAL SATELLITE SERVICE CATALOGUE OF PRODUCTS, THIRD EDITION

Dennis C. Dismachek, Arthur L. Booth, and John A. Leese Apr. 1980 134 p refs

(PB81-106270; NOAA-80081320; NOAA-TM-NESS-109) Avail: NTIS HC A07/MF A01 CSCL 04B

A brief description of the product, its known accuracies (when applicable), and an example of the product are given. A list of primary users is also presented. T.M.

N81-15727*# Systems and Applied Sciences Corp., Riverdale, Md.

A PROGRAM AND DATA BASE FOR EVALUATING SMMR ALGORITHMS Final Report

28 Sep. 1979 110 p

(Contract NAS5-25069)

(NASA-CR-160069; R-SAC-79-02) Avail: NTIS HC A06/MF A01 CSCL 09B

A program (PARAM) is described which enables a user to compare the values of meteorological parameters derived from data obtained by the scanning multichannel microwave radiometer (SMMR) instrument on NIMBUS 7 with surface observations made over the ocean. The input to this program is a data base, also described, which contains the surface observations and coincident SMMR data. The evaluation of meteorological parameters using SMMR data is done by a user supplied subroutine. Instruments are given for executing the program and writing the subroutine. M.G.

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INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A81-10724 **SATDAS - For air-sea interaction data acquisition using satellite telemetry.** R. N. Lobecker (Raytheon Ocean Systems Co., Newport, R.I.), S. SethuRaman (Brookhaven National Laboratory, Upton, N.Y.), and G. Field (Ocean Data Equipment Co., Middletown, R.I.). *American Meteorological Society, Bulletin*, vol. 61, Oct. 1980, p. 1212-1222. 7 refs. Contract No. DE-AC02-76CH-00016.

SATDAS (Satellite Data Acquisition System) is a data acquisition system utilizing a satellite telemetry link that has been developed for Brookhaven National Laboratory, Upton, N.Y. It is to be used for air-sea interaction and oceanographic experiments. It is microprocessor-based with all functions under software control. These include data interrogation and acquisition, timing control, tape storage, and data telemetry. Data processing programs are included to calculate averages, variances, and covariances. Diagnostic routines are included for system self-test. The use of the microprocessor has resulted in a very simple configuration with an accordingly high level of reliability. Telemetry to shore is via the GOES (Geostationary Operational Environmental Satellite). SATDAS provides a unique combination of in situ processing, system self-check, on-board recording, and satellite telemetry. (Author)

A81-13369 * # **Programmable performance - One aspect of smart sensing systems.** D. J. Jobson (NASA, Langley Research Center, Hampton, Va.). In: *Sensor Systems for the 80's Conference*, Colorado Springs, Colo., December 2-4, 1980, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 113-116. 14 refs. (AIAA 80-1950)

Programmable performance is the ability to flexibly alter basic spatial, spectral, and radiometric system response as a function of time. In this paper programmable performance is defined as a functional element of smart sensor systems for the 1990's. The uses and benefits of these classes of sensor systems are discussed with reference to multispectral scanners of the earth's surface. An overall technology trend is identified which couples a high degree of sensor performance flexibility to a need for advanced device technology developments. B.J.

A81-13376 * # **Experiments in infrared multispectral mapping of earth resources.** J. B. Wellman and A. F. H. Goetz (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: *Sensor Systems for the 80's Conference*, Colorado Springs, Colo., December 2-4, 1980, Technical Papers.

New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 163-174. 12 refs. Contract No. NAS7-100. (AIAA 80-1930)

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

A81-13943 **A potential ground-truth reference for calibration of space-borne thermal I.R. radiometers.** C. Tockert (Centre

National d'Etudes Spatiales, Toulouse, France). *International Journal of Remote Sensing*, vol. 1, July-Sept. 1980, p. 305.

A81-14419 * # **Backus effect observed by Magsat (NASA, Goddard Space Flight Center, Greenbelt, Md.).** *Geophysical Research Letters*, vol. 7, Nov. 1980, p. 941-944. 5 refs.

Two harmonic expansions of the geomagnetic potential, obtained from Magsat, are compared, one based on scalar data and one based on vector data. It is found that although the field magnitudes given by the two models are in close agreement, the vector fields are not; the vector difference was highly regular. Analysis of the data showed that the Backus effect (1970) accounted for most of the discrepancy. This result emphasizes the importance of using vector data in deriving global models of the geomagnetic field and suggests that some past models based on scalar data alone may suffer from errors of a similar nature. B.J.

A81-15670 **Electromagnetic studies of ice and snow. I - Radiometry of ice and snow. II - Radio echo sounding.** P. E. Gudmandsen (Danmarks Tekniske Højskole, Lyngby, Denmark). In: *Remote sensing application in agriculture and hydrology*.

Rotterdam, A. A. Balkema, 1980, p. 389-416. 26 refs.

The principles of using microwave radiometry for the remote sensing of ice and snow are described. Radiometry techniques are presented and attention is given to measurements from aircraft and satellites and to fundamental ground-based measurements. Some numerical models describing the electromagnetic properties of snow and ice are surveyed. In addition, the technique of the radio echo sounding of snow and ice is described with emphasis on physical aspects and system considerations. The radio echo sounding technique is examined with regard to radio wave propagation in ice, dielectric properties of ice, ice profiles and contouring, sounding of shallow ice, sounding of temperature glaciers, and sounding of snow. P.T.H.

A81-16104 **Optical instruments for space applications (Les instruments d'optique d'applications spatiales).** J.-P. Deshayes (Centre National d'Etudes Spatiales, Toulouse, France). (*CNRS, CNES, DGRST, and DRET, Conférence Européenne sur les Horizons de l'Optique, Pont-à-Mousson, Moselle, France, Apr. 22-25, 1980.*) *Journal of Optics*, vol. 11, Nov.-Dec. 1980, p. 373-379. 6 refs. In French.

The characteristics of spaceborne optical instruments are described with reference to their application in meteorology, remote sensing, climatology, and environmental monitoring. Two particular instruments are discussed: the Meteosat radiometer and the SPOT HRV instrument. B.J.

A81-16486 **The Magsat attitude control system.** K. J. Heffernan, G. H. Fountain, B. E. Tossman, and F. F. Mobley (Johns Hopkins University, Laurel, Md.). *Johns Hopkins APL Technical Digest*, vol. 1, July-Sept. 1980, p. 188-193.

An account is presented of techniques used for orienting Magsat in the desired three-axis controlled attitude in space. The pitch angle was sensed by an infrared horizon scanner and controlled by reaction torques from an internal reaction wheel. Roll angle was also sensed by the infrared scanner and controlled by torquing the satellite with a magnetic coil that interacted with the earth's magnetic field. A small on-board computer assessed the roll error and computed the proper strength of the magnetic coil in order to correct the error, accounting for the actual magnetic field strength and internal angular momentum. No direct measurement or control of yaw was necessary. (Author)

A81-16489 * **The Magsat scalar magnetometer.** W. H. Farthing (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Johns Hopkins APL Technical Digest*, vol. 1, July-Sept. 1980, p. 205-209. 5 refs.

The Magsat scalar magnetometer is derived from optical pump-

08 INSTRUMENTATION AND SENSORS

ing magnetometers flown on the orbiting geophysical observatories. The basic sensor, a cross-coupled arrangement of absorption cells, photodiodes, and amplifiers, oscillates at the Larmor frequency of atomic moments precessing about the ambient field direction. The Larmor frequency output is accumulated digitally and stored for transfer to the spacecraft telemetry stream. In orbit the instrument has met its principal objective of calibrating the vector magnetometer and providing scalar field data. (Author)

A81-17168 Lasers as probes for air and sea. S. Svanberg (Lund Institute of Technology, Lund, Sweden). *Contemporary Physics*, vol. 21, Nov.-Dec. 1980, p. 541-576. 40 refs. Research supported by the Statens Naturvetenskapliga Forskningsrad and Swedish Board for Space Activities.

The rapid development of quantum electronics has permitted the introduction of efficient remote-sensing techniques for air and sea, based on applied laser spectroscopy. In this paper basic interactions between laser light and molecules are discussed as a background for a description of laser probing of the atmosphere and the hydrosphere. For the atmosphere both meteorological parameters and pollution levels can be measured. Long-path absorption and lidar (laser radar) techniques yield average or range-resolved values for several environmental parameters. Tropospheric and stratospheric measurements of particles and gaseous pollutants are described. Laser light can be used for marine probing within the blue-green optical window of water. Much of the effort in this field aims at the development of airborne measuring systems. Bathymetric experiments and the detection of schools of fish are discussed. Laser-induced fluorescence can be used for airborne monitoring of pollutants like mineral oils and pulp-mill wastes. Accurate laboratory measurements of spectral 'signatures' of different materials are important. (Author)

A81-18255 The TIROS era - 1960-1980 and the decade ahead. A. Schnapf (RCA, Astro Electronics Div., Princeton, N.J.). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-50.* 19 p.

The history of the TIROS Meteorological Satellite system from 1960 to 1980 is surveyed, with reference to the four generations of satellites that have been designed: TIROS, ESSA, ITOS, and NOAA. The mission objectives and instrument payload of the TIROS-N/NOAA configuration, which is the present operational system, are presented. The channel characteristics of the Advanced Very High Resolution Radiometer (AVHRR) of the TIROS-N are given (five channels with wavelengths from 0.55 to 12.5 microns) as are the satellite's operational vertical sounder characteristics. The systems making up the TIROS-N, among them the power and thermal systems, are enumerated and discussed. The TIROS-N Operational System data flow is illustrated, and future improvements, including the search and rescue (SAR) missions and compatibility with the Space Shuttle, are covered. C.R.

A81-18269 Combined use of optical and SAR sensors satellite imagery. B. Apolloni (Calabria, Università, Cosenza, Italy), P. Murino, and L. G. Napolitano (Napoli, Università, Naples, Italy). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-77.* 14 p. 6 refs.

This paper concerns procedures for combining the information content of Seasat-A, Landsat, and cartographic data. The problem which first arises is the geometrical matching of the imageries of the same scene taken from two sensors having different resolutions. SAR and MSS sensors see the earth from different viewing geometries and because of the characteristics of the SAR signal, the displacements of the points on the radar imagery depend on their relative heights. The proposed analysis procedures use a three dimensional topographical model to estimate the height and the slope of the terrain in order to evaluate respectively the displacements of the points and the return parameter in the analyses of the SAR imageries. The paper presents

Landsat and Seasat imageries of an area located in the southern part of Italy. (Author)

A81-18273 Space cabin equipment for earth surface studies. R. D. Mercer (ORI, Inc., Silver Spring, Md.). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-85.* 9 p.

Crew-operated space cabins contain cameras, lenses, filters, and films for earth surface studies and are particularly useful when the surface features are changing rapidly or occupy small areas. Crop fields, mineral deposits, localized atmospheric and waterway contamination, and earthquakes are typical applications. In addition to crew image processing and flight qualifications, ground direction of observations is necessary for conserving crew time and attitude control propellants. A.T.

A81-18275 Earth and ocean observation payloads for the ESA remote sensing satellites programme. C. Honvault (ESA, Earth Observation Programme Dept., Toulouse, France). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-90.* 13 p.

The current state of development and future plans for the ESA program of satellite remote sensing are reviewed. Payload instruments under consideration for the first mission, ERS-1, to be launched by the end of 1985 for global and coastal ocean monitoring, are discussed, including the ocean color monitor, imaging microwave radiometer, synthetic aperture radar, radar altimeter and microwave scatterometer, and their requirements and specifications are pointed out. Consideration is also given to the optical imaging instrument to be carried along with a synthetic aperture radar on board ERS-2, which is intended for land applications. It is noted that ESA is currently beginning the preparation of specifications for a detailed definition phase for ERS-1, anticipating a positive decision by the participating member states by the end of 1980 and the availability of funding in early 1981. A.L.W.

A81-18279 Active microwave remote sensing by using circular polarization. H. Hirose, T. Kobayashi, and Y. Matsuzaka (Tokyo, University, Tokyo, Japan). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-97.* 11 p. 6 refs.

This paper proposes a use of circular polarization for active microwave remote sensing of the earth. A scatterometer that transmits left circular polarization and receives both right- and left-circularly polarized returns was constructed. Backscatter coefficients of soil surface and wind-driven water surface were measured for two polarization configurations (LR and LL) at X-band. The experimental results and some theoretical investigations indicate that LR and LL backscatter coefficients for oblique incidence differ in the surface-roughness sensitivity significantly, but do not in the dielectric-constant sensitivity. Both LR and LL components would have similar return power level for natural targets on the earth. Circular polarization can be used more advantageously to extract only desired geophysical parameters, such as moisture content or surface roughness, than the conventional linear polarization. (Author)

N81-10279*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

USE OF A SATELLITE MULTI-FREQUENCY RADIOMETER TO DETERMINE ATTENUATION SUFFERED BY A SATELLITE RADAR

G. J. Dome, R. K. Moore, I. J. Birrer, and K. VanSickle /in AGARD Propagation Effects in Space/Earth Paths Aug. 1980 12 p refs Sponsored by NASA

Avail: NTIS HC A22/MF A01 CSCL 20N

The antenna temperature of the radiometer observing the sea without attenuation can be calculated, for vertical polarization

and at Seasat Scanning Multifrequency Microwave Radiometer (SMMR's) 49 deg angle of incidence, if the surface temperature is known. Thus, an increase in the observed value above this value is an excess temperature caused by attenuation in the atmosphere. The amount of this excess temperature was determined for various model cloud and rain conditions, as was the attenuation. An empirical relation was determined between excess temperature at 37 GHz and 18 GHz, and the attenuation at 14.6 GHz. An algorithm was then developed to use the 37 GHz radiometer to establish small attenuations and the 18 GHz radiometer to establish moderate attenuations and large attenuations. This method was tested against some of the early Seasat observations, and was shown to be reasonably successful, within limitations posed by poor knowledge of the actual attenuation with which the results for the algorithm must be compared. L.F.M.

N81-11377# Stanford Univ., Calif. Edward R. Ginzton Lab. of Physics.

REMOTE ATMOSPHERIC MEASUREMENTS OF CH-4 USING A LiNbO3 TUNABLE SOURCE Final Report, Oct. 1978 - Jun. 1979

Robert L. Byer and Martin Endemann Tyndall AFB, Fla. AF Engineering and Services Lab. Mar. 1980 27 p refs (Grant EPA-R-805750-01; AF Proj. 1900) (AD-A089993; AFESC/ESL-TR-80-11) Avail: NTIS HC A03/MF A01 CSCL 20/5

A laser transmitter tuned by means of a lithium niobate optical parametric oscillator was employed to demonstrate the capability for remote measurement of gaseous pollutants in the atmosphere. Measurements of methane were obtained continuously over an 18-hour period with a precision of better than 0.06 parts per million. The long path measurements of methane were in excellent agreement with a Bay Area Pollution Control District point monitoring station. Capabilities of the tunable laser transmitter to measure other molecules, as well as atmospheric temperature, are discussed. GRA

N81-12310# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

THEORETICAL AND EXPERIMENTAL STUDY OF RADAR SCATTERING AND SIMULATION. PART 1: THEORY Final Report, 5 Jan. 1977 - 4 Jul. 1980

Adrian K. Fung Aug. 1980 43 p refs (Grant DAAG29-77-G-0075) (AD-A090500; ARO-14043.10-GS) Avail: NTIS HC A03/MF A01 CSCL 17/9

The objective is to develop theoretical radar backscatter models for targets needed for radar simulation. In particular, vegetation covered terrain has been given special attention. The models should provide polarization, frequency and angular variations of the radar backscattering coefficient which is an input parameter to the equation governing the graytone level of radar images. Theoretically, scattering from a natural terrain such as a vegetation canopy over soil comes from three processes: (a) volume scattering from the vegetation, (b) surface scattering from the underlying soil and (c) combined volume and surface scattering due to scattered waves which have interacted with both soil and vegetation before returning to radar. Results summarized in this report deal mainly with improvement and new findings in (a) and (b); an attempt to account for (c) has been carried out for an emission model. GRA

N81-12537# Thomson-CSF, Paris (France). Dept. Espace Satellites.

PHASE A STUDY OF SAR FOR THE EUROPEAN REMOTE SENSING PROGRAMME: ADDITIONAL STUDIES. EXECUTIVE SUMMARY Final Report

23 Jun. 1980 17 p Prepared in cooperation with Dornier System, Friedrichshafen, West Germany (Contract ESA-4226/80/F/CG(SC)) (ESA-CR(P)-1375) Avail: NTIS HC A02/MF A01

Modifications or improvements of a synthetic aperture radar remote sensing satellite are discussed. Derivation of radar

performances at non-optical incidence angles in environment research satellite orbit, performance calculations at different incident angles in shuttle orbit, consequences on the mean RF power for improved gray level resolution, absolute and relative accuracies on ground reflectivity estimate, and antenna tilting configuration and mechanism concepts are considered.

Author (ESA)

N81-13583# International Geophysical Year World Data Center A, Boulder, Colo. National Geophysical and Solar-Terrestrial Data Center.

THE ALASKA IMS MERIDIAN CHAIN: MAGNETIC VARIATIONS Progress Report, 9 Mar. - 27 Apr. 1978

H. W. Kroehl, G. P. Kosinski, S.-I. Akasofu, G. J. Romick, C. E. Campbell, G. K. Corrick, C. E. Hornback, and A. M. Gray World Data Center A for Solar-Terrestrial Physics. Jun. 1980 116 p refs Prepared in cooperation with Alaska Univ., Fairbanks (PB80-213820; UAG-75; NOAA-80071401) Avail: NTIS HC A06/MF A01 CSCL 04A

In support of the coordination aspects of the international Magnetospheric Study, the U.S. supported geomagnetic observations program of installing magnetometers, radio transmitters (for communications with SMS/GOES satellites) and/or magnetic tape recorders at 28 sites to complement/upgrade existing networks and facilities. The availability of data is indicated and the daily magnetic variations along the Alaska Chain and average magnetic variations along the Alaska Chain are charted. The appendix presents daily stack and polar plots of Alaska Chain magnetic variations (9 March-27 April 1978). GRA

N81-14382# SRI International Corp., Menlo Park, Calif. Atmospheric Science Center.

LIDAR OBSERVATIONS AT 0.7 MICROMETERS AND 10.6 MICROMETERS WAVELENGTHS DURING SMOKE WEEK 2 Final Report, 11 Oct. 1976 - 10 Oct. 1980

Edward E. Uthe Oct. 1980 88 p refs (Contract DAAG29-77-C-0001; SRI Proj. 5862) (AD-A091561; ARO-13833.5-GS) Avail: NTIS HC A05/MF A01 CSCL 17/8

A 10.6 micrometer wavelength lidar and a 0.7 micrometer wavelength lidar (Mark 4) were operated to observe smoke and dust clouds. The lidars observed cloud backscatter along horizontal parts that were nearly coincident with those observed by visible and infrared transmissometers operated by the Dugway Proving Ground. The lidar observed paths were terminated with a passive reflector so that time-dependent transmission over the lidar-to-target path could be evaluated from lidar observed target returns. Backscatter signatures for both lidars were digitized and recorded on magnetic tape using the Mark 4 lidar data processing system. Recorded lidar data were used to generate intensity-modulated TV displays depicting cloud structure along lidar observed paths as a function of time. These displays were used to choose sixteen Smoke Week 2 trials for quantitative analysis in terms of cloud attenuation and path-integrated backscattering. GRA

N81-14383# Naval Research Lab., Washington, D. C. SEASAT ALTIMETER ATMOSPHERIC RANGE CORRECTION Final Report

James P. Hollinger 25 Sep. 1980 27 p refs (AFOSR MIPR-HM0050-651; WR59553000) (AD-A091504; NRL-MR-4342) Avail: NTIS HC A03/MF A01 CSCL 20/14

This report describes the development and validation of the wet term of the atmospheric range correction for the SEASAT altimeter by the Naval Research Laboratory as part of its contribution to the WAFER 82 Sub-Working Group on Acquisition and Exploitation of SEASAT Altimeter Data. The algorithm uses antenna temperatures from the SEASAT Scanning Multichannel Microwave Radiometer (SMMR). It was developed by Macmillan M. Wisler at NRL using an optimal linear estimator, a theoretical-empirical atmospheric-ocean model and a statistical description of the environment. The algorithm tests were performed by the JPL SMMR Evaluation Task Group by comparing the range correction derived from the algorithm with the range correction calculated using radiosonde water vapor measurements from the

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islands of Bermuda and Kwajalein. The data used for the comparison were taken from eight different orbits during 13-30 September 1978. The wet term range correction varied from 19 to 42 centimeters. Apart from a relatively unimportant systematic bias, which is easily and accurately removed, the algorithm and radiosonde range corrections agreed very well with an RMS deviation of + or - 2.0 centimeters. Improved calibration and antenna pattern corrections of SMMR data and greater radiometric accuracy of future passive microwave systems along with further algorithm development undoubtedly will allow improved accuracy in determination of the range correction. GRA

N81-14578# Helsinki Univ. of Technology, Otaniemi (Finland).
Radio Lab.

MICROWAVE SIGNATURES OF SNOW MEASURED IN FINLAND

Martti Tiuri, Martti Hallikainen, Pekka Jakkula, and Henrik Schultz
1978 12 p refs
(Rept-S-109; ISBN-951-751-357-7) Avail: NTIS
HC A02/MF A01

Radiometry of ground covered by snow was started in Finland. Two radiometers, operating at 4.8 GHz and at 36.8 GHz, were used for brightness temperature measurements under typical winter and spring conditions in 1978. Results show that the brightness temperature at 36.8 GHz is sensitive to surface wetness, whereas at 4.8 GHz, the inpack properties of snow determine the brightness temperature. ESA

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Includes economic analysis.

A81-12051 # The Global Atmospheric Aerosol Radiation Experiment (Global'nyi aerazol'no-radiatsionnyi eksperiment). K. Ia. Kondrat'ev, V. I. Binenko, L. R. Dmitrieva-Arrago, N. E. Ter-Markariants, V. F. Zhvalev, V. A. Ivanov, and M. A. Prokof'ev (Glavnaia Geofizicheskaiia Observatoriia, Pulkovo, USSR). *Meteorologiya i Gidrologiya*, Sept. 1980, p. 5-11. 16 refs. In Russian.

The comprehensive program and the scientific objectives of the Global Atmospheric Aerosol Radiation Experiment (GAAREX) are presented. First results of GAAREX field studies performed in 1977-1979 are discussed, and the implementation of the 'Desert', 'Cloud', and 'Volcano' projects is considered. B.J.

A81-13378 * # The Earth Radiation Budget Experiment /ERBE/ - An overview. B. R. Barkstrom and J. B. Hall, Jr. (NASA, Langley Research Center, Hampton, Va.). In: Sensor Systems for the 80's Conference, Colorado Springs, Colo., December 2-4, 1980, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 180-186. (AIAA 80-1951)

An overview of the Earth Radiation Budget Experiment (ERBE) is presented along with a brief history relative to the evolution of the ERBE science measurement requirements. A description of the ERBE instrument is presented which includes both the non-scanner and scanner instrument packages. In addition, ERBE science investigations are summarized. The ERBE, to be flown on a three-satellite mission in the 1980's will, for the first time, provide radiation measurements with sufficient spatial and temporal resolution to determine the monthly average radiation budget on regional, zonal, and global scales and the diurnal variation on regional and monthly scales. (Author)

A81-18147 Project Gametag - An overview. D. D. Davis (Georgia Institute of Technology, Atlanta, Ga.). *Journal of Geophysical Research*, vol. 85, Dec. 20, 1980, p. 7285-7292. 7 refs. NSF-supported research.

Presented in this first paper of the Gametag series is an overview of the Gametag program. This presentation is intended to provide the reader with background information about several of the important characteristics of the program. These include (1) the sampling strategy and general philosophy of the program; (2) the field-sampling track; (3) the nature of the sampling platform; (4) a listing of instruments and measurements recorded; (5) Gametag data-archiving procedures; and (6) a listing of participating institutions, scientific team members, and principal investigators. (Author)

A81-18278 The German Atlas Program - Aerial cameras in space application. G. Konecny (Hannover, Universität, Hanover, West Germany), T. Miski (ERNO Raumfahrttechnik GmbH, Bremen, West Germany), and M. Schroeder (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Optoelektronik, Oberpfaffenhofen, West Germany). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-B-94*. 18 p.

Actual topographic maps are important tools for planning and the management of natural resources and socioeconomic environment. The global demand is roughly served by a map at a scale of 1:50,000. According to UN surveys the current mapping status for these medium scales does not even cover 25% of the global demand. This demand cannot be satisfied by the conventional land survey techniques in less than one century, and even the aerial survey methods in the last decades were not sufficient to speed up the progress of map production. Therefore, the mapping community looks forward to the use of space photographs to speed up the map

production of scales of 1:50,000 to 1:250,000. The objectives of the Atlas Program sponsored by the Federal Ministry of Research and Technology is to contribute to the worldwide mapping demand by means of high resolution space photographs taken with a photogrammetric camera on large film format. The paper discusses demand and requirements for cartographic products and outlines the Atlas program. (Author)

A81-18420 Economic benefit derived from use of satellite information. K. Tsuchiya, Y. Yamada, N. Ohono (National Space Development Agency of Japan, Tokyo, Japan), Y. Miki (Science and Technology Agency, Tokyo, Japan), H. Ochiai (Toba National Merchant Marine College, Toba, Japan), and A. Tani (Mitsubishi Research Institute, Japan). *International Astronautical Federation, International Astronautical Congress, 31st, Tokyo, Japan, Sept. 22-28, 1980, Paper 80-IAA-43*. 10 p. 6 refs.

An attempt is made to estimate the economic benefit derived from use of satellite information on a national scale. On the average it is estimated that 10% of conventional observation in research projects of various national organizations can be replaced with satellite observation. For example, 10-20% of total fuel consumption can be saved in the offshore fishing industry, while in the far sea fishing industry the amount of saving is estimated to be approximately 10%, provided information effective for searching the fishing field is supplied to fishermen in proper time. A fairly large amount of benefit can be obtained in exploration of natural resources, cereals yield prediction, and fisheries industries in general. (Author)

N81-11440*# National Aeronautics and Space Administration, Washington, D. C.

SOURCES FOR LANDSAT ASSISTANCE AND SERVICES.

MODULE U-6

Jan. 1980 41 p

(NASA-TM-80936) Avail: NTIS HC A03/MF A01 CSCL 05B

Directories of academic and commercial sources to assist the potential users of LANDSAT data and products are presented. In addition, points of contact for federal and state agencies are provided. L.F.M.

N81-12126# Finnish National Committee of COSPAR, Otaniemi. **SPACE ACTIVITIES IN FINLAND IN 1979 Annual Report** M. Tiuri, ed. and S. Urpo, ed. 1979 10 p refs

Avail: NTIS HC A02/MF A01

Space applications programs included remote sensing of Earth resources using LANDSAT. Forestry surveys, smallscale land use mapping and classification, and image enhancement for visual interpretation are mentioned. Daily use was made of automatic picture transmission (APT) photographs and infrared pictures from U.S. operational satellites. Communications activities include troposphere scintillation studies using INTELSAT 4, propagation experiments using SIRIO and OTS satellites, and use of APT pictures for ice surveys. The location and instrumentation of Finnish geophysical stations are shown and ionosphere and magnetosphere research outlined. Satellite geodesy activities included laser ranging of LAGEOS, GEOS-1, GEOS-3, and Starlette. Author (ESA)

N81-12127# Centre National d'Etudes Spatiales, Paris (France). **FRENCH SPACE PROGRAMS FOR 1979 [PROGRAMME SPATIAL FRANCAIS]**

1979 128 p refs In FRENCH Presented at 23rd COSPAR Meeting, Budapest, 2-14 Jun. 1980 Prepared in cooperation with Comite National Francais de Recherches dans l'Espace (CNFRE)

Avail: NTIS HC A07/MF A01

The organization of the French program is described together with the way in which different tasks are assigned. The main sectors of activity are: astronomy and solar physics; the solar system; physics of the ionosphere and the magnetosphere; aeronomy; meteorology; Earth resources; and space geodesy and geodynamics, space biology and medicine. The specific activities pursued by the different laboratories, organizations, and

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working groups in the framework of these sectors of activity are described. Author (ESA)

N81-12492*# Vermont Univ., Burlington. School of Natural Resources.

REMOTE SENSING PROGRAM ACTIVITY REPORT Progress Report, 1 Jun. 1978 - 31 May 1980

Roy A. Whitmore, Jr., Principal Investigator, Hugo H. John, and Gary S. Smith 31 May 1980 11 p ERTS (Grant NsG-7453)

(E81-10015; NASA-CR-163532) Avail: NTIS HC A02/MF A01 CSCL 05A

Major accomplishments in an effort to encourage investigation and technology transfer for practical applications of remote sensing to solve Earth resources problems in Vermont include: (1) acquisition, installation, and operation of the ORSER digital processing system on the University's IBM 3031 computer; (2) acquisition and operation of printing and CRT computer terminals for remote access to computer facilities for analysis of remotely sensed digital tape; (3) acquisition and operation of optical interpretation and image transfer devices for use with all types of aerial photography; (4) development of audio visual and other training materials for use in presentations, workshops, and short courses to enhance technology transfer; and (5) cooperation government agencies in demonstration projects to show the feasibility of using remote sensing technology.

A.R.H.

N81-12956# Office of Management and Budget, Washington, D. C.

AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, 1979 ACTIVITIES

1979 119 p

Avail: NTIS HC A06/MF A01

Developments in communications, Earth resources sensing, space transportation, and space energy are summarized and the activities of NASA and the Departments of Commerce, Interior, Defense, Transportation, and Energy are delineated. Budgets for space ventures and aeronautics are tabulated. The White House fact sheet on the management of the U.S. civilian remote sensing is included along with the text of the United Nations Moon Treaty and an analysis and commentary by the Department of State. A.R.H.

N81-13395# European Space Agency, Paris (France). Dept. des Applications Futures.

THE EUROPEAN REMOTE SENSING PROGRAM [LE PROGRAMME EUROPEEN DE TELEDETECTION]

G. Duchossois *In its* Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 53-63 refs In FRENCH

Avail: NTIS HC A07/MF A01

A summary of the European remote sensing program as defined by ESA is presented. The European regional objectives, Earth resources applications and development aid programs are summarized. The Earthnet program and Spacelab experiments are discussed. The future European satellite systems mission objectives and measurement requirements are examined.

Author (ESA)

N81-13422*# Environmental Research Inst. of Michigan, Ann Arbor.

LANDSAT TECHNOLOGY TRANSFER TO THE PRIVATE AND PUBLIC SECTORS THROUGH COMMUNITY COLLEGES AND OTHER LOCALLY AVAILABLE INSTITUTIONS Quarterly Progress Report, May - Aug. 1980

Robert H. Rogers, Principal Investigator Sep. 1980 68 p refs ERTS

(Contract NASw-3308)

(E81-10066; NASA-CR-163773; ERIM-147200-10-P; QPR:2) Avail: NTIS HC A04/MF A01 CSCL 05A

The results achieved during the first eight months of a program to transfer LANDSAT technology to practicing professionals in the private and public sectors (grass roots) through community

colleges and other locally available institutions are reported. The approach offers hands-on interactive analysis training and demonstrations through the use of color desktop computer terminals communicating with a host computer by telephone lines. The features of the terminals and associated training materials are reviewed together with plans for their use in training and demonstration projects. E.D.K.

N81-13452# Metrics, Inc., Atlanta, Ga.

OVERVIEW OF CONFERENCE WITH NON-FEDERAL USERS ON US OPERATIONAL LAND REMOTE SENSING SATELLITE PROGRAM

Apr. 1980 100 p Conf. held in Seattle, 14 Mar. 1980; in Chicago, 17 Mar. 1980; in Tallahassee, 21 Mar. 1980; in Washington, D.C., 25 Mar. 1980; and in Albuquerque, N. Mex., 28 Mar. 1980 Sponsored by NOAA

(PB80-219736; NOAA-80071501) Avail: NTIS HC A05/MF A01 CSCL 04B

The decision process leading up to Presidential Directive NSC/54, the operational role that NOAA/NESS has had with regard to weather satellites, and the history of NASA's Landsat program were reviewed. The role of NOAA as the management agency for all operational civil remote sensing satellite programs is examined as well as the planning process which will enable NOAA to take responsibility for the operational land remote sensing satellite program later in this decade. The results from 15 user working group indicate that NOAA's perception of user needs was generally correct; that spatial resolution requirements are grouped into three categories (i.e., 10, 30, 40, and 80 meters) and that the current MSS and TM bands satisfy most spectral requirements in the visible and solar infrared regions of the spectrum. Additionally, the groups recommended that: (1) the private sector have some formal input to NOAA's planning process; (2) technology transfer and training activities should continue; (3) data should be archived as long as possible; and (4) a quick look capability is essential for an operational system. GRA

N81-14375# Research Inst. of National Defence, Stockholm (Sweden).

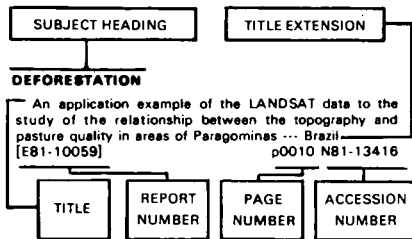
EARTH RESOURCES

Eskil Block Jan. 1980 90 p refs

(FOA-C-10148-M3) Avail: NTIS HC A05/MF A01

Basic scientific knowledge (dating methods and instruments, understanding of physical and biological systems) must be used extensively when attacking any large resources problem. However, the world is so politically constituted that the use of scientific knowledge may have increased opportunities to waste Earth resources and create new conflicts. A research policy must be established which disseminates results of scientific discoveries and promotes useful applications of the techniques developed. Advances in understanding of land and sea, air and weather, and our place in the solar system are summarized. The implementation and controversies of research policies in Sweden and elsewhere are considered. A.R.H.

Typical Subject Index Listing



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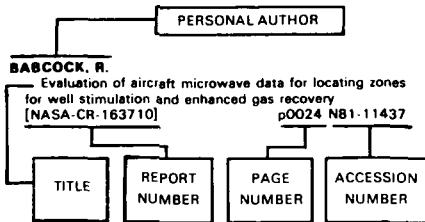
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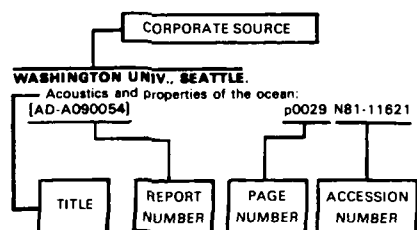
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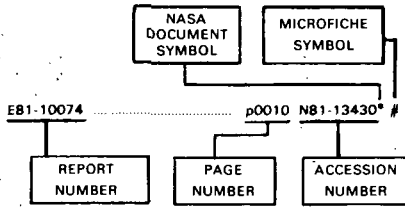
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