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Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041 (31)
October 1981

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Accession numbers cited in this Supplement fall within the following range

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

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NASA SP-7041(31)

EARTH RESOURCES

A Continuing Bibliography
With Indexes
Issue 31

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

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

NASA Scientific and Technical Information Branch 1981
National Aeronautics and Space Administration
Washington, DC

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INTRODUCTION

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

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

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

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

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

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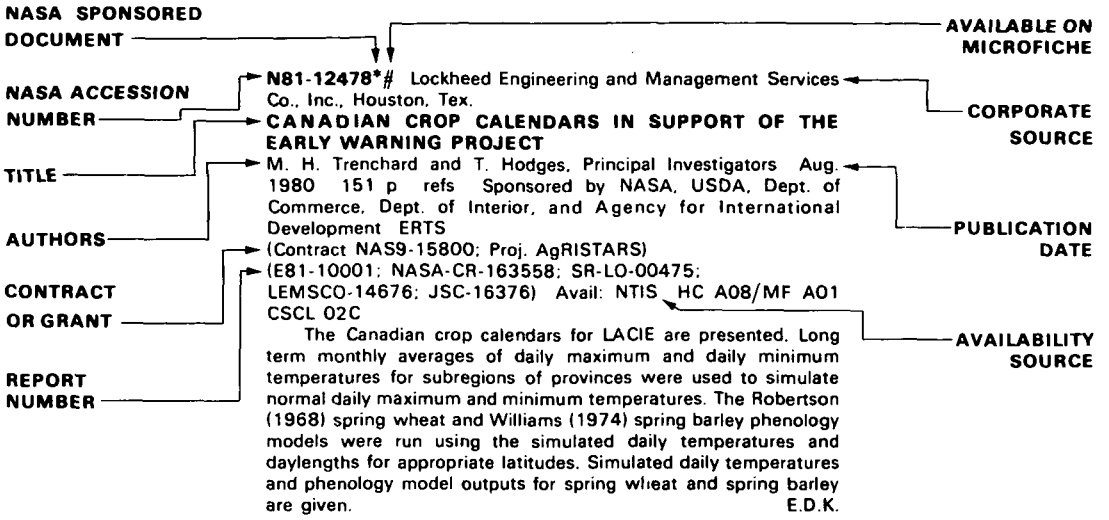

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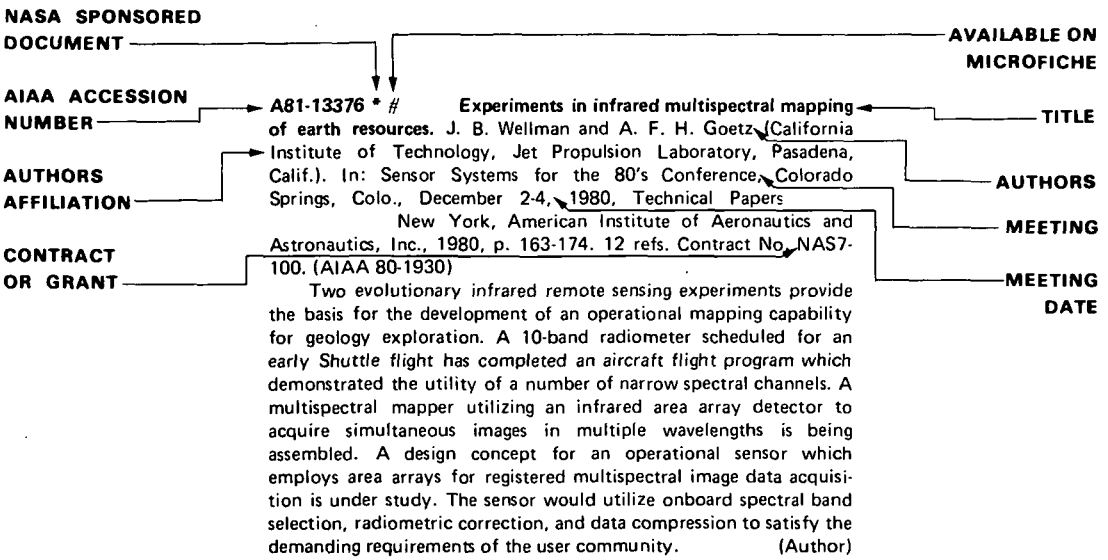

EARTH RESOURCES

A Continuing Bibliography (Issue 31)

OCTOBER 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.

A81-30567 # **Determination of snow depth on winter crop fields from aerial gamma-ray mapping data (Opredelenie vysoty snega na poliakh s posevami ozimykh kul'tur po rezul'tatam samoletnykh gamma-s'emok snezhnogo pokrova).** G. V. Shilin (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennogo Mashinostroeniia, Moscow, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 77-93. 13 refs. In Russian.

A81-33462 * **Crop identification and leaf area index calculations with Landsat multitemporal data.** J. E. Chance (Pan American University, Edinburg, Tex.). *International Journal of Remote Sensing,* vol. 2, Jan.-Mar. 1981, p. 1-14. 18 refs. Grant No. NsG-9033.

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

A81-33463 * **Stratification of natural vegetation for forest and rangeland inventory using Landsat digital imagery and collateral data.** A. H. Strahler (California, University, Santa Barbara, Calif.). *International Journal of Remote Sensing,* vol. 2, Jan.-Mar. 1981, p. 15-41. 25 refs. Research supported by thy U.S. Forest Service and University of California; Contracts No. NAS9-15509; No. NAS7-100.

A81-33464 **Multidate spectral reflectance as predictors of yield in water stressed wheat and barley.** P. J. Pinter, Jr., R. D. Jackson, S. B. Idso, and R. J. Reginato (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *International Journal of Remote Sensing,* vol. 2, Jan.-Mar. 1981, p. 43-48. 15 refs.

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

A81-33465 * **A comparison of two methods for classifying forestland.** R. F. Nelson (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). *International Journal of Remote Sensing,* vol. 2, Jan.-Mar. 1981, p. 49-60. 17 refs. Contract No. NAS9-15508.

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

A81-34472 # **Non-technical problems in the evolution of a renewable resource information system.** A. C. Hamilton and I. K. Isaacs (New Brunswick, University, Fredericton, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 313-322. 6 refs.

The nontechnical problems of designers and implementors of a renewable-resource information system for the Province of New Brunswick is presented. Hamilton's (1978) conceptual model of an agricultural information system, which contains five data bases and shows the major components from sensors, to data bases, to the decision process, is considered. Applications include regional analyses requiring large amounts of data and sophisticated procedures, and decision making with respect to individual farms, in which relevant data for each farm could be retrieved, merged appropriately, and presented in the format most useful to the farmer and to those who make decisions about the individual farms. An examination of the status of the data base is presented, and it reveals that it is most urgent that an inventory be made and that data be collected for the agricultural data base. The New Brunswick 1979 farm land inventory, designed for immediate utilization and as baseline data for a long-term monitoring program, is described, and comments on the status of the system for the Grand Falls area are given. K.S.

A81-34502 # ***On some aspects and results of rectification* for command area development.** H. K. Sinha (Survey of India, Pilot Map Production Plant, Hyderabad, India). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 645-654. 6 refs.

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

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

marks. M. Antrop (Gent, Rijksuniversiteit, Ghent, Belgium). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 15-23. 5 refs.

A81-34519 * # Spectral properties of agricultural crops and soils measured from space, aerial, field and laboratory sensors. M. E. Bauer, V. C. Vanderbilt, B. F. Robinson, and C. S. T. Daughtry (Purdue University, West Lafayette, Ind.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 56-73. 36 refs. Contract No. NAS9-15466.

It is pointed out that in order to develop the full potential of multispectral measurements acquired from satellite or aircraft sensors to monitor, map, and inventory agricultural resources, increased knowledge and understanding of the spectral properties of crops and soils are needed. The present state of knowledge is reviewed, emphasizing current investigations of the multispectral reflectance characteristics of crops and soils as measured from laboratory, field, aerial, and satellite sensor systems. The relationships of important biological and physical characteristics to their spectral properties of crops and soils are discussed. Future research needs are also indicated. C.R.

A81-34522 # Differences in the spectral characteristics between healthy and diseased crops determined for sugar beets and winter barley. B - In situ measurements with spectroradiometers. H.-J. Boehnel, W. Fischer, G. Knoll (Fraunhofer-Institut für physikalische Messtechnik, Freiburg im Breisgau, West Germany), and A. Kadro (Freiburg, Universität, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 92-101. Research supported by the Deutsche Forschungsgemeinschaft and Commission of the European Communities.

It is noted that radiometric measurements from 0.5 to 1.1 microns and from 1.5 to 2.4 microns were conducted on sugar beets during campaigns in July and September 1979 at three test sites in Italy showing infestations by nematodes, virus (rizomania), and fungus (cercospora leaf spot), respectively. Measurements of barley from 0.5 to 1.1 microns were carried out in 1979 at a German test site consisting of a field plot treated against mildew and fungus and a non-treated reference plot at intervals of two weeks during the last two months before the harvest. The spectral reflectance factors are calculated and compared with the corresponding values determined from measurements in the laboratory and with a multispectral scanner. C.R.

A81-34523 # The dependence of the spectral signature of sugar beets on the observation level and the reflection geometry - In situ measurements with spectroradiometers. H.-J. Boehnel, W. Fischer, and G. Knoll (Fraunhofer-Institut für physikalische Messtechnik, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 102-111. 5 refs. Research supported by the Deutsche Forschungsgemeinschaft.

A joint experiment carried out in September 1979 to determine the spectral reflection characteristics of sugar beets by (nearly) simultaneous measurements with a spectroradiometer and an airborne multispectral scanner in situ and with a spectrophotometer in the laboratory is discussed. It is noted that the measurements with the spectroradiometer were made in the spectral ranges from 0.5 to 1.1 microns and from 1.5 to 2.4 microns with different zenith angles (0, 15, 30, and 45 deg) and two aximuthal directions differing by 180 deg. The spectral reflectance factors are calculated and compared with the corresponding values determined from the MSS data and the laboratory measurements of leaf reflectance. C.R.

A81-34524 # Investigations regarding the classification of tree damages with the aid of colorimeters (Untersuchungen zur Klassifizierung von Baumschäden mit Farbmessgeräten). M. Cagirici (Gartenamt, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 112-121. 14 refs. In German.

A macrodensitometer and a microdensitometer with a minicomputer were used in the considered investigation. A computer program was written for conducting a comparison of the two instruments. The program provides the transmission values for the densities which are measured in connection with the red, green, and blue filters. On the basis of the transmission values, the program calculates percentage values regarding the color composition. It was found that the values concerning the color obtained for the same object and the same imagery material are almost the same for both instruments. G.R.

A81-34526 # The Brazilian forest cover monitoring programme. C. M. R. Carneiro (Santa Maria, Universidade Federal, Santa Maria; Instituto Brasileiro de Desenvolvimento Florestal, Brasília, Brazil). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 132-141. 5 refs.

An overview is given of the Brazilian forest cover monitoring activities which are based on the visual and computer assisted interpretation of Landsat MSS data. It is noted that the activities are primarily concerned with the periodic detection, analysis, and control of all changes occurring in the Brazilian Amazon forest cover as a result of human action. Attention is also given to the control of all planted forest areas as well as to integrated (multidisciplinary) surveys of all Brazilian parks. C.R.

A81-34528 # Putting remote sensing technology to work in forest damage evaluation. W. M. Ciesla (U.S. Department of Agriculture, Forest Service, Davis, Calif.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 151-160. 16 refs.

Color and color IR aerial photographs have been used successfully for data acquisition on status and trend of a variety of pests for pest management decision making. Aspects of operational implementation are considered, taking into account data requirements, data collection, and skills required. The use of panoramic aerial photography for mapping forest damage is discussed and an example is presented to illustrate how new sensor technology can be integrated into existing programs, provided that data requirements are clearly defined, and a proper mix of technical skills are available to evaluate, demonstrate, and implement the new technology. G.R.

A81-34529 # Remote sensing technology transfer to operational use in Canadian forestry. J. Cihlar, L. C. Goodfellow, and T. T. Alfoldi (Canada Centre for Remote Sensing, Ottawa, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 161-172. 46 refs.

Significant progress in the development of applications of remotely sensed data to forest inventory and management in Canada has occurred in the last decade. The process of transferring these developments to operational use occurs through interaction of the developers of the methodologies and the potential adopters. Two primary mechanisms for promoting this type of interaction include user liaison and joint projects. Attention is given to satellite data applications, small and medium scale color aerial photography, large scale aerial photography, and technology transfer mechanisms. A cooperative forestry project in Quebec is considered along with the application of large scale photos to forest inventory in Alberta, and

the use of satellite data for updating Nova Scotia forest inventory. G.R.

A81-34537 # **Role of remote sensing in the New Brunswick farm land inventory project.** E. E. Derenyi (New Brunswick, University, Fredericton, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 256-264. 7 refs.

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

A81-34539 # **Automatization of space photo data interpretation in forest resources assessment.** R. I. Elman and L. A. Kuzenkov (Vsesoiuznoe Ob'edinenie Lesproekt, Moscow, USSR). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 273-280.

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

A81-34543 * # **Computer classified Landsat data used as a forest stratifier.** L. Fox, III and K. E. Mayer (Humboldt State University, Arcata, Calif.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 308-315. 12 refs. Research supported by the U.S. Forest Service, McIntire Stennis Forestry Research Program, and NASA.

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

A81-34546 # **Environmental analysis by information processing applied to Landsat data - The example of soil moisture (Analyse de l'environnement par traitement informatique des données Landsat - Un exemple: l'humidité des sols).** M. C. Girard (Institut National de la Recherche Agronomique, Thiverval-Grignon, Yvelines and Paris, France) and J.-P. Rogala. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 335-344. 9 refs. In French.

A81-34548 # **Analysis of the reflection indicatrices of barley and wheat - Possibilities for stereoradiometry (Analyse des indicatrices de réflexion de l'orge et du blé - Possibilités de la stéréoradiométrie).** G. Guyot, P. Malet, and F. Baret (Institut National de la Recherche Agronomique, Montfavet, Vaucluse, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 372-381. 17 refs. In French.

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

A81-34549 # **Analysis of factors acting on the variability of spectral signatures of natural surfaces.** G. Guyot (Institut National de la Recherche Agronomique, Montfavet, Vaucluse, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 382-393. 28 refs.

The problems encountered in determining the spectral signature of such natural surfaces as bare soils and vegetation canopies are discussed. Examples are given of the order of magnitude of the spectral signature variability as a function of methodology and experimental conditions. It is shown that numerous factors act on the spectral signature variability of a natural surface. The importance of specifying the detailed characteristics of the studied surface, the conditions of measurement, and the characteristics of the instrumentation and experimental methodology is stressed. The influence of various factors on the determination of spectral signature is considered, among them the zenithal view angle, sun elevation, nebulosity, wind speed, and soil optical properties. C.R.

A81-34553 # **Computer processing of satellite data for assessing agricultural, forest, and rangeland resources.** R. M. Hoffer and P. H. Swain (Purdue University, West Lafayette, Ind.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 437-446. 11 refs.

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

A81-34554 # **Evaluation of satellite imagery for investigations in the field of soil science/land use, taking into account selected examples in Africa (Auswertung von Satellitenbildern für Untersuchungen im Bereich Bodenkunde/Landnutzung an ausgewählten Beispielen in Afrika).** R. Hoffmann, W. Kantor, and W. Kruck (Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the

International Congress for Photogrammetry, 1980, p. 447-456. 5 refs. In German.

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

A81-34556 # Spectral signatures of field layers and canopies of pine forest stands in Northern Finland. S. Jaakkola and P. Saukkola (Technical Research Centre of Finland, Esbo, Finland). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 467-476.

Spectral signatures of Scotch pine stands are determined in Northern Finland under both laboratory and field conditions using a telespectroradiometer system. Surface vegetation samples are measured both in the laboratory and outdoors. The samples are taken from the ground and field layers of mature Scotch pine stands. The objective is to study the effect of surface layer on the spectral radiation reflected from timber stands. The spectral signatures of pine forests representing one site type but variable development classes are then measured from a helicopter in order to acquire spectral knowledge for numerical timber type classification. The measuring conditions, techniques, and results are reported. The resulting spectral signatures are expressed numerically and shown graphically. Also reported is the statistical significance of the difference between targets. C.R.

A81-34557 # Observations regarding the spectral reflectance characteristics of pine and fir stands (Beobachtungen über das spektrale Reflexionsverhalten von Kiefern- und Fichtenbeständen). A. Kadro and G. Hildebrandt (Freiburg, Universität, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 487-496. 8 refs. In German.

The considered measurements were performed with a spectroradiometer placed on an 18-m pole. Continuous measurements were conducted in the spectral range from 400 to 1100 nm. The spectral conical reflection coefficient was calculated and the directional dependence of reflectance was studied. No basic differences could be observed between values from different types of trees. There were no fundamental differences concerning the curves obtained for the reflection coefficient, taking into account differing radiation angles and directions of reflectance. G.R.

A81-34558 International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8, Commission 7. Edited by F. Ackermann (Stuttgart, Universität, Stuttgart, West Germany). Hamburg, Committee of the International Congress for Photogrammetry, 1980. 490 p. In English, German, and French.

A brief description is presented of remote sensing development in Poland in the period from 1976 to 1980, and the main aims of the Polish Centre of Remote Sensing are examined. Attention is given to studies of the yield of cereal crops, the application of principal component analysis to soil survey in central Spain, the use of a digital terrain model in digital multispectral analysis, aerial data in forecasting the urban development and traffic of Tripoli, the photographic detection and quantification of urban tree stress, the use of aerial thermography in urban areas, the calculation of reflection coefficients on the basis of multispectral image data, the application of aerial photography in the Swiss national forest inventory, photo interpretation of the vegetation through densitometry, yield estimates for corn crop through colored infrared film, regional interpretation of radar imagery, modelling tree damage-type patterns for photo interpretation of SO2 injury, the application of remote sensing methods at macroscopic and microscopic levels in plant pathology, and the evaluation of radar images by visual methods. G.R.

A81-34559 # Yield estimates for cereal crops on the basis of aerial photographs (Abschätzung des Ernteertrages von Getreide aus Luftaufnahmen). E. Krauth (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Oberpfaffenhofen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 503-510. 6 refs. In German.

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

A81-34561 # Application of principal component analysis to soil survey in central Spain. J. L. Labrandero (Instituto de Edafología y Biología Vegetal, Madrid, Spain) and F. Palou (Universidad Autónoma de Madrid and IBM, Centro de Investigación, Madrid, Spain). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 519-529. 9 refs.

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

A81-34568 # Application of aerial photography in the Swiss National Forest Inventory /NFI/. F. Mahrer (Zürich, Eidgenössische Technische Hochschule, Birmensdorf, Switzerland). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 589-599. 7 refs.

A81-34570 # **Photo interpretation of the vegetation through densitometry.** D. Marchetti (Cerrado Agricultural Research Center, Brasilia, Brazil) and G. J. Garcia (Botucatu, Faculdade de Agronomia, São Paulo, Brazil). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 608-613. 9 refs.

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

A81-34571 # **Yield estimates for corn crop through the colored infrared film.** D. Marchetti (Cerrado Agricultural Research Center, Brasília, Brazil) and G. J. Garcia (Botucatu, Faculdade de Agronomia, São Paulo, Brazil). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 614-622. 16 refs.

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

A81-34577 # **Modelling tree damage-type patterns for photo interpretation of SO2 injury.** P. A. Murtha (British Columbia, University, Vancouver, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 667-679. 22 refs.

A81-34579 # **Application of remote sensing methods at macroscopic and microscopic levels in plant pathology.** H.-E. Nilsson (Sveriges Lantbruksuniversitet, Uppsala, Sweden). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 691-699. 6 refs.

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

A81-34580 # **Evaluation of radar images by means of visual methods (Auswertung von Radarbildern mit visuellen Methoden).** J. Nithack (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 700-708. In German.

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

A81-34582 # **Mapping polar vegetation at Spitsbergen by use of Landsat.** H. A. Odegaard, R. Ottesen (IBM, Oslo, Norway), and N. Oritsland (Norsk Polarinstitutt, Oslo, Norway). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 723-733. 8 refs.

A81-34586 # **Desertification - Generating hypotheses from aerial photographs.** L. E. Pla (Coro, Instituto Universitario de Tecnología, Coro, Venezuela). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 772-782. 17 refs.

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

A81-34587 # **A two-phase sample design for large-area forest inventories, using aerial photographs 1:50,000, and supplementary ground measurements (Ein zweiphasiges Stichprobensystem für forstliche Grossraum-Inventuren, gestützt auf IRC-Luftbilder 1:50,000 und ergänzende terrestrische Messungen).** J. Schade (Freiburg, Universität, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 794-803. 10 refs. In German.

A multiphase sample-design system was found to provide a suitable cost-effective approach for solving problems encountered in connection with large-area forest inventories in Central Europe. A complete set of informative forestry data could be assigned to each point of a grid structure covering the aerial photographs. The

product of crown cover (in percent) and age provided the best aerial-photograph parameter for estimating available supplies of various types of wood. The corresponding correlation values for the principal types of wood were about 0.9. Attention is given to the interpretation of the aerial photographs, details concerning the ground samples, aspects of data processing, and relations between the variables. G.R.

A81-34588 # A sampling technique to assess site, stand, and damage characteristics of pine forests on CIR aerial photographs. H. U. Scherrer, H. Flühler, F. Mahrer, and O. U. Bräker (Zürich, Eidgenössische Technische Hochschule, Birmensdorf, Switzerland). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 804-811.

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

A81-34594 # Use of Landsat imagery for forest management mapping - A case study of the 'Kobernausserwald' in Austria. G. S. Smit (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 863-873.

A81-34597 # Forest remote sensing system. V. I. Sukhikh (Vsesoiuznoe Ob'edinenie Lesproekt, Moscow, USSR). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 894-899.

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

A81-34598 # Study on plant damage caused by Mt. Usu eruption using remote sensing. S. Takahata and K. Miyama. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 907-915.

A81-34599 # Soil salinisation in semi-arid regions. A. E. Thies and R. P. Winter. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 916-923. 6 refs.

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

A81-34601 * # Simulated response of a multispectral scanner over wheat as a function of wavelength and view/illumination directions. V. C. Vanderbilt, B. F. Robinson, L. L. Biehl, M. E. Bauer, and A. S. Vanderbilt (Purdue University, West Lafayette, Ind.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 942-952. 18 refs. Contracts No. NAS9-14016; No. NAS9-14970; No. NAS9-15466.

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

A81-34605 # Classification of damaged vegetation using multispectral scanner images (Erfahrungen bei der Klassifikation geschädigter Vegetation mit Hilfe von multispektralen Scannerbildern). K. L. Zirm (Österreichisches Bundesinstitut für Gesundheitswesen, Vienna, Austria). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 979-987. 8 refs. In German.

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

A81-34627 # Remote sensing techniques applied to sugar beet diseases in Germany and Italy - Introduction to the results of a European project. A. Berg (Commission of the European Communities, Joint Research Centre, Ispra, Italy). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 457-462. 10 refs.

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

Valery (Institut National de la Recherche Argonomique, Versailles, Yvelines, France), and R. Perrin (Institut National de la Recherche Agronomique, Champenoux, Meurthe-et-Moselle, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 463-472. 7 refs. In French.

A81-34631 # **Differences in the spectral characteristics between healthy and diseased crops determined for sugar beet and winter barley - Definition of the ground truth data on the common sugar beet test sites /Bologna, Italy/ and description of the results acquired in the thermal infrared range.** C. de Carolis, P. Amodeo (Milano, Università, Milan, Italy), C. Cerato, G. Ciafardini (Istituto Sperimentale per le Colture Industriali, Bologna, Italy), and R. Tacconi (Osservatorio per le Malattie delle Piante, Bologna, Italy). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 486-502.

A81-34634 # **Fixed-base photogrammetry with wing-tip mounted cameras - Calibration procedure and forestry application.** I. Hadem (Norges Tekniske Hogskole, Trondheim, Norway) and G. Skramo (Norske Skogforsoksvesen, As, Norway). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 520-527. 7 refs.

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

A81-34637 # **Application of Landsat data for the management of forest resources.** Y. Mukai, S. Tanaka, S. Takeuchi (Remote Sensing Technology Center of Japan, Tokyo, Japan), I. Nakajima, I. Ohnuki (Forestry and Forest Products Research Institute, Kukizaki, Ibaraki, Japan), H. Watanabe, and R. Hatamura (Japan Forest Technical Association, Tokyo, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 567-579.

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

A81-34641 # **Spectral response of defoliated pine forests - Importance of tree environment (Réponse spectrale de forêts de pins défolies - Importance de l'environnement de l'arbre).** J. Riom (Institut National de la Recherche Agronomique, Cestas, Gironde, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 607-613. In French.

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

A81-34642 # **Detection of diseased pines by thermal infrared sensing /8-14 microns/ (Détection de pins malades dans l'infrarouge thermique /bande 8-14 microns/).** J. Riom (Institut National de la Recherche Agronomique, Gironde, France) and G. Guyot (Institut National de la Recherche Agronomique, Montfavet, Vaucluse, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 614-618. In French.

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

A81-34643 # **Differences in the spectral characteristics between healthy and diseased crops as determined for sugar beets and winter barley. A - Spectrophotometric measurements in the laboratory and ground truth data collection.** E. Sanwald (Hohenheim, Universität, Stuttgart, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 628-637. Research sponsored by the Deutsche Forschungsgemeinschaft.

A81-34644 # **State-of-the-art in agricultural and forest crop stress and damage detection by the use of remote sensing techniques - A critical review.** E. F. Sanwald (Hohenheim, Universität, Stuttgart, West Germany) and P.-G. Reichert (Freiburg, Universität, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 638-647. 13 refs.

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

A81-34648 # **Remote sensing and mapping of pastureland (Télédéction et cartographie des pâturages).** B. V. Vinogradov (Akademiia Nauk SSSR, Leningrad, USSR). In: International archives of photogrammetry; International Society for Photogramme-

try, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7, & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 738-747. 14 refs. In French.

Remote sensing and aerial images are used to map pastureland and to detect pasture structures and dynamics. Large-scale satellite imagery and smaller scale air images cover small-scale vegetation populations, larger scale units, local structures and ecological configurations and very large-scale regional features. Large-scale landscapes are identified showing the main types of pasture and synthesizing smaller-scale units. Changes in vegetation cover and use are detected by repeated surveys and image comparison. This monitoring allows identification of overgrazing, changes in plant composition or abandonment for economic uses or degradation and desert invasion. Ecosystem analysis based upon remotely sensed data can be used for establishing forecast maps. A systematic analysis covering 20-25 years was made for a region south of Kara-Kum (USSR) with extrapolation for the next 20-25 years. D.B.

A81-34990 * Radiative transfer theory for active remote sensing of a layer of small ellipsoidal scatterers. L. Tsang (Texas A & M University, College Station, Tex.), M. C. Kubacsi, and J. A. Kong (MIT, Cambridge, Mass.). *Radio Science,* vol. 16, May-June 1981, p. 321-329. 16 refs. NSF Grant No. ENG-78-23145; Contract No. F19628-80-C-0052; Grant No. NAG5-141.

The radiative transfer theory is applied within the Rayleigh approximation to calculate the backscattering cross section of a layer of randomly positioned and oriented small ellipsoids. The orientation of the ellipsoids is characterized by a probability density function of the Eulerian angles of rotation. The radiative transfer equations are solved by an iterative approach to first order in albedo. In the half space limit the results are identical to those obtained via the approach of Foldy's and distorted Born approximation. Numerical results of the theory are illustrated using parameters encountered in active remote sensing of vegetation layers. A distinctive characteristic is the strong depolarization shown by vertically aligned leaves. (Author)

A81-35730 # Experience with the use of space data for soil mapping in the near Baikal region and the northern Transbaikal (Opyt ispol'zovaniia kosmicheskikh materialov pri kartirovanii pochv Pribaikal'ia i Severnogo Zabaikal'ia). V. A. Kuz'min (Akademiia Nauk SSSR, Institut Geografii Sibiri i Dal'nego Vostoka, Irkutsk, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 31-35. In Russian.

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

A81-35969 # The use of spaceborne photography in agriculture (Ispol'zovanie kosmicheskikh s'emok v izyskaniiakh dlia sel'skogo khoziaistva). A. A. Zaletov, U. D. Samratov, and N. V. Sukhot'ko. *Geodeziia i Kartografiia,* Apr. 1981, p. 46-48. In Russian.

A81-35971 # Thematic forestry mapping using spaceborne photography data (Tematicheskoe lesokhoziaistvennoe kartografirovanie s ispol'zovaniem materialov kosmicheskoi s'emki). V. I. Sukhikh. *Geodeziia i Kartografiia,* Apr. 1981, p. 52-57. In Russian.

A81-36257 Spectral reflectance characteristics of agricultural crops and application to crop growth monitoring. N. J. J. Bunnik (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 21-40. 17 refs.

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

A81-36258 * Determination of growth stage from reflectance spectra of crops. S. G. Ungar and D. E. Bradley (NASA, Goddard Institute for Space Studies, New York, N.Y.). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 41-54.

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

A81-36259 * Microwave response of vegetation. F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 55-70. 24 refs. Contract No. NAS9-15421.

The radar backscatter behavior is discussed as a function of the vegetation geometrical and electrical properties. Experimental data covering the 1-18 GHz region are used to model the vegetation canopy as a water cloud, evaluate the attenuation of the canopy, and generate a vegetation clutter model describing the statistical distribution of vegetation backscatter under a wide range of environmental conditions. The use of radar in conjunction with optical sensors for crop identification is then discussed. Analysis of studies conducted to date indicates that the observation angle should be in the 50-70 deg range (from nadir) and the frequency should be higher than 8 GHz. V.L.

A81-36260 Application of HCMM satellite and airplane reflection and heat maps in agro-hydrology. G. J. A. Nieuwenhuis (Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen, Netherlands). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 71-86. 24 refs.

The feasibility of qualitative and quantitative evaluation of regional evapotranspiration from reflection and heat maps obtained by satellites is discussed. Simple relations have been found between certain reflection parameters as derived from the scanned reflection maps and the crop radiation temperature. From a combination of the reflection and the thermal behavior of crops, special hydrological conditions, e.g., drought, can be identified. Consideration is given to the TERGRA-model developed by Soer (1977) which simulates under specified meteorological and different soil water conditions the daily behavior of crop temperature as well as the components of the energy balance including the evapotranspiration rate. V.L.

A81-36261 Recognition of some crops from their reflection spectra. K. Ia. Kondrat'ev (Glavnaia Geofizicheskaia Observatoriia, Leningrad, USSR) and P. P. Fedchenko (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennoi Meteorologii, Obninsk, USSR). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 87, 88.

A81-36262 * Radar reflectivity of bare and vegetation-covered soil. F. T. Ulaby, M. C. Dobson, and G. A. Bradley (University of Kansas Center for Research, Inc., Lawrence, Kan.). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 91-104. 12 refs. Contract No. NAS9-14052.

Radar sensitivity to soil moisture content has been investigated experimentally for bare and vegetation-covered soil using detailed spectral measurements obtained by a truck-mounted radar spectrometer in the 1-8 GHz band and by airborne scatterometer observations at 1.6, 4.75, and 13.3 GHz. It is shown that radar can provide quantitative information on the soil moisture content of both bare and vegetation-covered soil. The observed soil moisture is in the form of the soil matric potential or a related quantity such as the percent of field capacity. The depth of the monitored layer varies from 1 cm for very wet soil to about 15 cm for very dry soil. V.L.

A81-36263 **Multifrequency radar measurements of soil parameters.** G. Flouzat, T. le Toan, A. Fluhr, and M. Pausader (Centre d'Etude Spatiale des Rayonnements, Toulouse, France). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 105-109. 7 refs.

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

A81-36264 **Results and conclusions from soil and vegetation reflection coefficient measurements.** H. Spiridonov, R. Kuncheva, and E. Misheva (B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia po Kosmicheski Izsledvaniia, Sofia, Bulgaria). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 111-114.

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

A81-36265 **Reflection from soil with sparse vegetation.** J. Otterman (Tel Aviv University, Tel Aviv, Israel). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 115-119.

A81-36273 **Spectral signature studies in optical region.** B. Sahai, R. R. Navalgund, N. K. Patel, and T. P. Singh (Space Applications Centre, Ahmedabad, India). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 221-224. 9 refs.

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

A81-37598 **Inclusion of a simple vegetation layer in terrain temperature models for thermal IR signature prediction.** L. K. Balick, R. K. Scoggins, and L. E. Link (U.S. Army, Environmental Laboratory, Vicksburg, Miss.). *IEEE Transactions on Geoscience and Remote Sensing,* vol. GE-19, July 1981, p. 143-152. 30 refs. DA Project 4A762730AT42; DA Project 4A762719AT40.

A time-dependent energy budget model designed to make possible the prediction of the temperature of terrain scene elements that contain a simple layer of vegetation and to diagnose the effect of vegetation on remotely sensed temperatures is discussed. It is noted that the model was developed for use as a module in conjunction with existing nonvegetated-terrain temperature models. Vegetation is assumed to be a horizontally homogeneous but porous layer partially covering a specified ground surface. Energy budgets for the foliage and the ground are evaluated separately but are interdependent. The sensitivity of the vegetation module to its input variables when used in tandem with a bare-ground model is examined and found to be most strongly dependent on the degree of foilage cover. The model results are verified against measurements made on two moderate days for a 10-cm high-grass canopy in Germany and are compared with results from a complex vegetation model. Results are highly satisfactory and similar for both models. C.R.

A81-38722 **The relationship between polarized visible light and vegetation amount.** P. Curran (Reading, University, Reading, Berks., England). *Remote Sensing of Environment,* vol. 11, May 1981, p. 87-92. 12 refs. Natural Environment Research Council Grant No. GR/3/1481.

Polarized visible light is an indicator of scene roughness; smooth surfaces polarize visible light to a greater extent than rough surfaces. On the assumption that canopy roughness is a function of vegetation amount, the relationship between polarized visible light and vegetation amount was investigated. Twelve aerial survey flights taking polarized visible light photography were made during an 18-month study. At the same time, either percent vegetation cover or dry green biomass (by harvest) were recorded for each of four vegetation types: mature and young bog-recovered meadows, scrub, and pasture. There was a linear relationship between polarized visible light and vegetation amount, with an average correlation of 0.63 (significant at the 5% level). In the winter, the sites had a variable canopy and percent polarization. In the summer, when canopies were complete and undisturbed, the ability to estimate vegetation amount was maximized, but the difference between sites minimized. (Author)

A81-38787 * # **Remote sensing of soil moisture content over bare field at 1.4 GHz frequency.** J. R. Wang and B. J. Choudhury (NASA, Goddard Space Flight Center, Greenbelt, MD). *Journal of Geophysical Research,* vol. 86, June 20, 1981, p. 5277-5282. 18 refs.

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

A81-40327 * **Remote sensing of total dry-matter accumulation in winter wheat.** C. J. Tucker, B. N. Holben (NASA, Goddard Space Flight Center, Greenbelt, MD), J. H. Elgin, Jr., and J. E. McMurtrey, III (U.S. Department of Agriculture, Beltsville Agricultural Research Center, Beltsville, MD). *Remote Sensing of Environment,* vol. 11, July 1981, p. 171-189. 68 refs.

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

A81-40329 **Microwave radar response to canopy moisture, leaf-area index, and dry weight of wheat, corn, and sorghum.** T. W. Brakke, E. T. Kanemasu, J. L. Steiner (Kansas State University, Manhattan, KS), F. T. Ulaby, and E. Wilson (Kansas, University, Lawrence, KS). *Remote Sensing of Environment,* vol. 11, July 1981, p. 207-220. 26 refs.

N81-22449*# **Dartmouth Coll., Hanover, N.H.**
AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. 1: LANDSAT. 2: REMOTE SENSING OF VOLCANIC EMISSIONS Semiannual Status Report, 1 Aug. 1980 - 31 Jan. 1981
Richard W. Birnie and Richard E. Stoiber, Principal Investigators
31 Jan. 1981 33 p ERTS
(Contract NCC5-22)
(E81-10133; NASA-CR-164122; SASR-2) Avail: NTIS HC A03/MF A01 CSCL 08K

A fanning technique based on a simplistic physical model

provided a classification algorithm for mixture landscapes. Results of applications to LANDSAT inventory of 1.5 million acres of forest land in Northern Maine are presented. Signatures for potential deer year habitat in New Hampshire were developed. Volcanic activity was monitored in Nicaragua, El Salvador, and Guatemala along with the Mt. St. Helens eruption. Emphasis in the monitoring was placed on the remote sensing of SO2 concentrations in the plumes of the volcanoes. T.M.

N81-22450*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STATEWIDE LANDSAT INVENTORY OF CALIFORNIA FORESTS

William Likens and David Peterson, Principal Investigators Feb. 1981 28 p refs ERTS

(E81-10134; NASA-TM-81255; A-8445) Avail: NTIS HC A03/MF A01 CSCL 02F

Six forest cover categories were mapped, along with 10 general land cover classes. To map the state's 100 million acres, 1.6 acre mapping units were utilized. Map products were created. Standing forest acreage for the state was computed to be 26.8 million acres. T.M.

N81-23543*# Science and Education Administration, Weslaco, Tex.

PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Final Report, 1 Dec. 1977 - Sep. 1980

Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Feb. 1981 183 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

(NASA Order S-40198-B)

(E81-10130; NASA-CR-164120) Avail: NTIS HC A09/MF A01 CSCL 02C

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

N81-23544*# Texas A&M Univ., College Station. Remote Sensing Center.

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

W. D. Rosenthal, J. C. Harlan, and Bruce J. Blanchard, Principal Investigators Oct. 1980 16 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM

(Contract NAS5-24383)

(E81-10131; NASA-CR-164121; PR-3712-11) Avail: NTIS HC A02/MF A01 CSCL 02C

Infrared data of the Wahita River watershed were screened to include areas having greater than 60% pasture. This improved the July 24/July 13 and October 5/August 30 temperature/antecedent precipitation index (API) relationships, but the coefficient of determination was not improved in the July 29/July 13 relationship. Surface temperatures were recalculated using the atmospheric correction factor calculated by the modified RADTRA model. In all cases the correction factor was reduced. The model estimate and lake surface temperatures may be used to calculate IR data if no meteorological data is available. Day/day surface temperature differences from HCMM were related to the API up to approximately seven days after a storm on July 21, 1978. After that period, the coefficient of determination decreased to 0.25 indicating other factors, such as land-use variability within each measurement site (5 square kilometers), are influencing temperature variation. Other data sets need to be analyzed to confirm the temperature difference API sensitivity period. A.R.H.

N81-23545*# Michigan State Univ., East Lansing. Dept. of Forestry.

AN EVALUATION OF SATELLITE DATA FOR ESTIMATING THE AREA OF SMALL FORESTLAND IN THE SOUTHERN LOWER PENINSULA OF MICHIGAN Ph.D. Thesis

Michael Apostolos Karteris, Principal Investigator 1980 200 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Grant NGL-23-004-083)

(E81-10136; NASA-CR-164139) Avail: NTIS HC A09/MF A01 CSCL 02F

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

N81-23547*# Kansas Univ., Lawrence. Space Technology Center.

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

E. A. Martinko, Principal Investigator, J. Poracsky, E. R. Kipp, and H. Krieger 30 Nov. 1980 34 p ERTS

(Grant NAG2-57)

(E81-10138; NASA-CR-164146; IR-1) Avail: NTIS HC A03/MF A01 CSCL 02C

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

N81-23548*# Kansas Univ., Lawrence. Space Technology Center.

CROP-PHENOLOGY AND LANDSAT-BASED IRRIGATED LANDS INVENTORY IN THE HIGH PLAINS Interim Report, 1 Dec. 1980 - 31 Jan. 1981

E. A. Martinko, Principal Investigator, J. Poracsky, E. R. Kipp, and H. Krieger 31 Jan. 1981 48 p ERTS

(Grant NAGw-57)

(E81-10139; NASA-CR-164147; IR-2) Avail: NTIS HC A03/MF A01 CSCL 02C

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

N81-24489*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

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

Howard W. Mielke, Principal Investigator (Macalester Coll.) Jul.

1980 25 p refs ERTS
(E81-10144; NASA-TM-80741) Avail: NTIS HC A02/MF A01 CSCL 08B

The use of LANDSAT as a tool for geobotanical prospecting was studied in a 13,137 sq km area from southeastern Pennsylvania to northern Virginia. Vegetation differences between known serpentine and non-sepentine sites were most easily distinguished on early summer images. A multispectral signature was derived from vegetation of two known serpentine sites and a map was produced of 159 similar signatures of vegetation in the study area. Authenticity of the serpentine nature of the mapped sites was checked via geochemical analysis of collected soils from 14% of the sites. Overall success of geobotanical prospecting was about 35% for the total study area. When vegetation distribution was taken into account, the success rate was 67% for the region north of the Potomac, demonstrates the effectiveness of the multispectral satellite for quickly and accurately locating mineral sensitive vegetation communities over vast tracts of land. A.R.H.

N81-24492*# Texas A&M Univ., College Station. Remote Sensing Center.

DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Final Report

J. C. Harlan, Principal Investigator, W. D. Rosenthal, and B. J. Blanchard [1981] 63 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 NAS5-24383)
(E81-10154; NASA-CR-164268; RSC-3712-12) Avail: NTIS HC A04/MF A01 CSCL 08E

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

N81-24493*# Alaska Univ., Fairbanks. Geophysical Inst.

APPLICATIONS OF REMOTE-SENSING DATA IN ALASKA Annual Report, 1 Jul. 1976 - 30 Sep. 1977

J. M. Miller, Principal Investigator 30 Sep. 1977 132 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Grant NGL-02-001-092)
(E81-10156; NASA-CR-164270) Avail: NTIS HC A07/MF A01 CSCL 08B

Public and private agencies were introduced to the use of remotely sensed data obtained by both satellite and aircraft, and benefitted from facilities for data processing enhancement and interpretation as well as from the institute's data library. Cooperative ventures involving the performance of operational activities included assistance to the Bureau of Land Management in the suppression of wildfires; the selection of sites for power line right-of-way; the mapping of leads in sea ice; determination of portions of public lands to be allocated for small scale farming; the identification of areas for large scale farming of barley; the observation of coastal processes and sediment transport near Prudhoe Bay; the establishment of a colar infrared file of the entire state; and photomapping for geological surveys. Monitoring of the outer continental shelf environment and reindeer herds was also conducted. Institutional constraints to full utilization of satellite remote sensing in the state are explored and plans for future activites include the generation of awareness by government agencies, the training of state personnel, and improving coordination and communication with users. A.R.H.

N81-24494*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A PARAMETERIZATION OF EFFECTIVE SOIL TEMPERATURE FOR MICROWAVE EMISSION

B. J. Choudhury, T. J. Schmugge, and T. Mo, Principal Investigators (Computer Sciences Corp., Silver Spring, Md.) Mar. 1981 14 p refs Submitted for publication Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E81-10157; NASA-TM-82100; SM-G1-04050) Avail: NTIS HC A02/MF A01 CSCL 08M

A parameterization of effective soil temperature is discussed, which when multiplied by the emissivity gives the brightness temperature in terms of surface (T sub o) and deep (T sub infinity) soil temperatures as T = T sub infinity + C (T sub o - T sub infinity). A coherent radiative transfer model and a large data base of observed soil moisture and temperature profiles are used to calculate the best-fit value of the parameter C. For 2.8, 6.0, 11.0, 21.0 and 49.0 cm wavelengths. The C values are respectively 0.802 + or - 0.006, 0.667 + or - 0.008, 0.480 + or - 0.010, 0.246 + or - 0.009, and 0.084 + or - 0.005. The parameterized equation gives results which are generally within one or two percent of the exact values. M.G.

N81-24495*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CALCULATIONS OF THE SPECTRAL NATURE OF THE MICROWAVE EMISSION FROM SOILS

T. Mo (Computer Sciences Corp., Silver Spring, Md.), T. J. Schmugge, and B. J. Choudhury, Principal Investigators Aug. 1980 66 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E81-10158; NASA-TM-82002; SM-GO-04018) Avail: NTIS HC A04/MF A01 CSCL 08M

The brightness temperatures for a set of soil profiles observed at USDA facilities in Arizona and Georgia were calculated at the wavelengths of 2.8, 6, 11, 21, and 49 cm using a coherent radiative transfer model. The soil moisture sampling depth is found to be a function of wavelength and is in the range 0.06 to 0.1 of a wavelength. The thermal sampling depth also depends on wavelength and is approximately equal to one wavelength at dry soil condition and 0.1 - 0.5 wavelengths at wet soil conditions. Calculated values of emissivity show strong diurnal variations when the soils are wet, while there is little diurnal change when the soil is dry. The soil moistures within the four depth intervals of 0-2, 0-5, 0-9, and 0-15 cm were parameterized as function of the calculated emissivity and brightness temperature. Best-fit parameters and correlation coefficients are presented for five wavelengths. Interrelationships among the effective temperature, surface temperature, and emissivity are displayed. A.R.H.

N81-24497*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EVALUATING LANDSAT WILDLAND CLASSIFICATION ACCURACIES

David L. Toll Aug. 1980 35 p refs
(Contract DI-14-16-0008-2160)
(NASA-TM-81993) Avail: NTIS HC A03/MF A01 CSCL 08B

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

N81-24505*# University of South Florida, Tampa.

STOCHASTIC ANALYSIS OF MULTIPLE-PASSBAND SPECTRAL CLASSIFICATIONS SYSTEMS AFFECTED BY OBSERVATION ERRORS

Chris P. Tsokos Dec. 1980 31 p
(Grant NAG1-9)
(NASA-CR-164366) Avail: NTIS HC A03/MF A01 CSCL 05B

The classification of targets viewed by a pushbroom type

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

N81-25453*# Humboldt State Univ., Arcata, Calif. Dept. of Forestry.
THE APPLICATION OF LANDSAT REMOTE SENSING TECHNOLOGY TO NATURAL RESOURCES MANAGEMENT. SECTION 1: INTRODUCTION TO VICAR - IMAGE CLASSIFICATION MODULE. SECTION 2: FOREST RESOURCE ASSESSMENT OF HUMBOLDT COUNTY. Final Report, Apr. - Dec. 1980
Lawrence Fox, III, Principal Investigator and Kenneth E. Mayer Dec. 1980 39 p refs ERTS
(Grant NsG-2341)
(E81-10120; NASA-CR-164114) Avail: NTIS HC A03/MF A01 CSCL 05B

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

N81-25454*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.
CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Jun. - 30 Nov. 1980
Ta Liang, Warren R. Philipson, Principal Investigators, and John A. Stanturf Dec. 1980 375 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Grant NGL-33-010-171)
(E81-10153; NASA-CR-164267) Avail: NTIS HC A16/MF A01 CSCL 05B

High altitude, color infrared aerial photography as well as imagery from Skylab and LANDSAT were used to inventory timber and assess potential sites for industrial development in New York State. The utility of small scale remotely sensed data for monitoring clearcutting in hardwood forests was also investigated. Consultation was provided regarding the Love Canal Landfill as part of environment protection efforts.

N81-25455*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.
APPENDIX A: FUELWOOD AVAILABILITY FOR A TEN MEGAWATT POWER PLANT IN TUPPER LAKE, NEW YORK, BASED ON REMOTELY SENSED AND OTHER DATA
In its Cornell Univ. Remote Sensing Program Dec. 1980 22 p refs ERTS
Avail: NTIS HC A16/MF A01 CSCL 08F

Forested land potentially available for fuelwood harvest within 30 km of Tupper Lake, N.Y. was delineated and classified as to forest using NASA aerial photography and LANDSAT imagery. Published inventory and growth data were used to estimate woody material on the available land. The information submitted to the Energy Office indicates that there is sufficient woody material to supply a 10 MW plant. A.R.H.

N81-25456*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.
APPENDIX B: INVENTORY OF CONIFEROUS FORESTS NEAR BATH, NEW YORK
John A. Stanturf *In its* Cornell Univ. Remote Sensing Program Dec. 1980 3 p ERTS

Avail: NTIS HC A16/MF A01 CSCL 02F

A zoom stereoscope was used to interpret aerial color photographs of the Finger Lakes region near Bath, New York, and areas of conifers were delineated on acetate sheets. Scale was determined for each photograph and units were converted to acres. Photographically enlarged positive transparencies of imagery from LANDSAT bands 5,6, and 7 for the southern portion of the study area were placed in a cold additive viewer and registered with each other to provide a composite image. A green filter was used on band 5, blue on band 6, and red on band 7. Conifers appeared at dark, reddish purple. Acreage was determined using a grid. Results show that the total confer stands within 50 miles of Bath is approximately 176,000 acres of which 60,000 acres are in Pennsylvania. The study was conducted to determine the feasibility of locating a particleboard manufacturing firm in the Southern Tier. A.R.H.

N81-25457*# Cornell Univ., Ithaca, N. Y.
APPENDIX C: A COMPARATIVE STUDY OF SMALL SCALE REMOTELY SENSED DATA FOR MONITORING CLEARCUTTING IN HARDWOOD FORESTS M.S. Thesis
William Robert Hafker *In its* Cornell Univ. Remote Sensing Program Dec. 1980 157 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A16/MF A01 CSCL 02F

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

N81-25482# Tennessee Valley Authority, Muscle Shoals, Ala. Office of Natural Resources.
REMOTE SENSING OF SULFUR DIOXIDE EFFECTS ON VEGETATION: SPECTRORADIOMETRY
C. Daniel Sapp Sep. 1980 54 p refs
(Contract EPA-IAG-E7-21DJ)
(PB81-154064; TVA/ONR-80/11; EPA-600/7-80-159) Avail: NTIS HC A04/MF A01 CSCL 06F

Remote measurements of spectral reflectance were made in a laboratory to study sulfur dioxide (SO2) effects on the foliage of soybean and winter wheat plants. The relationship between spectral reflectance and foliar injury from SO2 was analyzed by separating injury into its components chlorosis and necrosis and reflectance into bands within the visible and near infrared spectra for winter wheat, total visible reflectance as well as individual wavelength bands distinguish the O2 effects. Remote sensors that measure visible reflectance may be able to distinguish moderate to severe injury to wheat from low altitudes. Scans of soybeans provided less positive results. Significant differences in the means of green, red, and near infrared reflectance were found when unaffected and moderately to severely necrotic soybean classes were compared. GRA

N81-26512 Hawaii Univ., Honolulu.
IMAGE EVALUATION OF LANDSAT DATA FOR MONITORING CHANGE IN FOREST VIGOR: THE OHIA RAIN FOREST DECLINE ON THE ISLAND OF HAWAII Ph.D. Thesis
John Dorward Rockie 1980 213 p
Avail: Univ. Microfilms Order No. 8111345

The use of LANDSAT images for mapping variations in rain forest vigor and density in order to monitor ohia decline on the island of Hawaii is evaluated. Several types of images enhancement were evaluated, including density slicing, color enhancement, multispectral comparisons, densitometry and change detection. Density slicing and color enhancement gave the most reliable results. The principal reasons for low correspondence

levels were heterogeneity of both canopy and understory of the rain forest, inaccuracies in generalized vegetation maps used to evaluate density slice maps, and planimetric errors in LANDSAT images due to both geometric errors and misleading pixel portrayal. The change in the decline patterns was too small to be measured by either enhancement of LANDSAT images or interpretation of vegetation maps compiled from aerial photographs.
Dissert. Abstr.

N81-26526*# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT SUPPORTS DATA NEEDS FOR EPA 208 PLANNING
Sep. 1979 36 p Prepared in cooperation with Council of State Planning Agencies, Washington, D.C. ERTS
(E81-10148; NASA-TM-82382) Avail: NTIS HC A03/MF A01 CSCL 05B

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

N81-26527*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FIELD RESEARCH ON THE SPECTRAL PROPERTIES OF CROPS AND SOILS, VOLUME 1 Final Report, 1 Dec. 1979 - 30 Nov. 1980
M. E. Bauer, Principal Investigator, L. L. Biehl, and B. F. Robinson Nov. 1980 173 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS 2 Vol.
(Contract NAS9-15466; Proj. AgRISTARS)
(E81-10151; NASA-CR-164373; SR-PO-04022-Vol-1; LARS-FR-112680-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 02C

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

N81-26528*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
RESEARCH IN THE APPLICATION OF SPECTRAL DATA TO CROP IDENTIFICATION AND ASSESSMENT, VOLUME 2 Final Report, 1 Dec. 1979 - 30 Nov. 1980
C. S. T. Daughtry, Principal Investigator, M. M. Hixson, and M. E. Bauer Nov. 1980 120 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS 2 Vol.
(Contract NAS9-15466; Proj. AgRISTARS)
(E81-10152; NASA-CR-164266; SR-PO-04023-Vol-2; LARS-FR-112780-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 02C

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

N81-26534# Army Military Personnel Center, Alexandria, Va.
USE OF SATELLITE IMAGERY TO MONITOR THE OASIS AGRICULTURE IN THE TURPAN DEPRESSION, XINJIANG UYGUR AUTONOMOUS REGION, PEOPLE'S REPUBLIC OF CHINA: A CASE STUDY M.S. Thesis - Hawaii Univ.
Dorothy Fay Klasse May 1981 107 p refs
(AD-A099265) Avail: NTIS HC A06/MF A01 CSCL 02/4

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

N81-27573# Food and Agriculture Organization of the United Nations, Rome (Italy).
FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS OFFICE FOR SPECIAL RELIEF OPERATIONS (OSRO)
K. P. Wagner *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 7-12

Avail: NTIS HC A09/MF A01

The nature of assistance provided through OSRO in response to request for emergency aid in the agricultural, livestock and fishery sectors, from many parts of the world, is described. Activities include: agro-economic assessment and monitoring of emergency requirements and supply; carrying out relief and rehabilitation operations, e.g., provision of feed supplies, agricultural equipment, transport and storage facilities, breeding animals for livestock rehabilitation; and planning for disaster preparedness and prevention. Starting in the Sahelian countries in 1973, OSRO organized or participated in over 60 missions, involving 21 different countries by September 1980.
Author (ESA)

N81-27585# Bristol Univ. (England). Dept. of Geography.
SATELLITE MONITORING OF CONDITIONS CONDUCIVE TO THE UPSURGE OF INSECT PESTS
Eric C. Barrett *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 105-111 refs

Avail: NTIS HC A09/MF A01

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

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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.

A81-33554 # **Radio-physical methods for the monitoring of the environment (Radiofizicheskie metody distantsionnogo izucheniia okruzhaiushchei sredy).** N. A. Armand, A. E. Basharinov, L. F. Borodin, E. N. Zotova, and A. M. Shutko. In: Problems of present-day radio engineering and electronics.
Moscow, Izdatel'stvo Nauka, 1980, p. 95-138. 140 refs. In Russian.

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

A81-34452 # **Data base cartography for better mastery of urban space - The CARINE system (La cartographie informatisée pour une meilleure maitrise de l'espace urbain - Le système 'CARINE').** R. Boursault (Société Anonyme d'Economie Mixte d'Informatique pour les Collectivités de la Region Méditerranéenne, Marseille, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 82-91. In French.

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

A81-34454 # **Automated and digital mapping for highways in the U.S.A.** R. R. Chamard. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 109-118. 5 refs.

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

A81-34460 # **Photogrammetry as an aid for creating a modern survey and topographic system in urban settlement areas (Die Photogrammetrie als Hilfsmittel zum Aufbau eines modernen Vermessungs- und Kartenwerkes in städtischen Siedlungsgebieten).** R. Dörschel (Bayerisches Landesvermessungsamt, Munich, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 164-173. In German.

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

A81-34465 # **Low cost road mapping for road management.** P. O. Fagerholm. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 238-244.

A81-34467 # **Change detection by Landsat as a guide to planning aerial photography for revision mapping.** E. A. Fleming (Department of Energy, Mines and Resources, Topographical Survey Div., Ottawa, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 263-273.

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

A81-34473 # **Employment of analytical photogrammetry in planning (Einsatz der analytischen Photogrammetrie in der Planung).** K. Heiland (Baden-Württemberg, Landesamt für Flurbereinigung und Siedlung, Ludwigsburg, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 323-330. 10 refs. In German.

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

A81-34483 # **Error and accuracy analysis in application of photogrammetric methods to land surveys.** S.-C. Lue (Ohio, Dept. of Transportation, Worthington, Ohio). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4.

Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 442-447. 5 refs.

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

A81-34486 # **A computer-aided evaluation system for aerial photographs (Ein computer-unterstütztes Luftbildauswertesystem).** W. Lichtner. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 468-473. 7 refs. In German.

The considered system includes a minicomputer with a main storage of 144 K, a Planicomp C 100, comparators, terminals, and a printer. The system is used for aerotriangulation operations for land-register applications, altitude evaluation studies, and large-scale topographic evaluations undertaken for the plotting of special maps for planning operations. Attention is given to a use of a large computer for large-scale operations, the advantages of interactive digital data processing, and approaches envisaged for the reduction of errors which are not recognized in interactive digital data processing operations. G.R.

A81-34499 # **A method for the uniform storage and processing of geographic area data for regional planning (Eine Methode zur einheitlichen Speicherung und Verarbeitung geographischer Flächendaten für die Regionalplanung).** H. Schumacher (Klein und Stekl GmbH, Stuttgart, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 623-628. In German.

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

A81-34506 # **Semi-orthophotomaps by Landsat RBV camera imagery and high altitude photographs.** S. Tanaka, Y. Mukai, T. Sugimura (Remote Sensing Technology Center of Japan, Tokyo, Japan), H. Hasegawa (Pacific Aero Survey Co., Ltd., Tokyo, Japan), T. Jingu, and N. Takekawa (Asia Air Survey Co., Ltd., Tokyo, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 705-714.

Remote sensing data from the Landsat RBV camera and high altitude photographs are studied for their applicability in establishing and compiling semi-orthophotomaps for the purpose of the environmental change detection in urban areas. Results show that a semi-orthophotomap obtained by Landsat imagery has a possibility of detecting environmental changes, such as a new town formation at the scale of 1:50,000, with a horizontal displacement factor of less than 2.0 mm. A topographical map at 1:200,000 scale with contours at 100 m were obtained from Skylab S190 A photographs for small areas. Semi-orthophotomaps are given and analyzed in detail. E.B.

A81-34518 # **From aerial photography to map - A simple method for preparing land use maps (De la photographie aérienne à la carte - Une méthode simple d'élaboration de cartes d'utilisation du sol).** R. Bariou and D. Lecamus. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 46-55. In French.

A81-34521 # **Comparison of classification methods for urban images interpretation.** H. Beguin, H. Do Tu, and J. Wilmet (Louvain, Université Catholique, Louvain-la-Neuve, Belgium). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 84-91. 10 refs.

A81-34525 # **Experimental results on the development of thematic maps by remote sensing in a supervised regime, particularly in delta regions (Expériences portant sur l'étalissement par télédétection des cartes thématiques en regime supervisé, surtout pour des zones deltaiques).** V. Calistru and N. Oprescu (Ecole Supérieure de Génie Civil et du Bâtiment, Bucharest, Rumania). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 122-131. 5 refs. In French.

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

A81-34527 # **Planimetric and thematic mapping potential of Landsat MSS imagery for integrated surveys of South Brazilian natural resources.** C. M. R. Carneiro (Santa Maria, Universidade Federal, Santa Maria; Instituto Brasileiro de Desenvolvimento Florectal, Brasília, Brazil). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers., Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 142-150. 8 refs.

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

A81-34530 # **The classification and interpretation of land use in the humid tropics - An air photo study.** P. Collier and W. G. Collins (Aston, University, Birmingham, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 185-194. 8 refs.

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

A81-34531 # **A remote sensing evaluation of habitat resources in a new town site.** W. G. Collins and J. Nichol (Aston, University, Birmingham, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 195-203.

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

A81-34532 # **Derelict and degraded land surveys - An evaluation of the cost effectiveness of air survey methods.** W. G. Collins and L. Gibson (Aston, University, Birmingham, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 204-213. 10 refs.

The advantages of air survey methods are reviewed. It is shown that the field survey located only 87% of the sites, cost between 4.5 and 8.5 times as much, and took nearly 12 times as long as the equivalent air photo based survey. The remote sensing unit employed in the air survey operations has been developed as an operational system for identifying, mapping, and measuring derelict land for various county planning authorities in the U.K. Attention is given to the conduction of national surveys of derelict land, the West Midlands Derelict Land Survey, the importance of 'neglected waste land', questions of 'surrounding land use', vegetation type and cover, and the data sources used. G.R.

A81-34536 # **The production of a land-use map 1:200,000 on the basis of Landsat imagery for the Hannover area (Herstellung einer Landnutzugskarte 1:200,000 aus Landsat-Bilddaten für den Raum Hannover).** E. Dennert-Möller, H. P. Bähr (Hannover, Universität, Hanover, West Germany), and W. Lichtner (Niedersächsisches Landesverwaltungsamt, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 244-255. 5 refs. In German.

A81-34540 # **Air photo interpretation for the measurement of changes in urban land use.** C. Emmott (Preston Polytechnic, Preston, England) and W. G. Collins (Aston, University, Birmingham, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 281-290. 19 refs.

Experimental evidence indicates that the optimum system for measurement of urban land use involves the use of orthogonal dot grid overlays to aerial photographs. The system was developed and tested with reference to a 70 square kilometer surrounding the town of Preston, England, using panchromatic aerial photography taken in the years 1946 and 1973. A classification scheme devised had four levels of detail and the methodology required for the project produced both aerial data and a graphical representation of the data. Land use data was recorded in a cellular format directly from the photography and used as computer input, easing the production of selected multiple or single theme maps. Dot grids (optimum notational unit cell - 1.00 ha) produced better results than grid squares, since no estimations of proportions or domination are required. The method proved significant in that land use could be recorded at identical points for each year, maps produced could be combined without gaps or overlap, and the information was compatible with other data referenced to the National Grid or administrative units. Relationships were also recognized between the land use data obtained in the project and population data. J.F.

A81-34541 # **A strategy of computer-aided land-use classification (Eine Strategie der rechnergestützten Landnutzungsklassifizierung).** W. Fink (Battelle-Institut, Frankfurt am Main, West Germany) and K. Niemz (Institut für Angewandte Geodäsie, Frankfurt am Main, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 291-301. 10 refs. In German.

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

A81-34542 # **Applications of thermography to certain energy related problems (Applications de la thermographie à certains problèmes relatifs à l'énergie).** P. Foin and J. Poulain (Institut Géographique National Saint-Mandé, Val-de-Marne, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 302-307. In French.

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

A81-34547 # **Analysis, description and classification of rural regions on the basis of Landsat data (Analyse, description et classement de paysages ruraux à partir de données Landsat).** C. M. Girard and M. C. Girard (Institut National de la Recherche Agronomique, Thiverval-Grignon, Yvelines and Paris, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 345-354. 5 refs. In French.

A81-34550 # **Influence of radar azimuth angle on small settlement detection.** F. M. Henderson (New York, State University, Albany, N.Y.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 404-410. 8 refs.

SLAR imagery from K- and X-band systems, along with an ascending pass, digitally processed L-band Seasat SAR imagery of different environments and scales have been used to investigate the effect of radar azimuth angle on small settlement detection. It is

found that, on a broader scale, the detectability of small settlements (less than 1000 population) is affected by radar azimuth. If the entire settlement morphology and geometry are such that the street and building pattern is oriented within 10 deg parallel or perpendicular to the flightline, more of its surface area will be susceptible to specular return, thus increasing the probability of identification. V.L.

A81-34551 # **Extracting urban data from Seasat SAR imagery - The merit of image enlargements and density slicing.** F. M. Henderson (New York, State University, Albany, N.Y.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 411-420.

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

A81-34563 # **Aerial data in forecasting of urban development and traffic of Tripoli.** H. Leppanen. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 538-547.

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

A81-34564 # **Photographic detection and quantification of urban tree stress.** T. M. Lillesand (Minnesota, University, St. Paul, Minn.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 548-557. 10 refs. Research supported by the State University of New York and Minnesota Department of Agriculture.

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

A81-34565 # **Use of aerial thermography in urban areas.** S.-A. Ljungberg and R. Norberg (National Swedish Institute for Building Research, Gavle, Sweden). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 558-563.

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

A81-34572 # **Regional interpretation of radar imagery.** P. H. A. Martin-Kaye (Hunting Geology and Geophysics, Ltd., Elstree, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 624-633. 7 refs.

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

A81-34574 # **Application of remote sensing methods for environmental mapping on a European level (Anwendung von *Fernerkundungsmethoden für eine Umweltkartierung auf europäischer Ebene*).** R. Mössmer (München, Universität, Munich, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 639-647. In German.

A person charged with environmental planning tasks requires for his decisions a broad spectrum of area-related environmental data. The data needed are in many cases not available. Some of the environmental data required cannot be obtained with conventional methods. The difficulties presented by this situation can possibly be overcome by making use of the methods of remote sensing. A study was, therefore, conducted to obtain information concerning the

extent to which remote sensing procedures could contribute to a solution of the environmental mapping problems, taking into account the methods which would be suited to provide missing data and bring existing data up-to-date. Attention is given to the method the 'ecological mapping of the European Community', the requirements which remote sensing will have to meet, and the contribution made by remote sensing in providing the required data. G.R.

A81-34578 # Correlation studies between Landsat MSS data and population density in Japan. K. Naito, S.-I. Hanaki (Nippon Electric Co., Ltd., Central Research Laboratories, Kawasaki, Japan), J. Yamamoto, and K. Akizuki (Waseda University, Tokyo, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 681-690.

The relationship between remote sensing-based predictors (Landsat multispectral data) and ground-based criteria (population density according to a census) is analyzed. The data are Landsats 1 and 2 multispectral scanner (MSS) digital tapes and the grid square basis population density obtained from the Japanese census. Correlation analysis shows that MSS band 5 has a positive correlation with population density while band 7 has a negative one. On the assumption that the relationship is linear, multiple correlation analysis is applied and a correlation of approximately 0.75 is obtained. In addition, on the assumption that the relationship is a complex and nonlinear system, a heuristic self-organization approach - Group Method of Data Handling - is applied, and a more precise analysis is carried out for subdivided population density classes. According to the population density values of each subdivided class, the accuracy of population density identification from Landsat data is approximately 60-75%. C.R.

A81-34581 # Environmental remote sensing by simple means. D. O'Connor and G. Wright (Murdoch University, Murdoch, Australia). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 709-722.

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

A81-34593 # Interpretation of color aerial photographs for updating land register maps in Czechoslovakia. J. Sima. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 858-862.

A81-34596 # The climatic map of Hagen obtained on the basis of thermal pictures (Die klimakarte von Hagen erstellt auf der Basis von Thermalbildern). P. Stock (Ruhrgebiet, Kommunalverband, Essen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 881-893. 22 refs. In German.

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

A81-34602 # Natural resources inventory of East Kalimantan /Borneo/ Indonesia by side looking airborne radar surveys. F. Voss (Hamburg, Universität, Hamburg, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 953-958.

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

A81-34604 # Post processing for classified land use. T. Yoshida, H. Kurioka, Y. Matsuo, and S. Kasahara (Kajima Corp., Information Processing Center, Tokyo, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 969-978.

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

A81-34610 # Image properties with environmental factors. C. L. Norton (USAF, Hill AFB, Utah). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 71-87. 15 refs.

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

A81-34625 # **Investigations concerning the utilization of multispectral remote sensing image data for regional ecological problems (Untersuchungen zur Nutzung Multispektraler Fernerkundungsbilddaten für Landschaftsökologische Problemstellungen).** R. Bachhuber, C. Franke (München, Technische Universität, Freising-Weihenstephan, West Germany), and W. Kirchhof (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Oberpfaffenhofen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 426-435. In German.

An ecological model study regarding the Ingolstadt area in Bavaria, West Germany, is considered. The study is concerned with the detection of ecological relationships in the system: environment - land use - effects of land use. The effects of human land use and land use systems on natural resources are examined, taking into account water, soil, air, and animal and plant life. Remote sensing is employed as one of 13 different investigative techniques utilized in the study. Attention is given to the objectives of remote sensing, the location of the test area, the remote sensing data, the phenological situation, reference data, and details of image data processing. G.R.

A81-34629 # **The application of remote sensing to an occupational study concerning the ground required by hydraulic installations in Tunisia (Application de la télédétection à l'occupation du sol requis par les aménagements hydrauliques en Tunisie).** B. M. Hedi (Ministère de l'Equipement, Direction des Grands Travaux Hydrauliques, Tunis, Tunisia). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 473-475. In French.

A81-34630 # **Monitoring urban growth in the UK from Landsat satellite data.** P. Carter (Atomic Energy Research Establishment, Harwell, Oxon, England) and T. F. Smith (Department of the Environment, London, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 476-485. 6 refs. Research supported by the Department of the Environment.

Since regular aerial surveys of England and Wales would be expensive and difficult to organize because of cloud interference, the Department of Environment (DOE) in the UK is seeking to establish an alternative survey method coupled with an automated analysis system for extracting the required information in digital form. From an initial study it was concluded that the multispectral scanner in the Landsat series of satellites would be the most useful source of data for DOE's requirements because of the repetitive coverage and the low cost of the data. A description is provided of work carried out to check the accuracy of the Landsat data for monitoring urban development. Attention is given to test areas and automated processing of the Landsat data, results for delineating the overall urban areas, techniques for extracting areas of new growth from Landsat data, and a comparison of extracted urban growth from Landsat data with ground-truth. G.R.

A81-34635 # **Regional land use survey based on point sampling on aerial photographs.** O. Kölbl (Lausanne, Ecole Polytechnique Fédérale, Lausanne, Switzerland) and H. Trachsler (Zürich, Eidgenössische Technische Hochschule, Zurich, Switzerland). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 536-549. 5 refs.

A concept for a new national land-use survey of Switzerland is discussed. The existing statistics are mainly based on the cadastral survey. A new land-use survey appears necessary because the cadastral survey is accomplished only for 65 percent of the country and its revision is rather incomplete. It is proposed to base the new survey on point sampling in aerial photographs, using a 100 m grid. The position of the sample points on the aerial photographs is determined analytically. The procedure takes into account the relief as well as the position and inclination of the individual photographs. The points are plotted by means of an automatic procedure on a film that is used as overlay of the aerial photographs for the purely visual photointerpretation. G.R.

A81-35737 # **Prospects for the automatic analysis of aerial and space photographs in a system for the monitoring of anthropogenic changes of the atmosphere (Perspektivy avtomaticheskogo analiza aerokosmicheskikh snimkov v sisteme monitoringa antropogennykh izmenenii atmosfernogo vozdukha).** A. D. Kitov (Akademiia Nauk SSSR, Sibirskii Energeticheskii Institut, Irkutsk, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 87-91. 7 refs. In Russian.

A method for separating of the individual parts of smoke trails is presented along with an algorithm for connecting these parts into a unified smoke field along the direction of the wind. Attention is then given to a procedure for choosing smoke object features in air pollution monitoring and to criteria of image segmentation and mutual connection of separate smoke regions into a unified object at the recognition stage. B.J.

A81-35998 **Remote sensing for nuclear power plant siting.** B. S. Siegal (Ebasco Services Inc., Greensboro, N.C.) and C. W. Welby (North Carolina State University, Raleigh, N.C.). *(American Society of Civil Engineers, Annual Convention and Exposition, Atlanta, Ga., Oct. 22-26, 1979.) ASCE, Transportation Engineering Journal,* vol. 107, May 1981, p. 317-329. 5 refs.

It is shown that satellite remote sensing provides timely and cost-effective information for siting and site evaluation of nuclear power plants. Side-looking airborne radar (SLAR) imagery is especially valuable in regions of prolonged cloud cover and haze, and provides additional assurance in siting and licensing. In addition, a wide range of enhancement techniques should be employed and different types of image should be color-combined to provide structural and lithologic information. Coastal water circulation can also be studied through repetitive coverage and the inherently synoptic nature of imaging satellites. Among the issues discussed are snow cover, sun angle, and cloud cover, and actual site evaluation studies in the Bataan peninsula of the Philippines and Laguna Verde, California. O.C.

A81-36266 **Detection of volcanic ash coverage from Landsat MSS data.** K. Tsuchiya (National Space Development Agency of Japan, Tokyo, Japan), S. Uehara (National Research Center for Disaster Prevention, Ibaraki, Japan), Y. Tanaka (Meteorological Research Institute, Ibaraki, Japan), H. Ohnuki (Forest and Forest Products Research Institute, Ibaraki, Japan), and H. Ochiai (Toba National Merchant Marine College, Toba, Japan). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 121-128.

Landsat MSS imagery taken five days before and three days after the eruption of Mt. Ontake in the fall of 1979 was studied with a view to developing an effective method for detecting ash covered areas. The fact that discoloration of leaves produced a spectral response similar to that of ash cover made the task more difficult. It was found that the radiance of bands 4 and 5 of ash-covered area was larger than that of ash-free area, while the opposite was true for bands 6 and 7. It was also found that the ash-covered area could be more effectively detected by comparing radiances on the two days. The proposed method is capable of detecting areas covered with a layer of volcanic ash not less than 1 mm thick. V.L.

A81-36994 **The role of photogrammetry in a land information system (Die Rolle der Photogrammetrie in einem Landinformationssystem).** O. Kölbl (Lausanne, Ecole Polytechnique Fédérale, Lausanne, Switzerland). *Bildmessung und Luftbildwesen,* vol. 49, May 1, 1981, p. 65-75. Abridged. In German. (Translation).

The limitations of a purely graphical information system are easily recognized in connection with projects involving the integration of topographical information in a computational procedure. A

much higher level of flexibility can be obtained if cartographic information is suitably integrated in an electronic computer installation. Such an integration requires the digitizing of cartographic information and, the establishment of an appropriate data processing system. Model concepts concerning a land information system are considered and the practical applications of photogrammetry are discussed, taking into account topographic mapping, cadastral renovation, and land use studies. G.R.

A81-37698 **Simulation studies of infrared signatures from remote aerosols.** D. C. Fronterhouse, W. B. Heath, D. M. Smith, and F. T. Shively (Scientific Simulation, Inc., Albuquerque, NM). In: Infrared imaging systems technology; Proceedings of the Seminar, Washington, DC, April 10, 11, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 149-156. 5 refs. Contract No. N60921-79-R-A052.

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

A81-38725 **Arid land monitoring using Landsat albedo difference images.** C. J. Robinove (U.S. Geological Survey, Reston, VA), P. S. Chavez, Jr. (U.S. Geological Survey, Flagstaff, AZ), D. Gehring (Technicolor Graphic Services, Inc., Sioux Falls, SD), and R. Holmgren (U.S. Forest Service, Provo, UT). *Remote Sensing of Environment,* vol. 11, May 1981, p. 133-156. 19 refs.

N81-22641# BDM Corp., Monterey, Calif.
ENVIRONMENTAL MEASUREMENTS FOR MAGAT, BLM, AND STREX. INSTRUMENTATION AND DATA ACQUISITION PROGRAMS
C. W. Fairall and D. E. Spiel 12 Feb. 1981 52 p
(Contracts N00014-78-C-0204; N00014-79-C-0088)
(AD-A096942; BDM/M-TR-0003-81) Avail: NTIS HC A04/MF A01 CSCL 04/1

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

N81-23551*# Utah Univ., Salt Lake City. Center for Remote Sensing and Cartography.
INDENTIFYING ENVIRONMENTAL FEATURES FOR LAND MANAGEMENT DECISIONS Annual Report
31 Oct. 1980 10 p ERTS
(Grant NAGw-95)
(E81-10142; NASA-CR-164148) Avail: NTIS HC A02/MF A01 CSCL 08B

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

N81-23730# SRI International Corp., Menlo Park, Calif.
ASSESSING THE REPRESENTATIVENESS OF OZONE MONITORING DATA Final Report
F. L. Ludwig and Eugene Shelar Jan. 1980 75 p refs
(Contract EPA-68-02-2548; SRI Proj. 7863)
(PB81-146995; EPA-450/4-80-001) Avail: NTIS HC A04/MF A01 CSCL 13B

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

N81-24604# Epsilon Labs., Bedford, Mass.
STRATOSPHERIC AEROSOL MEASUREMENTS Final Report, 10 Jul. 1979 - 30 Oct. 1980
Henry A. Miranda, Jr. Dec. 1980 25 p refs
(Contract F19628-79-C-0130; AF Proj. 6687)
(AD-A097716; AFGL-TR-80-0366) Avail: NTIS HC A02/MF A01 CSCL 04/1

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

N81-25458*# Cornell Univ., Ithaca, N. Y.
APPENDIX D: ASSESSEMENT OF POTENTIAL INDUSTRIAL SITES IN ESSEX COUNTY, NEW YORK
Thomas M. Wozny *In its* Cornell Univ. Remote Sensing Program Dec. 1980 138 p refs ERTS

Avail: NTIS HC A16/MF A01 CSCL 08B

Potential industrial sites were assessed using high and medium altitude aircraft photographs and supporting information on the 4,730 sq. km. (1,825 sq. mile) county. Factors evaluated include land availability, slope, site accessibility, soil drainage, other subsurface characteristics, and the expected physical as well as visual impacts on existing land use. Areas unavailable or unsuitable for development were eliminated first, and the remaining areas evaluated and the best sites identified. Author

N81-25459*# Cornell Univ., Ithaca, N. Y.
APPENDIX E: RESEARCH PAPERS. ANALYSIS OF LANDFILLS WITH HISTORIC AIRPHOTOS
Ta Liang, Warren R. Philipson, Principal Investigators, Thomas L. Erb, and William L. Teng *In its* Cornell Univ. Remote Sensing Program Dec. 1980 5 p refs Repr. from Proc. of the Specialty Conf. of the Aerospace Div. of the Am. Soc. of Civil Engr., 1980 p 15-23 Presented at the Specialty Conf. of the Aerospace Div. of the Am. Soc. of Civil Engr., Madison, Wis., 13-14 Aug. 1980 ERTS
Avail: NTIS HC A16/MF A01 CSCL 08B

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

N81-25461*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.
APPENDIX E: RESEARCH PAPERS. USE OF REMOTE SENSING IN LANDSCAPE STRATIFICATION FOR ENVIRONMENTAL IMPACT ASSESSMENT
John A. Stanturf (Heimbuch-Stanturf, Inc., Ithaca, N.Y.) and Douglas G. Heimbuch *In its* Cornell Univ. Remote Sensing Program Dec. 1980 6 p refs Repr. from Tech. Papers of the

Am. of Photogrammetry Fall Tech. Meeting, 1980 Presented at the Am. Soc. of Photogrammetry Fall Tech. Meeting, Niagara Falls, N.Y., 7-10 Oct. 1980 ERTS

Avail: NTIS HC A16/MF A01 CSCL 13B

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

N81-27567*# National Aeronautics and Space Administration, Washington, D. C.

LANDSAT'S ROLE IN HUD 701 PROGRAMS

Oct. 1979 15 p Prepared in cooperation with the Council of State Planning Agencies, Washington, D.C. ERTS (E81-10146; NASA-TM-82383) Avail: NTIS HC A02/MF A01 CSCL 05B

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

N81-27568*# National Aeronautics and Space Administration, Washington, D. C.

LANDSAT'S ROLE IN STATE COASTAL MANAGEMENT PROGRAMS

Oct. 1979 18 p Prepared in cooperation with the Council of State Planning Agencies, Washington, D.C. ERTS (E81-10147; NASA-TM-82381) Avail: NTIS HC A02/MF A01 CSCL 08C

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

N81-27571# European Space Agency, Paris (France).

SATELLITE REMOTE SENSING. APPLICATIONS TO RURAL DISASTERS

1981 182 p refs Partly in ENGLISH and FRENCH Proceedings of the Joint ESA/FAO/WMO Intern. Training Course, Rome, 27 Oct. - 7 Nov. 1980 (ESA-SP-1035; RSC-Ser-5/80; ISSN-0379-6566) Avail: NTIS HC A09/MF A01

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

N81-27572# United Nations Disaster Relief Office, Geneva (Switzerland).

INTERNATIONAL DISASTER RELIEF AND THE ROLE OF THE UNITED NATIONS DISASTER RELIEF

L. Walter *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 5-6

Avail: NTIS HC A09/MF A01

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

N81-27574# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.

SATELLITE REMOTE SENSING APPLIED TO RURAL DISASTERS IN DEVELOPING COUNTRIES

J. A. Howard and A. vanDijk *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 13-19 refs

Avail: NTIS HC A09/MF A01

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

N81-27578# European Space Operations Center, Darmstadt (West Germany). Meteosat Data Management Dept.

ENVIRONMENTAL DATA RELAY VIA SATELLITE

A. Robson *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 45-49

Avail: NTIS HC A09/MF A01

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

N81-27580# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).

AUTOMATIC COLLECTION SYSTEMS FOR SATELLITE ENVIRONMENTAL DATA IN ARGENTINA

Oscar E. Marsano *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 61-68

Avail: NTIS HC A09/MF A01

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

N81-27582# National Environmental Satellite Service, Washington, D. C.

METHODS FOR TROPICAL CYCLONE INTENSITY ANALYSIS AND FORECASTING USING SATELLITE DATA

Vernon F. Dvorak *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 79-87 refs Presented also at WMO/ESCAP Typhoon Symp., Shanghai, 6-11 Oct. 1980

Submitted for publication

Avail: NTIS HC A09/MF A01

The use of satellite imagery for monitoring tropical storms is reviewed. A technique which provides reliable intensity estimates each day from a series of pictures instead of relying on the features observed in just one picture is presented. The analysis procedure includes: (1) locating the cloud system center and classifying the storm based on cloud patterns; (2) measuring the changes in spiral banding and cloud-top temperature; and (3) using a tropical cyclone development model which was empirically developed based on 15 years of data. This is an analysis procedure for both visible and infrared data. It gives a storm classification T-number which relates empirically to the central sea level pressure of the storm and to the maximum wind. Satellite pictures are used to detect the initial stages of tropical cyclone development before a storm reaches tropical storm intensity. A 24 hour storm intensity forecast is also possible by extrapolating forward along the modeled growth (or weakening) curve of the storm. Author (ESA)

N81-27589# Food and Agriculture Organization of the United Nations, Rome (Italy). Plant Protection Service.

APPLICATIONS OF REMOTE SENSING FOR MONITORING OF THE ENVIRONMENT IN ARID AREAS WITH PARTICULAR REFERENCE TO NATURAL VEGETATION FOR DESERT LOCUST SURVEILLANCE AND FORECASTING

Jelle U. Hielkema *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 125-152 refs

Avail: NTIS HC A09/MF A01

Satellite remote sensing techniques and methods for detection and monitoring of the ecological conditions of desert locust population development in its recession area were developed. The characteristics of the LANDSAT data feature space for arid areas and a technique for largely automated detection and monitoring of desert vegetation biomass relevant to locust development are given. Multitemporal LANDSAT data processing is specified, including a technique for data normalization to correct for atmospheric effects and a methodology for calculation of satellite determined potential breeding activity factors.

Author (ESA)

N81-27700# Meteorology Research, Inc., Santa Rosa, Calif.

AIRCRAFT MEASUREMENTS OF POLLUTANTS AND METEOROLOGICAL PARAMETERS DURING THE SULFATE REGIONAL EXPERIMENT (SURE) Final Report

D. L. Blumenthal, W. S. Keifer, and J. A. McDonald Apr. 1981 230 p refs

(EPRI Proj. 862-3)

(EPRI-EA-1909) Avail: NTIS HC A11/MF A01

Results of the aircraft measurements of pollutant and meteorological parameters performed during the Sulfate Regional Experiment (SURE) are summarized. Air quality and meteorological data were obtained for development and verification of models which describe the dispersion and transformation of atmospheric sulfur compounds emitted from industrial sources in the northeastern United States. Airborne data from several instrumented aircraft were acquired to complement data obtained by a network of ground stations and to provide additional information about transport phenomena not available from ground data alone. The SURE aircraft program, locations, dates, times of each sampling flight made, and analyses performed to date are described. DOE

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A81-34374 # **Aerial cameras of the TES type used for topographic surveying.** V. B. Il'in and V. G. Afremov (Tsentral'nyi Nauchno-Issledovatel'skii Institut Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 1. Commission 1. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 50-56. 6 refs.

Aerial cameras of TES type have been developed for the photography of various geographical regions. The cameras are equipped with rotor shutters and devices for automatic exposure control; the lenses are spherical (except for the AFA-TES-5 camera) distortion does not exceed 10 microns, resolution is within 35-25 lines/mm, and the accuracy of stereoviewing is + or - 3 microns. In particular, the AFA-TES-5 camera has an aspherical lens, and a distortion of not less than 16 lines/mm; the camera is used for the aerial photography of large areas at small scales. B.J.

A81-34392 # **Geometric model of projection plane for bilinear bundle of rays.** S. Agapov (Glavnoe Upravlenie Geodezii i Kartografii, Moscow, USSR). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 11-18.

It is noted that the development of aerial photography methods and methods of photogrammetric plotting has given rise to problems that go beyond the theory associated with the isomorphous representation of orthoscopic bundles of rays and planes onto a projection plane. A new approach to the projection plane is proposed here. The plane is regarded as the result of the reflection of a bilinear bundle consisting of two crossing lines and the totality of rays and second-order surfaces passing through those lines. C.R.

A81-34407 # **Digital correlation of remote sensing imagery from tidal lands.** M. Ehlers and B. Wrobel. *(Bildmessung und Luftbildwesen,* vol. 48, May 1, 1980, p. 67-79.) In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 202-213. Translation. Deutsche Forschungsgemeinschaft Contract No. SFB-149.

The paper reports on the development of a concept for rectification on a mutual reference image in order to permit correlation of remote sensing photographs of mud flats. It is reported that different objective functions show some deviations in the results due to the unstructured topography of the mud flats. Attention is given to quality and accuracy of two chosen objective functions which are presented by examples for autocorrelation as well as unitemporal and multitemporal correlation. Finally, a prehandling of the data by geometric or densitometric treatment is shown to be necessary for increasing the available information from the image signals. M.E.P.

A81-34412 # **Image processing of HCMM-satellite thermal images for super-position with other satellite imagery and topographic and thematic maps.** H. Gossmann (Freiburg, Universität, Freiburg im Breisgau, West Germany) and P. Haberäcker (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Oberpfaffenhofen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 256-271. 6 refs.

A81-34429 # **Experiments with automatic feature analysis using maps and images.** F. Leberl and W. Kropatsch (Graz, Technische Universität, Graz, Austria). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 451-457. 13 refs. Army-sponsored research.

It is noted that the automatic location of features in a digital image is feasible if the recognition is supported by a digital map data base. Experiments are carried out with part of a digital Landsat-image of southern Germany, and a map data base is established from topographic maps at a scale of 1:50,000. In the test scene, 13 features are recognized and the resulting image rectification leaves residual point errors of less than + or - 1 pixel. C.R.

A81-34430 # **Interpolation of raster heights from digitized contour lines.** F. Leberl, W. Kropatsch, and V. Lipp (Graz, Technische Universität, Graz, Austria). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th. Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 458-468. 13 refs. Research sponsored by the Mark Hurd Aerial Surveys, Inc. and Technische Universität Graz.

Digital height models (DHM's) from contour lines are considered to have particular significance because of the wide availability of contour sheets for topographic maps. The automatic conversion of contour lines to a rectangular raster of height values is seen as presenting specific problems because artificial morphological structures are generated in the process of interpolation. Using 15 test terrain forms, an algorithm designed to minimize this problem is presented and evaluated; it is found that the overall interpolation results compare well with manual interpolation, the differences amounting to 5-10% of the contourline interval. C.R.

A81-34431 # **An extended approach for photogrammetric point determination in geodetic nets.** M. M. Leupin and I. H. Hausammann (Université Laval, Quebec, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 469-475. 5 refs.

Experience with the densification of geodetic nets has helped in evaluating several problems connected mainly with the somewhat doubtful quality of the control points and the poor tie points between the strips. A mathematical model of an aerial triangulation is extended in order to balance out the influence of inconsistent geodetic control points. It is noted that flexibility in relating additional control points to their geodetic datum can be gained if control points are partially replaced by other geodetic observations, above all distances. The mathematical model presented for photogrammetric point determination features additional parameters for systematic errors, makes it possible to include geodetic observations, and makes use of collocation. Using the NRC Sudbury test area and a 1:8000 unit flown with a réseau-camera, practical results are given. Suggestions are made in view of an extensive application of the method for the densification of urban and semi-urban nets. C.R.

A81-34433 # **Error propagation in the analytical triangulation - Degree of the transformation polynomials.** Z. Marsik (Vysoke Uceni Technicke, Brno, Czechoslovakia). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 486-494. 5 refs.

Because of the deformations of aerial photographs caused by various physical factors, the relative orientation of a stereopair cannot be made perfectly. The model created is always more or less deformed. Formulas are derived for the error propagation from one model to the next for two cases. In the first, the preceding photograph is deformed; in the second, the attached photograph is deformed. Formulas for both random and systematic error propagation in strips and blocks are given. The use of polynomials of the

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

A81-34449 # **The use of SPOT images for the topographic mapping of industrial and developing nations (Utilisation des images SPOT pour la cartographie topographique des pays industriels et des pays neufs).** A. Baudoin (Institut Géographique National, Saint-Mandé, Val-de-Marne, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 56-65. 6 refs. In French.

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

A81-34478 # **The plotting of topographic maps on the basis of interferometric recordings with active sensors (Erstellung topographischer Karten aus interferometrischen Aufnahmen aktiver Sensoren).** D. Kolouch (Hannover, Universität, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 380-387. 5 refs. In German.

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

A81-34494 # **The positional accuracy of Landsat MSS imagery of Turkey (Die Lagegenauigkeit der Landsat MSS-Aufnahmen der Türkei).** C. Ormeci and M. Aytac (Istanbul, Technical University, Istanbul, Turkey). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 579-586. 6 refs. In German.

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

A81-34496 # **Transfer of targets between aerial photographs.** I. Persson, K. Viklander, and A.-C. Wirlee (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 597-599.

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

A81-34498 # **The production of large- and medium-scale topographic maps by the interactive digitization of stereoscopic models (Production des cartes topographiques à grande et à moyenne échelle par numérisation interactive des modèles stéréoscopiques).** C. de Saint Riquier, D. Bruger, and J. Côté. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 613-622. In French.

A81-34500 # **Cartographic basis of the structurization of digital topographic models (Kartentheoretische Grundlagen bei der Strukturierung digitaler Kartenmodelle).** W. Schwenk. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 629-638. 5 refs. In German.

A81-34503 # **Revision of topographic maps - Results of the Fribourg Test by Commission D of the OEEPE.** E. Spiess (Zürich, Eidgenössische Technische Hochschule, Zurich, Switzerland). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 655-669.

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

A81-34508 # **Anamorphotic integration of numerical photogrammetric surveys into a geodetic network (Intégration anamorphotique de levés photogrammétriques numériques dans un réseau géodésique).** U. L. W. van Twembeke (Ecole Royale Militaire de Belgique, Brussels; Louvain, Université Catholique, Louvain, Belgium). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 738-746. In French.

The paper presents a technique for converting photogrammetri-

cally derived topographic data into geodetic mapping on a one-to-one basis. A planimetric interpolation is devised to superimpose the geodetic coordinates onto aerial photographs and even existing cartography by imposing conditions of null residue and uniqueness during the reduction of multiple mappings into one coherency. An example is given which shows that the shape contours considered are either convex or not, and if convex, result in a sawtooth form. It is noted that the method has been used since 1976 for the remapping of rural Belgium. Information is digitally stored on magnetic disks for retrieval at a 1:2000 scale. D.H.K.

A81-34509 # A comparison of digital terrain models (Vergleich digitalter Geländemodelle). R. Winter (Niedersächsisches Landesverwaltungsamt, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 758-767. In German.

A comparison of programs for the calculation of digital terrain models and contour drawings is reported. Six programs, installed at various locations, are considered. Characteristics for five test areas with different structures were computed and plotted with the aid of the programs, taking into account photogrammetric measurements. Attention is given to the requirements regarding a digital terrain model, the selection of the test areas, the selection of the programs, and approaches for the calculation of contour lines. Lattice programs are considered along with triangular mesh programs, the results of test calculations, and the examination of contour lines on a geometrical basis. G.R.

A81-34513 # Topographic content investigation of Landsat classified multispectral images, displayed on a plotter. M. Albota, G. Vass, and G. Ioanid. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 1-5.

It is noted that Landsat and other automated remote sensor digital multispectral data classifications are performed with the aid of a medium capacity computer when the processing requires a large memory. Class definitions are accomplished by unsupervised pixel classifications using the main component method, and the classified image display is obtained at the established scale by means of a plotter. Thematic plotting is analyzed topographically and related to topographical maps and aerial photographs of the area under consideration. C.R.

A81-34562 # The use of a DTM in a digital multispectral analysis. J. Larsson (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 530-537.

It is pointed out that multispectral scanner data must be geometrically rectified before being used in a detailed analysis. It is also necessary that this rectification include corrections for terrain relief displacements. If available, terrain height information can be used in the rectification. In this way the point accuracy of the rectified image can be increased. It is noted that in a multispectral analysis, geometric information is used to only a slight extent. An attempt is made here to include topographic information obtained from a digital terrain model in a multispectral analysis. It is pointed out that with this technique a more accurate object classification can be obtained in certain cases where the information extracted from the spectral signature is insufficient. C.R.

A81-34647 # Spectral, morphological and textural data integration for remote sensing applications. S. Vetrella, A. Moccia, and L. De Fusco (Napoli, Università, Naples, Italy). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 726-737. 6 refs.

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

A81-35738 # Photogrammetric and cartographic features of space photographs of the earth, with orbital photography using the MKF-6 camera taken as an example (Fotogrammetricheskie i kartograficheskie osobennosti kadrovykh kosmicheskikh snimkov zemli /na primere orbital'noi s'emki mnogozonal'noi kameroi MKF-6/). B. A. Novakovskii (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 92-96. 6 refs. In Russian.

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

A81-35967 # The use of spaceborne photography data for the production of topographic maps (Ispol'zovanie materialov kosmicheskogo fotografirovaniia pri sozdanii topograficheskikh kart). E. A. Reshetov and V. M. Sigalov. *Geodeziia i Kartografiia,* Apr. 1981, p. 41, 42. In Russian.

A81-38213 # Complex evaluation of gravity anomalies and of data obtained from satellite altimetry. K. Arnold (Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, Potsdam, East Germany). *Gerlands Beiträge zur Geophysik,* vol. 90, no. 1, 1981, p. 38-42.

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

A81-38226 International Symposium on Space Geodesy and its Applications, Cannes, France, November 18-21, 1980, Transactions (Symposium International sur la Géodésie Spatiale et ses Applications, Cannes, France, November 18-21, 1980, Actes). Symposium sponsored by the Association Internationale de Géodésie and COSPAR. *Annales de Géophysique,* vol. 37, Jan.-Mar. 1981. 260 p. In French and English.

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

Doppler positioning in geodynamics studies, the effects of neutral and charged particle collisions on Lageos satellite motion, and a satellite laser ranging station. A.L.W.

A81-38229 Least squares combination of satellite and terrestrial data in physical geodesy. L. Sjoberg (Kungl. Tekniska Hogskolan, Stockholm, Sweden). *(Association Internationale de Géodésie and COSPAR, Symposium International sur la Géodésie Spatiale et ses Applications, Cannes, France, Nov. 18-21, 1980.) Annales de Géophysique,* vol. 37, Jan.-Mar. 1981, p. 25-30. 13 refs.

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

A81-38230 Geoid prediction in northern Greenland using collocation and digital terrain models. R. Forsberg and F. Madsen (Geodaetisk Institut, Charlottentlund, Denmark). *(Association Internationale de Géodésie and COSPAR, Symposium International sur la Géodésie Spatiale et ses Applications, Cannes, France, Nov. 18-21, 1980.) Annales de Géophysique,* vol. 37, Jan.-Mar. 1981, p. 31-36. 8 refs.

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

A81-38231 Application of NAVSTAR GPS geodetic receiver to geodesy and geophysics. R. J. Anderle (U.S. Navy, Naval Surface Weapons Center, Dahlgren, VA). *(Association Internationale de Géodésie and COSPAR, Symposium International sur la Géodésie Spatiale et ses Applications, Cannes, France, Nov. 18-21, 1980.) Annales de Géophysique,* vol. 37, Jan.-Mar. 1981, p. 37-46. 8 refs.

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 watervapor radiometers are used to obtain tropospheric refraction correction data. Initial studies show that the use of surface weather data, but without watervapor radiometers, would give 2- to 5-cm accuracies, but a more realistic modeling of the errors under these conditions is required. (Author)

A81-38233 The OSGB Scientific Network - Combination of satellite and terrestrial data. V. Ashkenazi, S. A. Crane (Nottingham University, Nottingham, England), and J. W. Williams (Ordnance Survey of Great Britain, Southampton, England). *(Association Internationale de Géodésie and COSPAR, Symposium International sur la Géodésie Spatiale et ses Applications, Cannes, France, Nov. 18-21, 1980.) Annales de Géophysique,* vol. 37, Jan.-Mar. 1981, p. 49-54. 17 refs.

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

A81-38234 Readjustment of the Australian primary geodetic network using a combination of terrestrial and satellite Doppler observations. J. S. Allman (New South Wales, University, Kensington, Australia). *(Association Internationale de Géodésie and COSPAR, Symposium International sur la Géodesie Spatiale et ses Applications, Cannes, France, Nov. 18-21, 1980.) Annales de Géophysique,* vol. 37, Jan.-Mar. 1981, p. 55-58. 8 refs. Research supported by the Australian Research Grants Committee.

The successful inclusion of Doppler satellite measurements into a least squares adjustment with terrestrial observations over an area of 7,682,300 sq km is described. The corrections to each type of observation conform to the statistical model based on the a priori variances and the precision of the adjusted coordinates is well within first order geodetic specifications. These results show that spatial measurements made for special projects can be incorporated into national data bases which will thus give maximum cost benefit. (Author)

A81-38249 Satellite Doppler positioning for geodynamics. J. Kouba (Department of Energy, Mines and Resources, Earth Physics Branch, Ottawa, Canada). *(Association Internationale de Géodésie and COSPAR, Symposium International sur la Géodésie Spatiale et ses Applications, Cannes, France, Nov. 18-21, 1980.) Annales de Géophysique,* vol. 37, Jan.-Mar. 1981, p. 205-212. 12 refs.

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

A81-40332 Simulation of the topographic influence on SLAR data for soil moisture detection in a hilly area. R. Meier (Zürich, Eidgenössische Technische Hochschule, Zurich, Switzerland). *Remote Sensing of Environment,* vol. 11, July 1981, p. 245-251. 5 refs. Research supported by the Swiss National Fund and Eidgenössische Technische Hochschule.

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

sitivity of microwave backscatter to decreasing incidence angle was obvious. Presentation of the spatial distribution of soil moisture was prevented by insufficient spatial resolution for the very heterogeneous catchment. (Author)

N81-22344*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEODETIC DISTANCE MEASURING APPARATUS Patent Application
James B. Abshire, inventor (to NASA) Filed 19 Dec. 1980 17 p
(NASA-Case-GSC-12609-1; US-Patent-Appl-SN-218586) Avail: NTIS HC A02/MF A01 CSCL 20E

A geodetic distance measuring apparatus which compensates for the refractive index of the atmosphere is discussed. A mode locked laser system with a laser device and its peripheral components is utilized to derive two mutually phase locked optical wavelength signals and one phase locked microwave CW signal which respectively traverse the same distance measurement path. The optical signals are comprised of pulse type signals. Phase comparison of the two optical wavelength pulse signals is used to provide the dry air density while phase comparison of one of the optical wavelength pulse signals and the microwave CW signal issued to provide wet or water vapor density of the air. The distance to be measured corrected for the atmospheric dry air and water vapor densities in the measurement path is computed from these measurements. A time interval unit is included for measuring transit time of individual optical pulses for resolving the phase ambiguity needed with the phase measurements to give the true target distance. NASA

N81-22444*# North Carolina State Univ., Raleigh. Dept. of Geosciences.
COMPATIBILITY STUDY OF THE MAGSAT DATA AND AEROMAGNETIC DATA IN THE EASTERN PIEDMONT OF US Progress Report
I. J. Won, Principal Investigator Dec. 1980 12 p ERTS
(Contract NAS5-26157)
(E81-10108; NASA-CR-164102) Avail: NTIS HC A02/MF A01 CSCL 08F

Data from a 2 day period recorded by Magsat were used to produce world magnetic maps of the scalar total field and three vector component total fields. Subtracting the reference field of Magsat 6/80, a scalar anomalous field and three vector component anomalous fields were also mapped. After removing 718 bad points from the original data, every fifth point was picked for contouring. While the main geomagnetic field of the Earth is surprisingly well mapped considering the short data period, the anomaly maps suffer from data sparseness. The entire Magsat file collected at altitudes of 500-700 m in nonmountainous terrain and at 900-1,000 m in mountainous terrain was averaged to reduce the total data to 6,500 measurements, yielding a 0.1 deg sampling interval along the flight path. A U.S. aeromagnetic anomaly surface map was produced and the field was upward continued to a 300 km altitude. Differences in anomaly structure between the POGO data and the map produced were attributed to insufficient removal of the reference field. Reprocessing of the data using the GSFC reference field (9/80-2) should remove the low harmonic field and improve the anomalous field structure. A.R.H.

N81-22446*# Business and Technological Systems, Inc., Seabrook, Md.
EQUIVALENT SOURCE MODELING OF THE MAIN FIELD USING MAGSAT DATA Quarterly Report, 1 Jul. - 30 Sep. 1980
30 Sep. 1980 4 p ERTS
(Contract NAS5-26047)
(E81-10110; NASA-CR-164104) Avail: NTIS HC A02/MF A01 CSCL 08G

A graphic software package was developed to plot the dipole positions for a particular model on a world map. An arrow is drawn at each dipole in the direction of the horizontal magnetization vector, with length proportional to the horizontal magnitude. A contouring package represents the radical component of the magnetization vector. Based on quiet Magsat data, several dipole models were derived. These are being verified against each other and against MGST (6/80) data set as to goodness of fit and stability of solution. The spatial power spectra computed from spherical harmonic expansions of the dipole models is being analyzed relative to crustal and core content. The power spectra for one of the dipole models and a spherical harmonic model based on Magsat data through degree and order 23 is presented. A.R.H.

N81-22447*# Manitoba Univ., Winnipeg. Dept. of Earth Sciences.
MAGSAT INVESTIGATION Progress Report
D. H. Hall, Principal Investigator 19 Nov. 1980 1 p Sponsored by NASA ERTS
(E81-10111; NASA-CR-164105) Avail: NTIS HC A02/MF A01 CSCL 08G

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

N81-22448*# North Carolina State Univ., Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
A NEW METHOD OF CURIE DEPTH EVALUATION FROM MAGNETIC DATA: THEORY Progress Report
I. J. Won, Principal Investigator 25 Feb. 1981 9 p refs ERTS
(Contract NAS5-26157)
(E81-10112; NASA-CR-164106) Avail: NTIS HC A02/MF A01 CSCL 08G

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

N81-22455*# National Aeronautics and Space Administration, Washington, D. C.
PUBLICATION OF THE MAPS OF TENKE AND MANONO (ZAIRE) FROM LANDSAT DATA
Musungayi Yampania (Presidential Study Service, Kinshasa, Republic of Zaire) Mar. 1981 39 p refs Transl. into ENGLISH of "Mise a jour des cartes de Tenke et Manono (Zaire) a partir des donnees LANDSAT" Rept. SDSU-RSI-VISP-81-02, Jan. 1981 31 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by South Dakota State Univ., Brookings
(Contract NASw-3198)
(NASA-TM-76479; SDSU-RSI-VISP-81-02) Avail: NTIS HC A03/MF A01 CSCL 08B

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

N81-24503*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH'S GRAVITY FIELD MAPPING REQUIREMENTS AND CONCEPT
F. O. Vonbun and W. D. Kahn Feb. 1981 23 p refs Submitted for publication
(NASA-TM-81996) Avail: NTIS HC A02/MF A01 CSCL 08B

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

N81-26517*# Tokyo Univ. (Japan). Geophysics Research Lab.

JAPANESE MAGSAT TEAM. A: CRUSTAL STRUCTURE NEAR JAPAN AND ITS ANTARCTIC STATION. B: ELECTRIC CURRENTS AND HYDROMAGNETIC WAVES IN THE IONOSPHERE AND THE MAGNETOSPHERE Progress Report, 15 Nov. 1980 - 15 Mar. 1981

Naoshi Fukushima, H. Maeda, T. Yukutake, M. Tanaka, S. Oshima, K. Ogawa, M. Kawamura, Y. Miyzaki, S. Uyeda, K. Kobayashi, Principal Investigators et al 28 Mar. 1981 8 p Sponsored by NASA ERTS

(E81-10096; NASA-CR-164094; PR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

Efforts continue in compiling tapes which contain vector and scalar data decimated at an interval of 0.5 sec, together with time and position data. A map of the total force field anomaly around Japan was developed which shows a negative magnetic anomaly in the Okhotsk Sea. Examination of vector residuals from the MGST model shows that the total force perturbation is almost ascribable to the perturbation parallel to the main geomagnetic field and that the contribution from the perturbation transverse to the main field to the total force perturbation is negligibly small. The influences of ionospheric current with equatorial electroject and of the magnetospheric field aligned current on the dawn-dusk asymmetry of daily geomagnetic variations are being considered. The total amount of electric current flowing through the plane of the Magsat orbit loop was calculated by direct application of Maxwell's equation. Results show that the total electric current is 1 to 5 ampheres, and the current direction is either sunward or antisunward. A.R.H.

N81-26518*# 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, 31 Dec. 1980 - 31 Mar. 1981

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

(Contract NAS5-26138)

(E81-10097; NASA-CR-164095; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 08G

Efforts continue in the development of a computer program for looking at the coupling of finite dimensioned source fields with a laterally heterogeneous Earth. An algorithm for calculating a time-varying reference field using ground-based magnetic observatory data is also under development as part of the production of noise-free estimates of global electromagnetic response functions using Magsat data. A.R.H.

N81-26519*# 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 Oct. - 31 Dec. 1980

John F. Hermance, Principal Investigator 9 Jan. 1981 12 p ERTS

(Contract NAS5-26138)

(E81-10103; NASA-CR-164097; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

A spherical harmonic analysis program is being tested which takes magnetic data in universal time from a set of arbitrarily space observatories and calculates a value for the instantaneous magnetic field at any point on the globe. The calculation is done as a least mean-squares value fit to a set of spherical harmonics up to any desired order. The program accepts as a set of input the orbit position of a satellite coordinates it with ground-based magnetic data for a given time. The output is a predicted time series for the magnetic field on the Earth's surface at the (r, theta) position directly under the hypothetically orbiting satellite for the duration of the time period of the input data set. By tracking the surface magnetic field beneath the satellite, narrow-band averages crosspowers between the spatially coordinated satellite and the ground-based data sets are computed. These crosspowers are used to calculate field transfer coefficients with minimum noise distortion. The application of this technique to calculating the vector response function W is discussed. Author

N81-26521*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.

[GRAVITY AND MAGNETIC ANOMALY MODELING AND CORRELATION USING THE SPHERE PROGRAM AND MAGSAT DATA] Quarterly Progress Report, Oct. - Dec. 1980

L. W. Braile, W. J. Hinze, Principal Investigators, and R. R. B. vonFrese Dec. 1980 7 p refs ERTS

(Contract NAS5-22816)

(E81-10115; NASA-CR-164109) Avail: NTIS HC A02/MF A01 CSCL 08G

The spherical Earth inversion, modeling, and contouring software were tested and modified for processing data in the Southern Hemisphere. Preliminary geologic/tectonic maps and selected cross sections for South and Central America and the Caribbean region are being compiled and as well as gravity and magnetic models for the major geological features of the area. A preliminary gravity model of the Andeas Beniff Zone was constructed so that the density columns east and west of the subducted plates are in approximate isostatic equilibrium. The magnetic anomaly for the corresponding magnetic model of the zone is being computed with the SPHERE program. A test tape containing global magnetic measurements was converted to a tape compatible with Purdue's CDC system. NOO data were screened for periods of high diurnal activity and reduced to anomaly form using the IGS-75 model. Magnetic intensity anomaly profiles were plotted on the conterminous U.S. map using the track lines as the anomaly base level. The transcontinental magnetic high seen in POGO and MAGSAT data is also represented in the NOO data. A.R.H.

N81-26522*# Phoenix Corp., McLean, Va.

IMPROVED DEFINITION OF CRUSTAL ANOMALIES FOR MAGSAT DATA Quarterly Report

25 Dec. 1980 2 p ERTS

(Contract NAS5-25882)

(E81-10116; NASA-CR-164110; QR-5) Avail: NTIS HC A02/MF A01 CSCL 08G

Final editing and reduction of the equatorial ground observatory data set was completed. Plots of delineation, and the vertical and horizontal components of the time varying field were generated from these data. Appropriate baselines were derived and deviations from these levels can be used as a continuous measure of the external variations at ground level in the sub-auroral zones. They may also be useful as quantitative measures of the intensity of external field activity. Other data sets assembled for dissemination include (1) Kp and Ap - the planetary magnetic indexes; (2) the international magnetic character indexes-Cp; (3) compilations of magnetic storm sudden commencements; (4) time of interplanetary magnetic sector changes; and (5) Dst-the storm disturbance measure. Fine attitude component data with its increased pointing resolution is reducing residuals by an order of magnitude. A.R.H.

N81-26523*# Phoenix Corp., McLean, Va.

IMPROVED DEFINITION OF CRUSTAL ANOMALIES FOR MAGSAT DATA Quarterly Report

25 Sep. 1980 2 p ERTS

(Contract NAS5-25882)

(E81-10117; NASA-CR-164111; QR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

Ongoing efforts to define and model external magnetic field activities are summarized. Data were obtained and plotted for the five international quiet days of each month Magsat was in orbit. The values of the magnetic field at midnight were also plotted for each of the quiet days. Results show that the zero level of the field fluctuates over the time interval considered. Statistical studies were made for the Kp and Ap indices and more sunspot numbers were obtained for the Magsat period. Satellite data are being thinned and reformatted to make them more amenable to testing the Dst and Sq corrections. The software for processing Magsat tapes is being tested with intermediate attitude data. A.R.H.

N81-26535# Lincoln Lab., Mass. Inst. of Tech., Lexington.

LINEAR FILTERING MODELS FOR TERRAIN IMAGE SEGMENTATION

Charles W. Therrien 4 Feb. 1981 28 p refs

(Contract F19628-80-C-0002; AF Proj. 4594)

(AD-A099034; TR-552; ESD-TR-80-245) Avail: NTIS HC A03/MF A01 CSCL 14/5

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

N81-27566*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.

[ANALYZING AND MODELING GRAVITY AND MAGNETIC ANOMALIES USING THE SPHERE PROGRAM AND MAGSAT DATA] Quarterly Progress Report, Jan. - Mar. 1981

L. W. Braile, W. J. Hinze, and R. R. B. vonFrese, Principal Investigators 30 Mar. 1981 2 p Sponsored by NASA ERTS (E81-10098; NASA-CR-164096) Avail: NTIS HC A02/MF A01 CSCL 08E

Computer codes were completed, tested, and documented for analyzing magnetic anomaly vector components by equivalent point dipole inversion. The codes are intended for use in inverting the magnetic anomaly due to a spherical prism in a horizontal geomagnetic field and for recomputing the anomaly in a vertical geomagnetic field. Modelling of potential fields at satellite elevations that are derived from three dimensional sources by program SPHERE was made significantly more efficient by improving the input routines. A preliminary model of the Andean subduction zone was used to compute the anomaly at satellite elevations using both actual geomagnetic parameters and vertical polarization. Program SPHERE is also being used to calculate satellite level magnetic and gravity anomalies from the Amazon River Aulacogen. A.R.H.

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04

GEOLOGY AND MINERAL RESOURCES

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

A81-30455 **Selective detection of uranium by laser-induced fluorescence - A potential remote-sensing technique. I - Optical characteristics of uranyl geologic targets. II - Experimental assessment of the remote sensing of uranyl geologic targets.** J. P. deNeufville (Energy Conversion Devices, Inc., Morristown, N.J.), A. Kasdan, and R. J. L. Chimenti (Exxon Corporate Research Science Laboratories, Linden, N.J.). *Applied Optics*, vol. 20, Apr. 15, 1981, p. 1279-1307. 46 refs.

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

A81-31998 **Aeromagnetic survey of Kansas.** H. L. Yarger (Kansas Geological Survey; Kansas, University, Lawrence, Kan.). *EOS*, vol. 62, Apr. 28, 1981, p. 173-178. 13 refs. Research supported by the Kansas Geological Survey; U.S. Geological Survey Grant No. 14-08-0001-G-137; Contracts No. AT(49-24)-0256; No. DE-AS07-19ET-27204.

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

A81-33373 * **Seasat orbital radar imagery for geologic mapping - Tennessee-Kentucky-Virginia.** J. P. Ford (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *American Association of Petroleum Geologists, Bulletin*, vol. 64, Dec. 1980, p. 2064-2094. 26 refs. Contract No. NAS7-100.

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

A81-34544 # **Map revision using SLAR imagery.** J. V. Gardner (MARS, Inc., Phoenix, Ariz.) and L. F. Dellwig (Kansas, University, Lawrence, Kan.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 316-325. 6 refs.

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

A81-34573 # **Does color change with type of rock - An application of multispectral analysis to the discrimination of rock types in S.E. Spain.** A. Martinez de Aragon (Instituto Geográfico Nacional, Madrid, Spain). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 634-638. 6 refs.

A81-34575 # **The employment of satellite remote sensing in the fields of geology/science of mineral deposits, hydrogeology, soil science/land use in projects of the Federal Institute of Geosciences and Raw Materials, Hannover (Bilanz über den Einsatz der Satellitenfernerkundung in den Bereichen Geologie/Lagerstättensuche, Hydrogeologie, Bodenkunde/Landnutzung im Rahmen von Projekten der Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover).** R. Mühlfeld (Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 648-654. 9 refs. In German.

A81-34585 # **Seasat-SAR data evaluation for structural and surficial geology.** S. Pala, R. Mussakowski, and E. Wedler (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 755-771. 5 refs.

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

A81-35726 # **Methodological aspects of using remote sensing data in oil and gas exploration (Metodicheskie aspekty ispol'zovaniia materialov distantsionnykh s'emok v neftegazopoiskovykh rabotakh).** M. I. Kostriukov and P. T. Tsarenko (GlavTiumen'neftegaz, Tyumen, USSR). *Issledovanie Zemli iz Kosmosa*, Mar.-Apr. 1981, p. 9-13. 8 refs. In Russian.

The use of remote sensing data for oil and gas exploration in the central part of the western Siberian plain is considered. Techniques

to increase the efficiency of interpretation of deep structures are examined, and the necessity of augmenting the development of automated interpretation systems is emphasized. B.J.

A81-35727 # Some results on the interpretation of space imagery devoted to the study of the geological structure of the middle Tien Shan (Nekotorye rezul'taty deshifrirovaniia kosmofotosnimkov pri izuchenii geologicheskogo stroeniia sredinnogo Tian'-Shania). R. I. Nadyrshin, D. A. Tashkhodzhaev, M. Sipikov, A. V. Shimolin, A. D. Baklanov, and F. M. Baiazitova (Ministerstvo Geologii Uzbekskoi SSR, Institut Geologii i Razvedki Neftianykh i Gazovykh Mestorozhdenii, Tashkent, Uzbek SSR; Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr Priroda, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 14-17. 5 refs. In Russian.

A81-35728 # Metallogeny of areal morphotectonic structures of the Altai-Sayan fold belt, as recognized on space images (Metallogeniia areal'nykh morfotektonicheskikh struktur Altae-Saianskoi Skladchatoi oblasti, ustanovlennykh po kosmicheskim snimkam). Ia. M. Gritsiuk, Z. S. Rossikhina, and V. A. Turbin (Zapadno-Sibirskoe Territorial'noe Geologicheskoe Upravlenie, Novokuznetsk, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 18-24. 9 refs. In Russian.

A81-35729 # The relationship of underground-water sources and aftershocks of the Dagestan earthquake of May 14, 1970 with lineaments revealed on space images (Sviaz' istochnikov podzemnykh vod i aftershokov Dagestanskogo zemletriaseniia 14 Maia 1970 g. s lineamentami, vyiavlennymi po kosmosnimkam). G. G. Bunin (Akademiia Nauk SSSR, Institut Geologii, Makhachkala, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 25-30. 8 refs. In Russian.

A81-35970 # The use of spaceborne photography data in geological surveys (Ob ispol'zovanii materialov kosmicheskoi s'emki pri geologicheskikh issledovaniiakh). N. V. Mezhelovskii and V. N. Briukhanov. *Geodeziia i Kartografiia,* Apr. 1981, p. 48-52. In Russian.

A81-36274 Objectives, accomplishments, and future plans of IGCP Project 143, Remote Sensing and Mineral Exploration. W. D. Carter and L. C. Rowan (U.S. Geological Survey, Reston, Va.). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 227-236. 119 refs.

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

A81-36275 Structural analysis of western Hungary. T. Czako (Budapesti Muszaki Egyetem, Budapest, Hungary). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 237-247. 20 refs.

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

A81-36276 Relations between JPL radar and Seasat observations and the geology of S.W. French Alps. P. Rebillard (Institut Dolomieu - Géologie et Minéralogie, Grenoble, France). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances on Space Research,* vol. 1, no. 10, 1981, p. 249-254. Centre National d'Etudes Spatiales Contracts No. 79-732; No. 80-232.

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

A81-36277 Space geological maps and their importance for mineragenic constructions. V. N. Briukhanov and A. L. Stavtsev (Ministerstvo Geologii SSSR, Ob'edinenie Aerogeologiia, Moscow, USSR). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 255-260.

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

A81-36278 Significant results from using earth observation satellites for mineral and energy resource exploration. W. D. Carter (U.S. Geological Survey, Earth Resources Observation Systems Office, Reston, Va.). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 261-269. 24 refs.

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

A81-36279 Influence of deep seated causes on geologic deformation recognized on satellite images made with a hand held camera. P. Bankwitz and K.-H. Marek (Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, Potsdam, East Germany). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 271-277.

Geological methods of interpretation are used to derive specific information about the structure and behavior of the uppermost parts of the lithosphere from satellite images. The reconnaissance of such deep-seated features is equivalent to the remote sensing of remote

sensing data interpretations. Study results nevertheless indicate that there is a high degree of useful information to be found in images taken during the BIOSPHERE experiment aboard Salyut 6 in 1978, with a hand-held camera. O.C.

A81-36280 Ore-controlling structures in volcanic regions, observed on space images. N. I. Filatova, F. A. Mazhenshtein, V. V. Kovaleva, A. P. Dorogutin, I. V. Egorov, I. A. Kuznetsova, and M. M. Smelovskaia (Ministerstvo Geologii SSSR, Ob'edinenie Aerogeologiia, Moscow, USSR). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 279-284.

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

A81-36281 I.G.C.P. Project No. 143 - Remote Sensing and Mineral Exploration - Current UK activities. D. I. J. Mallick (Institute of Geological Sciences, Nottingham, England). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 285-288.

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

A81-36282 New data about the neotectonics of Matra Mountains, Northern Hungary. T. Czako (Budapesti Muszaki Egyetem, Budapest, Hungary) and T. Zelenka (National Ore and Mineral Mining Co., Budapest, Hungary). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 289-298. 14 refs.

A81-36283 Regional tectonics and sulphide ore localisation in Delhi-Aravalli belt, Rajasthan, India - Use of Landsat imagery. D. K. Bharktya and R. P. Gupta (Roorkee, University, Roorkee, India). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 299-302. 6 refs.

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

A81-36284 Composition and meaning of lineaments in the Northern Calcareous Alps. F. Jaskolla (München, Technische Universität, Munich, West Germany). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 307-312. 6 refs.

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

A81-37774 Review of hologram matrix radars. K. Iizuka (Toronto, University, Toronto, Canada). In: 1980 International Optical Computing Conference, Washington, DC, April 8-11, 1980, Proceedings. Book 1. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 179-187. 18 refs.

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

A81-38275 # An improved single mineral specimen method for the evaluation of satellite element reserves (Methode perfectionnée des échantillons monominéraux pour l'évaluation des réserves en éléments-satellites). P. A. Vasilev (Comité de Géologie, Institut de Recherches de Minéraux Utiles, Sofia, Bulgaria). *Bolgarskaia Akademiia Nauk, Doklady,* vol. 34, no. 3, 1981, p. 371-373. In French.

A81-39363 Geological applications of multispectral techniques for lithologic and lineament analysis. J. D. Dykstra and C. Sheffield (Earth Satellite Corp., Washington, DC). In: Image processing for missile guidance; Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 343-349. 12 refs.

The potential use of data from existing and planned earth resources satellites for identifying surface materials is examined. Two different methods for applying existing data to surface materials identification are discussed. The first seeks to apply basic models of the physical processes that come into play in the reflection and emission of radiation. The second method employs 'training sets' to empirically determine the signature of particular materials under given illumination conditions. It is noted that several difficulties complicate the application of the first method, and it is concluded that the present and planned Landsat spacecraft probably do not justify the use of the basic physical models. The method using training sets is considered useful with presently available data. Several examples using special multispectral combinations of Landsat data illustrate the present potential of the existing earth resource satellite systems and suggest the increased potential promised by the higher spatial and spectral resolution of the next generation of earth resources satellite systems. C.R.

A81-39364 * **Use of thermal-inertia properties for material identification.** J. P. Schieldge, A. B. Kahle, R. E. Alley, and A. R. Gillespie (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: Image processing for missile guidance; Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 350-357. 15 refs. Contract No. NAS7-100.

It is noted that a knowledge of the thermal inertia of the earth's surface can be used in geologic mapping as a complement to surface reflectance data as provided by Landsat. Thermal inertia, which is a body property, cannot be determined directly but can be inferred from radiation temperature measurements made at various times in the diurnal heating cycle, combined with a model of the surface heating processes. A model of this type is developed and applied along with temperature measurements made in the field and by satellite to determine thermal properties of surface materials. An example from a test site in western Nevada is used to demonstrate the utility of this technique. C.R.

A81-40617 **Use of airborne radar mapping in geological and geographical studies (Primenenie radiolokatsionnoi aeros'emki pri geologo-geograficheskikh issledovaniiakh).** Edited by V. M. Glushkov and V. B. Komarov. Leningrad, Izdatel'stvo Nedra, 1981. 240 p. 58 refs. In Russian.

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

N81-23550*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

WESTERN ENERGY RELATED OVERHEAD MONITORING PROJECT. PHASE 2: SUMMARY Progress Report, 1 Jan. 1977 - 30 Jun. 1978

James E. Anderson, Principal Investigator Jan. 1979 113 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10141; NASA-TM-82328; Rept-176) Avail: NTIS HC A06/MF A01 CSCL 08F

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

N81-24488*# Florida Univ., Gainesville. Remote Sensing Applications Lab.

A REMOTE SENSING EVALUATION OF POTENTIAL FOR SINKHOLE OCCURRENCE

Jay Casper, Byron Ruth, and Janet Degner, Principal Investigators Jan. 1981 103 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10143; NASA-CR-164245) Avail: NTIS HC A06/MF A01 CSCL 08G

The relationship between lowering of the water table and sinkhole development in Pierson and in Hillsborough County, Florida was investigated. The locations of recently developed (1973) collapses were examined with respect to lineaments or fracture traces that are expressed in the terrain and visible in aerial photography and satellite imagery. It was anticipated that these relationships would provide the basis for establishment of criteria for mapping those land areas that have the greatest potential for sinkhole development. A very good correlation was found between mapped lineament intersections and known location of sinkhole occurrences for both study areas. This indicates that lineament and fracture trace mapping may be very useful in locating zones with the greatest potential for sinkhole development. It is further shown that this information is quite beneficial in land use planning applications. R.C.T.

N81-24490*# Washington Univ., Seattle. Dept. of Geological Sciences.

GEOLOGICAL REMOTE SENSING: IDENTIFICATION AND MAPPING OF ROCK TYPES FOR NON-RENEWABLE RESOURCES Semiannual Report, 1 Oct. 1980 - 31 Mar. 1981

John B. Adams, Principal Investigator 22 Apr. 1981 2 p ERTS

(Grant NAGw-85)

(E81-10145; NASA-CR-164259) Avail: NTIS HC A02/MF A01 CSCL 08B

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

N81-24512# Bendix Field Engineering Corp., Grand Junction, Colo.

STATISTICAL TECHNIQUES APPLIED TO AERIAL RADIOMETRIC SURVEYS (STAARS): PRINCIPAL COMPONENTS ANALYSIS USER'S MANUAL

C. D Koch, F. L. Pirkle, and J. S. Schmidt Jan. 1981 76 p refs

(Contract DE-AC13-76GJ-01664)

(GJBX-9-81) Avail: NTIS HC A05/MF A01

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

N81-25452*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.

STUDY ON VARIOUS ELEMENTS OF THE GEOSCIENCES WITH RESPECT TO SPACE TECHNOLOGY Final Report

James W. Head, III Apr. 1981 61 p Sponsored by NASA

(Contract JPL-955513)

(NASA-CR-164450) Avail: NTIS HC A04/MF A01 CSCL 08G

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

N81-26514*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Apr. - Jun. 1980

Helen N. Paley and Anne B. Kahle, Principal Investigators Aug. 1980 4 p HCMM

(Contract NAS7-100)

(E81-10090; NASA-CR-164086) Avail: NTIS HC A02/MF A01 CSCL 08G

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

N81-26516*# Texas Univ. at El Paso. Dept. of Geological Sciences.

EVALUATION OF EXISTING KNOWLEDGE OF THE TECTONIC HISTORY AND LITHOSPHERIC STRUCTURE OF SOUTH AMERICA Quarterly Report, 3 Oct. - 31 Dec. 1980

G. R. Keller and E. G. Lidiak, Principal Investigators 31 Dec. 1980 7 p HCMM
(Contract NAS5-26326)
(E81-10092; NASA-CR-164090) Avail: NTIS HC A02/MF A01 CSCL 08G

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

N81-27569*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROSPECTS FOR TLRS BASELINE ACCURACIES IN THE WESTERN USA

D. Christodoulidis (EG/G Washington Analytical Services Center, Inc., Riverdale, Md.) and David E. Smith Apr. 1981 45 p refs Submitted for publication
(Contract NAS5-26012)
(NASA-TM-82133) Avail: NTIS HC A03/MF A01 CSCL 08E

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

N81-27588# Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschanften.

PREDICTION AND ASSESSMENT OF DISASTERS RELATED TO EARTH'S CRUST MOVEMENTS: EARTHQUAKES AND VOLCANISM

Andreas Vogel *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 119-124 refs

Avail: NTIS HC A09/MF A01

The predictability of earthquakes is discussed and earthquake prediction research is defined. Global tectonics and the nature of earthquakes are considered. Present interdisciplinary approaches to earthquake prediction are shown. Precursory ground deformation observation with space geodetic techniques is described. Regarding seismotectonic studies which are of special concern in earthquake risk analysis, it is shown that remote sensing is a useful tool to delineate active and hazardous faults. Application of remote sensing for volcanic hazard assessment is also treated. The importance of satellite data collection systems in earthquake and volcanic hazard assessment is underlined.
Author (ESA)

05

OCEANOGRAPHY AND MARINE RESOURCES

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

A81-30542 # **Evaluation of the spatial-temporal dynamics of turbid waters from satellite multispectral images (K otsenke prostranstvenno-vremennoi dinamiki zamutnennykh vod po mnogozonal'nym kosmicheskim izobrazheniiam).** I. N. Alekseeva and M. Nazirov. In: Methods for the processing and interpretation of multispectral data on earth resources. Leningrad, Gidrometeoizdat, 1980, p. 137-145. 6 refs. In Russian.

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

A81-30635 # **Two-channel microwave radiometric determination of wind velocity from a satellite (Dvukhkanal'nyi SVCh-radiometricheskii metod opredeleniia skorosti vetra so sputnika).** L. M. Martsinkevich (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, USSR). *Meteorologiia i Gidrologiia,* Mar. 1981, p. 59-67. 8 refs. In Russian.

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

A81-32244 **Characteristics of synthetic-aperture radar imaging of ocean waves.** A. V. Ivanov (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *(Radiofizika,* vol. 23, no. 8, 1980, p. 923-933.) *Radiophysics and Quantum Electronics,* vol. 23, no. 8, Feb. 1981, p. 619-626. 17 refs. Translation.

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

A81-32273 ***Static and dynamic modeling of a SAR imaged ocean scene.*** R. A. Shuchman, A. Klooster, Jr. (Michigan, Environmental Research Institute, Ann Arbor, Mich.), and A. L. Maffett (Michigan, University, Dearborn, Mich.). *IEEE Journal of Oceanic Engineering,* vol. OE-6, Apr. 1981, p. 41-49. 20 refs. Contract No. N00014-76-C-1048; Contract No. NOAA-N-07-35328.

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

A81-32274 * **The wind-speed measurement capability of spaceborne radar altimeters.** G. S. Brown (Applied Science Associates, Apex, N.C.), H. R. Stanley (NASA, Wallops Flight Center, Wallops Island, Va.), and N. A. Roy (EG&G Washington Analytical Services Center, Inc., Pocomoke City, Md.). *IEEE Journal of Oceanic Engineering,* vol. OE-6, Apr. 1981, p. 59-63. 8 refs. NASA-supported research.

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

A81-32275 **Remote and synoptic water-wave measurements by aerial photography - A model, experimental results, and an application.** D. Sheres (Science Applications, Inc., La Jolla, Calif.). *IEEE Journal of Oceanic Engineering,* vol. OE-6, Apr. 1981, p. 63-69. 5 refs. Research supported by the Foundation for Ocean Research and U.S. Navy.

A81-32600 **A satellite mosaic of the Greenland ice sheet.** D. R. Wiesnet. In: World glacier inventory. Budapest, International Association of Hydrological Sciences (IAHS Publications, No. 126), 1980, p. 343-347; Discussion, p. 347, 348. 6 refs.

The impetus provided by the Satellite Image Atlas of Glaciers of the World Project, sponsored by the U.S. Geological Survey, to the use of satellite data for glacier studies is assessed. The NOAA-5 polar-orbiting satellite's 900-m resolution is found to be well suited for monitoring the Greenland ice sheet. A number of computer enhanced and rectified satellite-derived mosaics of the ice sheet are presented and discussed. The analysis provided of the satellite imagery suggests possible relationships between temperature and topography as well as the possibility of recording the position of the firn line. C.R.

A81-33466 **Use of laboratory spectrometry to predict the detection of phytoplankton luminescence by an airborne Fraunhofer line discriminator.** R. D. Watson, A. F. Theisen (U.S. Geological Survey, Flagstaff, Ariz.), and B. B. Prezelin (California, University, Santa Barbara, Calif.). *International Journal of Remote Sensing,* vol. 2, Jan.-Mar. 1981, p. 61-70. 18 refs. NSF Grant No. OCE-77-13919.

A81-33467 **Remote sensing of bottom reflectance and water attenuation parameters in shallow water using aircraft and Landsat data.** D. R. Lyzenga (Michigan, Environmental Research Institute, Ann Arbor, Mich.). *International Journal of Remote Sensing,* vol. 2, Jan.-Mar. 1981, p. 71-82. Contracts No. N00014-78-C-00458; No. DMA800-77-C-0053.

The reflectance of shallow water areas to solar illumination is a function of the water depth, the water optical properties and the bottom reflectance. Assuming the water optical properties to be uniform over a given scene area, the signals recorded by a multispectral scanner system may be combined to obtain information on the water attenuation and bottom reflectance parameters without knowledge of the water depth. These techniques are described and evaluated for a test site near North Cat Cay in the Bahamas. (Author)

A81-33829 # **Observations of the Mt. St. Helens ash cloud over the Atlantic Ocean.** D. J. O'Connor (U.S. Naval Oceanographic Office, Bay St. Louis, Miss.). *American Meteorological Society, Bulletin,* vol. 62, Feb. 1981, p. 237, 238.

A81-34517 * # **Spaceborne synthetic aperture radar for imaging sea ice.** F. T. Barath (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: International archives

of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 30-45. Contract No. NAS7-100.

A81-34520 * # Detection and tracking of a low energy swell system off the U.S. East Coast with the Seasat SAR. R. C. Beal (Johns Hopkins University, Applied Physics Laboratory, Laurel, Md.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 74-83. 7 refs. NASA-supported research; Contract No. NOAA-MO-A01-78-00-4330.

It is noted that on the morning of September 28, 1978, at 1520 GMT, Seasat approached the East Coast of the U.S. with the 100 km swath of its synthetic aperture radar (SAR) running approximately parallel to the coast but displayed eastward by about 20 km. This pass is analyzed and the following conclusions are drawn: (1) the SAR can successfully detect low-energy swell systems with wave heights under 1 m (actually 0.65 + or - 0.25 m); (2) the refraction of low-energy but well-organized swells deriving from changes in the local depth of the ocean is clearly detectable in both wavelength and direction; and (3) the complexity of the ocean spectrum (whether composed of more than one system or spread in direction and wave number) appears to have little bearing on the threshold detection limits. C.R.

A81-34533 # Sea ice morphology in the context of wave-ice interaction studies. A. M. Cowan (Cambridge University, Cambridge, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 214-224. 16 refs.

A seven year wave-ice interaction study was carried out in the Arctic Ocean, the Labrador Sea, the Bering Sea, and the coastal zones of Greenland, using side-looking airborne radar, infrared linescan imagery, laser and photographic sensors mounted on fixed-wing aircraft and helicopters, and sonar on nuclear submarines. Experiments were performed to establish such parameters as pressure-ridge spacing and the ratio of ridge sail height to keel draft. Of the morphological parameters, the one which emerges as being of greatest importance in the context of wave-ice interaction studies is floe-size distribution. As the waves propagate through an ice-field, they are scattered and attenuated by the distribution of floe sizes they partially create. The analysis, primarily of aerial photographs, was carried out with a modular scanning image analyser. K.S.

A81-34534 # The determination of chlorophyll-a and suspended sediment concentrations for EURASEP test site, during North Sea Ocean Colour Scanner experiment, from an analysis of a Landsat scene of 27th June 1977. A. P. Cracknell and S. M. Singh (Dundee, University, Dundee, Scotland). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 225-234. 8 refs. Research supported by the Science Research Council.

A81-34566 # The calculation of reflection factors on the basis of multispectral data (Die Berechnung von Reflexionsfaktoren aus multispektralen Bilddaten). P. Lohmann (Hannover, Universität, Hanover, West Germany), W. Reil (Prakla Seismos GmbH, Hanover, West Germany), and R. Stätter (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Optoelektronik, Oberpfaffenhofen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 564-573. 5 refs. In German.

Multispectral recordings of areas containing shoals at the German coast of the North Sea were obtained with a scanning device. Ground-based studies of atmospheric radiation parameters were conducted simultaneously with the air-borne measurements. An employment of the calibration function of the scanner and the utilization of the radiation parameters of the ground-based measurements make it possible to determine the radiation-density values of the surface of the areas involved. These values provide a basis for the determination of the reflection coefficients of certain objects. The values of the reflection coefficients calculated on the basis of the scanning data are compared with reflection spectra obtained by ground-based measurements. G.R.

A81-34567 # Digital correction of thermal pictures, obtained from medium altitudes, of water surfaces near the coast (Digitale Korrektur von Thermalaufnahmen aus mittleren Höhen von küstennahen Wasserflächen). P. Lohmann (Hannover, Universität, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 574-588. 6 refs. In German.

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

A81-34576 # A verification trial of the coast morphology of sand embankment by surf waves from Landsat-imagery. W. M. C. Mueksch (Dar es Salaam, University, Dar es Salaam, Tanzania). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 655-662. 15 refs.

Ground observations reveal that the borders of the sediment surfaces are similar to the curves caused by the refraction of waves against the shore. The data collection is carried out by point wise coordinate measurements of the deposit shapes on a false color frame. An older model of a coordinate measuring machine from the Astronomical Institute of Bonn University is used which produces a semi-automatic output with a sensitivity of 1 micron. The importance of such factors in the sedimentation process as wind, ebbstreams, turbulence, and fluvial processes is stressed. It is concluded that satellite imagery makes possible observations and interpretations of complex dynamic coast and oceanic submarine processes that would otherwise entail great difficulty and cost. C.R.

A81-34600 # Landsat imagery of phytoplankton development in the Baltic Sea. K. A. Ulbricht (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Oberpfaffenhofen, West Germany) and U. Horstmann (Kiel, Neue Universität, Kiel, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 932-941. 7 refs.

Remote sensing data application in the investigation of the variability and characteristics pertaining to phytoplankton growth patterns for possible ecological evaluation is studied, analyzing the complicated hydrography and mixing processes. Blue-green algae growth, predominantly of the Nodularia spumigena, is analyzed, and results are compared to previous data. General results confirm that the phytoplankton productivity, the variability of growth patterns, and the movement of plankton communities are determined by the intensity of light radiation, presence of mineral nutrients, and the particular wind and sea current system. Additionally, particular

results show that the length of the presence of the plankton community in the near surface of the euphotic layer influences the production of phytoplankton. Nitrogen fixation by algae was found to influence the nitrogen budget of the Baltic Sea area; however, since variations in the estimated N-fixation calculations range from 2000 to 100,000 tons annually, further research with satellite (Landsat) measurements compared to ground truth data is suggested. (Author)

A81-34632 # A summary of wind and wave conditions for 28 September 1978 extracted from 'conventional' data sources. P. DeLeonibus and J. Ernst (NOAA, National Environmental Satellite Service, Washington, D.C.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 503-509.

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

A81-34636 # Evaluation of ocean bottom features from ocean color scanner imagery. P. Lohmann (Hannover, Universität, Hanover, West Germany) and H. van der Piepen (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Optoelektronik, Oberpfaffenhofen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 558-566. 9 refs.

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

A81-34646 # Applications of remote sensing to oceanography and sea ice. R. Thoren (Forsvarets Forskningsanstalt, Stockholm, Sweden). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 662-725.

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

A81-34973 Monitoring winter sea ice dynamics in the Canadian Arctic with NOAA-TIR images. B. Dey (Howard University, Washington, D.C.). *Journal of Geophysical Research*, vol. 86, Apr. 20, 1981, p. 3223-3235. 22 refs. Research supported by the University of Saskatchewan and Howard University.

The study revealed the unique features of winter sea ice dynamics in the Canadian Arctic during 1974-1978 winter seasons. The features included the presence of open water and thin ice in parts of Smith Sound, northern Baffin Bay, western Jones Sound, Foxe Basin, Lancaster Sound, and southeast Baffin Bay. In addition, persistency of leads and polynyas at Smith Sound, Melville Bay, northern Lancaster Sound, Jones Sound, Home Bay, eastern Beaufort Sea, and Amundsen Gulf was remarkable phenomenon. Further, active leads were found in Baffin Bay and Beaufort Sea throughout the winter season. Two ice dams at Smith Sound and Barrow Strait regulated the influx of ice into northern Baffin Bay. The influx of ice into northern Baffin Bay through Smith Sound, Jones Sound, and Lancaster Sound estimated to be 654 cu km per year, whereas the influx of ice from the Arctic Ocean and the Central Archipelago through Robeson Channel, Fram Sound, and Barrow Strait was about 201 cu km per year. (Author)

A81-34982 Intrusion of loop current waters onto the West Florida continental shelf. O. K. Huh, W. J. Wiseman, Jr., and L. J. Rouse, Jr. (Louisiana State University, Baton Rouge, La.). *Journal of Geophysical Research*, vol. 86, May 20, 1981, p. 4186-4192. 10 refs. Navy-sponsored research.

An intrusion of loop current water up DeSoto Canyon and onto the West Florida continental shelf to within 8 km of the shore occurred in February 1977. Boat, aircraft, and satellite data collected in the area for another purpose were used to estimate the space and time scales of the intrusion and the ultimate fate of the intruded waters. The duration of the event was 18 days. Oceanic waters advanced across the shelf at speeds of 20 cm/s. At maximum intrusion, 6650 sq km of shelf were affected. Approximately half the intruded water receded off the shelf, and half appears to have been modified in situ. (Author)

A81-35742 # A measure of utilization of satellite-derived information in the fishing industry (O mere ispol'zovaniia kosmicheskoi informatsii dlia nuzhd rybnogo khoziaistva). V. V. Rossov (Poliarnyi Nauchno-Issledovatel'skii Institut Morskogo Rybnogo Khoziaistva i Okeanografii, Murmansk, USSR). *Issledovanie Zemli iz Kosmosa*, Mar.-Apr. 1981, p. 116, 117. In Russian.

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

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

A81-36109 First FGGE results from satellites; Proceedings of the Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980. Symposium sponsored by COSPAR, ICSU, WMO, and IAMAP. Edited by T. Tanczer, G. Götz, and G. Major (Orszagos Meteorologiai Szolgalat, Budapest, Hungary). *Advances in Space Research*, vol. 1, no. 4, 1981. 339 p.

Space systems used in the First GARP Global Experiment (FGGE) of the Global Atmospheric Research Program (GARP) are discussed along with special observing systems, observations in the tropics, wind determination, and data assessment. Other topics considered are related to air-sea interaction, the structure of the troposphere, the stratosphere, radiation processes, and cloud studies. Attention is given to the role of space techniques in FGGE, geostationary operational environmental satellite system performance, the Meteosat system during the FGGE, the performance of the FGGE drifting buoy system, actual performance and capabilities

of the Argos system, the determination of wind vectors from Meteosat water vapor channel data, FGGE operations and data management, U.S. FGGE special data sets and special effort, vertical mass and moisture structure from TIROS-N, measurements of the earth radiation budget from satellites during the FGGE, and the sensitivity of the earth's radiation budget to changes in cloudiness. G.R.

A81-36111 Geostationary operational environmental satellite system performance. G. Ludwig and D. Johnson (NOAA, National Environmental Satellite Service, Suitland, Md.). *(COSPAR, ICSU, WMO, and IAMAP, Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 4, 1981, p. 23-31.

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

A81-36114 The United States operational polar-orbiting satellite series - TIROS-N. H. Yates (NOAA, National Environmental Satellite Service, Washington, D.C.). *(COSPAR, ICSU, WMO, and IAMAP, Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 4, 1981, p. 57-71.

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

A81-36116 The performance of the FGGE drifting buoy system. J. Garrett (Institute of Ocean Sciences, Sidney, British Columbia, Canada). *(COSPAR, ICSU, WMO, and IAMAP, Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 4, 1981, p. 87-94. 5 refs.

A81-36117 Actual performance and capabilities of the Argos system. M. Taillade (Centre National d'Etudes Spatiales, Toulouse, France). *(COSPAR, ICSU, WMO, and IAMAP, Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 4, 1981, p. 95-110.

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

A81-36119 A study of the onset of the Indian monsoon as seen from GEOS I.O. satellite. M. Desbois (CNRS, Laboratoire de Météorologie Dynamique, Paris, France). *(COSPAR, ICSU, WMO, and IAMAP, Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 4, 1981, p. 121-125. 7 refs.

A81-36121 Wind-field analysis on the basis of Meteosat images. F. Rakoczi (Eotvos Lorand Tudomanyegyetem, Budapest, Hungary) and E. Kovacs (Institute for Coordination of Computer Techniques, Budapest, Hungary). *(COSPAR, ICSU, WMO, and IAMAP, Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 4, 1981, p. 133-137. 5 refs.

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

A81-36125 U.S. FGGE special data sets and special effort. W. E. McGovern (NOAA, Rockville, Md.). *(COSPAR, ICSU, WMO, and IAMAP, Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 4, 1981, p. 189-193.

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

A81-36127 Ocean circulation studies in the vicinity of Southern Africa - Preliminary results using FGGE drifters and remote sensing. J. R. E. Lutjeharms and H. R. Valentine (South African Council for Scientific and Industrial Research, National Research Institute for Oceanology, Stellenbosch, Republic of South Africa). *(COSPAR, ICSU, WMO, and IAMAP, Symposium on Systems Performance and Early Results of the Global Observing System for FGGE, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 4, 1981, p. 211-223. 30 refs.

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

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

Development Agency of Japan, Earth Observation Systems Dept., Tokyo, Japan). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 165-176. 9 refs.

A81-37295 * Microwave radiometric measurements of sea surface temperature from the Seasat satellite - First results. R. Hofer, E. G. Njoku, and J. W. Waters (California Institute of Technology, Jet Propulsion Laboratory, Earth and Space Sciences Div., Pasadena, Calif.). *Science,* vol. 212, June 19, 1981, p. 1385-1387. 30 refs. Research supported by the National Academy of Sciences; Contract No. NAS7-100.

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

A81-38238 Study of the variability of dynamic ocean topography west of the mid-Atlantic ridge between 30 deg N and 55 deg N latitude (Etude de la variabilité de la topographie dynamique des océans à l'ouest de la dorsale médio-Atlantique entre 30 deg N et 55 deg N en latitude). Y. Menard (Centre National d'Etudes Spatiales, Groupe de Recherches de Géodésie Spatiale, Toulouse, France). *(Association Internationale de Géodésie and COSPAR, Symposium International sur la Géodésie Spatiale et ses Applications, Cannes, France, Nov. 18-21, 1980.) Annales de Géophysique,* vol. 37, Jan.-Mar. 1981, p. 99-106. 28 refs. In French.

A81-38724 Turbidity of coastal water determined from Landsat. S. Aranuvachapun and P. H. LeBlond (British Columbia, University, Vancouver, Canada). *Remote Sensing of Environment,* vol. 11, May 1981, p. 113-132. 26 refs. Research supported by the Natural Sciences and Engineering Research Council of Canada.

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

A81-38788 * # Multifrequency radiometer detection of submarine freshwater sources along the Puerto Rican coastline. H.-J. C. Blume, B. M. Kendall, and J. C. Fedors (NASA, Langley Research Center, Hampton, VA). *Journal of Geophysical Research,* vol. 86, June 20, 1981, p. 5283-5291. 11 refs.

The surface area above submarine springs of fresh water exhibit temperatures and salinities lower than the surrounding sea waters. A multifrequency radiometer system which earlier demonstrated an accuracy of 1 degree C and 1 part per thousand in remotely detecting the surface temperature and salinities, respectively, was used to detect submarine freshwater springs. The first mission on February 4, 1978, consisted of overflight measurements over three fourths of the coastal areas around the Island of Puerto Rico. During the second mission on February 6, 1978, special attention was directed to the northwest portion of Puerto Rico where several submarine springs had been reported. The previously reported spring locations correlated well with the locations detected by the radiometers. After separating the surface runoffs such as rivers, lagoons, marshes, and bays, 44 submarine freshwater springs were identified which indicates that the submarine freshwater outflow locations are more numerous around the island than had earlier been estimated. The majority of the submarine springs are located at the northwest and southeast portion of the Puerto Rican coastline. The success of detecting the same submarine springs during both missions at the northwest portion of the island was 39%. (Author)

A81-39362 Remote sensing of the sea/air interphase as an indicator of subsurface activity. R. E. Baier, C. W. Rogers, V. A. DePalma, and R. J. Pilie (Calspan Corp., Environmental Sciences Dept., Buffalo, NY). In: Image processing for missile guidance; Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 334-342. 24 refs. Research supported by the Calspan Corp. and U.S. Navy.

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

A81-40686 * Application of aerial photography to the study of small scale upper ocean phenomena. T. Ichiye and M. Carnes (Texas A & M University, College Station, TX). *Pure and Applied Geophysics,* vol. 119, no. 2, 1981, p. 294-308. 17 refs. NOAA-NASA-supported research.

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

A81-40767 # Possible differences between mean sea-levels from satellite altimetry. M. Bursa and Z. Sima (Ceskoslovenska Akademie Ved, Astronomicky Ustav, Prague, Czechoslovakia). *Studia Geophysica et Geodaetica,* vol. 25, no. 1, 1981, p. 1-4.

Differences between the mean sea levels of the Pacific, Atlantic and Indian Oceans and the Mediterranean Sea are determined based on an analysis of satellite altimetry data. Values of the geopotential geoid were computed for 5 x 5 deg blocks using mean geoidal heights reported by Rapp (1979) from GEOS altimeter data and various geopotential models. When the geopotential models with the greatest internal consistency (GEM 7, 10 and 10B) are used, differences of less than 0.5 m are obtained between the mean sea levels in the Pacific, Atlantic and Indian Oceans and the Mediterranean Sea, and less than 0.2 m between the Pacific, Atlantic and Indian Oceans. The accuracy of the determinations is noted to be limited by the accuracy of the geopotential models. A.L.W.

N81-22675# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.

SEA STATE MEASUREMENT WITH A TWO FREQUENCY SCATTEROMETER: THEORY

Michael Kelintz May 1980 161 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-710)

(DFVLR-FB-80-32) Avail: NTIS HC A08/MF A01

In the context of the SPACELAB program, sea state measurements with a two frequency scatterometer are considered. A system analysis of two frequency scatterometry, especially signal analysis for stationary and airborne (aircraft; satellite) measurements, is presented, and an unambiguous method for wind direction determination is given. A statistical model of sea state, based on the frequency spectrum of the water wave height distribution, is used. The radar echo from the sea surface is

characterized for a monochromatic output signal. An autocorrelation function is developed, and application in consideration of the Doppler spectrum of the sea surface reflectance function is shown. Author (ESA)

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

DETERMINATION OF BACKSCATTER CHARACTERISTICS OF SEA ICE USING SYNTHETIC APERTURE RADAR DATA Final Report, 1 Jul. 1979 - 31 Aug. 1980

Richard W. Larson, James D. Lyden, Robert A. Shuchman, and Ray T. Lowry Mar. 1981 198 p refs

(Contract N00014-79-C-0690)

(AD-A097341; ERIM-142600-1-F) Avail: NTIS HC A09/MF A01 CSCL 17/9

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

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

THE OCEANOGRAPHIC ENVIRONMENTAL REFERENCE SERVICE RETRIEVAL PROGRAM USERS GUIDE Final Report

Richard L. Rein Feb. 1981 39 p

(AD-A097340; NOO-RP-31) Avail: NTIS HC A03/MF A01 CSCL 05/2

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

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

REMOTE SENSING OF PRECIPITABLE WATER OVER THE OCEANS FROM NIMBUS-7 MICROWAVE MEASUREMENTS

C. Prabhakara, H. D. Change (Computer Sciences Corp., Silver Spring, Md.), and A. T. C. Chang Apr. 1981 29 p refs

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

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

N81-24682*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SEASAT: - JASIN WORKSHOP REPORT. VOLUME 1: FINDINGS AND CONCLUSIONS

Dec. 1980 408 p refs

(NASA-CR-164360; JPL-Pub-80-62-Vol-1) Avail: NTIS HC A18/MF A01 CSCL 04B

Data acquired from the Joint Air-Sea Interaction (JASIN) Experiment and Seasat data from overpasses that covered the JASIN area were compared and evaluated. The JASIN data were used as a high quality withheld data set. The Seasat data were prepared for each instrument: the Seasat-A Satellite Scatterometer (SASS), the Scanning Multichannel Microwave Radiometer (SMMR), and the synthetic aperture radar (SAR). The following results demonstrate the performance of Seasat: it was possible to identify mesoscale systems with the SASS as well as fronts; the SMMR provided accurate water vapor content of the atmosphere; the SAR showed evidence of helical rolls in the marine boundary layer; a SASS anomaly could be traced back to thunderstorm activity. J.M.S.

N81-24684*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ICE CONDITIONS ON THE CHESAPEAKE BAY AS OBSERVED FROM LANDSAT DURING THE WINTERS OF 1977, 1978 AND 1979

James L. Foster Mar. 1980 36 p refs Submitted for publication

(NASA-TM-80657) Avail: NTIS HC A03/MF A01 CSCL 04B

The LANDSAT observations during the winters of 1977, 1978 and 1979, which were unusually cold in the northeastern U.S. and in the Chesapeake Bay area, were evaluated. Abnormal atmospheric circulation patterns displaced cold polar air to the south, and as a result, the Chesapeake Bay experienced much greater than normal icing conditions during these 3 years. The LANDSAT observations of the Chesapeake Bay area during these winters demonstrate the satellite's capabilities to monitor ice growth and melt, to detect ice motions, and to measure ice extent. E.A.K.

N81-24705# National Oceanic and Atmospheric Administration, Washington, D. C. National Earth Satellite Service.

REPORT ON THE CONFERENCES ON THE NATIONAL OCEANIC SATELLITE SYSTEM

John W. Sherman, III Sep. 1980 139 p refs

(PB81-154957; NOAA-80123103) Avail: NTIS HC A07/MF A01 CSCL 08J

Approximately 400 persons participated in five conferences on the Potential National Oceanic Satellite System. The presentations and discussions at the conferences are documented and the initial analyses of the Conference Worksheets completed by 144 marine operational and research users are presented. The report includes the points raised by these users and presents a series of findings and concerns. GRA

N81-26548# California Univ., Santa Barbara. Geography Remote Sensing Unit.

ANALYSIS OF SEASAT-A SAR (SYNTHETIC APERTURE RADAR) DATA FOR THE DETECTION OF OIL ON THE OCEAN SURFACE

John E. Estes, Michael Wilson, and Earl Haijic 1 Oct. 1980 106 p refs

(Contract NA79SAC-00734)

(PB81-153405; NOAA-80123102) Avail: NTIS HC A06/MF A01 CSCL 13B

The smoothing effects of oil slicks on ocean surfaces were examined and two problems were encountered. These were: lack of concurrent surface verification data, and the appearance of so called confusion targets in the imagery. To 'synthesize' necessary surface truth information, a linear deterministic oil trajectory model was developed which sums the effects of winds, currents, and tides to predict hourly oil slick configurations within the area. Using output oil slick trajectory predictions as a guide, a collecion of 128 x 128 byte subimages was gathered from oil affected areas. Zones of reduced backscatter which could not be attributed to oil/surface tension effects (confusion targets) provided a similar set of subimages. GRA

N81-26642 Kansas Univ., Lawrence.

OCEANIC WIND VECTOR DETERMINATION USING

SEASAT SATELLITE Ph.D. Thesis
George John Dome 1980 189 p
Avail: Univ. Microfilms Order No. 8111793

Geophysical modeling activities and algorithms developed for the SEASAT-I satellite prior to August 1979 are described. Models are presented to describe the wind vector (speed and directional) properties of the radar backscatter and to describe the measurement scene of a downward looking radiometer over the ocean when clouds and rain are present. Descriptions are given for algorithms to co-locate fore and aft beam SEASAT scatterometer measurements, to estimate the wind vector using orthogonal pairs of (SEASAT) radar scatterometer measurements, to co-locate SEASAT microwave scatterometer and radiometer measurements and to estimate the atmospheric corrections for (SEASAT) scatterometer due to absorption using microwave radiometer measurements. Dissert. Abstr.

N81-27174# Coast Guard, Washington, D.C. Oceanographic Unit.
OPERATIONAL USE OF TIROS/ARGOS SYSTEM IN INTERNATIONAL ICE PATROL
J. J. Murray and C. R. Weir *In* CNES Data Collection and Location by Satellite 1979 11 p

Avail: NTIS HC A06/MF A01

The feasibility of using satellite trackable transmitters on buoys in order to measure the Labrador Current and the North Atlantic Current off the coast of Newfoundland was studied. Results would be used for warning mariners of the hazards presented by drifting ice and icebergs. The local user terminal is described and the handling of satellite tracked buoy data is depicted. Results show that a more sophisticated computer model which predicts iceberg drift can be implemented using satellite information. Author (ESA)

N81-27175# National Oceanic and Atmospheric Administration, Bay St. Louis, Miss.
U.S. DRIFTING BUOY PERFORMANCE DURING FGGE
E. G. Kerut and R. P. Kozak *In* CNES Data Collection and Location by Satellite 1979 13 p

Avail: NTIS HC A06/MF A01

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

N81-27178# Naval Oceanographic Office, Bay St. Louis, Miss.
PRELIMINARY RESULTS OF GULF STREAM RING TRACKING VIA SATELLITE-TRACKED DRIFTERS
Barry P. Blumenthal *In* CNES Data Collection and Location by Satellite 1979 11 p Submitted for publication

Avail: NTIS HC A06/MF A01

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

N81-27590# Centre National d'Etudes Spatiales, Toulouse (France).
EXAMPLES OF METEOROLOGICAL SATELLITE DATA UTILIZATION [EXEMPLES D'UTILISATION DE DONNEES DE SATELLITE METEOROLOGIQUES]
J. C. Favard *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 153-171 refs In FRENCH

Avail: NTIS HC A09/MF A01

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

N81-27770 British Library Lending Div., Boston Spa (England).
GEOSTROPHIC CURRENTS OF THE NORTHEASTERN PART OF THE ATLANTIC
E. S. Erofeeva Nov. 1980 21 p refs Transl. into ENGLISH from Tr. Gos. Okeanogr. Inst. (USSR), no. 114, 1972 p 96-108
(BLL-RTS-12431) Avail: British Library Lending Div., Boston Spa, England

Data on the geostrophic currents, obtained from results of oceangraphic surveys carried out in the North Atlantic, are presented in discussion and map form. Calculations of the currents were based on hydrological data collected July to August of 1967 and 1968. S.F.

N81-27774# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
PRELIMINARY DEVELOPMENT OF A MEASURING NETWORK FOR THE NORTH SEA AND BALTIC (VEMNO 1 AND 2). EXPERIMENTAL INVESTIGATIONS, DEVELOPMENT AND TEST OF EQUIPMENT FOR AUTOMATIC MEASURING STATIONS AT SEA WITH DATA TRANSMISSION Final Report
Hartmut Schulze (Gesellschaft fuer Kernernergieverwertung in Schiffbau und Schiffahrt m.b.H.) and Siegfried Govaers Bonn Dec. 1980 94 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-M-80-003; ISSN-0340-8868; BMFT-MTK-0013; BMFT-MTK-0021) Avail: NTIS HC A05/MF A01

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

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06
HYDROLOGY AND WATER MANAGEMENT

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

A81-30541 # **Results of satellite observations of the dynamics of the seasonal snow line in mountains of western Tien Shan (Rezul'taty sputnikovykh nabliudenii za dinamikoi sezonnoi snegovoi granitsy v gorakh zapadnogo Tian'-Shania).** B. K. Tsarev. In: Methods for the processing and interpretation of multispectral data on earth resources. Leningrad, Gidrometeoizdat, 1980, p. 128-136. 10 refs. In Russian.

A81-30559 **Aerial gamma-ray mapping of soil moisture and snow cover (Aviatsionnaia gamma-s'emka vlazhnosti pochvy i snezhnogo pokrova).** Edited by M. V. Nikiforov. Moscow, Gidrometeoizdat (Gosudarstvennyi Komitet SSSR po Gidrometeorologii i Kontroliu Prirodnoi Sredy, Institut Eksperimental'noi Meteorologii, Trudy, No. 14), 1980. 128 p. In Russian.

Studies included in this volume summarize recent research and practical results in the field of aerial gamma-ray mapping of water resources. Consideration is given to instrumentation and measurement techniques, data analysis and verification, and various applications of gamma-ray mapping data. V.L.

A81-30560 # **Development and application of aerial gamma-ray mapping of snow cover and soil moisture (Razvitie i vnedrenie aviatsionnoi gamma-s'emki snezhnogo pokrova i vlazhnosti pochvy).** N. A. Bochin (Gosudarstvennyi Komitet SSSR po Gidrometeorologii i Kontroliu Prirodnoi Sredy, Moscow, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 3-5. In Russian.

A81-30561 # **Current status of aerial gamma-ray mapping of snow cover and soil moisture (Sovremennoe sostoianie aviatsionnykh gamma-s'emok snezhnogo pokrova i vlazhnosti pochvy).** M. V. Nikiforov (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennogo Mashinostroeniia, Moscow, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 6-27. 26 refs. In Russian.

State-of-the-art of gamma-ray mapping of snow cover and soil moisture is reviewed with reference to underlying theory, instrumentation, and measurement techniques. The suitability of gamma-ray techniques for snow mapping in mountainous areas is considered. Aerial route optimization with respect to information and cost is also discussed. V.L.

A81-30562 # ***Experience of aerial snow cover mapping in* the European part of the USSR (Opyt proizvodstva samoletnykh snegos'emok na Evropeiskoi territorii SSSR).** A. N. Stroganov (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennogo Mashinostroeniia, Moscow, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 28-45. 8 refs. In Russian.

Experience of aerial gamma-ray mapping of snow cover in the European part of the USSR during the period 1971-1978 is summarized with reference to the structure of aerial route networks, topographic maps and equipment used, data verification and analysis, mapping records, and data recording and transmission. Determination of the residual noise background and calculation of water resources from the mean ratios for pairs of mapping routes are also discussed. V.L.

A81-30563 # **Industrial use of aerial gamma-ray mapping of snow cover in the Asian part of the USSR (Opyt proizvodstvennogo primeneniia aviatsionnoi gamma-s'emki snezhnogo pokrova na Aziatskoi territorii SSSR).** A. A. Markhevskaia (ZSRNIGMI, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 46-54. 8 refs. In Russian.

A81-30564 # **Use of aerial snow mapping data for short-range hydrological forecasting (Opyt ispol'zovaniia rezul'tatov samoletnykh snegos'emok v operativnoi rabote po sostavleniiu gidrologicheskikh prognozov).** N. F. Dement'ev (Gidrometeorologicheskii Nauchno-Issledovatel'skii Tsentr SSSR, Moscow, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 55-60. In Russian.

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

A81-30565 # **Results of experimental gamma-ray mapping of snow cover in mountains (Nekotorye rezul'taty eksperimental'nykh gamma-s'emok snezhnogo pokrova v gorakh).** M. I. Getker, A. V. Suslov (Saratovskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Saratov, USSR), M. V. Nikiforov, and N. N. Pegoev (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennogo Mashinostroeniia, Moscow, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 67-72. In Russian.

Aerial gamma-ray mapping experiments were conducted in the mountains of Tien Shan at altitudes 1200-3500 m above sea level over an area covered by a network of 160 routes, each 1-5 km long. Gamma radiation intensity was measured in the energy range 0.3-3.0 MeV. Snow distribution curves are presented. V.L.

A81-30566 # **Instrumentation for aerial gamma-ray mapping of snow cover and soil moisture (Apparatura dlia aviatsionnykh gamma-s'emok snezhnogo pokrova i vlazhnosti pochvy).** A. D. Bogachev, V. V. Erokhin, V. A. Zaitseva (Tsentral'noe Konstruktorskoe Biuro Gidrometeopriborostroeniia, USSR), N. N. Pegoev, and A. N. Stroganov (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennogo Mashinostroeniia, Moscow, USSR). In: Aerial gamma-ray mapping of soil moisture and snow cover. Moscow, Gidrometeoizdat, 1980, p. 73-76. In Russian.

Commercial instrumentation has been developed for aerial gamma-ray mapping which is capable of determining the water content of snow cover in the water equivalent range 10-300 mm with an accuracy of 10 mm or a weight moisture content of up to 50% in the surface soil layer with an accuracy of 1%. Essentially, the instrumentation consists of a specialized aerial radiometer which measures gamma-quantum fluxes in the energy ranges 0.02-3.00 MeV and 2.4-3.0 MeV, flight altitude, and flight duration. V.L.

A81-31925 # **The use of aerial and space photographs for hydrogeological studies in deserts (Ispol'zovanie aerokosmicheskikh fotosnimkov pri gidrogeologicheskikh issledovaniiakh v pustyniakh).** E. A. Vostokova. Moscow, Izdatel'stvo Nedra, 1980. 161 p. 213 refs. In Russian.

The work discusses photointerpretation principles that can be applied to the search for and mapping of subsurface water in arid regions and also for the investigation of hydrogeological changes in such regions caused by anthropogenic factors. Particular attention is given to the use of large- and medium-scale photographs for the mapping of ground water and to the use of small- and medium-scale photographs for the hydrogeological mapping and exploration of exogenic processes associated with subsurface water. The use of remote sensing methods to compile maps intended for the protection of subsurface water from pollution is discussed along with the search for regions that are suitable for the subsurface storage of surface water. B.J.

A81-32352 * **Passive microwave observations of snow, ice, and rain from satellites.** D. H. Staelin and S. R. Rotman (MIT,

Cambridge, Mass.). In: ICC '80; International Conference on Communications, Seattle, Wash., June 8-12, 1980, Conference Record. Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 49.1.1, 49.1.2. 5 refs. Contract No. NAS5-21980.

Observations of precipitation performed with the five-channel passive Scanning Microwave Spectrometer of Nimbus 6 are discussed. It is shown that, at centimeter wavelengths, the rain emission is generally dominated by absorption processes except in the cores of intense precipitation cells where the wavelength dependence can shift markedly. The observations of rainfall over the ocean exhibit considerable long-range order in both instantaneous and two-week average maps. The observations of snow and ice also reveal interesting systematic behavior associated with the inhomogeneities and loss tangent of the bulk subsurface material. In general, ice is more isotropically organized internally than the accumulated layers of snow in Antarctica and Greenland. B.J.

A81-32355 * Surface effects on the microwave backscatter and emission of snow. A. K. Fung, W. H. Stiles, and F. T. Ulaby (University of Kansas Center for Research, Inc., Lawrence, Kan.). In: ICC '80; International Conference on Communications, Seattle, Wash., June 8-12, 1980, Conference Record. Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 49.6.1-49.6.7. 12 refs. NSF Grant No. ENG-79-09374; Grant No. NsG-5335.

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

A81-33897 Measuring the concentration of chlorophyll in a large Nebraska reservoir from earth-orbiting satellites. R. J. Stirling (Nebraska, University, Omaha, Neb.) *Remote Sensing Quarterly*, vol. 2, Oct. 1980, p. 3-16. 10 refs.

A statistical study is made of Lake McConaughty, Nebraska by associating Landsat multispectral data from six satellite passes with plant chlorophyll data in order to examine the process of eutrophication. The reflectances and chlorophyll data were processed by the Statistical Package for the Social Sciences and by computer, and both bivariate and multiple regression analysis revealed many relationships connecting chlorophyll with band 4, 5, 6 and 7 reflectances. A bivariate regression equation utilizing band 7 reflectances was selected as the best available descriptor and predictor of chlorophyll. Regression equations relating reflectance to chlorophyll must, however, continue to be refined by retrieving accurate ground truth information to support satellite data. D.K.

A81-34560 # Evaluation of Landsat imagery for practical hydrogeologic objectives in Africa (Auswertung von Landsatabbildungen für praktische hydrogeologische Aufgaben in Afrika). W. Kruck (Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 511-517. 6 refs. In German.

The hydrogeologic interpretation of Landsat imagery is concerned with the northern part of the Republic of Botswana, the western part of the Republic of Niger, and the Republic of Upper Volta. Regarding Botswana, an investigation was conducted concerning the information provided by satellite imagery and existing data about the salt content and the flow conditions in the case of underground water in the vicinity of the surface. A study of satellite imagery obtained from Niger was to furnish information which would help to overcome problems in connection with the supply of water. Investigations related to Upper Volta provided an indication regarding the frequency of fractures in the geologic structure. G.R.

A81-34591 # Remote sensing of thermal loadings on aquatic systems. J. R. Schott (Calspan Corp., Buffalo, N.Y.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 829-838. 7 refs.

Data from an airborne IR scanner and aerial photography of power plant cooling water discharges along the lower Hudson River were subjected to densitometric analysis. Varying flight levels and parallel paths flying allowed determination of attenuation, air and sky radiance, three factors which, when included in the Planck equation with the density of each point of the scanner images, yielded actual images. Ground truth figures from a boat using thermistors at a 6 in. depth agreed to within 0.5 C. The aerial photographs were analyzed for total suspended particles, chlorophyll, and yellowing organics. The Volume Spectral Response agreed well with laboratory modeling, and though no identity correlation was found with actual samples, standard errors of 5.5 ppb for chlorophyll and 3.0 ppm for suspended solids were considered well within effective bounds. Use of the techniques for rooftop heat loss studies, fishing, and long and short term tidal cycles is suggested. D.H.K.

A81-34603 # Characterization of types of mud flats through image structure parameters (Charakterisierung von Wattypen durch Bildstrukturparameter). U. Wieczorek (München, Universität, Munich, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 959-968. In German.

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

A81-34633 # Timescale as interface of satellite data acquisition systems against coastal water and tidal region processes. H. G. Gierloff-Emden. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 510-519. 14 refs.

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

A81-34638 # Ecological monitoring of balancing lakes by multispectral remote sensing. J. Nichol and W. G. Collins (Aston, University, Birmingham, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 580-589.

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

A81-34645 # **Technical improvement of remote sensing interpretation in hydrologic studies (Technische Verbesserung der Fernerkundungsinterpretation bei Gewässeruntersuchungen).** M. Sartori (AUSTROPLAN-SPACETEC, Vienna, Austria; SPACETEC Datengewinnung GmbH, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 648-654. In German.

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

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

A81-36267 * **Microwave response of snow.** F. T. Ulaby and W. H. Stiles (University of Kansas Center for Research, Inc., Lawrence, Kan.). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 131-149. 28 refs. Grant No. NsG-5335.

Truck-mounted microwave sensors were used to acquire backscattering coefficient and apparent temperature data for snow-covered terrain at 19 frequencies between 1 and 18 GHz and at 35.6 GHz. Passive microwave measurements were made at 10.7, 37, and 94 GHz. The radar backscattering coefficient and radiometric emissivity were evaluated as a function of snow depth, wetness, surface roughness, and other snow parameters. It is shown that volume scattering makes the radar backscattering coefficient to increase and the radiometric emissivity to decrease with increasing snow depth until the snow layer appears electromagnetically semi-infinite in extent. The presence of liquid water in the snowpack results in increased attenuation and reduction in scattering which leads to less backscatter and more emission by the snow volume. It is concluded that microwave sensors have the potential capability for remotely monitoring both the snow equivalent and wetness of snowpacks. V.L.

A81-36268 Optimum characteristics for snow pack evaluation by microwave radiometry. E. Schanda and C. Mätzler (Bern, Universität, Berne, Switzerland). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 151-162. 16 refs.

Results of a long-term program of ground-based microwave measurements of snow parameters at an Alpine test site are reviewed. Three seasonal types of snow have been identified: (1) the winter snow which is characterized by the absence of melting metamorphism and exhibits a decreasing brightness temperature with increasing frequency above 10 GHz; (2) the spring snow for which the phases of melting and refreezing of the surface layer are discriminated by a complete reversal of the microwave brightness temperature spectrum around 2 cm wavelength; and (3) the summer snow which is characterized by extremely high brightness temperature due to melting, particularly above 10 GHz. V.L.

A81-36270 Investigation of Hungarian lakes by means of Landsat data. G. Buttner (Satellite Geodetic Observatory, Budapest, Hungary) and L. Voros (Magyar Tudomanyos Akademia, Biologiai Kutato Intezet, Tihany, Hungary). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 177-189. 7 refs.

A81-39322 Data collection via satellite for water management. W. G. Shope and R. W. Paulson (U.S. Geological Survey, Water Resources Div., Reston, VA). *(American Society of Civil Engineers, Convention and Exposition, Hollywood, FL, Oct. 27-31, 1980.) ASCE, Transportation Engineering Journal,* vol. 107, July 1981, p. 445-455. 7 refs.

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

A81-39525 Pulse transmission mode /PTM/ Nd:YAG laser for airborne hydrography. M. B. Rankin, N. J. Hall, and G. D. Ferguson (U.S. Naval Material Command, Naval Air Development Center, Warminster, PA). In: Advances in laser engineering and applications; Proceedings of the Seminar, San Diego, CA, July 31, August 1, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 157-161. 15 refs.

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

N81-22451*# Wisconsin Univ. - Madison. Environmental Remote Sensing Center.
WETLAND MAPPING FROM DIGITIZED AERIAL PHOTOGRAPHY
F. L. Scarpace, B. K. Quirk, R. W. Kiefer, and S. L. Wynn 1981 24 p refs Sponsored by NASA Original contains color illustrations
(NASA-CR-164199) Avail: NTIS HC A02/MF A01 CSCL 08B

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

N81-23542*# Geological Survey, Malaysia. Water Resources Div.

IMPROVING STREAMFLOW ESTIMATES THROUGH THE USE OF LANDSAT

Gregory J. Allord, Principal Investigators and Frank L. Scarpace (Wisconsin-Madison Univ.) [1981] 16 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10129; NASA-CR-164119) Avail: NTIS HC A02/MF A01 CSCL 08H

Estimates of low flow and flood frequency in several southwestern Wisconsin basins were improved by determining land cover from LANDSAT imagery. With the use of estimates of land cover in multiple-regression techniques, the standard error of estimate (SE) for the least annual 7-day low flow for 2- and 10-year recurrence intervals of ungaged sites were lowered by 9% each. The SE of flood frequency in the 'Driftless Area' of Wisconsin for 10-, 50-, and 100-year recurrence intervals were lowered by 14%. Four of nine basin characteristics determined from satellite imagery were significant variables in the multiple-regression techniques, whereas only 1 of the 12 characteristics determined from topographic maps was significant. The percentages of land cover categories in each basin were determined by merging basin boundaries, digitized from quadrangles, with a classified LANDSAT scene. Both the basin boundary X-Y polygon coordinates and the satellite coordinates were converted to latitude-longitude for merging compatibility. T.M.

N81-23546*# Geological Survey, Reston, Va.

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

Alden P. Colvocoresses, Principal Investigator 3 Mar. 1980 4 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center"; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites". HCMM

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

Graphics are presented which show HCMM mapped water-surface temperature in Lake Anna, a 13,000 dendrically-shaped lake which provides cooling for a nuclear power plant in Virginia. The HCMM digital data, produced by NASA were processed by NOAA/NESS into image and line-printer form. A LANDSAT image of the lake illustrates the relationship between MSS band 7 data and the HCMM data as processed by the NASA image processing facility which transforms the data to the same distortion-free hotline oblique Mercator projection. Spatial correlation of the two images is relatively simple by either digital or analog means and the HCMM image has a potential accuracy approaching the 80 m of the original LANDSAT data. While it is difficult to get readings that are not diluted by radiation from cooler adjacent land areas in narrow portions of the lake, digital data indicated by the line-printer display five different temperatures for open-water areas. Where the water surface response was not diluted by land areas, the temperature difference recorded by HCMM corresponds to in situ readings with rsme on the order of 1 C. A.R.H.

N81-23553*# California Univ., Berkeley.

REMOTE SENSING OF WATER QUALITY IN RESERVOIRS AND LAKES IN SEMI-ARID CLIMATES Final Report

Harold M. Anderson and Alexander J. Horne Dec. 1975 143 p refs

(Grant NsG-2003)

(NASA-CR-166178; SERL-75-1) Avail: NTIS HC A07/MF A01 CSCL 08H

Overlake measurements using aerial cameras (remote sensing) combined with water truth collected from boats most economically provided wide-band photographs rather than precise spectra. With use of false color infrared film (400-950 nm), the reflected spectral signatures seen from hundreds to thousands of meters above the lake merged to produce various color tones. Such colors were easily and inexpensively obtained and could be recognized by lake management personnel without any prior training. The characteristic spectral signatures of various algal types were also recognizable in part by the color tone produced by remote sensing. T.M.

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

COMPARING ENERGY TECHNOLOGY ALTERNATIVES FROM AN ENVIRONMENTAL PERSPECTIVE

P. W. House, J. A. Coleman, R. D. Shull, R. W. Matheny, and J. C. Hock Feb. 1981 73 p refs

(DOE/EV-0109) Avail: NTIS HC A04/MF A01

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

N81-25460*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.

APPENDIX E: RESEARCH PAPERS. MANUAL VERSUS DIGITAL LANDSAT ANALYSIS FOR MODELING RIVER FLOODING

Warren R. Philipson, Principal Investigator and William R. Hafker *In its* Cornell Univ. Remote Sensing Program Dec. 1980 6 p refs Repr. from Tech. Papers of the Am. Soc. of Photogrammetry Fall Tech. Meeting, 1980 Presented at the Am. Soc. of Photogrammetry Fall Tech. Meeting, Niagara Falls, N.Y., 7-10 Oct. 1980 ERTS

(ISSN-0271-4040) Avail: NTIS HC A16/MF A01 CSCL 05A

The comparative value of manual versus digital image analysis for determining flood boundaries is being examined in a study of the use of LANDSAT data for modeling flooding of the Black River, in northern New York. The work is an extension of an earlier study in which Black River flooding was assessed through visually interpreted, multi-date LANDSAT band 7 images. Based on the results to date, it appears that neither color-additive viewing nor digital analysis of LANDSAT data provide improvement in accuracy over visual analysis of band 7 images, for delineating the boundaries of flood-affected areas. Author

N81-26524*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

REMOTE SENSING DATA APPLIED TO THE EVALUATION OF SOIL EROSION CAUSED BY LAND-USE. RIBEIRAO ANHUMAS BASIN AREA: A CASE STUDY

Nelson deJesusParada, Principal Investigator, Sergio dosAnjosFerreiraPinto, and Hermann J. H. Kux Dec. 1980 15 p refs Presented at the Intern. Symp. on Erosion and Sediment Transport Meas., Firenzi, Italy, 22-25 Jun. 1981 Sponsored by NASA ERTS

(E81-10121; NASA-CR-164375; INPE-1965-RPE/276) Avail: NTIS HC A02/MF A01 CSCL 05B

Formerly covered by a tropical forest, the study area was deforested in the early 40's for coffee plantation and cattle raising, which caused intense gully erosion problems. To develop a method to analyze the relationship between land use and soil erosion, visual interpretations of aerial photographs (scale 1:25.000), MSS-LANDSAT imagery (scale 1:250,000), as well as automatic interpretation of computer compatible tapes by IMAGE-100 system were carried out. From visual interpretation the following data were obtained: land use and cover tapes, slope classes, ravine frequency, and a texture sketch map. During field work, soil samples were collected for texture and X-ray analysis. The texture sketch map indicate that the areas with higher slope angles have a higher susceptibilty to the development of gullies. Also, the over carriage of pastureland, together with very friable lithologies (mainly sandstone) occuring in that area, seem to be the main factors influencing the catastrophic extension of ravines in the study site. A.R.H,

N81-26530*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
DEVELOPMENT OF A UNIVERSAL WATER SIGNATURE FOR THE LANDSAT-3 MULTISPECTRAL SCANNER, PART 1 Final Report, Jan. - Sep. 1980
Edward H. Schlosser Sep. 1980 27 p refs
(NAS9-15800)
(NASA-CR-161012; LEMSCO-15621-Pt-1; JSC-17003-Pt-1)
Avail: NTIS HC A03/MF A01 CSCL 08H

A generalized four channel hyperplane to discriminate water from nonwater was developed using LANDSAT-3 multispectral scaner (MSS) scenes and matching same/next day color infrared aerial photography. The MSS scenes varied in sun elevation angle from 40 to 58 deg. The 28 matching air photo frames contained over 1400 water bodies larger than one surface acre. A preliminary water discriminant, was used to screen the data and eliminate from further consideration all pixels distant from water in MSS spectral space. A linear discriminant was iteratively fitted to the labelled pixels. This discriminant correctly classified 98.7% of the water pixels and 98.6% of the nonwater pixels. The discriminant detected 91.3% of the 414 water bodies over 10 acres in surface area, and misclassified as water 36 groups of contiguous nonwater pixels. E.A.K.

N81-26531*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
DEVELOPMENT OF A UNIVERSAL WATER SIGNATURE FOR THE LANDSAT-3 MULTISPECTRAL SCANNER, PART 2 OF 2 Final Report, Jan. - Sep. 1980
Edward H. Schlosser Sep. 1980 220 p
(Contract NAS9-5800)
(NASA-CR-161010; LEMSCO-15621-Pt-2) Avail: NTIS HC A10/MF A01 CSCL 08H

A generalized four-channel hyperplane to discriminate water from non-water was developed using LANDSAT-3 multispectral scanner (MSS) scences and matching same/next-day color infrared aerial photography. The MSS scenes over upstate New York, eastern Washington, Montana and Louisiana taken between May and October 1978 varied in Sun elevation angle from 40 to 58 degrees. The 28 matching air photo frames selected for analysis contained over 1400 water bodies larger than one surface acre. A preliminary water discriminant was used to screen the data and eliminate from further consideration all pixels distant from water in MSS spectral space. Approximately 1300 pixels, half of them non-edge water pixels and half non-water pixels spectrally close to water, were labelled. A linear discriminant was iteratively fitted to the labelled pixels, giving more weight to those pixels that were difficult to discriminate. This discriminant correctly classified 98.7 percent of the water pixels and 98.6 percent of the non-water pixels. T.M.

N81-26547# National Oceanic and Atmospheric Administration, Washington, D. C.
SATELLITE OBSERVATION OF GREAT LAKES ICE: WINTER 1978-79
Jenifer Wartha-Clark Oct. 1980 44 p
(PB81-167439; NOAA-TM-NESS-112; NOAA-81012703)
Avail: NTIS HC A03/MF A01 CSCL 08L

Ice conditions on the five Great Lakes and Lake St. Clair were monitored from satellite imagery. The formation, movement, and dissipation of lake ice were traced from December 1978 through May 1979. Wind speeds and directions were correlated with ice movement, and air temperatures were related to ice formation and decay. GOES and TIROS-N visible images are presented.
GRA

N81-27583# Bristol Univ. (England). Dept. of Geography.
SATELLITE-IMPROVED MONITORING OF RAINFALL
Eric C. Barrett *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 89-95 refs

Avail: NTIS HC A09/MF A01

The distinction is drawn between environmental hazards and disasters. Rainfall is seen to be a significant hazard sometimes leading to disasters in rural areas. Satellite remote sensing of rainfall is discussed in terms of principles of improved rainfall monitoring by satellite. Methods are presented with special attention paid to the Bristol Method of improved rainfall monitoring. A manual cloud-indexing method which has been applied successfully to the monitoring of rainfall for a wide variety of purposes in several regions of the world, mainly within the tropics is discussed. Author (ESA)

N81-27584# Bristol Univ. (England). Dept. of Geography.
SATELLITE MONITORING OF EXTREME RAINFALL EVENTS
Eric C. Barrett *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 97-103 refs

Avail: NTIS HC A09/MF A01

Extreme rainfall events are caterogized in terms of the lengths of time taken for them to develop to severe hazard or disaster proportions. Examples are given of satellite methods for improved monitoring and assessment of slowly developing droughts, rainfall surpluses, and floods associated with sudden, high intensity rainfall events. Concluding references are made to satellite-improved monitoring of some key hydrological variables related to rainfall, e.g., stream hydrograph peaks and basin runoff changes. Author (ESA)

N81-27586# Norwegian Water Resources and Electricity Board, Oslo.
SNOW MELT WATER RUN-OFF PREDICTION
Gunnar Oestrem *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 113-114

Avail: NTIS HC A09/MF A01

Several methods for determining the amount of snow which will, in due course, produce melt water runoff are reviewed. The conventional methods are generally based on direct field measurements of the snow pack in the spring or meteorological observations during the winter. Certain remote sensing techniques are also utilized to determine water equivalent of the snow. It is quite clear that satellite data can be used to study the snow cover, at least in areas of little vegetation, but there is no simple method which determines directly the snow depth or its water equivalent. Therefore, a more indirect method was developed, using the percent snow coverage as found in the spring to determine expected melt water runoff. The method is based on an empirical relation between the areal extent of remaining snow cover and runoff. Author (ESA)

N81-27587# Geological Survey, Washington, D. C.
REMOTE SENSING FOR FLOOD MAPPING AND FLOODPLAIN DAMAGE ASSESSMENT
Morris Deutsch *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 115-118 refs

Avail: NTIS HC A09/MF A01

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

N81-27695# WAPORA, Inc., Chevy Chase, Md.
POTENTIAL EFFECTS OF ENVIRONMENTAL REGULATORY PROCEDURES ON GEOTHERMAL DEVELOPMENT
Gene V. Beeland and David B. Boies Jan. 1981 100 p refs
(Contract DE-AC01-80ET-27208)
(DOE/ET-27208/T2) Avail: NTIS HC A05/MF A01

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

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07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A81-30526 **Methods for the processing and interpretation of multispectral data on earth resources (Metody obrabotki i interpretatsii mnogozonal'noi informatsii o prirodnykh resursakh zemli).** Edited by A. P. Tishchenko and A. I. Burtsev. Leningrad, Gidrometeoizdat (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Trudy, No. 8), 1980. 153 p. In Russian.

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

A81-30528 # **Digital correction of geometric distortions of space remote sensing imagery (Korrektsiia geometricheskikh iskazhenii kosmicheskoi videoinformatsii tsifrovymi metodami).** V. P. Bocharov and S. M. Sazhin. In: Methods for the processing and interpretation of multispectral data on earth resources. Leningrad, Gidrometeoizdat, 1980, p. 8-16. In Russian.

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

A81-30540 # **The possibility of using the brightness coefficients of natural objects for the interpretation of space images (O vozmozhnosti ispol'zovaniia koeffitsientov iarkosti prirodnykh obrazovanii pri deshifrirovanii kosmicheskikh izobrazhenii).** G. I. Borisoglebskii, A. V. Kovda, and N. N. Koptseva. In: Methods for the processing and interpretation of multispectral data on earth resources. Leningrad, Gidrometeoizdat, 1980, p. 123-127. In Russian.

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

A81-30967 **Analysis technology for land remote sensing.** D. A. Landgrebe (Purdue University, West Lafayette, Ind.). *IEEE, Proceedings*, vol. 69, May 1981, p. 628-642. 53 refs.

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

A81-32356 * **Digital preprocessing of SEASAT imagery.** V. S. Frost, J. A. Stiles, J. C. Holtzman (University of Kansas Center for Research, Inc., Lawrence, Kan.), and D. N. Held (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: ICC '80; International Conference on Communications, Seattle, Wash., June 8-12, 1980, Conference Record. Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 49.7.1-49.7.5. 10 refs. Research supported by the California Institute of Technology; Contract No. NAS7-100; Grant No. DAAG29-77-G-0075.

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

A81-32485 **An infrared target and backgrounds data base.** R. E. Sampson (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Electro-optical technology for autonomous vehicles; Proceedings of the Seminar, Los Angeles, Calif., February 6, 7, 1980. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1980, p. 7-12. 10 refs. Contracts No. N60530-79-R-0036; No. F33615-76-C-1360. DARPA Order 03293.

IR imagery from various terrain backgrounds has been collected by the Environmental Research Institute of Michigan using the ERIM M-7 scanner and analyzed to determine the statistics of both radiometric and spatial features. Some of the terrain-background characteristics in the form of histograms, equivalent ellipse statistics, and power spectra for several IR bands are described. In addition, the industrial target data collected as part of the development of a DARPA image data base for autonomous terminal homing technology evaluation is described. B.J.

A81-32590 * **Spaceborne and airborne imaging radar observations of sand dunes.** R. Blom and C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Journal of Geophysical Research*, vol. 86, Apr. 10, 1981, p. 3061-3073. 37 refs. Contract No. NAS7-100.

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

A81-33542 * # **Earth observation data systems in the 1980's.** P. A. Bracken (NASA, Washington, D.C.). *American Astronautical Society and American Institute of Aeronautics and Astronautics, Annual Meeting on Space Enhancing Technological Leadership, Boston, Mass., Oct. 20-23, 1980, AAS Paper 80-240.* 20 p. 7 refs.

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

A81-34371 # **Utilization of Landsat data in the CNES - Quality control of processed products (L'exploitation des données Landsat au CNES contrôle qualité des produits élaborés).** D. Borel (Centre National d'Etudes Spatiales, Toulouse, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 1. Commission 1. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 6-14. In French.

A81-34376 # The current status of aerial photogrammetry survey systems (Über den gegenwärtigen Stand aerophotogrammetrischer Aufnahmesysteme). H.-K. Meier (Carl Zeiss, Oberkochen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 1. Commission 1. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 74-83. 5 refs. In German.

A81-34390 International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Edited by F. Ackermann (Stuttgart, Universität, Stuttgart, West Germany). Hamburg, Committee of the International Congress for Photogrammetry, 1980. 798 p. In English, French, and German.

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

A81-34391 # Blockadjustment with additional parameters. F. Ackermann (Stuttgart, Universität, Stuttgart, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 1-10. 25 refs.

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

A81-34394 * # Geometric representation methods for multitype self-defining remote sensing data sets. P. E. Anuta (Purdue University, West Lafayette, Ind.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 32-40. 6 refs. NSF Grants No. ENG-76-14400; No. ENG-78-20466; Contract No. NAS9-15466.

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

A81-34395 # Analog versus digital image processing of photogrammetric imagery. H. P. Bähr (Hannover, Universität, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 41-55. 12 refs.

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

A81-34396 # The radiometric and geometric quality of SPOT images (Qualité radiométrique et géométrique des images fournies par SPOT). G. Begni and M. Rayssiguier (Centre National d'Etudes Spatiales, Paris, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 76-86. In French.

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

A81-34397 # Error detection and reliability studies in analytically formed strips. T. Bouloucos (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 87-98. 9 refs.

A method is described for gross error detection during the process of strip formation from independent models based on the data snooping technique developed at Delft University, the Netherlands. In addition, the planimetric coordinates of the points are checked for errors arising from point misidentification between strips. A study of the reliability of the observations is also carried out. The method presented is found to be very effective for checking observational data prior to the execution of aerial triangulation using strips as units. Errors of a magnitude of 6 to 9 units of variance factor can be readily located. It is also pointed out that the x coordinate of the projection centers is difficult to control. C.R.

A81-34400 # Analytical aerial triangulation with idealised models. G. B. Das (North East London Polytechnic. London,

England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 135-141.

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

A81-34401 # **Planimetric transformation of synthetic aperture radar imagery.** E. E. Derenyi and L. Szabo (New Brunswick, University, Fredericton, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 142-148. Research supported by the Department of Energy, Mines and Resources.

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

A81-34403 # **Photogrammetric applications of Landsat MSS imagery.** I. J. Dowman and M. A. Mohammad (University College, London, England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 158-167. 6 refs.

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

A81-34406 # **Filter techniques and their application in digital correlation.** M. Ehlers. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 193-201. 6 refs.

It is pointed out that filter techniques for noise reduction and amplification of desired information are of great importance in digital image analysis. Two-dimensional filter theory is briefly discussed, and the effects of certain designed filters are described. The results of digital correlation after image filtering are compared with those received without filtering. It is shown that especially a low pass filter increases the accuracy and efficiency of the objective function at the correlation process to a high degree. It is noted that for the purpose of rectification, change detection, and classification in multitemporal pictures, it is necessary to locate identical points in different images of the same object. Similarity or correlation algorithms are seen as leading to this result. C.R.

A81-34408 # **Some remarks on Landsat MSS pictures.** F. I. Fister (Erdeszeti es Faipari Egyetem, Szekesfehervar, Hungary). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 214-222. 5 refs.

The possibility of matching MSS pictures to a Hungarian projection system is investigated. It is noted that an MSS picture issued in Universal Transversal Mercator (UTM) at a scale of 1:1,000,000 can be transformed into the Gauss-Krueger projection system. In this way, a suitable photo base can be obtained for producing a photomap at the scale and in the projection system required. An investigation is carried out on the difference between the two projection systems from the point of view of transforming possibilities. It is noted that a difference exists between the Hayford and Krasovsky ellipsoids. It is attempted to find a fast, simple method of transformation that can be implemented using established photogrammetric techniques and instruments. It is found that the difference between the UTM and Gauss-Krueger systems will not cause deviations when enlarging the MSS imagery. C.R.

A81-34409 # **The theoretical reliability of photogrammetric coordinates.** W. Förstner (Stuttgart, Universität, Stuttgart, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 223-235. 12 refs.

Aerial triangulation is theoretically a precise tool for determining photogrammetric coordinates. Reliability is considered both internal (the detection of gross errors or the ability to control observations by statistical testing) and external (the effect of nondetectable gross errors on the result of the block adjustment or the reliability of the coordinates). Reliability depends on different block parameters: block size, overlap, control point, and the tie point distribution. Weak points in photogrammetric blocks are the geodetic control, the perimeter of the blocks, and the points with two or three rays in bundle blocks. Controllability is most homogeneous in the interior of the block with precision decreasing at border parts and worst at control points. Bundle blocks are more sensitive against gross errors than independent model blocks, and horizontal controllability is better in bundle blocks. Groups of control points can be used to overcome low controllability at large intervals, although the highest precision is obtained by using only the interior of blocks, which is superior to measuring more points per unit. J.F.

A81-34413 # **Internal reliability models for aerial bundle systems.** A. Grun (Ohio State University, Columbus, Ohio). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 272-283.

A81-34415 # **Differential rectification of digital or digitized imageries.** R. Hössler (München, Technische Universität, Munich, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 294-303. 15 refs.

An image processing technique, termed digital rectification, which deals with the calculated transformation parameters between image and terrain coordinates, is presented. The direct and indirect methods are discussed as they apply to the transfer of every pixel from its actual position to the corrected location. The direct method calculates an output position in a rectangular coordinate system for each pixel of the rectangular matrix. The indirect method calculates the corresponding input position for the transfer of gray shades for each pixel for a rectangular output grid. Applications include the rectification of digital satellite and aircraft images, and digitized two-dimensional images, with a discussion of problems such as restitution of exterior orientation, implementation of digital height models, and post-processing of the output image. Attention is given to data handling, which includes input and output matrices, direct access technique, and computing time. K.S.

A81-34416 # **Attempt at obtaining the best possible accuracy in bundle block adjustment.** K. Jacobsen (Hannover, Universität, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 304-313. 8 refs.

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

A81-34418 # **Geometric rectification of blocks of multispectral scanner images.** J. Jansa (Wien, Technische Universität, Vienna, Austria). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 330-339. 5 refs.

A81-34425 # **Correlations and standard errors in bundle block adjustment with some emphasis on additional parameters.** G. Kupfer and L. Mauelshagen (Bonn, Universität, Bonn, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 398-420. 10 refs.

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

A81-34426 # **Efficient design of a system for simultaneous adjustment of photogrammetric and geodetic observations and additional parameters.** R. Larsson (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 421-428.

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

A81-34427 # **The construction of a computer-assisted photogrammetric system.** R. Larsson (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 429-434.

A81-34428 # **Current status of metric reduction of active scanner images.** F. W. Leberl (Graz, Technische Universität, Graz, Austria) and E. Clerici (Queensland, University, Brisbane, Australia). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 435-450. 47 refs.

A81-34432 # **Digital rectification of imagery with the aid of a minicomputer (Digitale Bild-Entzerrung mit Hilfe eines Minicomputers).** P. Lohmann and H. Schumacher (Klein und Stekl, Gesellschaft für Anwendungsberatung mbH, Stuttgart, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 476-485. 9 refs. In German.

A81-34434 # **Application of digital models to geometrical image processing (Application des modèles numériques au traitement géométrique des images).** G. de Masson d'Autume (Institut Géographique National, Saint-Mandé, Val-de-Marne, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 495-503. In French.

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

A81-34437 # **The Terrestrial/Photogrammetric /TP/ technique for the detection and compensation of systematic height errors in block aerial triangulation.** M. M. Abdel Rahim (Glasgow, University, Glasgow, Scotland). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers.

Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 598-607. 12 refs. Research supported by the Survey Department of Sudan.

A81-34441 # Analysis and application of algorithms for digital orthophotos. W. Schuhr (Hannover, Universität, Hanover, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 643-652. 9 refs. Research sponsored by the Deutsche Forschungsgemeinschaft and Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt.

A81-34442 * # Pattern recognition for remote sensing - Progress and prospects. P. H. Swain (Purdue University, West Lafayette, Ind.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 716-725. 19 refs. Contract No. NAS9-15466.

An overview is given of the current state of automatic image pattern recognition as applied to remote sensing of the earth's resources. The framework for the discussion is provided by four important aspects of the remote sensing problem: scene information content, characterization of scene information, information extraction methods, and the net value of extractable information. Outstanding problems are surveyed, as are the prospects for future developments. The effect of increasingly complex data bases and the rapidly evolving digital computer technology are highlighted. C.R.

A81-34444 International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Edited by F. Ackermann (Stuttgart, Universität, Stuttgart, West Germany). Hamburg, Committee of the International Congress for Photogrammetry, 1980. 794 p. In English, German, and French.

Topographic and cartographic applications are considered, taking into account a mathematical model for analytical triangulation of space photography, status and future of extraterrestrial mapping programs, the present status and future of scanning methods for digitization and edit of cartographic data, automated and digital mapping for highways in the U.S.A., a computer-assisted system for large scale engineering mapping, status and future of electro-optical mapping systems in space, and the versatility of the Kelsh K-320 Orthoscan with the DTM converter. Attention is also given to the adjustment of overlapping areas in neighboring models, computer-supported geological photointerpretation, a minicomputer program package for height interpolation by finite elements, the status of software in digital mapping, low-cost road mapping for road management, change detection by Landsat as a guide to planning aerial photography for revision mapping, a data base towards the digitally controlled production of Orthophotos, resource mapping by Landsats in developing countries, digital map production, and error and accuracy analysis in application of photogrammetric methods to land surveys. G.R.

A81-34446 # Mathematical model for analytical triangulation of space photography. M. E. O. Ali (Gendron, Lefebvre, Inc., Quebec, Canada) and A. J. Brandenberger (Université Laval, Quebec, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 11-20. 8 refs.

A mathematical model and a computer program developed to perform analytical aerial triangulation for space photography are discussed. It is noted that in aerial triangulations using space photography (there being no ground control as such and point coordinates being obtained from small-scale maps) the coordinates of the ground control must be treated as observed values and must be adjusted when solving the photogrammetric system. This requirement led to the development of two bundle adjustment algorithms. In the first, the coordinates of the ground control as well as the photo measurements are used as observations in the collinearity condition equations. In the second algorithm, the camera parameters, the ground coordinates of the control points, and the photo measurements are employed as observations in the collinearity condition equations. C.R.

A81-34447 # A review of data acquisition systems - Present and future and their effect on cartographic information systems. M. M. Allam (Department of Energy, Mines and Resources, Topographical Survey Div., Ottawa, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 21-35. 10 refs.

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

A81-34450 # OEEPE - The work of the Commission E 'Interpretation' (OEEPE - Die Arbeiten der Kommission E 'Interpretation'). M. Bernhard (Bundesamt für Eich- und Vermessungswesen, Vienna, Austria) and H. Schmidt-Falkenberg (Institut für angewandte Geodäsie, Frankfurt am Main, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 66-72. In German.

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

A81-34457 # Revision of large-scale topographic maps by digitizing (Die Erneuerung der grossmasstäbigen topographischen Karten durch Digitalisierung). G. Corcodel. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 134-140. In German.

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

A81-34468 # **Determination of the geographical position of isolated islands using the Digital Image Correction System for Landsat MSS imagery.** E. A. Fleming (Department of Energy, Mines and Resources, Topographical Survey Div., Ottawa, Canada) and F. E. Cuertin (Canada Centre for Remote Sensing, Ottawa, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 274-283. 5 refs.

It is noted that the Digital Image Correction System of the Canada Centre for Remote Sensing produces Landsat MSS subscenes in which the imagery has been corrected and resampled to 50 m pixels aligned with the metric grid of the U.T.M. projection. To determine island positions in a large lake, a geometric correction of the total image is carried out using photo-identified photogrammetric control points, which results in a position accuracy at test points of 30 m. The subscenes containing the islands are then displayed using a video monitor to extract the U.T.M. coordinates of photo-identifiable points on the islands. A high resolution film product from the computer tape containing the image provides an alternative method for positioning the islands of new 1:50,000 map compilations. C.R.

A81-34480 # **Databank- and information systems for digital topographic photogrammetry.** F. S. Kröll (München, Hochschule der Bundeswehr, Neubiberg, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 397-404. 26 refs.

The principal features and functions of data bank and information systems available for use in automated topographic photogrammetry are reviewed with a view toward aiding potential users in specifying their requirements. The importance of assigning a unique code for the semantic information contained in each piece of data as well as its geometric coordinates for subsequent use of the data base for purposes other than the original is emphasized, and it is noted that the resulting structure of the data collection phase is that of a digital map. General requirements for the hardware and software components comprising a data bank or information system are then defined in regard to access to data, response times, interactive capabilities and data structures, organization and protection. Two levels of search criteria required to access the stored information are distinguished on the basis of the complexity of the processing involved. Organizational aids employed for accelerating search procedures are then indicated, including reference addresses, chaining addresses, inverted files and logical relationships, and means of accessing the stored information are pointed out. It is concluded that a high level of flexibility and ease of usage may be achieved with presently available data bank and information systems. A.L.W.

A81-34481 # **Digital map production.** J. D. Leatherdale and K. M. Keir (Hunting Surveys, Ltd., Borehamwood, Herts., England). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 405-414.

The digital mapping system considered consists of a minicomputer, eight stereoplotters with linear encoders, a Freescan digitizer table, and a flatbed plotter. Occasional use is made of a Calcomp 1051 drum plotter, and a digitizer table. The computer software is structured to permit twelve operations concurrently, all of which can relate to different projects with very different specifications. Attention is given to aerial triangulation, the digital mapping procedure, details of cartographic data flow, a model for inter-surface volume calculation, and economic and human considerations. The digital mapping system is well suited to producing digital models of ground elevation, cultural details, property lines, and most other geographically based information. It can also be used for the assessment of areas and volumes. G.R.

A81-34484 # **The use of ultra-small scale aerial photograhy in medium scale mapping and revision.** K. J. Lester and P. L. Meadows. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 448-457.

The applications of high-flown, super-wide angle aerial photography within the scale range 1:140,000-1:160,000 to both initial medium scale mapping and subsequent revision procedures in South Africa are discussed. Attention is also given to aerial triangulation, the production of 1:50,000 orthophoto maps, and the later use of these maps in various related cartographic processes. It is noted that the work thus far undertaken has yielded very promising results, especially with regard to economy, accuracy, and the depiction of extensive areas of bush, sand dunes, and desert. C.R.

A81-34485 # **The use of an automatically generated DTM for mapping at different scales.** M. M. Leupin and M. Cherkaoui (Université Laval, Quebec, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 458-467.

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

A81-34489 # **Accuracy and time comparisons of digital maps - An international test.** S. E. Masry, Y. C. Lee (New Brunswick, University, Fredericton, Canada), and J. R. R. Gauthier (Department of Energy, Mines and Resources, Topographical Survey Div., Ottawa, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 493-539. 14 refs.

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

A81-34491 # **Littoral mapping from digitized oblique aerial photograph.** S. Murai (Tokyo, University, Tokyo, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 552-561.

The analytical rectification of digitized oblique aerial photographs into an ortho-photo projection is discussed. It is noted that such advantages as wide coverage and the ability to select ground control points and avoid sun glitter make this process well suited to the mapping of coastal areas. The procedures include the exterior orientation for metric and nonmetric cameras, grid insertion onto the oblique photograph, geometric resampling for ortho-photo projection and automated image output. Examples are given for a panchromatic aerial photograph taken with a metric camera, a color aerial photograph taken with a nonmetric camera, and a color space photograph taken by a 70-mm camera borne in Skylab. C.R.

A81-34492 # **Three dimensional representation for Landsat MSS data.** S. Murai (Tokyo, University, Tokyo, Japan) and R. Tateishi (Chiba University, Chiba, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 562-569.

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

A81-34493 # **Digital mosaic of color aerial photographs.** S. Murai, T. Okuda (Tokyo, University, Tokyo, Japan), and M. Akiyama (Ministry of Construction, Geographic Survey Institute, Ibaraki, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 570-578.

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

A81-34501 # **Digital mapping.** G. Simonsson, E. Westermark, and B. Wiberg (Kungl. Tekniska Hogskolan, Stockholm, Sweden). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 639-644. 5 refs.

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

A81-34504 # **A contribution to the generation and the imaging of three-dimensional digital settlement models (Ein Beitrag zur Erzeugung und Abbildung dreidimensionaler digitaler Siedlungsmodelle).** B. Streich (Bonn, Universität, Bonn, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 681-692. 5 refs. In German.

A81-34510 # **Remote sensing in map compilation and revision.** N. Zegheru. In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 774-781.

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

A81-34512 **International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.** Edited by F. Ackermann. Hamburg, Committee of the International Congress for Photogrammetry, 1980. 503 p. In English, French, and German.

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

A81-34514 # **Connection between remote sensing and data-bank for the land thematic mapping.** E. Amadesi (Bologna, Università, Bologna, Italy) and G. Vianello (Emilia-Romagna, Cartography and Soil Department, Italy). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 6-14.

A81-34516 # **A fast way from the analysis of multispectral satellite data to the printing of thematic maps (Ein schneller Weg von der Analyse multispektraler Satellitendaten zum Druck thematischer Karten).** D. Bannert, R. W. Scholz (Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, West Germany), and G. Pöhlmann (Berlin, Technische Fachhochschule, Berlin, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 24-29. In German.

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

A81-34552 # **The visual interpretation of colour synthesis images.** K. Herda (JENOPTIK Jena GmbH, Jena, East Germany), K.-H. John, and V. Kroitzsch (Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, Potsdam, East Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July

13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 421-429. 7 refs.

The use of color synthesis as a means of processing remote sensing images to facilitate their visual interpretation is discussed. The production of color synthesis images by color-mixing or multispectral projectors which optically combine the images of different camera channels, which are color coded according to spectral range, into a single image is considered, and it is noted that the human eye is capable of discerning about 100 times more color tones than grey values on a photograph. Color synthesis images obtained from multispectral photographs of the Baikal region taken by Soyuz 22, of the Columbia River plains taken by Skylab and of Yellowstone National Park taken by Landsat are interpreted in order to illustrate the capabilities of the process in distinguishing terrain features. A.L.W.

A81-34555 # **Towards a world index of space imagery.** J. A. Howard and A. van Dijk (United Nations, Food and Agriculture Organization, Rome, Italy). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 457-466.

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

A81-34584 # **An aid to the photointerpretation of Landsat data (Une aide à la photo-interprétation des images Landsat).** M.-F. Oudin and D. Chaume (IBM France, S.A., Centre Scientifique, Paris, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 744-753. 5 refs. In French.

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

A81-34589 # **Inferences by analogy in photo interpretation (Über analogieschlüsse in der Photointerpretation).** H. Schmidt-Falkenberg (Institut für angewandte Geodäsie, Frankfurt am Main, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 812-818. 6 refs. In German.

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

A81-34590 # **Object-dependent spatial variations of spectral signatures on infrared colour aerial photographs.** W. Schneider and A. Lantschner (Wien, Universität für Bodenkultur, Vienna, Austria). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 819-828. 10 refs.

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

A81-34595 # **Preliminary digital processing methods in automated systems of visual interpretation for space images.** M. Solomatin (Glavnoe Upravlenie Geodezii i Kartografii, Moscow, USSR). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 8. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 874-880.

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

A81-34606 **International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement.** Edited by F. Ackermann (Stuttgart, Universität, Stuttgart, West Germany). Hamburg, Committee of the International Congress for Photogrammetry, 1980. 657 p. In English, German, and French.

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

A81-34611 # **A simple method for correcting the geometric distortion of airborne multispectral data.** T. Oka, K. Yazawa, and T. Inagaki (National Aerospace Laboratory, Tokyo, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 88-97. Research supported by the Science and Technology Agency of Japan.

An experimental study has been made to correct the geometric distortion of airborne multispectral imagery. Distorted images were corrected using measured attitude angles (Pitch & Yaw) by means of the newly developed program which was established by numerical simulations. Comparing the corrected images with the corresponding photographs clearly proves the advantage of this simple method for correction. (Author)

A81-34616 # **The effect of light-beam refraction on the spatial coordinates of points at the evaluation of stereo aerial photograph pairs (Über den Einfluss der Lichtstrahlenrefraktion auf die räumlichen Koordinaten der Punkte bei der Auswertung von Stereo-Luftbildpaaren).** G. I. Genov (Wissenschaftlich-Technischer Verband, Sofia, Bulgaria). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 379-386. 5 refs. In German.

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

A81-34617 # **Automatic noise removal and contour mapping on low gradient imagery.** W. Mehl (Commission of the European Communities, Joint Research Centre, Ispra, Italy). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 436-444.

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

A81-34618 # **A view of digital image processing.** N. J. Mulder (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 445-453. 7 refs.

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

A81-34619 # **Digital differential rectification of air-borne MSS data for geothermal mapping.** M. Nasu, K. Shimamoto, H. Kano, and M. Fuchimoto (Asia Air Survey Co., Ltd., Tokyo, Japan). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 454-470. 6 refs.

A81-34621 * # **Stereosat - A global digital stereo imaging mission.** A. F. H. Goetz (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 563-570. Contract No. NAS7-100.

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

A81-34624 # **Introduction to image quality definition and requirements for remote sensing satellites.** J. P. Antikidis (ESA, Earth Observation Programme Office, Toulouse, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 416-425.

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

A81-34626 # **Remote sensing of object's state as a statistical estimation problem - General considerations and algorithm.** B. M. Balter and V. V. Egorov (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 448-456. 7 refs.

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

A81-35735 # **Television methods of color filtering in aerial and spaceborne studies of the earth (Televizionnye metody tsvetovoi fil'tratsii v aerokosmicheskikh issledovaniiakh zemli).** R. E. Bykov, N. V. Ignat'eva, and Iu. M. Titov (Leningradskii Elektrotekhnicheskii Institut, Leningrad, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 76-81. 7 refs. In Russian.

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

A81-35736 # **Input-output of multispectral image data with the elimination of information redundancy (Vvod/vyvod mnogozonal'noi videoinformatsii s ustraneniem informatsionnoi izbytochnosti).** V. V. Asmus, A. S. Mishkina, L. Iu. Rivkin, A. P. Tishchenko, and S. V. Shapovalov (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 82-86. In Russian.

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

A81-35743 The detection and segmentation of blobs in infrared images. L. G. Minor (U.S. Army, Missile Command, Redstone Arsenal, Ala.) and J. Sklansky (California, University, Irvine, Calif.). *IEEE Transactions on Systems, Man, and Cybernetics,* vol. SMC-11, Mar. 1981, p. 194-201. 8 refs.

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

A81-35744 Visual effects of sampling in digital picture processing - A pilot experiment. L. Linde, H. Marmolin, and S. Nyberg (Forsvarets Forskningsanstalt, Linkoping, Sweden). *IEEE Transactions on Systems, Man, and Cybernetics,* vol. SMC-11, Mar. 1981, p. 201-207. 7 refs.

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

A81-35746 Gradient magnitude as an aid in color pixel classification. A. Broder and A. Rosenfeld (Maryland, University, College Park, Md.). *IEEE Transactions on Systems, Man, and Cybernetics,* vol. SMC-11, Mar. 1981, p. 248, 249. Grant No. DAAG53-76-C-0138. DARPA Order 3206.

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

A81-35966 # Automated processing of space imagery (Avtomatizatsiia obrabotki kosmicheskoi videoinformatsii). A. M. Dynkin, L. I. Zlobin, and M. E. Solomatin. *Geodeziia i Kartografiia,* Apr. 1981, p. 37-41. In Russian.

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

A81-35968 # Analytical phototriangulation on the basis of space photographs (Analiticheskaia fototrianguliatsiia po kosmicheskim fotosnimkam). Sh. E. Kuznetsova, E. A. Reshetov, B. I. Savel'ev, and V. V. Kiselev. *Geodeziia i Kartografiia,* Apr. 1981, p. 43-45. In Russian.

A81-36271 An active method for measuring thermal infrared effective emissivities - Implications and perspectives for remote sensing. F. Becker, W. Ngai, and M. P. Stoll (Strasbourgh I, Université, Strasbourgh, France). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 193-210. 16 refs. Research supported by the Centre National d'Etudes Spatiales.

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

A81-36272 Characterization of the spectral signature of tropical terrain units by means of the principal component analysis /PCA/ (Caractérisation de la signature spectrale des unités de paysages tropicaux à l'aide de l'analyse en composantes principales /ACP/). D. Chaume, T. Nguyen, M. F. Oudin, and G. Savary (IBM France, S.A., Centre Scientifique, Paris, France). *(COSPAR, Topical Meeting - Sessions on Remote Sensing 1980, Budapest, Hungary, June 2-14, 1980.) Advances in Space Research,* vol. 1, no. 10, 1981, p. 215-219. In French.

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

A81-36995 The optimization of digital-analog conversion (Über die Optimierung der Digital-Analog-Wandlung). K.-J. Seegel (Institut für angewandte Geodäsie, Frankfurt im Main, West Germany). *Bildmessung und Luftbildwesen,* vol. 49, May 1, 1981, p. 76-85. 18 refs. In German.

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

A81-36996 National Point of Contact /NPOC/ in the Earthnet program and scientific user support for remote sensing in the DFVLR (Nationales Ansprechzentrum /NPOC/ im Earthnet-Programm und wissenschaftliche Nutzerunterstützung für die Fernerkundung in der DFVLR). H. Engel and R. Winter (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen, West Germany). *Bildmessung und Luftbildwesen,* vol. 49, May 1, 1981, p. 86-98. 7 refs. In German.

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

A81-37599 * Textural features for radar image analysis. K. S. Shanmugan, V. Narayanan, V. S. Frost, J. A. Stiles, and J. C. Holtzman (Kansas, University, Lawrence, Kan.). *IEEE Transactions on Geoscience and Remote Sensing*, vol. GE-19, July 1981, p. 153-156. 10 refs. Research supported by the University of Kansas; Grant No. NAG9-3.

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

A81-38208 Use of Landsat data continues to grow. B. M. Elson. *Aviation Week and Space Technology*, vol. 114, June 22, 1981, p. 94-99, 101, 103.

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

A81-38723 Operational data collection and platform location by satellite. J. L. Bessis (Centre National d'Etudes Spatiales, Toulouse, France). *Remote Sensing of Environment*, vol. 11, May 1981, p. 93-111.

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

A81-39365 Using digital terrain data to model image formation in remote sensing. R. J. Woodham (British Columbia, University, Vancouver, Canada). In: Image processing for missile guidance; Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 361-369. 15 refs. Research supported by the Ministry of Forests of British Columbia; Natural Sciences and Engineering Research Council of Canada Grant No. A-3390.

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

A81-39371 Geographic data bases supporting scene generation. G. E. Lukes (U.S. Army, Research Institute, Fort Belvoir, VA). In: Image processing for missile guidance; Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 406-413. 6 refs.

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

A81-39374 A criterion for best shapes for edge correlation. C. A. McPherson, J. J. Hwang, and E. L. Hall (Tennessee, University, Knoxville, TN). In: Image processing for missile guidance; Proceedings of the Seminar, San Diego, CA, July 29-August 1, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 454-460. 12 refs. Research supported by the California State University; Contract No. F40701-79-C-0072.

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

A81-39394 Airborne video image enhancement. R. Y. Wong, M. L. Lee, and P. R. Hardaker (California State University, Northridge, CA). In: Real-time signal processing III; Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 47-50. Research supported by the Research Foundation, California State University, and U.S. Air Force.

Images of objects and scenes on earth taken from high and low altitude aircraft have been used for many purposes including natural resource analysis, weather prediction and navigational aid. For an image of low contrast, the amplitude variations of the high frequency components of the video are small and can be masked by noise introduced during recording and transmission. Analog and digital enhancement techniques are used to enhance and retain the detail information of the scene represented by the high frequency components. Experimental results are presented for the processing of optical and radar images. (Author)

A81-39400 **Direct electronic Fourier transform /DEFT/ spectra for terrain feature classification.** J. F. Hannigan (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, VA). In: Real-time signal processing III; Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 122-128. 13 refs.

This paper presents the experimental results obtained with a Direct Electronic Fourier Transform (DEFT) device. Emphasis is placed on the use of DEFT spectra for terrain feature classification. These spectra indicate the potential of DEFT technology for distinguishing between natural features and cultural or man-made features. These same spectra appear to have potential for distinguishing between certain subclasses of terrain features, e.g., open fields, bodies of water, and woods. A potential application of DEFT spectra could be the preliminary analysis of aerial imagery to automatically flag certain photographs for subsequent detailed analysis by a human photointerpreter, and to automatically select or reject specific photographs before digitization for mapping or other purposes. New devices use surface acoustic waves to generate a two-dimensional limited bandwidth Fourier transform of an image in real time without the aid of a computer. These devices permit spectra analysis for a two-dimensional image as a communications engineer would analyze the RF spectrum of a radio signal. Appropriate references and a brief description of DEFT technology is presented. (Author)

A81-39428 **A new film for reconnaissance and earth resources applications.** B. K. Boller (Eastman Kodak Co., Photographic Technology Div., Rochester, NY). In: Long focal length, high altitude standoff reconnaissance; Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 96-100.

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

A81-39566 * **Data compression for National Oceanic and Atmospheric Administration /NOAA/ weather satellite systems.** R. F. Rice and A. P. Schlutsmeyer (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: Advances in image transmission II; Proceedings of the Seminar, San Diego, CA, July 31, August 1, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 131-137. 5 refs. Contract No. NAS7-100. NOAA Project RD-152.

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

A81-40330 **A method for satellite identification of surface temperature fields of subpixel resolution.** J. Dozier (NOAA, National Earth Satellite Service, Washington, DC). *Remote Sensing of Environment*, vol. 11, July 1981, p. 221-229. 14 refs.

It is possible to measure surface radiant temperature fields of subpixel spatial resolution from satellites which contain more than one channel in the thermal infrared spectral region. Because of the different response of the Planck function at different wavelengths, the radiant temperatures measured in two channels may be expressed in terms of contributions from two temperature fields, each occupying a portion of the pixel, where the portions are not necessarily contiguous. The resulting simultaneous nonlinear equations may be solved for the complimentary portions of the pixel occupied and one unknown temperature. In two adjacent pixels which can be assumed to have the same target temperatures and same background temperatures, both unknown temperatures may be found. (Author)

A81-40331 **The logic of multispectral classification and mapping of land.** C. J. Robinove (U.S. Geological Survey, Reston, VA). *Remote Sensing of Environment*, vol. 11, July 1981, p. 231-244. 9 refs.

The use of multispectral reflectance data as surrogates for land attributes must be done within strict rules of logic and with a recognition of judgmental factors such as the use of a priori or a posteriori classification schemes. The naming and describing of spectral classes as surrogates of information classes is a critical element in the logic of mapping and must be complete and logically consistent. Maps of information classes derived from multispectral data should be portrayed without class boundaries so as to indicate the degree of homogeneity or heterogeneity of classes on maps in which these characteristics are of major importance. (Author)

N81-22445*# Business and Technological Systems, Inc., Seabrook, Md.

MAGSAT SCIENCE INVESTIGATIONS Quarterly Report, 9 Sep. - 30 Nov. 1980

30 Nov. 1980 4 p ERTS

(Contract NAS5-26328)

(E81-10109; NASA-CR-164103; QR-1) Avail: NTIS HC A02/MF A01 CSCL 05B

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

N81-22457# Technische Univ., Graz (Austria). Inst. for National Surveying and Photogrammetry.

AUTOMATED REGISTRATION OF SCANNED SATELLITE IMAGERY WITH A DIGITAL MAP DATA BASE Final Technical Report, Feb. 1978 - Nov. 1980

Franz W. Leberl and Walter Kropatsch Nov. 1980 159 p refs

(Grant DA-ERO-78-G-044; DA Proj. 1T1-61102-BH-57)

(AD-A096132) Avail: NTIS HC A08/MF A01 CSCL 09/2

Analysis of digital remote sensing images can, and should employ all the information that is available about the area of interest. Maps often do exist, so that the question arises how map information can be automatically used to direct image analysis. With an appropriate organization of digital map data banks it becomes possible to merge image and map. Attention is concentrated on areal features. The algorithms and data structures used for the task are described and experiences using specific examples of LANDSAT images in southern Germany and Austria to automatically recognize features for subsequent rectification are reported. GRA

N81-22460# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Digitale Bildverarbeitung.

COMPARATIVE EXPERIMENTAL STUDY ON THE USE OF ORIGINAL AND COMPRESSED MULTISPECTRAL LANDSAT DATA FOR APPLIED RESEARCH

Klaus A. Ulbricht Feb. 1980 82 p refs Original contains color illustrations

(DFVLR-FB-80-03) Avail: NTIS HC A05/MF A01

The LANDSAT images of the Bayuda desert in Sudan and the Baltic Sea were submitted to supervised maximum likelihood classification. Partitioning of classified images is given on a percentage basis as a function of sigma. Three dimensional clusters of spectral channels and histograms show the influence of compression. After classification the substance in its com-

pressed state has a higher or lower share of the total area than the original substance, depending on the training area. For all sigma values applied; the compressed classification percentages within one substance either stay totally above or totally below original percentages. Author (ESA)

N81-23561*# Texas A&M Univ., College Station. Dept. of Mathematics.
BASIC RESEARCH PLANNING IN MATHEMATICAL PATTERN RECOGNITION AND IMAGE ANALYSIS Final Report
Jack Bryant and L. F. Guseman, Jr. Jan. 1981 77 p refs
(Contract NAS9-15964)
(NASA-CR-160946) Avail: NTIS HC A05/MF A01 CSCL 05B

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

N81-24487 Missouri Univ. -Columbia.
DEVELOPMENT OF AUTOMATED TECHNIQUES FOR CREATING A NATURAL RESOURCES INFORMATION SYSTEM Ph.D. Thesis
Tachpong Hotrabhavananda 1980 252 p
Avail: Univ. Microfilms Order No. 8108804

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

N81-26515*# Calspan Advanced Technology Center, Buffalo, N.Y.
APPLICATIONS OF HCMM SATELLITE DATA Quarterly Report, 23 May - 23 Aug. 1980
23 Aug. 1980 10 p HCMM
(Contract NAS5-24263)
(E81-10091; NASA-CR-164089; QR-12) Avail: NTIS HC A02/MF A01 CSCL 05B

Underflight data were radiometrically calibrated at several locations and surface water temperature measurements were made for several areas approximating the field of view of the HCMM sensor in a study of the thermal properties of Lake Ontario and Lake Erie and of the heat island problem in selected areas adjacent to these lakes. The temperatures obtained from the radiometrically collected imagery were then plotted against the apparent temperatures for these same locations obtained from HCMM computer compatible tapes. The sensor calibration provides a foundation for development of a refined model for radiometric correction of HCMM data to produce maps of thermal bar development in Lake Ontario. Thermal patterns of several urban areas were generated from HCMM tapes and scaled to corresponding land use and topographic maps. The resulting map overlays are being interpreted in terms of land use influence on the extend and severity of heat island indicators. A.R.H.

N81-26657# Ministero dell'Agricoltura e delle Foreste, Rome (Italy). Central Office of Agricultural Ecology.
USE OF METEOROLOGICAL SATELLITES FOR THUNDERSTORM OBSERVATIONS: FIRST RESULTS OBTAINED FROM METEOSAT-1
R. Caponigro *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 81-84 refs

Avail: NTIS HC A14/MF A01

Various Meteosat images were studied in order to investigate the possibility of using the Meteosat system for the observation of thunderstorms, particularly hailstorms, at middle latitudes. A simple and repeatable treatment of the images that can be used for operational purposes of meteorological services on a local scale is specified. The processing method is based on the digital analysis of images, identifying from among cloud bodies those of a cellular form and those with lowest radiance in the thermic IR band. The hypothesis is that these correspond to convective clouds with strong vertical growth. Twelve storms that occurred in the northeastern Po Valley were reconstructed, using thunderstorm ground truth data and Meteosat imagery. A synthesis of the ground data and the Meteosat image analysis serves as an example of the method proposed and of the good results that can be obtained. Author (ESA)

N81-26664# Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).
SATELLITE DATA IN ALPEX
F. R. Cayla *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 125-130 refs

Avail: NTIS HC A14/MF A01

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

N81-26671# Centre d'Etudes de Meteorologie Spatiale, Lannion (France).
CYCLOGENESIS IN WESTERN EUROPE AND THE MEDITERRANEAN [CYCLOGENESE SUR L'EUROPE DE L'OUEST ET LA MEDITERRANEE]
Y. LeNinivin *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 187-194 refs In FRENCH

Avail: NTIS HC A14/MF A01

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

N81-26749*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 4A: SOFTWARE SYSTEM MANUAL, PART 1 Final Report, Jan. - Sep. 1980
Edward H. Schlosser Sep. 1980 668 p
(Contract NAS9-15800)
(NASA-CR-161013; LEMSCO-15615-Pt-1; JSC-17024-Pt-1)
Avail: NTIS HC A99/MF A01 CSCL 09B

The package is an integrated set of manual procedures, computer programs, and graphic devices designed for efficient

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

N81-26750*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 4B: SOFTWARE SYSTEM MANUAL, PART 2 Final Report
Edward H. Schlosser Sep. 1980 721 p
(Contract NAS9-15800)
(NASA-CR-161014; LEMSCO-15616-Pt-2; JSC-17024-Pt-2)
Avail: NTIS HC A99/MF A01 CSCL 09B

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

N81-27170# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.
DATA COLLECTION AND LOCATION BY SATELLITE
1979 107 p Conference held at Lanham, Maryland, 13-14 Sep. 1979
Avail: NTIS HC A06/MF A01

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

N81-27575# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.
BASIC PRINCIPLES OF REMOTE SENSING
A. VanDijk *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 21-24

Avail: NTIS HC A09/MF A01

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

N81-27579# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.
ACTUAL PERFORMANCE OF THE ARGOS SYSTEM
J. L. Bessis *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 51-60

Avail: NTIS HC A09/MF A01

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

N81-27581# Direction de la Meteorologie Nationale, Paris (France).
TROPICAL DISTURBANCES [PERTURBATIONS TROPICALES]
G. Dhonneur *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 69-77 refs In FRENCH

Avail: NTIS HC A09/MF A01

The surveillance of tropical storms, particularly hurricanes, is discussed, and appropriate actions both on a regional and national scale are discussed. The need for accurate meteorological data when making forecasts is brought out. Application of specialized radar for in situ aerial reconnaissance is considered, and interpretation of satellite imagery is covered. Concepts of tropical meteorology are reviewed, relating to image analysis. Hurricane climatology and cyclogenesis are treated. A classification of tropical disturbances is formulated. Hurricane direction and storm intensity forecasting are described. Author (ESA)

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A81-32353 Detection of rainfall rates over ocean and land backgrounds utilizing spaceborne microwave radiometers. H.-H. K. Burke, K. R. Hardy, N. K. Tripp, and K. C. Jones (Environmental Research and Technology, Inc., Concord, Mass.). In: ICC '80; International Conference on Communications, Seattle, Wash., June 8-12, 1980, Conference Record. Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 49.2.1-49.2.6. 9 refs.

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

A81-32354 Effect of scattering on active and passive remote sensing of earth terrain. J. A. Kong (MIT, Cambridge, Mass.). In: ICC '80; International Conference on Communications, Seattle, Wash., June 8-12, 1980, Conference Record. Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1980, p. 49.3.1-49.3.3. 7 refs. USAF-supported research.

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

A81-32526 # Passive methods of atmospheric sounding (Méthodes passives de sondage atmosphèrique). A. Girard (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *(Centre National de la Recherche Scientifique, Ecole d'Hiver sur les Applications de la Physique Moléculaire à l'Atmosphère, l'Environnement, France, Dec. 1-10, 1980.) ONERA, TP* no. 1981-6, 1981. 38 p. In French.

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

A81-32990 * # Tropical cyclone rainfall characteristics as determined from a satellite passive microwave radiometer. E. B. Rodgers and R. F. Adler (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Monthly Weather Review,* vol. 109, Mar. 1981, p. 506-521. 34 refs.

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

A81-33302 Three elementary tools in the processing of remote sensing data - A unifying approach. N. J. Mulder (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *British Interplanetary Society, Journal (Image Processing, Space Technology),* vol. 34, Apr. 1981, p. 129-134. 6 refs.

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

A81-33307 High throughput image preprocessing techniques for earth resources imagery. D. J. Stanley and P. S. Redstone (Logica, Ltd., London, England). *British Interplanetary Society, Journal (Image Processing, Space Technology),* vol. 34, Apr. 1981, p. 155-161. 9 refs.

It is shown that the overall performance of the Distributed Array Processor (DAP) in earth resources imagery preprocessing is very high, and that single-instruction, multiple-datastream (SIMD) processors are nearly ideal for such image processing. Although the DAP could preprocess up to six multispectral scanner frames per hour to the highest precision, it is thought unlikely that such a throughput will be required in a British computing facility until the late 1980s. Characteristics of the Landsat imaging system, of preprocessor operations such as radiometric correction, resampling, principal component transformation, and automatic registration, and of image processor architectures like that of the AP-120B, are considered in detail. O.C.

A81-33526 # Visible and infrared sensors for earth resource observation in the '80s. D. C. Smith and R. H. Howell (Itek Corp., Lexington, Mass.). *American Astronautical Society and American Institute of Aeronautics and Astronautics, Annual Meeting on Space Enhancing Technological Leadership, Boston, Mass., Oct. 20-23, 1980, AAS Paper 80-238.* 29 p. 6 refs.

The major development of visible and IR sensors for earth resources observation will be undertaken in the next decade to meet the demands of increased resolution, higher radiometric sensitivity, spectral band diversity, and greater geometric precision without sacrificing the terrain coverage available from current systems. This development will attempt to incorporate advances in large-scale integrated circuits as applied to detector arrays, optical technology, and image data processing in order to produce a new generation of sensors based on pushbroom scanning. This paper examines the system architecture implied by the requirements for these sensors and suggests configurations and performance characteristics that may result. P.T.H.

A81-33544 * # **Microwave sensors for earth resource observations in the 1980's.** J. W. Rouse, Jr. (Missouri-Columbia, University, Columbia, Mo.) and M. J. Harnage, Jr. (NASA, Johnson Space Flight Center, Houston, Tex.). *American Astronautical Society and American Institute of Aeronautics and Astronautics, Annual Meeting on Space Enhancing Technological Leadership, Boston, Mass., Oct. 20-23, 1980, AAS Paper 80-239.* 13 p. 9 refs.

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

A81-34370 **International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 1. Commission 1.** Edited by F. Ackermann (Stuttgart, Universität, Stuttgart, West Germany). Hamburg, Committee of the International Congress for Photogrammetry, 1980. 235 p. In English, German, and French.

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

A81-34373 # **A modular, opto-electronic, multispectral satellite imaging system /MOMS/ by MBB (Ein modulares, Optoelektronisches, Multispektrales Satellitenbild-Aufnahme-System /MOMS/ von MBB).** O. Hofmann, M. Hofmann, and D. Meissner (Messerschmitt-Bölkow-Blohm GmbH, Ottobrunn, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 1. Commission 1. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 42-49. 12 refs. In German.

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

A81-34385 # **Environmental factors in the design of the Large Format Camera.** G. A. Wood (Itek Corp., Optical Systems Div., Lexington, Mass.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 1. Commission 1. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 182-188.

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

A81-34387 # **New studies for European remote sensing satellites and earth-oriented Spacelab missions (Neuere Untersuchungen für Europäische Erderkundungssatelliten und Erdorientierte Spacelabmissionen).** E. H. Velten (Dornier System GmbH, Friedrichshafen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 1. Commission 1. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 198-207. 8 refs.

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

A81-34388 # **MKF-6 multispectral camera from Jena.** A. Zickler (Jenoptik Jena GmbH, Jena, East Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 1. Commission 1. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 208-214.

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

A81-34399 # **Two methods of plotting from Landsat imagery using analogue instruments.** E. Clerici and I. Harley (Queensland, University, Brisbane, Australia). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 117-124.

The reported investigation is concerned with a practical problem of Landsat imagery users, who have to transfer image data to an existing map. Methods of planimetric restitution of Landsat images, based on a linear affine transformation, are described. These methods make use of the Stereotop and the PG2, and require little or no instrument modification. Experiments indicate very good agreement of the plotted points with a topographic map at 1:250,000. Attention is given to theoretical considerations, a method based on the Stereotop, two methods based on the PG2, and some tests. The feasibility of restitution with the Stereotop has been tested by plotting hydrological details in a band 7 Landsat image of the Brisbane region on an existing 1:250,000 scale topographic map. Both methods using the PG2 are shown to be sufficiently accurate for planimetric map revision at 1:250,000. G.R.

A81-34405 # **A mathematical model for the reconstruction of objects using a multilens camera with a focal plane shutter and FMC.** H. Ebner and M. Stephani (München, Technische Universität, Munich, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers.

Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 178-192. 5 refs.

It is noted that from the point of view of photogrammetry the search for the accuracy level that can be attempted using the photos for object point coordinate determination is of great interest. A camera having a focal plane shutter and a forward motion compensation (FMC) device is described. It is noted that the camera avoids the projective cylindrical distortions of a panoramic camera. In addition, the combination of a focal plane shutter and FMC, which allows low flying altitudes, results in an image geometry which is different from the unique central perspective usually realized in photogrammetry. The common effect of the focal plane shutter and FMC on the image coordinates is described. A mathematical model for the dynamic image generation with the described system is then presented and used for a rigorous reconstruction of object point coordinates from image coordinate measurements, inner orientation data, and recordings of the exterior orientation parameters. The accuracy of the entire system is estimated by computer simulations. C.R.

A81-34443 # **Integration of remote sensing data sets by rectification to UTM coordinates with the use of digital terrain models.** P. M. Teillet, B. Guindon, and D. G. Goodenough (Canada Center for Remote Sensing, Ottawa, Canada). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 3. Commission 3. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 726-733.

It is noted that a digital analysis of integrated multisensor data sets acquired from aircraft and satellite platforms requires rectification of the data sets to a common geographical coordinate system. The relative importance of factors bearing on registration is discussed quantitatively. The Universal Transverse Mercator projection is selected as the standard in an experiment to compare Landsat 4-channel multispectral scanner (MSS) data, aircraft 11-channel MSS data, and aircraft 4-channel synthetic aperture radar data for agricultural forest test sites. For the aircraft imagery, a geometric correction scheme is developed to model the flight path of the sensor relative to the ground. Digital terrain elevation models are incorporated into the rectification process in order to correct for positional distortions caused by topographic relief. C.R.

A81-34474 # **The significance of the Zeiss-Planicomp for photogrammetric practice (Die Bedeutung des Zeiss-Planicomp für die photogrammetrische Praxis).** D. Hobbie (Carl Zeiss, Oberkochen, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 331-341. 20 refs. In German.

The analytical stereoplotting system Planicomp C-100 was first presented to a wider public in 1976. A description of the system is presented, and the advantages of the Planicomp for various applications are discussed. The Planicomp C-100 consists of three functional groups, including measuring device, control unit, and peripheral equipment. The accuracy of positioning and measuring systems is, on an average, about 2 microns per axis. The control unit makes use of a 16-bit minicomputer. Attention is given to peripheral devices, special system configurations, the available software, advantages of the Planicomp for aerotriangulation operations, and the measurement of digital terrain models. G.R.

A81-34505 # **Rationalization of map production and map revision with modern automated and digitized photogrammetric instruments and technologies.** K. Szangolies (Jenoptik Jena GmbH, Jena, East Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 4. Commission 4. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 693-704. 7 refs.

A81-34538 # **Solar sensing by optic fibers for in flight calibration of the camera on board the SPOT satellite (Capteur solaire à fibres optiques pour l'étalonnage en vol d'un instrument de prise de vue embarqué sur le satellite SPOT).** M. Dinguirard and J. M. Maisonneuve (ONERA, Département d'Etudes et de Recherches en Optique, Toulouse, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 265-272. In French.

A system devised by ONERA to use solar reference for camera calibration on board the SPOT satellite is described. Silicon optic fibers 200 microns in diameter and 3 m long radiate from a spherical bundle, twisted linearly at a constant 10 degrees, through mode couplers and optical connectors to processing devices, to transmit received sunlight from solar angles as low as 6 degrees onto radiometric sensors. Linear silicon charge coupled devices with 6000 elements (a panchromatic eye is spatially separated from these) are situated in the camera focal plane. Calibration is to occur once per month for the two year life of the satellite, and spectral bands are noted in four intervals between .5 and .9 micron with clarity of 10 percent absolute and 2 percent relative. A minimum of 10 elements are always kept sunward and any change of direction involves at least two elements. Calibration takes place just past eclipse and the spherical shape of the bundle guarantees clarity in all seasons. D.H.K.

A81-34612 # **Optical imaging instruments for the remote sensing programme of the European Space Agency.** M. Reynolds (ESA, Earth Observation Programme Office, Toulouse, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 9. Commissions 1, 2, 3 & 4. Supplement. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 98-108.

ESA activity in remote sensing is concentrated in three main areas: the Earthnet program, remote sensing experiments for the first Spacelab payload, and the preparation of a European remote sensing satellite program. This paper defines the requirements on optical and infrared multispectral imaging established for coastal and land applications, and outlines the payload and technology studies in progress, along with the most likely design solutions to be adopted. B.J.

A81-34639 # **Spectral separability - Using non-parametric statistical tests, with special reference to Kolmogorov-Smirinov two tailed test.** V. Parthasarathy, P. S. Roy (Freiburg, Universität, Freiburg im Breisgau, West Germany; National Remote Sensing Agency, Secunderabad, India), and P. Reichert (Freiburg, Universität, Freiburg im Breisgau, West Germany). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 590-595.

The modular multispectral scanner, presently in use, has the capability to collect spectral values in 11 channels including the thermal channel. The variation in spectral behavior provides a scope for spectral separability among different objects. A study was undertaken to investigate, whether the statistical comparison of two sample distributions of spectral values representing different cover types has any correlation with the separability. It is pointed out that the statistical tests considered only indicate whether two given samples differ significantly or not. However, it is difficult to infer on the degree of separability. The maximum difference statistic used in the K-S test indicates the degree of separability and would be a helpful tool for evaluating initial separability. G.R.

A81-34640 # **Applications of airborne thermal infrared scanners to engineering problems.** P. K. Pleitner (Daedalus Enterprises, Inc., Ann Arbor, Mich.). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers.

Volume 23, Part B 10. Commissions 6, 7 & 8.
Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 596-606.

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

A81-34945 Aerial triangulation - Accuracy improvement and quality control. F. Amer, T. Bouloucos, J. Kure, M. Molenaar, M. Radwan, and P. Stefanovic. *(International Institute for Aerial Survey and Earth Sciences, Seminar, Enschede, Netherlands, Aug. 4-8, 1980.) ITC Journal,* no. 4, 1980, p. 582-637.

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

A81-35733 # Selection of spectral ranges of remote sensors for the identification of natural objects from their spectral characteristics (K vyboru spektral'nykh intervalov priborov distantsionnogo zondirovaniia dlia razlicheniia prirodnykh ob'ektov po ikh spektral'nym kharakteristikam). V. V. Balabanov, V. V. Gogokhiia, and A. D. Dobrozrakov (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 57-62. 8 refs. In Russian.

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

A81-35963 # Experiments on the remote sensing of earth resources carried out from the Salyut-6 orbital station (Eksperimenty po izucheniiu prirodnykh resursov zemli s orbital'noi stantsii 'Saliut-6'.). V. V. Arkhipov, L. V. Desinov, L. I. Zlobin, A. D. Koval', and A. V. Filipchenko. *Geodeziia i Kartografiia,* Apr. 1981, p. 21-26. In Russian.

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

A81-37682 Infrared imaging systems technology; Proceedings of the Seminar, Washington, DC, April 10, 11, 1980. Seminar sponsored by the Society of Photo-Optical Instrumentation Engineers. Edited by J. Zimmerman (Honeywell Electro-Optics Center, Lexington, MA) and W. L. Wolfe (Arizona, University, Tucson, AZ). Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 226), 1980. 166 p. $37.

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

A81-37685 * Development of an earth resource pushbroom scanner utilizing a 90-element 8-14 micrometer /Hg,Cd/Te array. T. J. Brown (Honeywell Electro-Optics Center, Lexington, MA). In: Infrared imaging systems technology; Proceedings of the Seminar, Washington, DC, April 10, 11, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 18-37. 7 refs. Contract No. NAS5-24323; No. NAS5-25662.

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

A81-37686 Wide-field imagers - Pushbroom or whiskbroom scanners. K. Nummedal (Hughes Aircraft Co., Culver City, CA). In: Infrared imaging systems technology; Proceedings of the Seminar, Washington, DC, April 10, 11, 1980.
Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 38-52. 17 refs.

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

A81-39390 * Considerations on real-time processing of spaceborne synthetic aperture radar data. C. Wu (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). In: Real-time signal processing III; Proceedings of the Seminar, San Diego, CA, July 29, 30, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 11-19. 17 refs. Contract No. NAS7-100.

This paper comprises a description of Synthetic Aperture Radar (SAR) processing approaches and a discussion on the processor complexity measures. The objective of the paper is to provide basic system knowledge on the design of a real-time signal processor for spaceborne synthetic aperture radar. A review of SAR sensor performance capability and general electronic processing approaches will be given first. The discussion of SAR processor complexity is divided into two areas: the arithmetic complexity and the control complexity. A generalized treatment of these subjects is provided. The results could be readily extended to special cases. (Author)

A81-39597 * **Magnetic field satellite /MAGSAT/ spacecraft vector magnetometer calibration.** S. W. Hinkal (NASA, Goddard Space Flight Center, Greenbelt, MD). In: Optical alignment; Proceedings of the Seminar, San Diego, CA, July 29-31, 1980. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1980, p. 190-196.

The low-flying MAGSAT spacecraft, launched October 30, 1979, included a Vector Magnetometer to accurately map the magnitude and direction of the magnetic field of the earth. Calibration of the magnetometer included arc-second precision determination of the relative orientations of the three sensor axes in a coordinate system defined by optical references. This determination began with laboratory measurements of the relative alignments of optical components mounted with the magnetometer. The actual calibration procedure then consisted basically of accurate and repeatable positioning of the Vector Magnetometer within a unique magnetic test facility which nulls the earth's magnetic field, then generates magnetic fields of various orientations and strengths. Analysis of the magnetometer sensor outputs together with the position and alignment data then gave the axes orientations. We used precision theodolites and methods related to surveying techniques to achieve the accurate positioning and optical component alignment measurements. The final calibration accuracy exceeded results previously achieved in the facility. (Author)

A81-40328 * **Atmospheric corrections to satellite radiometric data over rugged terrain.** J. Dozier and J. Frew (California, University, Santa Barbara, CA). *Remote Sensing of Environment*, vol. 11, July 1981, p. 191-205. 36 refs. Research supported by the University of California and California Space Group; Grants No. NsG-5262; No. NOAA-04-8-MO-78.

Radiometric measurements from satellites in the solar portion of the electromagnetic spectrum can be converted to measurements of surface exitance. Over rugged terrain, the satellite image must be precisely registered to a terrain data set. For small areas a first-order polynomial interpolation scheme is generally satisfactory for the geometric rectification. If there are saturated pixels, a nearest-neighbor procedure is used for the interpolated satellite radiance numbers; otherwise a cubic-convolution algorithm is used. Path radiance and path transmittance are calculated with a simple spectral model, which requires an estimate of the water vapor and aerosol content of the atmosphere. (Author)

N81-24496*# Calspan Advanced Technology Center, Buffalo, N.Y.

DATA USE INVESTIGATIONS FOR APPLICATIONS EXPLORER MISSION A (HEAT CAPACITY MAPPING MISSION): HCMM'S ROLE IN STUDIES OF THE URBAN HEAT ISLAND, GREAT LAKES THERMAL PHENOMENA AND RADIOMETRIC CALIBRATION OF SATELLITE DATA Final Report

John R. Schott, Principal Investigator and Edward W. Schimminger Jan. 1981 138 p refs Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to "Attn: National Space Science Data Center"; non-domestic users send orders to "Attn: World Data Center A for Rockets and Satellites". HCMM

(Contract NAS5-24263)

(E81-10159; NASA-CR-164271; Calspan-6175-M-1) Avail: NTIS HC A07/MF A01 CSCL 05B

The utility of data from NASA's heat capacity mapping mission satellite for studies of the urban heat island, thermal phenomena in large lakes and radiometric calibration of satellite sensors was assessed. The data were found to be of significant value in all cases. Using HCMM data, the existence and microstructure of the heat island can be observed and associated with land cover within the urban complex. The formation and development of the thermal bar in the Great Lakes can be observed and quantitatively mapped using HCMM data. In addition, the thermal patterns observed can be associated with water quality variations observed both from other remote sensing platforms and in situ. The imaging radiometer on-board the HCMM satellite is shown to be calibratible to within about 1.1 C of actual surface temperatures. These findings, as well as the analytical procedures used in studying the HCMM data, are included. A.R.H.

N81-24498*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SMMR SIMULATOR RADIATIVE TRANSFER CALIBRATION MODEL. 2: ALGORITHM DEVELOPMENT

Susan Link, C. Calhoon, and B. Krupp Dec. 1980 120 p refs (NASA-TM-80735) Avail: NTIS HC A06/MF A01 CSCL 14B

Passive microwave measurements performed from Earth orbit can be used to provide global data on a wide range of geophysical and meteorological phenomena. A Scanning Multichannel Microwave Radiometer (SMMR) is being flown on the Nimbus-G satellite. The SMMR Simulator duplicates the frequency bands utilized in the spacecraft instruments through an amalgamate of radiometer systems. The algorithm developed utilizes data from the fall 1978 NASA CV-990 Nimbus-G underflight test series and subsequent laboratory testing. T.M.

N81-24513# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.

STUDY ON THE ELECTRONIC IMAGING SYSTEM MOMS IN THE REFLECTED AND THERMAL INFRARED SPECTRUM Final Report

Bernd Kunkel Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 105 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-80-026; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

A modular optoelectronic multispectral scanner (MOMS) was designed and developed for ESA-LASS orbit requirements. The sensor modules for the spectral channels 1.55 to 1.75 microns, 2.08 to 2.30 microns, and 10 to 12 microns are centered on. The MOMS missions and sensor specifications are briefly summarized. Concepts for the linear IR detector arrays, the optics, and for the signal readout electronics are compared. A breadboard model, incorporating a 'common module' HgCdTe array with 180 detectors and parallel serial digital data output is defined on the component level. Author (ESA)

N81-25463*# Operations Research, Inc., Silver Spring, Md.

MULTISPECTRAL RESOURCE SAMPLER (MRS): PROOF OF CONCEPT STUDY ON ATMOSPHERIC CORRECTIONS. DETERMINATIONS OF ATMOSPHERIC OPTICAL PARAMETERS USING THE MULTISPECTRAL RESOURCE SAMPLER ATMOSPHERIC OPTICAL Final Report, 15 May 1979 - 15 Jan. 1980

Robert E. Turner (Science Applications, Inc.) Dec. 1979 76 p refs 5 Vol.

(Contract NAS5-25606)

(NASA-CR-166664) Avail: NTIS HC A05/MF A01 CSCL 20F

An investigation was performed to determine which mathematical algorithms should be used in the calculation of atmospheric optical parameters using the Multispectral Resource Sampler (MRS) sensor. A simulation of the MRS sensor was performed using a radiative-transfer model. The simulation provides the spectral radiance at the satellite sensor in terms of various atmospheric parameters, such as optical thickness, solar zenith angle, nadir view angle, relative azimuth angle, bi-directional reflectance of the target, background albedo, and wavelength. Atmospheric correction algorithms were also developed for the determination of the total spectral optical thickness of the atmosphere for: (1) homogeneous (horizontal) hazy atmospheres with diffuse targets; (2) inhomogeneous (horizontal) hazy atmospheres with diffuse targets; and (3) homogeneous (horizontal) hazy atmospheres with non-diffuse targets. S.F.

N81-25464*# Operations Research, Inc., Silver Spring, Md.

MULTISPECTRAL RESOURCE SAMPLER (MRS): PROOF OF CONCEPT. STUDY ON BIDIRECTIONAL REFLECTANCE. A SIMULATION ANALYSIS OF BIDIRECTIONAL REFLECTANCE PROPERTIES AND THEIR EFFECTS ON SCENE RADIANCE. IMPLICATIONS FOR THE MRS Final Report, 15 May 1979 - 15 Jan. 1980

James A. Smith (Colorado State Univ.) Jan. 1980 132 p

refs 5 Vol.
(Contract NAS5-25606)
(NASA-CR-166668) Avail: NTIS HC A07/MF A01 CSCL 20F

A study was performed to evaluate the geometrical implication of a Multispectral Resource Sampler; a pointable sensor. Several vegetative targets representative of natural and agricultural canopies were considered in two wavelength bands. All combinations of Sun and view angles between 5 and 85 degrees zenith for a range of azimuths were simulated to examine geometrical dependance arising from seasonal as well as latitudinal variation. The effects of three different atmospheres corresponding to clear, medium and heavy haze conditions are included. An extensive model data base was generated to provide investigators with means for possible further study of atmospheric correction procedures and sensor design questions.
S.F.

N81-26324# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
A MICROWAVE REMOTE SENSING EXPERIMENT (MRSE) ONBOARD SPACELAB [DAS MRSE (MICROWAVE REMOTE SENSING EXPERIMENT), EIN MIKROWELLEN-FERNERKUNDUNGSEXPERIMENT IM SPACELAB]
Marian Werner *In its* Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 71-79 In GERMAN

Avail: NTIS HC A06/MF A01

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

N81-26529*# Systems and Applied Sciences Corp., Riverdale, Md.
FINDING THE TIMES THAT SMMR OBSERVED A SHIP Final Report
9 Jul. 1979 46 p
(Contract NAS5-25072)
(NASA-CR-159998; R-SAR-79-01) Avail: NTIS HC A03/MF A01 CSCL 05B

In order to facilitate the coincidence calculations, the coordinates of the ship and the satellite were transformed to the ECO system in which the equatorial plane is the plane of the satellite's orbit. The transformation matrices for each step are presented. The ship could be observed when it was in a band about the equator in the ECO system. The width of the band was determined by the scan pattern of the instrument.
T.M.

N81-26658# Aeronautica Militare Italiana, Rome.
EXPERIMENTAL USES OF AVHRR IMAGES
B. Bizzarri, G. Renzi, and R. Cossu (Bari Univ., Italy) *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 85-89 Original contains color illustrations

Avail: NTIS HC A14/MF A01

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

N81-27576# European Space Agency, Toulouse (France).
A SURVEY OF EARTH OBSERVATION SPACE SYSTEMS
P. Louis *In its* Satellite Remote Sensing Appl. to Rural Disasters 1981 p 25-39
Avail: NTIS HC A09/MF A01

Earth observation space systems which use satellites, are considered, including the general features of such systems. Thematic applications of observations from space are discussed relative to the spectral windows offered by the atmosphere. Space systems requirements and constraints are discussed, stressing orbits, payloads and platforms, data acquisition, preprocessing, archiving and distribution of products to data user stations. The METEOSAT system is described as an example. Author (ESA)

N81-27577# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Centre.
SATELLITE IMAGERY AND RELATED SENSORS
Carlo Travaglia, comp., Bryan Bayley, and C. Trautwein *In* ESA Satellite Remote Sensing Appl. to Rural Disasters 1981 p 41-43 refs
Avail: NTIS HC A09/MF A01

Basic principles of imagery analysis and interpretation are explained together with a logical work sequence to obtain meaningful image interpretation. Synoptic view, repetitivity and integrated approach concepts are given. The most widely used imaging instruments in satellite sensing are the multispectral scanner (MSS) and the return beam vidicon (RBV) which are both carried by LANDSAT satellites. However, it is generally agreed that MSS images are equal or superior in quality to those from the RBV. As examples, LANDSAT imagery availability and formats are considered. Author (ESA)

09
GENERAL

Includes economic analysis.

A81-36414 # **What is new in the legal regulations of activities in outer space.** E. G. Vasilevskaia (Akademiia Nauk SSSR, Institut Gosudarstva i Prava, Moscow, USSR). In: Colloquium on The Law of Outer Space, 23rd, Tokyo, Japan, September 21-28, 1980, Proceedings. New York, American Institute of Aeronautics and Astronautics, Inc., 1981, p. 79-82.

A81-36255 **Sessions on remote sensing 1980; Proceedings of the Topical Meeting, Budapest, Hungary, June 2-14, 1980.** Meeting sponsored by COSPAR. Edited bv A. B. Kahle (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), G. Weill (Centre National d'Etudes Spatiales, Paris, France), and W. D. Carter (U.S. Geological Survey, Reston, Va.). *Advances in Space Research,* vol. 1, no. 10, 1981. 321 p. In English and French.

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

A81-35739 # **Comparative efficiency of aircraft and satellites in the remote sensing of earth resources (O sravnitel'noi effektivnosti samoletov i sputnikov v issledovaniiakh prirodnykh resursov zemli).** Ia. L. Ziman (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) and D. N. Mishev (B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia po Kosmicheski Izsledvaniia, Sofia, Bulgaria). *Issledovanie Zemli iz Kosmosa,* Mar.-Apr. 1981, p. 97-102. In Russian.

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

A81-34622 **International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 10. Commissions 6, 7 & 8.** Edited by F. Ackermann (Stuttgart, Universität, Stuttgart, West Germany). Hamburg, Committee of the International Congress for Photogrammetry, 1980. 820 p. In English, German, and French.

Aspects of nontopographic photogrammetry are considered along with economic and educational aspects of photogrammetry and investigations related to the interpretation of data. Attention is given to low altitude aerial photography, photologging as a close range photogrammetry tool for highway engineers, pericontourography, precision of geodesy versus photogrammetry in building control, photogrammetric education and course curricula in developing countries, remote sensing techniques applied to sugar beet diseases in Germany and Italy, fixed-base photogrammetry with wing-tip mounted cameras, a regional land use survey based on point sampling on aerial photographs, evaluation of ocean bottom features from ocean color scanner imagery, the application of Landsat data for the management of forest resources, the ecological monitoring of balancing lakes by multispectral remote sensing, applications of airborne thermal infrared scanners to engineering problems, the state-of-the-art in agricultural and forest crop stress and damage detection by the use of remote sensing techniques, and the applications of remote sensing to oceanography and sea ice. G.R.

A81-34535 # **SPOT and user services (SPOT et le service aux utilisateurs).** J.-P. Delpont (Centre National d'Etudes Spatiales, Toulouse, France). In: International archives of photogrammetry; International Society for Photogrammetry, Congress, 14th, Hamburg, West Germany, July 13-25, 1980, Presented Papers. Volume 23, Part B 7. Commission 7. Hamburg, Committee of the International Congress for Photogrammetry, 1980, p. 235-243. In French.

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

A81-33536 * # **Renewable resource applications of remote sensing in the 1980's.** R. M. Ragan (Maryland, University, College Park, Md.) and M. A. Calabrese (NASA, Washington, D.C.). *American Astronautical Society and American Institute of Aeronautics and Astronautics, Annual Meeting on Space Enhancing Technological Leadership, Boston, Mass., Oct. 20-23, 1980, AAS Paper 80-236.* 50 p. 21 refs.

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

N81-22454*# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT LANGUAGE AT OUR REACH. FIRST SWEDISH SATELLITE. CIVILIZATION DETECTORS
D. L. Wayne and V. Bravo Apr. 1981 18 p Transl. into ENGLISH from Aerospacia (Argentina), Nov. - Dec. 1980 p 50-58 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-76477) Avail: NTIS HC A02/MF A01 CSCL 05B

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

N81-23583# Indian Photo-Interpretation Inst., Dehra Dun. Indian Society of Photo-Interpretation and Remote Sensing.
SEMINAR ON APPLICATION OF AERIAL PHOTO-INTERPRETATION AND REMOTE SENSING TECHNIQUES FOR NATURAL RESOURCES SURVEY AND ENVIRONMENTAL ANALYSIS, ABSTRACTS
1980 112 p Seminar held at Dehra Dun, India, 8-10 Oct. 1980
(PB81-145153) Avail: NTIS HC A06/MF A01 CSCL 08E
Topic areas cover: Geology, Geotechnics, Geomorphology,

Hydrogeology, Soil conservation and watershed management, Land use and agriculture, and Forest resources inventory. Instrumentation and methodology are also covered. GRA

N81-24499*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH SURVEY APPLICATIONS DIVISION Reasearch Report, 1980
Lloyd Carpenter, ed. Jan. 1981 355 p refs Submitted for publication
(NASA-TM-82071) Avail: NTIS HC A16/MF A01 CSCL 05B

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

N81-25462# Committee on Science and Technology (U. S. House).
OPERATIONAL CIVIL REMOTE SENSING SYSTEMS
Washington GPO 1980 318 p refs Hearings before the Subcomm. on Space Sci. and Appl. and Subcomm. on Nat. Resources and Environ. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 131, 24-25 Jun. and 29 Jul. 1980 (GPO-66-645) Avail: Subcommittee on Space Science and Applications

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

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

A syllabus and training materials prepared and used in a series of one-day workshops to introduce modern remote sensing technology to selected groups of professional personnel in Vermont are described. Success in using computer compatible tapes, LANDSAT imagery and aerial photographs is reported for the following applications: (1) mapping defoliation of hardwood forests by tent caterpillar and gypsy moth; (2) differentiating conifer species; (3) mapping ground cover of major lake and pond watersheds; (4) inventorying and locating artificially regenerated conifer forest stands; (5) mapping water quality; (6) ascertaining the boat population to quantify recreational activity on lakes and waterways; and (7) identifying potential aquaculture sites. A.R.H.

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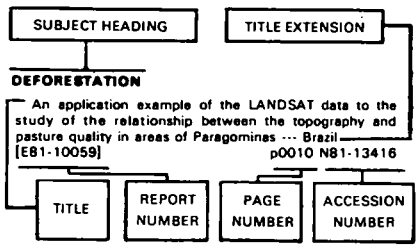

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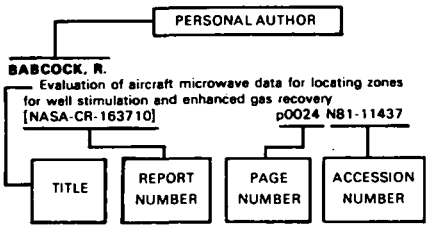

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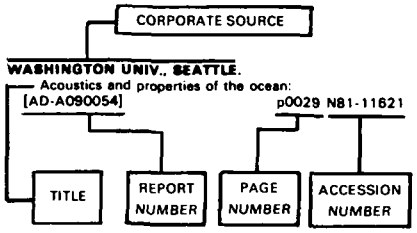

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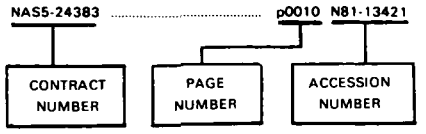

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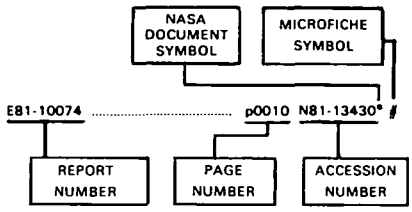

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