International Aerospace Literature

During 1997 the *AIAA Journal* will carry selected aerospace literature abstracts on leading research topics from Russia, Japan, France, Germany, Italy, and the United Kingdom. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features Aircraft Control from Russia, Satellite Observation from Japan and Germany, and Remote Sensing from the United Kingdom.

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Russian Aerospace Literature
This month: *Aircraft Control*

A96-42554 Optimal control of the elastic structures of flight vehicles (Optimal'noe upravlenie uprugimi konstruktsiyami letatel'nykh apparatov). A. A. GUSEV (Kazanskij Gosudarstvennyj Tekhnicheskij Univ., Kazan, Russia), *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 2, 1996, pp. 23–28. In Russian. 7 Refs. Documents available from AIAA Dispatch.

An optimal control synthesis algorithm for the elastic structural elements of a flight vehicle is developed for the case where the measurements of the state of the structural elements are incomplete. The control is represented in terms of distributed and concentrated actions. The optimal control synthesis algorithm proposed here makes it possible to develop efficient computational schemes. An example is presented which involves the synthesis of optimal control for the surface shape of an elastic mirror.

A96-38141 Methods and criteria of simulator versus aircraft similarity evaluation. V. N. SHIHALEYEV and Y. V. MIHEYEV (Penza Simulation Design Co., Russia), *Training—Lowering the cost, maintaining the fidelity; Proceedings of the Conference*, London, UK, 1996 (A96-38130 10-09), London, Royal Aeronautical Society, 1996, pp. 12.1–12.4. Documents available from AIAA Dispatch.

The current practice of flight simulator development is based mainly on the implementation of the design engineering requirements. Human engineering requirements are implemented subjectively, as a rule, taking into account the concrete pilot, and so have qualitative features. Human engineering approach is complex, that is, the simulator ergonomics specifications should include the simulator technical specifications and not vice versa. (Author)

A96-35611 Longitudinal flight control in a windshear via *H*-infinity methods. A. P. KURDJUKOV, B. V. PAVLOV, and V. N. TIMIN (Inst. of Control Sciences, Moscow, Russia), *AIAA Guidance, Navigation, and Control Conference*, San Diego, CA, 1996, p. 7. 9 Refs. Documents available from AIAA Dispatch.

The design of the control of an aircraft encountering windshear in the landing approach is treated as a problem of minimizing the *H*-infinity gain between the windshear and two components of the aircraft state space vector: air velocity and the height. The features of application of *H*-infinity control methods for aircraft control design are examined. A comparison of the derived *H*-infinity control algorithms (with and without weight functions) to LQG algorithms is given. (Author)

A96-31845 Similarity criteria and some requirements to feel system modelling. L. E. ZAICHIK, V. V. RODCHENKO, and Y. P. YASHIN (TsAGI, Zhukovsky, Russia), *AIAA 2nd Test and Evaluation International Aerospace Forum*, London, UK, 1996, TP (A96-31842 08-01), Reston, VA, American Inst. of Aeronautics and Astronautics, 1996, pp. 18–24. 9 Refs. Documents available from AIAA Dispatch.

A methodology of experimental investigations of manipulator and control sensitivity characteristics affecting aircraft controllability is considered. The basic concepts of a theoretical approach to assessing the influence of various manipulator and control sensitivity characteristics on handling qualities are presented. The similarity criteria of controllability are developed for aircraft with different manipulator and control sensitivity characteristics. A method is proposed which allows one to assess the controllability of an aircraft with certain manipulator and control sensitivity characteristics by making a comparison with the respective data obtained for the aircraft with other values of these characteristics. Recommendations are given for modeling the controllability of an aircraft with certain manipulator and control sensitivity characteristics on ground-based and in-flight simulators which may have other values of these characteristics. The requirements on the dynamic characteristics of a manipulator feel system used in ground-based and in-flight simulators are considered. (Author)

A96-29675 A system look at electromechanical actuation for primary flight control. E. A. LOMONOVA, *Delft, Netherlands*, Delft Univ. of Technology, 1995, p. 117. 48 Refs. Documents available from AIAA Dispatch.

An overview is presented of the emergence of the all-electric flight control system (FCS) or power-by-wire concept. The development of the primary flight control electromechanical actuators (EMAs) is one of the essential steps in the implementation of the all-electric aircraft. There is a great deal of interest in the application of brushless motors (BM) with rare-Earth magnet rotors using external commutation as EMAs for FCSs. The BM, with its simple mechanical construction, represents a very complex nonlinear multivariable control plant. In contrast to the dc motor, which has a more complicated mechanical design but a simple control structure, the BM machine must be fed with alternating currents of variable amplitude, frequency, and phase. It is for these reasons that no standard solution for the control of BMs has emerged, as in the case of the dc motor. This paper presents a theoretical investigation of EMAs based on the BM description. To design current, position, torque, and current control systems for BM, the general theory of electromechanical and electromagnetic processes in electrical machines and power converters is used. A basic approach is described for the creation of mathematical models for BM with rectangular and sinusoidal current waves. The hardware for position, torque, and current control systems for EMAs is presented. The analysis and synthesis of different aircraft power systems with EMAs is treated. Finally, the basic approach for the preliminary design of EMAs is presented. (Author)

A96-27316 The principles of ground-effect aircraft control over an expanded altitude range (Printsipy upravleniya ehkranoplanom v rasshirennom diapazone vysot). L. A. SEVEROV, V. K. PONOMAREV, A. I. PANFEROV, and E. V. KAMINA (Sankt-Peterburgskaya Akademiya Aehrokosmicheskogo Priborostroeniya, St. Petersburg, Russia), *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 4, 1995, pp. 19–22. In Russian. Documents available from AIAA Dispatch.

The paper is concerned with the generation of control signals that would ensure the landing of a ground-effect aircraft on the air cushion and its take-off from it. Particular attention is given to the issues of conjugating the segments of the flight trajectory and providing for the required balancing.

A96-17853 A theory for the aeroinertial rotation and spin of aircraft (Teoriya aehroinertsionnogo vrashcheniya i shtopora samoleta). V. F. NATUSHKIN (Moskovskij Aviatsionnyj Inst., Filial 'Voskhod,' Leninsk, Russia), *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 3, 1995, pp. 14–20. In Russian. 8 Refs. Documents available from AIAA Dispatch.

The aeroinertial rotation and spin theory for aircraft is further extended by introducing the Euler kinematics in nontraditional phase coordinates: three-dimensional angle of attack, aerodynamic bank angle, rotation angle, and their derivatives. Errors are identified in the aeroinertial rotation theory proposed by Phillips (1948). Aircraft control laws are obtained which ensure aircraft stability with respect to steady and quasi-steady aeroinertial rotation and steady spin.

A96-17852 The problem of calculating the reliability of data processing and measuring systems; for the design of aircraft control equipment (K zadache rascheta nadezhnosti informatsionno-izmeritel'nykh sistem).

A. E. KONDRAT'EV (KPO SVT, Kazan, Russia) and G. E. POPOVA (Kazanskij Gosudarstvennyj Tekhnicheskij Univ., Kazan, Russia), *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 3, 1995, pp. 10–13. In Russian. 3 Refs. Documents available from AIAA Dispatch.

The problem of calculating the reliability characteristics of data processing and measuring systems is examined in the context of ensuring flight safety. In particular, attention is given to the definition of standard requirements for the characteristics of control, data processing, and measuring systems in terms of reliability. The characteristics considered are used in the design of different types of control and measuring equipment, the development of fail-safe systems for newly designed aircraft of various classes, and the development of operating manuals for data processing and measuring systems.

A96-13539 A flight control system for ground-effect aircraft with adaptation properties (Sistema upravleniya poletom ehkranoplana so svojstvami adaptatsii). A. I. BOGOMOLOV and P. K. SEMENOV (Kazanskij Gosudarstvennyj Tekhnicheskij Univ., Kazan, Russia), *Aviatsionnaya Tekhnika* (ISSN 579-2975), No. 2, 1995, pp. 20–26. In Russian. 3 Refs. Documents available from AIAA Dispatch.

A ground-effect aircraft control system is developed using the approach described in previous studies (Bogomolov and Semenov, 1992, 1993). In accordance with this approach, the command signals, generated by the pilot through the operation of levers controlling individual motion parameters, are dynamically transformed in a special digital filter with allowance for the information produced by the autopilot-aircraft system. The control algorithm provides for a practically ideal tracking of the reference transient processes at all flight regimes, stability of control characteristics in the presence of a large scatter of autopilot and aircraft characteristics, and control resolution in terms of angular and linear motion parameters.

A96-10160 Methods for determining the stability and controllability characteristics of aircraft (Metody opredeleniya kharakteristik ustojchivosti i upravlyaemosti samoleta). Y. I. SNESHKO, V. N. CHETVERGOV, V. V. VASYANIN, E. V. DANILEVICH, I. M. PASHKOVSKIJ, G. A. ERUSALIMSKIJ, L. V. RAZLOZHKOVA, and S. L. TYRTYSHNIKOV, *Moscow, Izdatel'stvo Mashinostroenie*, 1994, p. 224. In Russian. 22 Refs. Documents available from AIAA Dispatch.

The book presents methods for determining aircraft stability and controllability characteristics during normal flight and under special flight conditions. The discussion covers maneuvers carried out during flight tests, methods for processing flight data, and methods for evaluating test results. Particular attention is given to methods for the flight testing of aircraft with state-of-the-art automatic control systems and methods for determining the stability and controllability characteristics on the basis of the analysis of transient flight regimes.

N95-31728 FBIS report: Science and technology. Central Eurasia. *Foreign Broadcast Information Service*, Washington, DC. Documents available from AIAA Dispatch.

Translated articles cover the following topics: Use of radar set with synthesized antenna for estimating effectiveness of active masking and simulating interference signals; Simulation of echo signals picked from sea surface by grazing radar beam at low grazing angle; Methods and algorithms of sea surface radar image processing and identification; Aircraft optimum control synthesis based on group analysis of motion equations; On issue of maximizing aircraft glide range planning; Effect of amplitude and phase noise on quality of radar image formation; Narrow-Band infrared (1.0–1.2 μ) photodiodes on stressed selective epitaxial GaAs/InGaAs structures; Selection of transverse modes in InGaAsP lasers with dielectric coating on mirrors; Single-mode strip-geometry lambda = 1.55 μ stripe-geometry InGaAsP/InP lasers; and Effect of hydrogen on cracking of metals and testing them for indication of cracking processes by acoustic emission.

A95-42796 On a flight safety problem—Internal fluid motion in an aircraft. V. V. VYSHINSKIJ and S. A. KRAVCHENKO (TsAGI, Moscow, Russia), *AIAA 1st Aircraft Engineering, Technology, and Operations Congress*, Los Angeles, CA, 1995, p. 12. 11 Refs. Documents available from AIAA Dispatch.

The problem of the unsteady motion of a fluid in an aircraft fuel tank with a free surface is solved in a noninertial coordinate system, within the frameworks of both the shallow water theory equations and the incompressible Euler equations. To solve boundary value problems in both cases, numerical schemes are employed in conjunction with upwind differences. This recourse is stable, without artificial viscosity, and allows solutions with low dissipation to be investigated over long time-intervals.

A95-23757 The problem of the synthesis of multimode dynamic systems on the basis of the motion stability condition (Zadacha sinteza mnogorezhimnykh dinamicheskikh sistem po usloviyu ustojchivosti dvizheniya). T. K. SIRAZETDINOV (Kazanskij Gosudarstvennyj Tekhnicheskij Univ., Kazan, Russia), *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 3, 1994, pp. 36–40. In Russian. 4 Refs. Documents available from AIAA Dispatch.

The various aspects of the modeling and synthesis of multimode technical systems on the basis of the stability condition are examined. The necessary and sufficient conditions are presented for the sign invariance of quadratic forms with coefficients depending on the multimode parameter. The approach adopted here employs Liapunov functions.

A95-23755 An anthropocentric model of pilot actions as the operator in the loop operator-dynamic system (Antropotsentricheskaya model' dejstvij letchika kak operatora v konture 'operator-dinamicheskaya sistema'). V. N. PUGACHEV (Voenno-Vozdushnaya Inzhenernaya Akademiya, Moscow, Russia), *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 3, 1994, pp. 24–29. In Russian. 5 Refs. Documents available from AIAA Dispatch.

An anthropocentric approach is proposed for modeling pilot's actions during flight safety studies at the stage of flight vehicle design. The approach is based on the psychophysical characteristics of human interaction with the controlled plant. The modeling of pilot's actions on the basis of the anthropocentric model makes it possible to carry out computer simulations of flight tests at the flight vehicle design stage.

A95-23754 The problem of ensuring the stability of the safe flight regime of aircraft (K probleme obespecheniya ustojchivosti bezopasnogo rezhima poleta samoleta). G. V. KOLPAKOV (Kazanskij Gosudarstvennyj Tekhnicheskij Univ., Kazan, Russia), *Aviatsionnaya Tekhnika* (ISSN 0579-2975), No. 3, 1994, pp. 18–24. In Russian. 5 Refs. Documents available from AIAA Dispatch.

A method for analyzing flight safety is proposed which is based on the properties of safety indices, concepts of motion stability theory, and method of Liapunov functions. Algorithms for the avoidance and prevention of hazardous flight regimes are presented which can be used in aircraft control. The approach is illustrated for the case of safe aircraft landing.

A95-21172 Distributed estimation systems with a random structure (Raspredelennye sistemy otsenivaniya so sluchajnoj strukturoj). A. S. BURYJ (Voennaya Akademiya, Moscow, Russia), *Avtomatika i Telemekhanika* (ISSN 0005-2310), No. 12, 1994, pp. 70–75. In Russian. 6 Refs. Documents available from AIAA Dispatch.

Attention is given to multiple-stage distributed estimation systems with a randomly changing structure, with the change representing a Markovian process. Recursive Bayes algorithms are proposed for determining the a posteriori probabilities of the system structure change and for estimating the state vector of a plant. Experimental results are presented, with particular reference to smoothing filters in the form of power polynomials.

A95-16949 Control of an aircraft landing in windshear. V. S. PATSKO, N. D. BOTKIN (Russian Academy of Sciences, Inst. of Mathematics and Mechanics, Yekaterinburg, Russia), V. M. KEIN (Civil Aviation Academy, St. Petersburg, Russia), V. L. TUROVA, and M. A. ZARKH (Russian Academy of Sciences, Inst. of Mathematics and Mechanics, Yekaterinburg, Russia), *Journal of Optimization Theory and Applications* (ISSN 0022-3239), Vol. 83, No. 2, 1994, pp. 237–267. 27 Refs. Documents available from AIAA Dispatch.

The landing problem for midsize transport aircraft is considered. The aircraft dynamics is described using a sufficiently complete nonlinear system taking the time lag of servomechanics into account. The landing process from the altitude of 400 m up to the time when the runway threshold is reached is considered. Numerical differential game (DG) algorithms are used for the feedback control synthesis. The complete system is linearized with respect to the nominal motion along the descending glide path and decomposed into a vertical motion subsystem and a lateral motion subsystem. DGs with a terminal performance index are formulated for both subsystems. The numerical solution for these games gives the minimax feedback control for the linear models. Control laws are applied to the original nonlinear system and tested by simulating the motion of the nonlinear system under various wind disturbances.

N94-37006 JPRS report: Science and technology. Central Eurasia. *Joint Publications Research Service, Arlington, VA. Documents available from AIAA Dispatch.*

Translated articles cover the following topics: Power laser with compound beam aperture, phase conjugation mirrors, and pulse compressors; Forming informational signals with two-frequency YAG:Nd+++ lasers for communication and ranging; Gain limitation effect in electric-discharge CO_2-lasers; Pattern recognition and data processing in remote laser sounding of Earth surface and geosystems; NH_3–CO_2 9–13 μ lidar for sounding the atmosphere; Efficient operating mode of frequency-tunable liquid laser; Feasibility of electric-discharge excimer laser with condensed noble gas as active medium; Pumping wide-aperture excimer laser, 'GARPUN' with counterpropagating electron beams; Coherent Doppler wind lidar with TEA CO_2-laser; Free-electron X-ray laser operating in quantum mode; Propagation of ultrashort light pulses through nonlinear medium; Resonator for technological YAG:Nd laser; Instruments for remote sensing of Earth in optical wavelength range; Environment signatures and simulation of inputs to optoelectronic remote observation systems; Evaluating probability of resolution of test objects by ensemble of aerospace IR instruments in surface tests; Use of holographic diffraction patterns for inspection of multiple-aperture optical telescopic system phasing; Constructing equation systems to control aircraft with nonlinear aerodynamics based on principle of step-by-step adaptive control; Measurement of carrier frequency of phase manipulated signal using fast Fourier transform; Scattering of sound and radio waves by turbulent structures in the stratosphere; Experimental study of optical pulse propagation through clouds; and Unique characteristics of radiation scattering by nonspherical particles of atmospheric aerosol.

A94-22544 Su-25 attack aircraft. K. TRUBETSKOJ, *Military Parade*, Feb. 1994, pp. 38–41. In English and Russian. Documents available from AIAA Dispatch.

An account is given of the performance characteristics and representative weaponry of the Su-25 ground-attack aircraft, which is of very simple, low-maintenance design for primitive field conditions; if aviation kerosene is unavailable, diesel fuel will be accepted by its engines. Attention is given to the enhanced capabilities of the latest variant of this aircraft, the Su-25 TK, whose sophisticated target-acquisition electronics are optimized for antitank operations.

Japanese Aerospace Literature This month: *Satellite Observation*

A96-43811 Global environment monitor of the Earth by ADEOS series satellites. T. ONIGATA (NASDA, Tokyo, Japan), *IAF 47th International Astronautical Congress*, Beijing, China, 1996, p. 12. Documents available from AIAA Dispatch.

Recently the Earth has been beset with a lot of problems: ozone layer depletion, abnormal worldwide climatic conditions, decimation of forests due overdevelopment and acid rain. An indispensable means dealing with these problems of the global environment is long-term continuous observation of natural phenomena in the atmosphere, oceans, geosphere, and biosphere on a global scale. In the context of the situation described above, the Advanced Earth Observing Satellite (ADEOS) launch mission was completed successfully on Aug. 17. This paper reports an overview of the latest status of ADEOS, including results of the launch mission. Consideration is also given to the latest development status of ADEOS-II as a post-ADEOS Earth observation satellite, including differences in the satellites. (Author)

A96-43003 Monitoring of the sea surface thermal patterns in a marginal sea affected by an ocean. S. NAKAMURA (Shirahama Oceanographic Observatory, Katada, Japan), *IGARSS '96; International Geoscience and Remote Sensing Symposium*, Lincoln, NE, 1996, TP, Vol. 2 (A96-43001 12-42), Piscataway, NJ, Inst. of Electrical and Electronics Engineers, Inc., 1996, pp. 830–832. 4 Refs. Documents available from AIAA Dispatch.

This work concerns monitoring of thermal patterns on the sea surface in a marginal sea. Some timely variations of the thermal pattern can be well detected by using the NOAA's APT (Automatic Picture Transform) imagery. Special reference is made to eddy tracking in the Japan Sea. The evolution of the eddy suggests a dynamical process in the sea where effects of the ocean can be seen. Geographic and bathymetric effects must contribute to the process. (Author)

A96-42979 A hierarchical fuzzy clustering algorithm using pyramid linking data and land-cover classification experiments. M. NAKA (Remote Sensing Technology Center of Japan, Tokyo), T. MIYAZAKI (National Inst. for Environmental Studies, Tsukuba, Japan), and Y. IWATA (Fujitsu F. I. P., Inc., Tokyo, Japan), *IGARSS '96; International Geoscience and Remote Sensing Symposium*, Lincoln, NE, 1996, TP, Vol. 1 (A96-42751 11-43), Piscataway, NJ, Inst. of Electrical and Electronics Engineers, Inc., 1996, pp. 781–783. 2 Refs. Documents available from AIAA Dispatch.

This paper proposes a hierarchical fuzzy clustering algorithm using pyramid linking data. The authors implemented a computational code of the hierarchical fuzzy clustering scheme on a Sun workstation. The code incorporates flexible computational modes. The authors evaluated the code experimentally using hypothetical data and image data of Earth observation satellites. Three levels of pyramid-linking data system from these data are generated using 1–16 neighbor pixel averaging based on the pyramid linking information. The hypothetical data are efficiently segmented. Some test sites of satellite imaging are experimentally classified with this code.

A96-33943 Monitoring of grassland annual change using multitemporal satellite data. N. MINO, G. SAITO, and A. HIRANO (National Inst. of Agro-Environmental Sciences, Tsukuba, Japan), *Proceedings of the International Symposium on Vegetation Monitoring*, Chiba, Japan, 1995 (A96-33901 08-43), Chiba, Japan, Chiba Univ., 1995, pp. 292–297. 5 Refs. Documents available from AIAA Dispatch.

In Hokkaido, Japan, there are many dairy farming regions; their grassland is managed intensively for mowing or grazing. Since grassland covers a wide area, field surveys involve much labor and time to collect spatial information on annual grassland change. Satellite observations can collect a wide range of spatially distributed information. If satellite data can be used for grassland monitoring, this will be an effective tool for various types of management. The objective of this study is to elucidate characteristics of grassland annual change in reflectance. (Author)

A96-32736 Electron acceleration in solar flares—Reconnection configuration. S. HINATA (National Astronomical Observatory, Tokyo, Japan; Auburn Univ., AL), *Proceedings of the 3rd China–Japan Seminar on Solar Physics*, Dunhuang, China, 1994 (A96-32701 08-92), Beijing, China, International Academic Publishers, 1995, pp. 212–216. 8 Refs. Documents available from AIAA Dispatch.

We briefly review the highlights of Yohkoh satellite observations relevant to electron acceleration, and discuss merits and problems associated with acceleration mechanisms. The three potential locations for accleration and heating are the neutral current sheet and its immediate surroundings, slow shocks above and below the X-point, and fast shocks formed when the outflowing plasma from the X-point encounters a standing loop that is anchored in the photosphere. (Author)

A96-32734 Structure and dynamics of magnetic reconnection in the solar corona. S. TSUNETA (Tokyo Univ., Japan), *Proceedings of the 3rd China–Japan Seminar on Solar Physics*, Dunhuang, China, 1994 (A96-32701 08-92), Beijing, China, International Academic Publishers, 1995, pp. 197–204. 16 Refs. Documents available from AIAA Dispatch.

Yohkoh satellite observations of an LDE flare show that the outer soft X-ray loops systematically have higher temperatures, reaching the peak (13 MK) far outside the bright X-ray loop. The reconnection point is estimated to be located twice as high as the apparent top of the flare loop. The high temperature ridges are heated by the standing isothermal slow shocks with lengths of a few 10 exp 4 km. The bright soft X-ray loops are the reconnected loops subsequently filled with evaporated plasmas. We also present the observation that the transequatorial field lines in the quiet sun are formed between the active regions located on the opposite hemispheres. There are pieces of evidence that these field lines are formed by magnetic reconnection. (Author)

A96-32594 Applications of space systems on the earthquake in the Kobe-Osaka-Awaji area. T. TOKUNAGA and H. HAYASHI (NEC Corp., Yokohama, Japan), *Strengthening cooperation in the 21st century; Proceedings of the 6th International Space Conference of Pacific Basin Societies*, Marina Del Rey, CA, 1995 (A96-32532 08-12), San Diego, CA, American Astronautical Society (Advances in Astronautical Sciences, Vol. 91), 1996, pp. 755–770. 29 Refs. Documents available from AIAA Dispatch.

This paper describes the Space System that assisted people in the Hanshin-Awaji Earthquake and analyzes the disaster prevention measures in chronological order. The kinds of systems that could be utilized in different situations are explored. Via comparison of the Space System with other systems, including cable broadcasting systems, ways in which future communication systems for disaster prevention should be set up are investigated. (Author)

A96-32590 Global environmental monitoring with remote sensing data. A. HIRANO and M. ANIYA (Tsukuba Univ., Japan), *Strengthening cooperation in the 21st century; Proceedings of the 6th International Space Conference of Pacific Basin Societies*, Marina Del Rey, CA, 1995 (A96-32532 08-12), San Diego, CA, American Astronautical Society (Advances in Astronautical Sciences. Vol. 91), 1996, pp. 713–725. 7 Refs. Documents available from AIAA Dispatch.

Using satellite remote sensing data, recent glacier variations in the Northern Patagonia Icefield were monitored and examined. The Geographic Information System was used to measure glacier variations. Glaciers in this area showed clear recession at the terminus, which corresponds well with the recent apparent global warming trend. The retreating rate of individual glaciers varied greatly, implying that their recessions are caused not only by ambient climatic conditions such as precipitation and air temperature, but also by local topoclimatic effects and glacier dynamics.

A96-32575 A plan for a global disaster observation satellite system (GDOS). T. KURODA, S. KOIZUMI, and T. ORII (NEC Corp., Yokohama, Japan), *Strengthening cooperation in the 21st century; Proceedings of the 6th International Space Conference of Pacific Basin Societies*, Marina Del Rey, CA, 1995 (A96-32532 08-12), San Diego, CA, American Astronautical Society (Advances in Astronautical Sciences. Vol. 91), 1996, pp. 485–502. 9 Refs. Documents available from AIAA Dispatch.

Since 1987 the authors have been studying the implementation of a world environment and disaster observation satellite system (WEDOS), and have proposed the system on every available occasion to the relevant world organizations and assemblies. WEDOS has been proposed in order to establish a satellite system whereby any point on the Earth's surface could be observed at least one time per day in order to provide accurate information with regard to the occurrence of disasters and changes in the environment, and to ensure greater safety for all the peoples of the world. Recent studies by the authors have shown that when any disaster occurs it is very important and necessary for disaster observation systems to be able to provide information as promptly as possible, during both daytime and nighttime. This paper describes GDOS, with specific focus on disaster observation, as an alternative version of WEDOS. (Author)

A96-31886 An overview of the planetary boundary layer observations over equatorial Indonesia with an L-band clear-air Doppler radar. H. HASHIGUCHI, S. FUKAO, T. TSUDA, M. D. YAMANAKA (Kyoto Univ., Japan), S. W. B. HARIJONO (Agency for Assessment and Application of Technology, Djakarta, Indonesia), and H. WIRYOSUMARTO (National Inst. of Aeronautics and Space, Djakarta, Indonesia), *Contributions to Atmospheric Physics/Beitraege zur Physik der Atmosphaere* (ISSN 0005-8173), Vol. 61, No. 9, 1996, pp. 13–25. 41 Refs. Documents available from AIAA Dispatch.

An L-band (1357.5 MHz) boundary layer radar (BLR) has been in continuous successful operation in Serpong, Indonesia (6.4°S, 106.7°E) since November 1992. This paper highlights results of the BLR observations until 1994. Firstly, we have found two types of strong echo structures appearing systematically as diurnal variations in the equatorial planetary boundary layer (PBL) on clear days. The first type is the striking appearance of a strong echo layer ascending from below 300 m (in the morning) to above 3–5 km (in the afternoon), which is identified as a diurnal variation of the top of the mixing PBL, which is stronger than in the extratropics. The second type, which seem to be coincident with large humidity gradient, is a layer echo appearing at 2–3 km during nighttime and early morning. Secondly, we have found a striking reversal of the wind direction from easterly to westerly at the beginning of December 1992. It is confirmed from geostationary meteorological satellite observation data that this reversal was associated with an eastward movement of the convection center (a super cluster) situated between the Indian Ocean monsoon (westerly) dominant area and the Pacific Ocean trade wind (easterly) dominant area.

The lower-tropospheric wind variations associated with (super) cloud clusters are presented. Finally, frequency power spectra are analyzed from zonal and meridional wind velocities which are observed continuously below 2.5 km with the BLR. We have found that the spectral slope in a period range from a few hours to a few days is approximately -1, and that the power spectral densities in the rainy season are at least about two times larger than those in the dry season.

A96-29551 Electron temperature distribution in the inner plasmasphere I (mid and low latitudes). K.-I. OYAMA (Inst. of Space and Astronautical Science, Sagamihara, Japan), T. ABE (Aoyama Gakuin Univ., Tokyo, Japan), Y. SAKAIDE (Univ. of Electro-Communications, Chofu, Japan), I. KUTIEV (Bulgarian Academy of Sciences, Geophysical Inst., Sofia, Bulgaria), T. OKUZAWA (Univ. of Electro-Communications, Chofu, Japan), T. CHOI, and Y. CHOI (Korean Aerospace Inst. of Technology, Taejon, Republic of Korea), *Advances in Space Research* (ISSN 0273-1177), Vol. 17, No. 10, 1996, pp. 185–188. 4 Refs. Documents available from AIAA Dispatch.

With a special set of planar probes, the Japanese satellite, AKEBONO has continued electron temperature (Te) measurement up to the height of about 10,000 km in all latitude ranges, since its launch in 1989. Although the data are still being analyzed and the results obtained so far are preliminary, we discuss the height profiles in the latitude range lower than 60° in terms of local time, geomagnetic latitude, and seasonal variations. Although quite a large amount of theoretical work on the thermal structure of the high altitude has been done so far, the results obtained by means of the satellite AKEBONO present a first systematic picture of the inner plasmasphere of the Earth. (Author)

A96-29539 Characteristics of VLF emissions observed by DE-1 in the equatorial magnetosphere. T. OHDOH and Y. NAKAMURA (Communications Research Lab., Koganei, Japan), *Advances in Space Research* (ISSN 0273-1177), Vol. 17, No. 10, 1996, pp. 99–104. 6 Refs. Documents available from AIAA Dispatch.

Whistler-triggered hiss, banded hiss, ELF hiss, impulsive VLF waves, and magnetospheric chorus are analyzed by using analog data of wideband electric fields (650 Hz–40 kHz) from the DE-1 satellite received at Kashima, Japan in the NASA DE guest investigator program. The whistler-triggered hiss was observed after a whistler trace at frequencies below about 15 kHz in the low-latitude plasmasphere, and its generation models are discussed. Wave modes of banded hiss, impulsive VLF waves, and ELF hiss successively observed for about one minute are discussed in terms of the spin modulated effect of whistler-mode ELF hiss. Magnetospheric chorus with a frequency gap around 5.8 kHz was observed in the geomagnetic storm recovery phase. This indicates a field decrease by about one fifth of the quiet-time geomagnetic field produced by a storm-time equatorial ring current. (Author)

A96-29535 New observations, new theoretical results and controversies regarding Pc 3-5 waves. K. TAKAHASHI (Nagoya Univ., Toyokawa, Japan), *Advances in Space Research* (ISSN 0273-1177), Vol. 17, No. 10, 1996, pp. 63–71. 23 Refs. Documents available from AIAA Dispatch.

Observations and theories of medium- to long-period (Pc 3-5) magnetic pulsations excited by magnetospheric particles are described. Satellite observations indicate that most pulsations can be classified into two groups according to their magnetic field polarization. One group has a transverse magnetic perturbation, and the other a strongly compressional perturbation. Despite this difference in polarization, they share common characteristics, including large azimuthal wave number, westward propagation, and antisymmetric field-aligned structure. Recent theories describe these observations in a unified framework. It has been pointed out that trapped energetic ions play an important role in determining the instability threshold and the mode structure of the pulsations. Observations and theories of energetic particle response to the excited pulsations are also described. (Author)

A96-27215 Ground surface features of the Taklimakan Desert. T. ISHIYAMA (Chiba Univ., Inage, Japan), K. TSUCHIYA (Teikyo Univ., Utsunomiya, Japan), and S. SUGIHARA (Shimonoseki Univ. of Fisheries, Japan), *Advances in Space Research* (ISSN 0273-1177), Vol. 17, No. 8, 1996, pp. 41–48. 13 Refs. Documents available from AIAA Dispatch.

In an attempt to utilize satellite data to obtain land surface features of Taklimakan Desert in China, in situ measurements of spectral reflectance of the land surface were made with a portable spectroradiometer in the spectral range of 400–2500 nm. The analyses of the data show the following features. The difference in spectral reflectance of different soils is comparatively small. There is a tendency that spectral reflectance of soils increases with increases of wavelength; for example, the average reflectance of the sands in the periphery areas of the Taklimakan Desert is 21 and 38% in the visible and NIR spectra, respectively. It is found that reflectance of the soils decreases with increase of moisture content. A large decrease is recognized in the 1450 and 1950 nm spectra water absorption bands. This fact suggests that the monitoring of soil moisture is possible by measuring the radiance at these spectra; thus Landsat TM Bands 5 and 7 will be effective for monitoring soil moisture content. (Author)

A96-22420 Three-dimensional precipitation structure of mid-latitude mesoscale convective systems—A combined remote sensing study using ground-based Doppler radar and satellite-borne radiometers. T. KOZU and T. IGUCHI (Communications Research Lab., Tokyo, Japan), *27th Conference on Radar Meteorology*, Vail, CO, 1995, Preprints (A96-22185 05-47), Boston, MA, American Meteorological Society, 1995, pp. 797–799. 4 Refs. Documents available from AIAA Dispatch.

The horizontal and vertical structures of two mesoscale convective systems (MCS) in the midwestern United States are examined using a variety of remote sensing observations, such as ground-based Doppler radar measurements, SSM/I microwave observations, and geostationary satellite observations. In particular, WSR-88D Doppler radar data along with SSM/I passive microwave and GOES infrared observations in two active MCSs are used to verify results of previous studies and to extend the knowledge of the three-dimensional structure of the MCSs. By exploiting the increased sensitivity and temporal resolution of the WSR-88D radar, the study provides improved radar assessment of the vertical microphysical structure of MCSs.

N96-12077 Utilization of advanced microwave sounding unit on board next generation of NOAA satellites: Visiting the National Oceanic and Atmospheric Administration and the University of Wisconsin. Y. TAKEUCHI. Meteorological Satellite Center, Tokyo, Japan, *Meteorological Satellite Center Technical Note*, No. 30, 1995, pp. 87–99. Documents available from AIAA Dispatch.

This report outlines the current status and future plans of the National Oceanic and Atmospheric Administration/National Environmental Satellite Data and Information Service (NOAA/NESDIS) on the utilization of microwave data from the Defense Meteorological Satellite Program (DMSP) satellites and the current and the next generation of NOAA satellites. The topics related to sounding processing are described in detail. Some remarks as to the developments at the Meteorological Satellite Center (MSC) in the near future are also included. (Author)

N96-12076 NOAA data realtime display and processing system using personal computer. T. TANAKA and T. YANAGIYA. Meteorological Satellite Center, Tokyo, Japan. *Meteorological Satellite Center Technical Note*, No. 30, 1995, pp. 53–85. Documents available from AIAA Dispatch.

Nowadays the improvement of personal computer performance is remarkable and it enables the handling of large amounts of data, such as image data, without an inferior operational environment, if the data processing can be limited to that specific purpose. The National Ocean and Atmospheric Administration (NOAA) data acquisition and processing system use of personal computers is being investigated with attention being paid to the previously mentioned point. The following is our interim report that is concerned with this investigation which includes: 1) the interruption technique which enables the simultaneous retrieval of the NOAA image data file and the real-time display of the image file using personal computers; 2) the results of the study on reasonable data file size which are cut from full image data taken with the NOAA-12 polar orbit meteorological satellite, which was found to insure a comfortable operational environment and allow a shorter data transmission time for local users who only need data from a specific region; and 3) a technique for cutting out data from specific regions using the six (6) orbital elements of the NOAA satellite, which are provided each morning from NOAA. (Author (revised))

N96-12072 Meteorological Satellite Center Technical Note, No. 30, 1995. Meteorological Satellite Center, Tokyo, Japan. Documents available from AIAA Dispatch.

This document contains articles concerned with meteorology from the Meteorological Satellite Center in Tokyo, Japan. Areas of interest are: subtropical cyclones intensity estimates in the northwestern Pacific; outline of an Emergency Information System using a Geostationary Meteorological Satellite (GMS) data function relay; requirements for the imaging function of the Multi-functional Transport SATellite (MTSAT); investigation and characterization of using personal computers with the National Oceanic and Atmospheric Administration data acquisition and processing system; and current status and future plans of the National Ocean and Atmospheric Administration National Environmental Satellite Data and Information Service (NOAA/NESDIS) concerning the development of future NOAA satellites and the processing and utilization of the Defense Meteorological Satellite Program (DMSP) microwave data. For individual titles, see N96-12073–N96-12077.

A96-20706 Environmental monitoring of land and sea surface using multisensors. Y. SUGA (Hiroshima Inst. of Technology, Japan), S. TAKEUCHI, H. KIMURA, and A. INANAGA (Remote Sensing Technology Center of Japan, Tokyo), *Calibration and applications of satellite sensors for environmental monitoring; Proceedings of the 30th A3.1 Symposium of COSPAR Scientific Commission A*, COSPAR Scientific Assembly, Hamburg, Germany, 1994 (A96-20689 04-19), Oxford, UK, Pergamon, 1996, pp. 97–106. 4 Refs. Documents available from AIAA Dispatch.

This study deals with the problems of acquiring the features of land and sea surface environments from multiple satellite sensor data. The Seto Inland Sea area of Japan characterized with remarkable population increase was selected as an intensive study area. An emphasis was put on environmental parameters such as land cover and surface temperature information from multiple sensor data. A modified maximum likelihood method using the multilayer classification image was applied to LANDSAT/TM data of two different dates for producing a precise land cover change map of a regional scale. The capability for land cover change detection of NOAA/AVHRR data was investigated using the combined data set of AVHRR and LANDSAT/TM. The discriminative capability of the spectra of AVHRR was evaluated on the basis of regression analysis between the land cover classes retrieved from TM data and the spectral feature of AVHRR. Fairly good correlation was obtained for the vegetation and nonvegetation class, which suggests a possibility for the detection of the land cover change due to urban development using NOAA/AVHRR data. (Author)

A96-20524 Measuring the coral reef distribution of Kuroshima Island by satellite remote sensing. T. MIYAZAKI, A. HARASHIMA (National Inst. for Environmental Studies, Tsukuba, Japan), and Y. NAKATANI (NASDA, Tokyo, Japan), *Global process monitoring and remote sensing of the ocean and sea ice; Proceedings of the Conference*, Paris, France, 1995 (A96-20517 04-42), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2586), 1995, pp. 65–72. 4 Refs. Documents available from AIAA Dispatch.

Measuring the spectral signatures of under water coral reefs and mapping of coral reefs by satellite remote sensing are described. The spectral signatures of different species of the coral reefs were measured using a spectroradiometer off Kuroshima Island and spectral differences between different species of coral reefs were investigated. Laboratory experiments measuring the spectral signatures of nine different species of coral reefs were carried out with the same spectroradiometer. The spectral reflectance of the each coral reef showed that a narrow absorption band exist in the spectral region between 660 and 680 nm, and very strong spectral reflectance from about 700 nm toward the longer wavelength range. On the other hand, absorption and the high reflectance region were not observed from the bottom sands or bare rocks underwater. These results suggest that there is a significant spectral difference between coral reefs and bottom sands or bare rocks and so the best spectral range for separating the coral reefs from other underwater objects in the ocean would be between 700 and 800 nm. (Author)

A96-17334 Satellite monitoring of oceanic turbulence around Japan islands. T. NISHIMURA, T. KOBAYASHI (Tokyo Science Univ., Noda, Japan), S. TANAKA, and T. SUGIMURA (Remote Sensing Technology Center of Japan, Tokyo), *Advances in Space Research* (ISSN 0273-1177), Vol. 16, No. 10, 1995, pp. 137–140. 7 Refs. Documents available from AIAA Dispatch.

Based on kinematic features of the coherent structure dominant in the oceanic turbulence around the Japanese islands, obtained from NOAA/AVHRR monitoring, the Kuroshio behavior was discussed. Most eddies shed from cusped capes on the Pacific Coast increase the turbulent boundary layer and form an organized coherent structure of mesoscale eddies interlocked in the Shikoku-Basin. Some eddies shed from the Cape Shionomisaki, however, trap part of the Kuroshio watermass and deviate it coastward, leading to a decay of the boundary layer. The formed coherent structure induces the basin-scale Kuroshio variability, which has usually been described through the meandering and nonmeandering phenomena of the Kuroshio path.

A96-16797 Whale ecology observation satellite. T. HAYASHI, G. ETOH (Shiba Inst. of Technology, Narashino, Japan), T. ORII (NEC Corp., Yokohama, Japan), K. MAEDA, and Y. MASUMOTO (NEC Aerospace Systems, Ltd., Yokohama, Japan), *Proceedings of the 9th AIAA/Utah State University Annual Conference on Small Satellites*, Utah State Univ., Logan, 1995 (A96-16782 03-18), Logan, Utah State Univ., 1995, p. 9. Documents available from AIAA Dispatch.

Japan's Whale Observation Satellite System encompasses a Whale Ecology Observation Satellite in polar orbit, ecological sensor probes attached to whales of such little-understood species as the blue whale, memory capacity for recording the information collected, a UHF transmitter, and a GPS receiver. When a probe-carrying whale comes to the sea surface, the GPS receiver locates it and the probe transmits its ecological data to the satellite for storage and relay to ground stations.

A96-16338 Balloon campaigns at Kiruna-ESRANGE planned in ILAS correlative measurements program. H. KANZAWA (National Inst. for Environmental Studies, Tsukuba, Japan), Y. KONDO (Nagoya Univ., Toyokawa, Japan), C. CAMY-PEYRET (Paris VI Univ., France), and Y. SASANO (National Inst. for Environmental Studies, Tsukuba, Japan), *Proceedings of the 12th ESA Symposium on European Rocket and Balloon Programmes and Related Research*, Lillehammer, Norway, 1995 (A96-16286 03-12), Noordwijk, Netherlands, European Space Agency, 1995, pp. 345–349. 2 Refs. Documents available from AIAA Dispatch.

We present a plan for correlative measurements with the satellite sensor of ILAS (Improved Limb Atmospheric Spectrometer), giving attention to concepts of correlative measurements and validation experiments for ILAS, as well as the present plan for validation experiments with the balloon campaigns. ILAS, a solar occultation sensor, will be aboard the Advanced Earth Observing Satellite, and will measure vertical profiles of ozone and ozone-related species in the high-latitude stratosphere. (Author)

A96-16126 Wide-area determination of cloud microphysical properties from NOAA AVHRR measurements for FIRE and ASTEX regions. T. Y. NAKAJIMA and T. NAKAJIMA (Tokyo Univ., Japan), *Journal of the Atmospheric Sciences* (ISSN 0022-4928), Vol. 52, No. 23, 1995, pp. 4043–4059. 51 Refs. Documents available from AIAA Dispatch.

A method for satellite remote sensing of cloud optical thickness and effective particle radius has been developed to apply to NOAA AVHRR multispectral radiance data. Undesirable radiation components are guessed from satellite-received radiances in channels 1, 3, and 4 of AVHRR and subtracted from radiances in channels 1 and 3 to derive the reflected solar radiation of a cloud layer that includes information about cloud microphysical properties. This method can be applied to a broad range of water clouds from semitransparent to thick clouds. This method was applied to AVHRR data acquired over oceans during the First ISCCP Regional Experiment and the Atlantic Stratocumulus Transition Experiment. The authors found good agreement between satellite-derived and in situ microphysical quantities. The presence of drizzle droplets in optically thin clouds was also confirmed from the satellite observation. Furthermore, the results show that marine stratocumulus clouds were drastically modified by ship track effluents and dust-contaminated airflow from the continent. (Author)

A96-13955 A high-temperature component in coronal holes observed with Yohkoh SXT. H. HARA (National Astronomical Observatory, Mitaka, Japan), S. TSUNETA (Tokyo Univ., Mitaka, Japan), L. W. ACTON (Montana State Univ., Bozeman), M. E. BRUNER, J. R. LEMEN (Lockheed Research Lab., Palo Alto, CA), and Y. OGAWARA (Inst. of Space and Astronautical Science, Sagamihara, Japan), *Advances in Space Research* (ISSN 0273-1177), Vol. 17, Nos. 4 and 5, 1996, pp. 231–234. 13 Refs. Documents available from AIAA Dispatch.

Temperatures of coronal holes are estimated from several sets of soft X-ray images taken through various broadband filters with the Soft X-ray Telescope (SXT) aboard Yohkoh. The effect of scattered X-rays from bright regions surrounding a temperature determination area, especially those from nearby active regions, is carefully removed with the point spread function derived from the postlaunch data. An isothermal approximation is applied to thus corrected data. The temperatures of coronal holes near the disk center are found to be 1.8—2.4 $\times$ 10 exp 6 K, which is almost the same as those derived for quiet regions. The emission measures in coronal holes are estimated to be 10 exp 25.5–26.2 cm/s, about 10 times smaller than in quiet regions. We conclude that temperatures in coronal holes do not differ from those in quiet regions, and that the depression in soft X-ray intensity of coronal hole regions results from a lower density by a factor of 3 than quiet regions. We propose that the coronal hole component observed with the SXT is not the same one which is observed with the Skylab EUV instrument. An X-ray intensity from a coronal hole is independently confirmed by the eclipse observation on Nov. 13, 1993 and consistent with intensities derived from the scattering correction. (Author)

A96-13947 Coronal X-ray jets observed with Yohkoh/SXT. K. SHIBATA, T. YOKOYAMA (National Astronomical Observatory, Mitaka, Japan), and M. SHIMOJO (Tokai Univ., Kanagawa, Japan), *Advances in Space Research* (ISSN 0273-1177), Vol. 17, Nos. 4 and 5, 1996, pp. 197–200. 16 Refs. Documents available from AIAA Dispatch.

The soft X-ray telescope aboard Yohkoh has discovered coronal X-ray jets associated with small flares in X-ray bright points, emerging flux regions, or active regions. The common observed characteristics of these jets are discussed mainly from morphological points of view. It is suggested that magnetic reconnection between emerging magnetic flux and the overlying coronal/chromospheric magnetic field is a key physical process for producing these jets. (Author)

A96-13915 New aspects about solar flares revealed by the wide-dynamic range, high-cadence observations from Yohkoh. Y. UCHIDA (Tokyo Science Univ.; Tokyo Univ., Japan), *Advances in Space Research* (ISSN 0273-1177), Vol. 17, Nos. 4 and 5, 1996, pp. 19–28. 26 Refs. Documents available from AIAA Dispatch.

Observations by the X-ray satellite Yohkoh have provided us with a number of new findings about the high temperature and high energy phenomena in solar flares, in active regions, and in the background corona. Yohkoh's wide-dynamic range and high-cadence observations revealed, among others, new clues to the flare mechanism hidden in the still fainter and relatively short stages before the rise phase of flares, both of the arcade type and of the simple loop type flares. There are unexpected structures and their dynamical changes in the fainter preflare stages in both of those types of flares. Observations of these preflare structures and their changes in X-rays are very essential in discussing the mechanism of flares, but were not available before Yohkoh. We try to give some discussions about the influence of these findings to the interpretations proposed and discussed thus far. (Author)

A96-10518 Student competition on satellite design—Achievements and lessons learned. T. YASAKA (Kyushu Univ., Fukuoka, Japan), *IAF 46th International Astronautical Congress*, Oslo, Norway, 1995, p. 6. Documents available from AIAA Dispatch.

A 'Satellite Design Contest', aimed primarily for Japanese university students, is described for the purpose of fostering the building of short-life single-mission spacecraft to be launched and operated by relatively small groups of students and instructors with modest funding. The Contest was set up under the initiative of the Space Engineering TC of JASME, wherein three organizations came to agree that academic societies bear the responsibility and have the capability to widen the chances of space access by students. The Contest procedures are described, and the accomplishments of the Contest program are evaluated. The role of the contest is not to provide financial support for actual space hardware development or launch, but to set up an environment so that individual groups may find a way for easy access to space. Support from space-related companies will become important once participants decide to go on further into the next step of flight hardware integration.

A96-10372 Earth observation satellite programs in Japan. Y. HARUYAMA and M. KASUYA (NASDA, Tokyo, Japan), *IAF 46th International Astronautical Congress*, Oslo, Norway, 1995, p. 10. Documents available from AIAA Dispatch.

Japan's Earth observation satellites include GMS series, MOS-1b, JERS-1, ADEOS, TRMM, ADEOS-II, and ALOS. MOS-1b, JERS-1, and GMS-5 are in service. ADEOS, TRMM, and ADEOS-II are being developed by NASDA, and NASDA is conducting a conceptual study on ALOS. This paper describes the outline and the mission of NASDA's Earth observation satellites to introduce Japan's Earth observation satellite program. (Author)

A95-28779 Penetration characteristics of electromagnetic emissions from an underground seismic source into the atmosphere, ionosphere,

and magnetosphere. O. A. MOLCHANOV, M. HAYAKAWA, and V. A. RAFALSKY (Sugadaira Space Radio Observatory, Chofu, Japan), *Journal of Geophysical Research* (ISSN 0148-0227), Vol. 100, No. A2, 1995, pp. 1691–1712. 35 Refs. Documents available from AIAA Dispatch.

Theoretical calculations are made on EM fields in the frequency range 10 exp −2 to 10 exp 2 Hz on the ground surface and above the ionosphere induced by stochastic microcurrent activity inside the future seismic sources on the assumption of cylindrical symmetry of the effective current and three types of polarization. The inhomogeneity of the ground and atmosphere conductivity and anisotropy of the ionosphere are taken into consideration. The intensity of ULF magnetic and electric precursors observed on the ground, and their spatial distribution can be explained by using the results of the present computations. It is found that only the fields from a magnetic type source can penetrate into the magnetosphere and generate propagating Alfven waves. The expected values of magnetospheric electric and magnetic field are 1–10 μ-V/m Hz exp $\frac{1}{2}$ and 1–10 pT/Hz exp $\frac{1}{2}$ respectively, and the horizontal scale of their distribution is about 100–200 km. These theoretical predictions are compared with the corresponding results of satellite observations. (Author)

A95-27333 The trapped He flux dynamics observed on the OHZORA satellite during 1984–1987. T. KOHNO (Inst. of Physical and Chemical Research, Wako, Japan), A. A. GUSEV, I. M. MARTIN, and G. I. PUGACHEVA (Campinas Univ., Estadual, Brazil), *Geophysical Research Letters* (ISSN 0094-8276), Vol. 22, No. 8, 1995, pp. 877–880. 7. Refs. Documents available from AIAA Dispatch.

The results of observations of spatial distribution and dynamics of trapped He fluxes with energy of 3.2–9.2 MeV/nuc obtained by the low-altitude Japanese OHZORA satellite are reported. Transient trapped He fluxes associated with solar and magnetospheric activity were observed at low altitudes in the region of L = 2.0–3.0. Possible sources of the fluxes, including remnants of solar particle population trapped during substorms, acceleration of hot plasma from the outer magnetosphere, and pitch-angle scattering from the top of the magnetic field line, are discussed.

German Literature
This month: *Satellite Observation*

A96-45150 Potential of a satellite-based, operational earthquake forecasting system based on ionosphere measurements (Einsatzmoeglichkeiten satellitengestuetzter Erdbebenvorhersage auf der Basis von Ionosphaerenmessungen). C. SEEHOLZER (DLR, Oberpfaffenhofen, Germany), *Cologne, Germany, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt* (DLR-Forschungsbericht 96-05), 1996, p. 129. In German. 189 Refs. Documents available from AIAA Dispatch.

This work investigates the possibilities of a mission in which a constellation of small satellites in low, mid-inclined orbits searches for precursory ionospheric effects occurring hours to days before an earthquake and which, hence, can be of use as a warning. These effects are changes in the ELF/VLR radiation in the ionosphere in the range 0–20 kHz, total electron content, intensity of the high-energy particle flux, and airglow intensity in two oxygen bands. On the basis of these requirements, a satellite mission is designed. It is shown that a Molniya orbit with an inclination of 63.4° in the altitude range of 500–1250 km is best suited, and that a constellation of eight identical small satellites with a mass of about 250 kg each can accomplish the mission. An operational concept allowing regional utilization and central operation is elaborated. (Author)

A96-43864 The use of satellite Earth observation for natural disasters management. C. KESSLER (VRS GmbH, Leipzig, Germany), S. KUNTZ, and C. STRECK (Kayser-Threde GmbH, Munich, Germany), *IAF 47th International Astronautical Congress*, Beijing, China, 1996, p. 11. 8 Refs. Documents available from AIAA Dispatch.

A study called EOFIND (Earth Observation for Identification of Natural Disasters) was performed in the frame of the pathfinder phase of the Centre of Earth Observation (CEO) of the European Commission to evaluate the feasibility of CEO for disaster management. The objective of this study was to demonstrate how disaster management can be supported by using satellite Earth observation images as a part of the CEO Program. In addition to EOFIND a study is currently performed to assess the role of Earth observation data and GIS techniques to support flood management approaches in China. The study Flood Management System for China (FMS) aims to demonstrate the status of recent achievements of German science and industry in terms of all kinds of space techniques. Operational concepts to implement these techniques are suggested. This paper presents the results of the EOFIND study as well as of the FMS study and future plans and projects in the field of natural disaster management using space techniques. (Author)

A96-40880 Hotspot-ridge interaction in the Indian Ocean—Constraints from Geosat/ERM altimetry. I. GREVEMEYER (Hamburg Univ., Germany), *Geophysical Journal International* (ISSN 0956-540X), Vol. 126, No. 3, 1996, pp. 796–804. 47 Refs. Documents available from AIAA Dispatch.

Upper-mantle structure of Indian Ocean spreading ridges was investigated by track segments of Geosat/ERM altimeter measurements. To determine the upper-mantle structure of the Earth's gravity field, a low-degree and -order spherical harmonic representation of the geoid was removed. A test of several reference fields suggested that a degree 2–25 field with gradually rolled off coefficients (Sandwell and Renkin, 1988) offers an adequate representation of the long-wavelength geoidal undulations. Filtered profiles of three individual ridge segments display a strong asymmetry in geoid vs age trends of conjugated rift flanks. The unusually low geoid slopes on one flank can perhaps best be explained as a dynamic or thermal phenomenon reflecting a flow connection between a neighboring off-axis hotspot plume and the ridge axis, while the other flank simply cools as it spreads away from the axial zone. It seems reasonable to hypothesize that the Southwest Indian Ridge and the Southeast Indian Ridge act as sinks for plumes beneath Agulhas Plateau and Kerguelen Islands, respectively. The Carlsberg Ridge data suggest that the Reunion hotspot contaminated northwestern African lithosphere until 15 Ma. Moreover, symmetric flattening of geoid vs age trends of conjugated ridge flanks offers evidence that plume events affect geoid vs age trends. (Author)

A96-38616 A method for subtracting foregrounds from multifrequency CMB sky maps. M. TEGMARK (Max-Planck-Inst. fuer Physik, Munich, Germany) and G. EFSTATHIOU (Oxford Univ., UK), *Royal Astronomical Society, Monthly Notices* (ISSN 0035-8711), Vol. 281, No. 4, 1996, pp. 1297–1314. 50 Refs. Documents available from AIAA Dispatch.

An improved method for subtracting contaminants from cosmic microwave background (CMB) sky maps is presented and used to estimate how well future experiments will be able to recover the primordial CMB fluctuations. We find that the naive method of subtracting foregrounds (such as dust emission, synchrotron radiation, free-free emission, unresolved point sources, etc.) on a pixel-by-pixel basis can be improved by more than an order of magnitude by taking advantage of the correlation of the emission in neighboring pixels. The optimal multifrequency subtraction method improves on simple pixel-by-pixel subtraction, both by taking noise levels into account and by exploiting the fact that most contaminants have angular power spectra that differ substantially from that of the CMB. The results are natural to visualize in the two-dimensional plane with axes defined by multipole and frequency. We present a brief overview of the geography of this plane, showing the regions probed by various experiments and where we expect contaminants to dominate. We illustrate the method by estimating how well the proposed ESA COBRAS/SAMBA mission will be able to recover the CMB fluctuations against contaminating foregrounds.

A96-33761 Thematic mapping with satellite photography (Flaechennutzungskartierung mit Satellitenaufnahmen). N. PRECHTEL (Dresden Technische Univ., Germany), *Dresden, Technische Universitaet, Wissenschaftliche Zeitschrift* (ISSN 0043-6925), Vol. 45, No. 1, 1996, pp. 62–66. In German. 15 Refs. Documents available from AIAA Dispatch.

Under contract of the Federal Agency of Environment and Geology of Saxony, the Institute of Cartography of Dresden University of Technology digitally classified a monotemporal set of actual Landsat TM data has been digitally classified to generate a digital land use data bank for the whole territory of Saxony and adjacent areas based on a 16-category classification key. After the evaluation by the orderer and some minor corrections, the Institute was put in charge of producing an analog 1:100,000 land use map series from the digital information in cooperation with the Federal Geodetic Survey of Saxony. In this article methods and techniques related to the two projects are discussed. (Author)

N96-15676 Monthly mean large-scale analyses of upper-tropospheric humidity and wind field divergence derived from three geostationary satellites. J. SCHMETZ, W. P. MENZEL (National Environmental Satellite Service, Madison, WI), C. VELDEN (Wisconsin Univ., Madison, WI), X. WU (Wisconsin Univ., Madison, WI), L. VANDEBERG (European Space Agency, European Space Operations Center, Darmstadt, Germany), S. NIEMAN (Wisconsin Univ., Madison, WI), C. HAYDEN (National Environmental Satellite Service, Madison, WI), K. HOLMLUND (European Space Agency, European Space Operations Center, Darmstadt, Germany), and C. GEIJO (European Space Agency, European Space Operations Center, Darmstadt, Germany), *European Organization for the Exploitation of Meteorological Satellites*, Darmstadt, Germany. Documents available from AIAA Dispatch.

This paper describes the results from a collaborative study between the European Space Operations Center, the European Organization for the Exploitation of Meteorological Satellites, the National Oceanic and Atmospheric Administration, and the Cooperative Institute for Meteorological Satellite Studies investigating the relationship between satellite-derived monthly mean fields of wind and humidity in the upper troposphere for March 1994. Three geostationary meteorological satellites GOES-7, Meteosat-3, and Meteosat-5 are used to cover an area from roughly 160°W–50°E. The wind fields are derived from tracking features in successive images of upper-tropospheric water vapor (WV) as depicted in the 6.5-μ absorption band. The upper-tropospheric relative humidity (UTH) is inferred from measured water vapor radiances with a physical retrieval scheme based on radiative forward calculations. Quantitative information on large-scale circulation patterns in the upper-troposphere is possible with the dense spatial coverage of the WV wind vectors. The monthly mean wind field is used to estimate the large-scale divergence; values range between about $-5 \times 10(\exp -6)$ and $5 \times 10(\exp 6)$/s when averaged over a scale length of about 1000–2000 km. The spatial patterns of the UTH field and the divergence of the wind field closely resemble one another, suggesting that UTH patterns are principally determined by the large-scale circulation. Since the upper-tropospheric humidity absorbs upwelling radiation from lower-tropospheric levels and therefore contributes significantly to the atmospheric greenhouse effect, this work implies that studies on the climate relevance of water vapor should include three-dimensional modeling of the atmospheric dynamics. The fields of UTH and WV winds are useful parameters for a climate-monitoring system based on satellite data. The results from this one-month analysis suggest the desirability of further GOES and Meteosat studies to characterize the changes in the upper-tropospheric moisture sources and sinks over the past decade. (Author)

A96-20446 The discretized Mie formalism for plane wave scattering by dielectric objects with non-separable geometries; satellite remote sensing of ice clouds and atmosphere. K. SCHMIDT and T. ROTHER (DLR, Neustrelitz, Germany), *Passive infrared remote sensing of clouds and the atmosphere III; Proceedings of the Meeting*, Paris, France, 1995 (A96-20419 04-47), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings, Vol. 2578), 1995, pp. 262–272. 29 Refs. Documents available from AIAA Dispatch.

In satellite remote sensing of clouds and the atmosphere, the knowledge of the scattering behavior of different irregularly shaped particles is of particular interest. Though there are various methods for describing nonspherical scattering, we present a formalism which is applicable to a variety of particles with nonseparable geometries. This formalism uses the Method of Lines to solve the Helmholtz equation and results in a numerical generalization of the Mie theory for separable boundaries. In our contribution, we focus on nonspherical axisymmetric scatterers and infinitely extended cylinders with noncircular cross sections. Separable geometries are included as borderline cases. (Author)

A96-18085 Determination of the reflection function of orographically structured land surfaces (German book: Die Bestimmung der Reflexionsfunktion orographisch strukturierter Landoberflaechen). W. THOMAS (DLR, Inst. fuer Physik der Atmosphaere, Oberpfaffenhofen Germany), *Cologne, Germany, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt* (DLR Forschungsbericht 95-27), 1995, p. 137. In German. 61 Refs. Documents available from AIAA Dispatch.

A new algorithm was developed which make it possible to calculate the bidirectional reflection function (BRDF) of inhomogeneous and orographically

structured land surfaces. The algorithm uses both a digital terrain model and premeasured BRDFs of various homogeneous surface types. The model was used to simulate the BRDFs of several test sites in the German alpine regions with different orographic structure and known surface types and a reliable surface classification. A typical deviation of 25% in the NIR region was found between the reflectance factors of a flat surface and a vertically structured surface. For sun zenith angles greater than 70 deg, differences of more than 100% were calculated. If the vertical structure of the test sites is neglected, in most cases the albedo of the flat surface is higher, up to a factor of five compared with the corresponding albedo of the structured surface. For an optimized incident angle the opposite effect is observed. It is concluded that in this spatial scale the assumption of a flat surface cannot be a valid approximation for mountainous terrain.

A96-16901 Lidar techniques for remote sensing II; Proceedings of the Meeting, Paris, France, Sept. 25, 26, 1995. C. WERNER, ED. (DLR, Wessling, Germany), *Bellingham, WA, Society of Photo-Optical Instrumentation Engineers* (SPIE Proceedings. Vol. 2581), 1995, p. 262 (For individual items see A96-16902–A96-16926). Documents available from AIAA Dispatch.

The present volume on lidar techniques for remote sensing discusses laser ranging, LITE, backscatter lidar and multiple scattering, DIAL, and Doppler lidar. Attention is given to a laser rangefinder for the near-Earth asteroid rendezvous mission, integrating lidar capabilities into satellite ranging operations, observations of aerosol clouds with LITE, and potential contributions of a backscatter lidar to climatological studies. Other topics addressed include discriminants in a backscatter lidar, a simulation for atmospheric water vapor measurements from spaceborne DIAL, the relevance of multiple scattering for spaceborne lidar returns, and Doppler lidar on the space station.

A96-14820 The market structure for environmentally related satellite remote sensing data—Investigation of necessities for governmental regulations (German book: Die Struktur des Marktes fuer umweltrelevante Satellitendaten—Untersuchung zur Notwendigkeit staatlicher Markteinflussnahme). T. WALDSCHMIDT (DLR, Cologne, Germany), *Cologne, Germany, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt* (DLR-Forschungsbericht 95-30), 1995, p. 244. In German. 239 Refs. Documents available from AIAA Dispatch.

The market structure for environmentally related satellite remote sensing data is analyzed with respect to competition. The main objective is to see if the participation of governmental institutions in market processes can realize efficient market performance. The economic analysis must focus on the technical characteristics of the market. Special attention is given to several important factors: different kinds of information products, optimized satellite structures, orbit design, and alternatives for data transition. The market is influenced by the aforementioned technical characteristics, but its final structure is mainly determined by different groups of market participants, i.e., producers of satellite raw data, value-added firms, and consumers of value-added products. This oligopolistic market structure allows one to give a nearly realistic description of market conduct, performance, and structure. The governmental influence on market processes is found to be the most important driving factor during the analysis. Consequently, the justification of government regulations vs free competition has to be proven. An examination of the relevance of public good and natural monopoly theories indicates that only in some market segments (i.e., natural monopolies) is governmental participation efficient. The option of franchise bidding instead of general governmental regulation is discussed.

A96-13073 Monthly mean large-scale analyses of upper-tropospheric humidity and wind field divergence derived from three geostationary satellites. J. SCHMETZ (European Organization for the Exploitation of Meteorological Satellites, Darmstadt, Germany), W. P. MENZEL, C. HAYDEN (NOAA, NESDIS, Madison, WI), C. VELDEN, X. WU, S. NIEMAN (Wisconsin Univ., Madison), L. VAN DE BERG, K. HOLMLUND, and C. GEIJO (ESA, Darmstadt, Germany), *American Meteorological Society*, Bulletin (ISSN 0003-0007), Vol. 76, No. 9, 1995, pp. 1578–1584. 21 Refs. Documents available from AIAA Dispatch.

This paper describes the results from a collaborative study between the European Space Operations Center, the European Organization for the Exploitation of Meteorological Satellites, NOAA, and the Cooperative Institute for Meteorological Satellite Studies investigating the relationship between satellite-derived monthly mean wind and humidity fields in the upper troposphere for March 1994. Three geostationary meteorological satellites GOES-7, Meteosat-3, and Meteosat-5 are used to cover an area from roughly 160°W–50°E. The wind fields are derived from tracking features in successive images of upper-tropospheric water vapor (WV) as depicted in the 6.5-μ absorption band. The upper-tropospheric relative humidity (UTH) is inferred from measured WV radiances with a physical retrieval scheme based on radiative forward calculations. The spatial patterns of the UTH field and the divergence of the wind field closely resemble one another, suggesting that UTH patterns are principally determined by the large-scale circulation. Since the upper-tropospheric humidity absorbs upwelling radiation from lower-tropospheric levels and therefore contributes significantly to the atmospheric greenhouse effect, this work implies that studies on the climate relevance of water vapor should include three-dimensional modeling of the atmospheric dynamics.

A95-39233 Three frequencies—A better perspective. G. WANGE, *Space* (ISSN 0935-2694), No. 1, 1995, pp. 22–26. Documents available from AIAA Dispatch.

The present development history and development trends evaluation for satelliteborne Earth observation SARs notes that multifrequency radar systems open onto novel capabilities for farming- and forestry-related remote sensing. While it is too early to implement such systems on Envisat, the spacecraft generation succeeding the ERS satellites, additional research can be conducted with the SIR-C/X-SAR multifrequency radar instrument mounted in the Space Shuttle Orbiter's cargo bay.

A95-38921 Ion temperatures in the Io plasma torus. N. THOMAS (Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, Germany), *Journal of Geophysical Research* (ISSN 0148-0227), Vol. 100, No. A5, 1995, pp. 7925–7935. 43 Refs. Documents available from AIAA Dispatch.

Observations of the radial dependence of the perpendicular ion temperatures of the four major ion species in the Io plasma torus are reported. Doppler-resolved forbidden line emissions of S(+), S(2+), O(+), and O_2(+) were observed within a period of 72 h on March 3–5, 1993, with the 3.6-m telescope of the European Southern Observatory. The long slit spectra of S(+) show a sharp increase in the perpendicular ion temperature at the position of the 'ribbon' where enhanced electron densities and forbidden S II emission were observed. The observations are broadly consistent with models of line profiles based on average ion temperatures derived from Voyager 1 plasma science data. The SNR for the S(+) observations was sufficient to reveal two velocity components in the distribution, at 33 and 188 eV, inside Io's orbit. Modeling shows that the two components arise from the superposition of hot outer ions upon a core of cool inner torus ions as a result of line-of-sight effects. Outside Io's orbit, the temperature of S(+) ions decreases from 120 eV at 6.0 R(J) to 80 eV at 6.8 R(J). (Author)

A95-38385 Active experiments in space plasmas; Proceedings of the D4.1 Symposium of COSPAR Scientific Commission D of the 30th COSPAR Scientific Assembly, Hamburg, Germany, July 11–21, 1994. M. T. RIETVELD, ED. (Max-Planck-Inst. fuer Aeronomie, Lindau, Germany), 1995, p. 163 (For individual items see A95-38386–A95-38421). Documents available from AIAA Dispatch.

The present conference discusses the AMPAS mission, new aspects of whistler waves, wave excitation by pulsed electron beams injected into the ionosphere, the heating of the auroral electrojet by high power radio waves, the generation of stimulated electromagnetic emission, the effects of microwave discharges on the lower ionosphere and middle atmosphere, and the interaction of high-voltage spheres with the ionosphere. Also discussed are the field-aligned expansion of plasma clouds in the ionosphere, ionospheric effects due to barium releases, optical observations of artificial clouds in the CRRES experiments, the estimation of plasma density from cold electron plasma wave data, and seismoionospheric fountain effects as an analog of active space experiments.

A95-37472 Small satellite constellations for disaster detection and monitoring. H. IGLSEDER (Center of Applied Space Technology and microgravity, Bremen, Germany), W. ARENS-FISCHER (STMS, Sittensen, Germany), and W. WOLFSBERGER (Deutsche Aerospace, Bremen, Germany), *Advances in Space Research* (ISSN 0273-1177), Vol. 15, No. 11, 1995, pp. 79–85. 9 Refs. Documents available from AIAA Dispatch.

Remote sensing satellites can provide valuable inputs on natural-disaster management both for an accurate prediction and for a rapid assessment of the location and extent of damage. Currently, several remote sensing satellites are orbiting the Earth, collecting large amounts of data. Characteristic parameters of spaceborne remote sensing are spectral coverage, spectral resolution, revisit time, and spatial resolution. The analysis of currently operating spaceborne infrastructure shows that it covers global aspects of environmental monitoring excellently but is not well suited for disaster mitigation. This is mainly due to a low repetition in time and a relatively bad spatial resolution. For disaster monitoring a growing demand for observation with high repetition rates between $\frac{1}{2}$–1 h and 7 d and medium to high resolution in time between 10 m and 1 km is evident. Constellations of small satellites can close the gap left by the existing systems in a cost-effective manner. Small satellites are characterized by low volume, a mass limited to 250–400 kg, and a power consumption below 350 W. A design to cost is achieved by using subsystem components which are commercially available. Different constellations with 4–32 satellites are investigated. The focus is on constellations using sunsynchronous orbits. It is inferred that a resolution in time of about $\frac{1}{2}$ h can be achieved by a system comprising 32 satellites. (Author)

A95-37470 Problems of mountain hazard mapping using spaceborne remote sensing techniques. M. F. BUCHROITHNER (Dresden Univ. of Technology, Germany), *Advances in Space Research* (ISSN 0273-1177), Vol. 15, No. 11, 1995, pp. 57–66. 5 Refs. Documents available from AIAA Dispatch.

Despite the high potential of remote sensing for information acquisition about remote and inaccessible regions, several relief-induced factors hamper or even prohibit the use of spaceborne imagery. These factors, geometric as well as climatic ones, are listed and briefly discussed. Approaches to overcome these problems are set forth. Two case histories about snow avalanche mapping in the Alps using ERS SAR and mudflow mapping in the Himalayas using Metric Camera and SPOT XS data are described. (Author)

A95-33802 Ion heating at the Earth's quasi-perpendicular bow shock. N. SCKOPKE (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany), *Advances in Space Research* (ISSN 0273-1177), Vol. 15, Nos. 8 and 9, 1995, pp. 261–269. 21 Refs. Documents available from AIAA Dispatch.

This paper summarizes plasma and magnetic-field observations made in the vicinity of the quasi-perpendicular bow shock at moderate and higher flow Mach numbers when a fraction of the incident ions are initially reflected from, but gyrate back to, the shock surface. This reflection constitutes an important first step of the ion heating process. (Author)

A95-33210 Real-time rapid-static and kinematic surveying at the centimeter level and below. A. MATHES and M. GIANNIOU (Darmstadt Technical Univ., Germany), *ION GPS-94; Proceedings of the 7th International Technical Meeting of the Satellite Division of the Institute of Navigation*, Salt Lake City, UT, 1994. Pt. 1 (A95-33201 08-17), Alexandria, VA, Inst. of Navigation, 1994, pp. 105–113. 13 Refs. Documents available from AIAA Dispatch.

Today's requirements for a satellite based surveying and navigation system call for more reliable, more accurate and faster techniques of observation and computation using GPS. The paper presents the strategy and algorithms of GPS carrier phase real-time computation and data-handling, e.g., the transmission and receipt of observational data via a radio modem. Additionally the development of a powerful ambiguity resolution algorithm for static and kinematic applications requiring only a few epochs of observation data and its implementation in a real-time kinematic environment are shown. To obtain reliable solutions with highest accuracies the questions of integrity, error-budgets, and quality of the registered GPS signals are discussed. First results and experiences also in the presence of antispoofing are given and compared to classical terrestrial and GPS surveying techniques. (Author)

A95-31207 Venus mesosphere radiative transfer simulations on the basis of Venera-15 FTIR-experiment. K. SCHAEFER (Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen, Germany), R. HAUS, H. GOERING (Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Berlin, Germany), and R. DUBOIS (Inst. fuer Troposphaerenforschung, Leipzig, Germany), *Advances in Space Research* (ISSN 0273-1177), Vol. 15, No. 4, 1995, pp. 69–72. 15 Refs. Documents available from AIAA Dispatch.

A Fourier-Transform-Infrared-Spectrometer worked on board of Venera-15 in 1983. Spectra of the outgoing radiation of Venus atmosphere were measured with a spectral resolution of 5/cm in the spectral range from 250 to 1600/cm. On this basis a zonal averaged temperature field of Northern Hemisphere in the altitude range from 60 to 95 km has been retrieved. With these data the radiative transfer including multiple scattering of solar and thermal radiation was simulated. The most intensive heating is in the upper cloud layer in equatorial latitudes. The detailed investigation of radiation transfer in Venus clouds gives more understanding for the great relevance of clouds in energetic balance. (Author)

N95-17189 Overview on METEOSAT geometrical image data processing. F. J. DIEKMANN. *NASA Goddard Space Flight Center, Third International Symposium on Space Mission Operations and Ground Data Systems*, Pt. 1, pp. 85–93. Documents available from AIAA Dispatch.

Digital Images acquired from the geostationary METEOSAT satellites are processed and disseminated at ESA's European Space Operations Centre in Darmstadt, Germany. Their scientific value is mainly dependent on their radiometric quality and geometric stability. This paper will give an overview on the image processing activities performed at ESOC, concentrating on the geometrical restoration and quality evaluation. The performance of the rectification process for the various satellites over the past years will be presented and the impacts of external events as for instance the Pinatubo eruption in 1991 will be explained. Special developments both in hard and software, necessary to cope with demanding tasks as new image resampling or to correct for spacecraft anomalies, are presented as well. The rotating lens of MET-5 causing severe geometrical image distortions is an example for the latter. (Author)

A95-26201 Observation of the Earth and its environment—Survey of missions and sensors (2nd revised and enlarged edition); Book. H. J. KRAMER (DLR, Deutsches Fernerkundungsdatenzentrum, Oberpfaffenhofen, Germany), *Berlin and New York*, Springer–Verlag, 1994, p. 601. 631 Refs. Documents available from AIAA Dispatch.

A survey and a short description of Earth observing missions are presented. Completed, operational, and planned missions on an international scale are considered. Attention is given to observations of solar-terrestrial interactions, dynamic atmosphere, dynamic oceans and coastal regions, solid Earth, biosphere, and Earth climate. A typical mission description of this survey features the following elements for layout: mission definition, objectives, planned launch, areas of application, orbit parameters, short descriptions of sensors (spectral ranges, resolutions, swath width, etc.), and data (rates, types, availability, onboard storage, etc.). The survey demonstrates the multitude of opportunities given through cooperation and participation in programs, activities or developments on a world-wide scale.

A95-23686 Online access to remote sensing data with the satellite-data information system ISIS. G. STRUNZ and H.-J. LOTZ-IWEN (DLR, Oberpfaffenhofen, Germany), *Proceedings of the ISPRS Commission III Symposium on Spatial Information from Digital Photogrammetry and Computer Vision*, Munich, Germany, 1994 (A95-23619 05-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2357; International Archives of Photogrammetry and Remote Sensing. Vol. 30, Pt. 3/2), 1994, pp. 801–805. 7 Refs. Documents available from AIAA Dispatch.

The paper describes the underlying concepts of ISIS and the recent state of realization. It explains the overall structure of the system and the functionality of each of its components. Emphasis is put on the description of the advisory system, the catalog retrieval, and the online access and transfer of image data. The integration into a future global environmental data network is outlined. (Author)

A95-23341 The variation of optical properties in the Baltic Sea and algorithms for the application of remote sensing data. H. SIEGEL, M. GERTH, and M. BECKERT (Baltic Sea Research Inst. Warnemuende, Rostock, Germany), *Ocean optics XII; Proceedings of the Meeting*, Bergen, Norway, 1994 (A95-23305 05-48), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2258), 1994, pp. 894–905. 11 Refs. Documents available from AIAA Dispatch.

The variation of the optical properties of seawater was studied in the open Baltic Sea and in the coastal waters of the Pomeranian Bight for more than ten years. The optical properties in the open Baltic Sea are strongly influenced by plankton blooms with typical phytoplankton compositions. This led to significant seasonal variations in spectral reflectances. In the coastal waters of the Pomeranian Bight, the origin of the water masses and the dwell period of the river water in different lagoon-like areas and bays determine the composition of the water constituents and their optical properties. Strong temporal and spatial variations in spectral reflectance, the spectral absorption of phytoplankton pigments, detritus, and yellow substances (gelbstoff) were found within an area of 50 sq km. The data set was used to develop ground truth algorithms to determine water constituents of Baltic Sea water from satellite data using CZCS, SeaWiFS, and MERIS. (Author)

A95-22908 France's military aircraft (Frankreichs militaerische Raumfahrt). W. VON KRIES, *Luft- und Raumfahrt* (ISSN 0173-6264), Vol. 15, No. 4, 1994, pp. 19–24. In German. Documents available from AIAA Dispatch.

France will soon launch its first military observation satellites. The development of the French program to this point is examined. The main aims of the French military satellite program are addressed.

A94-34994 Influence of plumes from biomass burning on atmospheric chemistry over the equatorial and tropical South Atlantic during CITE 3. M. O. ANDREAE (Max Planck Inst. for Chemistry, Mainz, Germany), B. E. ANDERSON (NASA Langley Research Center, Hampton, VA), D. R. BLAKE (California Univ., Irvine), J. D. BRADSHAW (Georgia Inst. of Technology, Atlanta), J. E. COLLINS, G. L. GREGORY, G. W. SACHSE, and M. C. SHIPHAM (NASA Langley Research Center, Hampton, VA), *Journal of Geophysical Research* (ISSN 0148-0227), Vol. 99, No. D6, 1994, pp. 12,793–12,808. 59 Refs. Documents available from AIAA Dispatch.

Airborne measurements of trace gases and aerosols are presented which correspond with tropospheric haze layers over the equatorial and tropical South Atlantic. Elevated concentrations of aerosols, O_3, CO, and other trace gases are found which relate to biomass burning emissions, based on the characteristics of the haze layers, trajectory calculations, and remote-sensing information.

United Kingdom Literature This month: *Remote Sensing*

A96-45997 Geometric correction of SPOT and Landsat imagery—A comparison of map- and GPS-derived control points. N. G. KARDOULAS, A. C. BIRD, and A. I. LAWAN (Cranfield Univ., Bedford, UK), *PE&RS—Photogrammetric Engineering and Remote Sensing* (ISSN 0099-1112), Vol. 62, No. 10, 1996, pp. 1173–1177. 11 Refs. Documents available from AIAA Dispatch.

Problems arise with the geometric correction of satellite imagery in areas where suitable topographic maps are not available. GPS technology is increasingly seen as a potential solution in such areas. In this study, the geometric correction of Landsat MSS, Landsat TM, and SPOT Panchromatic satellite images was investigated using 1:100,000-scale topographic maps and GPS data in an area of Nigeria. The geometric corrections with first-degree polynomials, using either GPs-derived points or 1:100,000-scale topographic map derived points, yielded rms error values on the order of ±35 m for all three types of satellite image regardless of pixel size. The importance of employing independent check points for assessing the accuracy of the correction was demonstrated. (Author)

A96-45840 Restoration of corrupted optical Fuyo-1 (JERS-1) data using frequency domain techniques. C. R. DE SOUZA FILHO, S. A. DRURY, A. M. DENNISS, R. W. T. CARLTON, and D. A. ROTHERY (Open Univ., Milton Keynes, UK), *PE&RS—Photogrammetric Engineering and Remote Sensing* (ISSN 0099-1112), Vol. 62, No. 9, 1996, pp. 1037–1048. 38 Refs. Documents available from AIAA Dispatch.

The image data collected by Fuyo-1's sensors covering the visible and the short wave infrared (SWIR) are affected by severe noise problems. The important narrow SWIR channels show the worst defects. Artifacts originally introduced by the satellite sensors were exaggerated by the Earth-rotation correction applied by NASDA. Fourier analysis is used to characterize these artifacts in the frequency domain. A scene-dependent Fourier operator that is able to eliminate the major noise components is described. This involves the construction of a binary mask derived from the difference between the Fourier spectra of two channels containing noise signals at similar frequencies and amplitude. This mask is used to modulate frequency domain images, so removing all noise components while preserving real image data with minimum loss and distortion in the spatial domain. Fuyo-1 brightness saturation problems can also be minimized by applying a Gaussian contrast stretch to the Fourier spectra prior to image inversion. (Author)

A96-45532 Airborne remote sensing of the sediment fluxes within the Humber Estuary, UK. K. J. YOUNGS (Plymouth Univ., UK) and K. P. MORRIS (Plymouth Marine Lab., UK), *Proceedings of the 2nd International Airborne Remote Sensing Conference and Exhibition—Technology, Measurement, and Analysis*, San Francisco, CA, 1996, Vol. 3 (A96-45468 12-35), Ann Arbor, MI, Environmental Research Inst. of Michigan, 1996, pp. III-578–III-588. 22 Refs. Documents available from AIAA Dispatch.

Estuarine environments are characterized by dynamic and small scale features that occur over very short time scales. Remote sensing for measuring water quality parameters has previously been dominated by the use of satellite sensors. Given the significant disadvantages of using satellite sensors for such localized conditions, only airborne remote sensing can meet the requirements of environmental scientists measuring, for example, sediment fluxes. The area of interest for this study is the Humber Estuary, with sources of suspended particulate matter derived from both river and sea. Airborne remote sensing campaigns have been carried out using CASI and ATM sensors to measure these sediment fluxes over different stages of the tidal cycle. The results show that using CASI is a powerful tool for measuring and delineating temporally and spatially fine scale, subtidal sediment features. It is especially important to model the source, transport, and sink of these inorganic suspended materials due to the ecological and economic significance of the estuary. (Author)

A96-45529 Remote sensing for chemical monitoring; of vegetation canopies. R. A. JAGO and P. J. CURRAN (Southampton Univ., UK), *Proceedings of the 2nd International Airborne Remote Sensing Conference and Exhibition—Technology, Measurement, and Analysis*, San Francisco, CA, 1996, Vol. 3 (A96-45468 12-35), Ann Arbor, MI, Environmental Research Inst. of Michigan, 1996, pp. III-549–III-558. 30 Refs. Documents available from AIAA Dispatch.

Imaging spectrometry offers the potential of estimating the biochemical content of vegetation canopies, which is likely to provide a more powerful discriminant of land contamination than remotely sensed estimates of vegetation cover. A red edge/chlorophyll concentration/land contamination relationship provides a novel link between reflectance and the biochemical results of contamination. Canopy reflectance data were collected using a field spectrometer in conjunction with substantial ground-based measurements of chlorophyll concentration and leaf area index (LAI) across a contaminated site. There was a strong red edge/chlorophyll concentration/land contamination relationship across the study site, and the correlation between red edge position and chlorophyll concentration was $r = 0.86$. Spectral mixture modelling demonstrated the effects of variable canopy cover and land contamination on the position of the red edge and provided an understanding of double-peaked maxima present in derivative spectra. Strong red edge/chlorophyll concentration/land contamination relationships at this study site highlighted the potential use of the CASI to estimate depleted canopy chlorophyll concentration and evaluate further the utility of imaging spectrometers for the remote sensing of contaminated land. (Author)

A96-45475 Geometric rectification of airborne sensor data using GPS-based attitude and position information. A. K. WILSON (British National Space Centre, Huntingdon, UK) and W. MOCKRIDGE (Azimuth Systems, Longtown, UK), *Proceedings of the 2nd International Airborne Remote Sensing Conference and Exhibition—Technology, Measurement, and Analysis*, San Francisco, CA, 1996, Vol. 3 (A96-45468 12-35), Ann Arbor, MI, Environmental Research Inst. of Michigan, 1996, pp. III-73–III-82. 6 Refs. Documents available from AIAA Dispatch.

The geometric rectification of remotely sensed data, acquired using airborne platforms, is an essential prerequisite for quantitative processing and analysis, due to the complex distortions inherent in such imagery. The Natural Environment Research Council (NERC) has implemented an Integrated Data System (IDS) on-board its survey aircraft to derive both attitude and position for use in a parametric solution to the geometric correction of data from two airborne sensors. This paper describes the elements of the NERC IDS and the complementary ground data processing system that carries out navigation pre-processing and geometric resampling of the airborne data. Test flights have been flown and processed to demonstrate the potential of this completely GPS-based solution to providing high quality, spatially referenced data for use in environmental monitoring applications. (Author)

A96-43867 Network of low cost small satellites for monitoring and mitigation of natural disasters. M. N. SWEETING (Surrey Satellite Technology, Ltd.; Surrey Univ., Guildford, UK) and F.-Y. CHEN (Chinese Academy of Sciences, Beijing, China), *IAF 47th International Astronautical Congress*, Beijing, China, 1996, p. 7. 5 Refs. Documents available from AIAA Dispatch.

Effective and timely monitoring from space is an urgent national requirement in order to be able to react quickly to mitigate the effects of natural disasters. Networks of Earth observation satellites have been proposed in order to improve upon the coverage and revisit time of existing systems, however, the very high cost of conventional remote sensing satellites has thus far made this proposal impracticable. Surrey Satellite Technology Ltd (SSTL) has developed and demonstrated in orbit a series of highly capable, long-lifetime microsatellites using advanced Earth observation payloads with powerful onboard processing to provide routine Earth observation from space at very low-cost. These modern microsatellites now make the rapid implementation of a network of disaster monitoring and mitigation satellites both feasible and affordable. Each microsatellite would cost about U.S. $2.5M and thus a constellation of seven satellites could be built for less than U.S. $18M—a small fraction of the cost of a single conventional Earth observation satellite. The small mass and volume of the microsatellites allows the whole network to be launched on a single small launcher into LEO. (Author)

A96-43841 Earth observation using low cost SSTL microsatellites. M. FOUQUET and M. SWEETING (Surrey Satellite Technology, Ltd.; Surrey Univ., Guildford, UK), *IAF 47th International Astronautical Congress*, Beijing, China, 1996, p. 11. 9 Refs. Documents available from AIAA Dispatch.

Surrey Satellite Technology Ltd (SSTL) has designed, built, launched, and operated a series of twelve 50 kg microsatellites in LEO which carry a wide range of satellite communications, space science, remote sensing, and in-orbit technology demonstration payloads for both civil and military applications. Each of these has been built and launched for around U.S. $3M. Launched in 1991, UoSAT-5 was the world's first microsatellite to demonstrate reliable and repeatable Earth imaging. Since then, SSTL's Earth observation program has developed rapidly and successfully—eight of SSTL's microsatellites have carried CCD Earth imaging cameras. Despite their small size, the microsatellites possess powerful onboard computing using a pair of Inmos Transputers, each containing up to 32 MBytes of error-protected SRAM, which can be operated either individually or in parallel to support image processing. SSTL's microsatellites routinely provide autonomous functions such as image targeting using the on-board GPS receiver; image quality assessment (cloud editing); scene-dependent image compression; and high compression 'thumb-nail' images for quick-look image assessment. This paper reviews SSTL's remote sensing capabilities and presents image results from the microsatellite cameras in LEO. (Author)

A96-43140 SeaWiFS and MERIS—A comparison of their performance for the estimation of optically active components in ocean water. P. CIPOLLINI (Southampton Oceanography Centre, UK) and G. CORSINI (Pisa Univ., Italy), *IGARSS '96; International Geoscience and Remote Sensing Symposium*, Lincoln, NE, 1996, TP. Vol. 2 (A96-43001 12-42), Piscataway, NJ, Inst. of Electrical and Electronics Engineers, Inc., 1996, pp. 1398–1400. 14 Refs. Documents available from AIAA Dispatch.

SeaWiFS and MERIS capabilities for the estimation of optically active components in ocean waters are analyzed by means of a semitheoretical model of ocean color which also takes account of the chlorophyll fluorescence signal at about 685 nm. The reflectance curves simulated with the model over various types of water have been integrated over the bands of the two sensors, and a regressive analysis has been used to find the algorithms for the retrieval of the three main classes of optically active components and the corresponding correlation coefficients. The results show that the availability of SeaWiFS data

will give unprecedented capabilities for the retrieval of optically active parameters from satellite imagery, especially over case 1 waters. MERIS will have the same potential in those waters; moreover, the presence of two additional channels in the red region makes this instrument very interesting also for the parameter retrieval over case 2 waters.

A96-42880 Solar irradiance determination by using ATSR-2 data. Y. XUE, D. T. LLEWELLYN-JONES, and S. P. LAWRENCE (Leicester Univ., UK), *IGARSS '96; International Geoscience and Remote Sensing Symposium*, Lincoln, NE, 1996, TP, Vol. 1 (A96-42751 11-43), Piscataway, NJ, Inst. of Electrical and Electronics Engineers, Inc., 1996, pp. 417–419. 11 Refs. Documents available from AIAA Dispatch.

Three physical methods were used to determine solar irradiance by using ERS ATSR-2 data. The schemes were applied to the land and sea areas. The visible and NIR reflectance were derived from ERS-2 ATSR-2 spectral bands by using atmospheric radiative transfer model developed by Xue and Cracknell (1995). The narrowband reflectances are combined into a measure of surface albedo by use of a weighted averaged scheme. The schemes were applied to the land and sea areas. The three schemes are in good agreement with each other. All three schemes can also be developed to determine the hourly or daily solar irradiance. (Author)

A96-42722 Inferring urban land use from satellite sensor images using kernel-based spatial reclassification. M. J. BARNSLEY and S. L. BARR (Univ. College, London, UK), *PE&RS—Photogrammetric Engineering and Remote Sensing* (ISSN 0099-1112), Vol. 62, No. 8, 1996, pp. 949–958. 46 Refs. Documents available from AIAA Dispatch.

Per-pixel classification algorithms are poorly equipped to monitor urban land use in images acquired by the current generation of high spatial resolution satellite sensors. This is because urban areas commonly comprise a complex spatial assemblage of spectrally distinct land-cover types. In this study, a technique is described that attempts to derive information on urban land use in two stages. The first involves classification of the image into broad land-cover types. In the second stage, referred to as spatial reclassification, the classified pixels are grouped into discrete land-use categories on the basis of both the frequency and the spatial arrangement of the land-cover labels within a square kernel. The application of this technique, known as SPARK (SPAtial Reclassification Kernel), is demonstrated using a SPOT-1 HRV multispectral image of southeast London, England. Preliminary results indicate that SPARK can be used to distinguish quite subtle differences of land use in urban areas. (Author)

A96-41120 ICARUS—Instrumentation characterising aerosol radii using sunphotometry. A. K. WILSON (British National Space Centre, Huntingdon, UK), *Proceedings of the 2nd International Airborne Remote Sensing Conference and Exhibition—Technology, Measurement, and Analysis*, San Francisco, CA, 1996, Vol. 2 (A96-41100 11-35), Ann Arbor, MI, Environmental Research Inst. of Michigan, 1996, pp. 180–187. 9 Refs. Documents available from AIAA Dispatch.

There is a major requirement for an instrument to support atmospheric and remote sensing research by retrieving the main atmospheric optical parameters that affect radiative transfer at optical wavelengths. To enhance airborne remote sensing operations and provide details of the horizontal and vertical variability of atmospheric aerosol characteristics, an instrument is required that can simultaneously measure numerous multispectral channels across the uv to shortwave infrared from a moving aircraft platform. The ICARUS prototype is being developed to meet these requirements. The optical characteristics of the atmosphere's main constituents that affect radiative transfer are discussed and provide the basis for the measurement and design requirements for such an instrument. A brief description of ICARUS is provided with an analysis of the initial uv-NIR spectral channel selection. (Author)

A96-40484 Radar backscatter characteristics of a desert surface. J. RIDLEY, R. CARD (London Univ. College, Dorking, UK), F. STRAWBRIDGE (Bath College of Higher Education, UK), and H. PHILLIPS (New South Wales Univ., Sydney, Australia), *Remote Sensing of Environment* (ISSN 0034-4257), Vol. 57, No. 2, 1996, pp. 63–78. 32 Refs. Documents available from AIAA Dispatch.

Satellite radar altimeter measurements have shown spatial and temporal variations in the backscattered signal from desert surfaces. To understand these variations, we have carried out extensive in situ measurements for the validation of a compilation of existing backscatter models. The model predictions are in excellent agreement with ground- and satellite-based measurements of the radar backscatter coefficient, and show that the altimeter backscatter measurements are strongly affected by variations in soil moisture following rainfall and by the presence of dew on the surface. Regional, but time-invariant, differences in backscatter are attributed to variations in surface topography. (Author)

A96-39014 Airborne remote sensing combating marine pollution in the United Kingdom. C. GOODMAN, J. SMALL (Coastguard Agency, Marine Pollution Control Unit, London, UK), and D. MASON (Air Atlantique, Coventry, UK), *Proceedings of the 2nd International Airborne Remote Sensing Conference and Exhibition—Technology, Measurement, and Analysis*, San Francisco, CA, 1996, Vol. 1 (A96—38966 10-43), Ann Arbor, MI, Environmental Research Inst. of Michigan, 1996, pp. I-453–I-460. 3 Refs. Documents available from AIAA Dispatch.

The Marine Pollution Control Unit (MPCU) is a small command, control, and rapid response organization set up to exercise the responsibility accepted by the United Kingdom Government for counter pollution operations at sea when spilled oil (or other dangerous substances) from ships threatens major pollution of the UK coast. Resources used by MPCU to respond to pollution incidents include two surveillance aircraft fitted with side-looking radar (SLAR), and infrared and ultraviolet remote sensing equipment. The paper describes the use of airborne remote sensing in an operational role and demonstrate how the United Kingdom Government responds to pollution incidents. The paper also explains how airborne remote sensing is used to patrol the waters surrounding the United Kingdom. Reference is made to coordinated flights carried out under the Bonn Agreement, a nonmandatory support organization involving all states bordering the North Sea, and the EU. (Author)

A96-38991 A model approach to the biochemical analysis of coniferous forests from AVIRIS data. T. P. DAWSON, P. J. CURRAN (Southampton Univ., UK), and S. E. PLUMMER (British National Space Centre, Abbots Ripton, UK), *Proceedings of the 2nd International Airborne Remote Sensing Conference and Exhibition—Technology, Measurement, and Analysis*, San Francisco, CA, 1996, Vol. 1 (A96-38966 10-43), Ann Arbor, MI, Environmental Research Inst. of Michigan, 1996, pp. I-221–I-227. 20 Refs. Documents available from AIAA Dispatch.

The biochemical concentration of vegetation leaves and canopies is an important determinant of the net primary productivity of forests. Recent research has demonstrated strong correlations between the concentration of these biochemicals and specific absorption peaks in laboratory and AVIRIS spectra. However, our limited understanding of canopy radiative processes prevents the optimum selection of wavebands for the regression equations. A leaf model named LIBERTY (Leaf Incorporating Biochemistry Exhibiting Reflectance and Transmittance Yields) was used to develop this understanding and optimize our ability to link foliar spectra and biochemical concentration. This model was characterized for coniferous needles with specific absorption coefficients of pure pigments, water, cellulose and lignin and output was compared with both dry and fresh leaf spectra. Initial studies suggest that LIBERTY inversion, combined with forest canopy structural parameters, can assist in the estimation of biochemical concentrations from atmospherically corrected vegetation spectra (AVIRIS). (Author)

A96-38975 Integration of CASI data and sea-truth measurements in the coastal zone. K. P. MORRIS (Plymouth Marine Lab., UK), M.-C. ROBINSON, K. J. YOUNGS, S. H. LAVENDER (Plymouth Univ., UK), and R. J. MURPHY (NIWA, Wellington, New Zealand), *Proceedings of the 2nd International Airborne Remote Sensing Conference and Exhibition—Technology, Measurement, and Analysis*, San Francisco, CA, 1996, Vol. 1 (A96-38966 10-43), Ann Arbor, MI, Environmental Research Inst. of Michigan, 1996, pp. I-74–I-82. 7 Refs. Documents available from AIAA Dispatch.

The Land-Ocean Interaction Study project aims to quantify the exchange, transformation, and storage of materials at the land-ocean boundary. Airborne remote sensing is a central part of the project, providing products including chlorophyll and suspended particulate matter which can be input into models of the coastal zone which in turn will improve our understanding of this environment. Other data acquired within LOIS include sea-truth data from research vessels and fixed moorings. These can be used as further inputs to models and as validation of image product algorithms. This paper highlights some of the ways in which the two types of data may be integrated and the problems that are involved. Unfortunately, the poor geometric correction that is achievable is presently a major stumbling block, although GPS data acquired onboard the aircraft will hopefully overcome this problem for 1995-6 images of the LOIS study area. (Author)

A96-31132 Global sea surface temperatures to 0.25-K precision. A. R. HARRIS and M. A. SAUNDERS (Univ. College, London, UK), *8th Conference on Satellite Meteorology and Oceanography*, Atlanta, GA, 1996, Preprints (A96-31001 08-47), Boston, MA, American Meteorological Society, 1996, pp. 525, 526. 6 Refs. Documents available from AIAA Dispatch.

This paper investigates optimization of the ATSR's (Along Track Scanning Radiometer) global SST retrieval precision against drifting buoys. A highest global pixel precision of 0.26 K (or 0.25 K if 0.5-deg spatial averages are taken) is achieved by using a retrieval algorithm incorporating only the 3.7- and 11-μ nadir view channels. This precision is more than a factor of two better than that achievable with AVHRR. The improved precision is due to the better calibration and lower detector noise of ATSR compared to AVHRR, and to the use of the 'low-noise' 3.7-11-μ algorithm. The success of the 3.7-11-μ nadir algorithm derives from the small absolute value of its coefficients.

A96-30747 Relating the land-cover composition of mixed pixels to artificial neural network classification output. G. M. FOODY (Salford Univ., UK), *PE&RS—Photogrammetric Engineering and Remote Sensing* (ISSN 0099-1112), Vol. 62, No. 5, 1996, pp. 491–499. 46 Refs. Documents available from AIAA Dispatch.

This paper investigates the potential to derive information on the land-cover composition of mixed pixels from an artificial neural network classification. The approach was based on relating the activation level of artificial neural network output units, which indicate the strength of class membership, to land-cover composition. Two case studies are discussed which illustrate that the activation levels of the artificial neural network outputs themselves were not strongly related to pixel composition. However, re-scaling the activation levels, to remove the bias towards very high and low strengths of class membership imposed by the unit activation function, produced measures that were strongly related to the land-cover composition of mixed pixels. In both case studies, significant correlations (all r greater than 0.8) between the rescaled activation level of an output unit and the percentage cover of the class associated with the unit were obtained. (Author)

A96-29248 Identifying terrestrial carbon sinks—Classification of successional stages in regenerating tropical forest from Landsat TM data. G. M. FOODY (Salford Univ., UK), G. PALUBINSKAS (Inst. of Mathematics and Informatics, Vilnius, Lithuania), R. M. LUCAS, P. J. CURRAN (Southampton Univ., UK), and M. HONZAK (Univ. of Wales, Swansea, UK), *Remote Sensing of Environment* (ISSN 0034-4257), Vol. 55, No. 3, 1996, pp. 205–216. 68 Refs. Documents available from AIAA Dispatch.

Remote sensing has generally been used to study the role of tropical forests as a source of atmospheric carbon, primarily through land-use change, such as deforestation and biomass burning. Regeneration of forest on previously cleared areas, however, is a significant carbon sink. The strength of this carbon sink is dependent on the age and composition of the regenerating forest. The ability to identify regenerating forest classes that may differ in terms of carbon sink strength was investigated with Landsat TM data of a test site near Manaus, Brazil. A number of forest age classes were defined from a time series of Landsat sensor data, and their separability in Landsat TM data was assessed by maximum likelihood classifications. A high level of class separability was observed with a weighted kappa coefficient of 0.8569 obtained for a classification of six forest regeneration classes. Of the classification errors observed, most were found to be associated with the youngest forest age class. At the test site, however, two main successional pathways were followed, and the differences between areas of forest of the same age but on different pathways was most apparent with the youngest forests. Splitting the regenerating forests by the successional pathway was found to increase classification accuracy, with a weighted kappa coefficient of 0.9315 observed for an 11-class classification. A range of tropical forest classes that vary in strength as carbon sinks could therefore be identified accurately from Landsat TM data. (Author)

A96-23221 Quality measures for image segmentation using generated images. T. E. SCHOUTEN and M. S. K. GEBBINCK (Nijmegen, Katholieke Univ., Netherlands), *Image and signal processing for remote sensing II; Proceedings of the Conference*, Paris, France, 1995 (A96-23181 05-43), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2579), 1995, pp. 411–422. 11 Refs. Documents available from AIAA Dispatch.

To provide a quantitative measure of the quality of a segmentation of an image, a 'true' segmentation must be known and the differences between the two segmentations must be transformed into one or more quality values. A method is described to generate a realistic satellite image and its true segmentation to subpixel level using ground truth data and a real image. Quality measures are described which evaluate two kinds of errors: the splitting of a real field into more than one segment and the merging of pixels from different fields into a segment. Results for various segmentation methods are discussed. (Author)

A96-23219 Towards an automated building detection system from satellite data. T. KIM and J.-P. MULLER (London Univ. College, UK), *Image and signal processing for remote sensing II; Proceedings of the Conference*, Paris, France, 1995 (A96-23181 05-43), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2579), 1995, pp. 394–404. 11 Refs. Documents available from AIAA Dispatch.

An automated building detection system has been developed on the basis of a line-relation-graph. This paper describes improvements made on this building detection system originally developed for aerial imagery. Major improvement has been achieved by introducing a 'super' building hypothesis, which refers to a building hypothesis formed from a 'U'-shaped chain of lines. This paper also reports experiments on automated building detection from 2-m resolution spaceborne imagery (DD5) using the improved system. Although small buildings could not be extracted (as they were not visible), the improved system showed strong feasibilities of (fully) automated extraction of large buildings from DD5 imagery. (Author)

A96-23212 Wavelet texture analysis for remote sensing. N. FATEMI-GHOMI, M. PETROU, and P. L. PALMER (Surrey Univ., Guildford, UK), *Image and signal processing for remote sensing II; Proceedings of the Conference*, Paris, France, 1995 (A96-23181 05-43), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2579), 1995, pp. 329–340. 13 Refs. Documents available from AIAA Dispatch.

We investigate the use of wavelet transforms to texture segmentation of remotely sensed images. The method adopted is multiresolution with maximum overlap. Various wavelet filters are considered. To investigate the usefulness of these filters and the relevance of the various resolution levels, we introduce a novel probe. For the feature derived from a certain filter combination, we calculate the two-point correlation function in the feature domain. This function allows us to judge whether this particular feature segregates the data into clusters or not. We also show that it gives an indication of the number of clusters present in the feature space. At the end we identify the useful features and perform image segmentation using all of them with the help of a C-means clustering technique. We conclude that the most useful results are obtained by using the Daubechies coiflet filter. (Author)

A96-23193 Reduction of the topographic effect in SPOT imagery—An examination of the Minnaert model. C. R. COSTA-POSADA and B. J. DEVEREUX (Cambridge Univ., UK), *Image and signal processing for remote sensing II; Proceedings of the Conference*, Paris, France, 1995 (A96-23181 05-43), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2579), 1995, pp. 137–149. 11 Refs. Documents available from AIAA Dispatch.

In contrast to previous studies using a single study area with many classes and restricted topographic parameters, this paper examines variations in image radiometry due to slope in relation to a single vegetation class growing on all azimuths (0–360 deg) and slopes from 10 to 60 deg. It demonstrates that the non-Lambertian Minnaert model was able to produce substantially better results than more traditional approaches on the cypress and pine forests covering the gorges of southwest Crete. These landforms represent extreme geographic features and include the Samaria gorge, which is the largest in Europe. To improve the understanding of the model, a sensitivity analysis to evaluate the effect of the main variables known to affect the Minnaert 'K' constant was performed. Regardless of gorge, image, and date, these values produced excellent results. (Author)

A96-20900 GIS in nature conservation—The Zdarske vrchy project, Czech Republic. J. R. PETCH, D. I. HEYWOOD (Manchester Metropolitan Univ., UK), and E. PAUKNEROVA (Foresta, GIS and Remote Sensing Unit, Prague, Czech Republic), *ITC Journal* (ISSN 0303-2434), No. 2, 1995, pp. 133–142. 30 Refs. Documents available from AIAA Dispatch.

Zdarske vrchy is a protected landscape area subject to complex conflicts of land use and conservation. As part of a strategy to assist decision making, a geographic information system (GIS) program was created by a Czech-British team. This involved a three-part strategy of research, development of a management tool, and training. Research involved the development of methods for populating a database and designing data processing algorithms based on landscape ecology concepts. Emphasis has been placed on the usability of the GIS by managers; this is achieved in part by a program of awareness training and systems training, which is also available to personnel from other conservation areas. (Author)

A96-20518 Simulation of the MERIS instrument and constituent estimation; Medium Resolution Imaging Spectrometer for oceanic remote sensing. D. BUCKTON, S. DANAHER (Leeds Metropolitan Univ., UK), and E. O'MONGAIN (Dublin Univ. College, Ireland), *Global process monitoring and remote sensing of the ocean and sea ice; Proceedings of the Conference*, Paris, France, 1995 (A96-20517 04-42), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2586), 1995, pp. 2–13. 5 Refs. Documents available from AIAA Dispatch.

A simulation is defined and tested for oceanic constituent estimation in case II waters, for the future Medium Resolution Imaging Spectrometer (MERIS) oceanic remote sensing instrument, using Singular Valued Decomposition (SVD) and Artificial Neural Networks (ANN) inversion techniques. A model is developed for the calculation of oceanic surface reflectance, as a function of the three major constituents which contribute to the optical properties of the water. The oceanic models have been validated using optical data acquired in the North Sea using the MARAS instrument. This surface reflectance is used to predict top of atmosphere radiance, which is then inputted to the MERIS instrument model. The algorithm's are implemented on the simulated data to provide robust algorithms for the estimation of chlorophyll, sediment, and yellow substance concentrations. The results of this investigation are presented with emphasis on recommendations for algorithm development, preprocessing, and sampling strategies. (Author)

A96-20227 Extracting topographic information from SAR data using surface archetypes. K. E. MACFARLANE and R. E. BURGE (King's College, London, UK), *Synthetic aperture radar and passive microwave sensing; Proceedings of the Conference*, Paris, France, 1995 (A96-20201 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2584), 1995, pp. 264–273. 5 Refs. Documents available from AIAA Dispatch.

This paper adapts Pentland's (1982) technique of Shape from Shading using assumed umbilical points, for application to SAR. A new surface archetype suitable for SAR geometry is developed to replace the spherical archetype of the optical technique. Comparisons are drawn between the optical and the SAR case, discussing the problems of ambiguity in the solution surfaces. The accuracy of this method is explored by comparing the surface generated from simulated SAR images with the data used to create the images. The problems of speckle and self-shadowing that will be found in real SAR cases are discussed. (Author)

A96-20225 Change detection and backscatter modelling applied to forest monitoring by SAR. S. QUEGAN and K. D. GROVER (Sheffield Univ., UK), *Synthetic aperture radar and passive microwave sensing; Proceedings of the Conference*, Paris, France, 1995 (A96-20201 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2584), 1995, pp. 241–251. 12 Refs. Documents available from AIAA Dispatch.

The use of the ERS-1 C band SAR for monitoring tropical forest areas is assessed using three ERS images from the Tapajos region of Amazonia gathered in 1992. Forest areas display a very stable RCS, while nonforest areas in some cases exhibit changes which appear to be associated with soil moisture variations. Discrimination between forest and nonforest is greatest after a dry period. Because of distortions in RCS caused by topography, change detection provides a more useful discrimination approach than RCS differences on single images. A number of automatic change detection techniques are compared and their ability to classify forest and nonforest are quantitatively assessed, assuming that a forest map inferred from a 1992 Landsat TM image is correct. Block averaging followed by image ratioing provides a reasonable approach to detecting the large scale structure of the image, but simulated annealing provides improved performance at a computational cost which is becoming competitive with simpler methods. Approximately 50% of the nonforest region can be detected from the ERS-1 images. (Author)

A96-20224 Multi-channel SAR segmentation—Algorithms and applications. R. G. CAVES and S. QUEGAN (Sheffield Univ., UK), *Synthetic aperture*

radar and passive microwave sensing; Proceedings of the Conference, Paris, France, 1995 (A96-20201 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2584), 1995, pp. 234–240. 10 Refs. Documents available from AIAA Dispatch.

Many emerging SAR applications require imagery which is multichannel either in time, frequency, or polarization. If SAR segmentation algorithms are going to be of genuine utility they must be applicable to such datasets. Two approaches to multichannel segmentation are considered: segmenting each channel separately and then recombining the results; and segmenting the multichannel image as a single entity. In both cases segmentation is based on edge detection and segment growing. The utility of multichannel segmentation for change detection, classification, and analyzing the information content of multichannel data, is discussed. A multitemporal ERS-1 image, and a multipolarized, multifrequency AIRSAR image of the same agricultural scene are used for case studies. (Author)

A96-20220 Clutter discrimination in polarimetric SAR imagery. D. BLACKNELL and R. J. A. TOUGH (Defence Research Agency, Malvern, UK), *Synthetic aperture radar and passive microwave sensing; Proceedings of the Conference*, Paris, France, 1995 (A96-20201 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2584), 1995, pp. 188–199. 5 Refs. Documents available from AIAA Dispatch.

Polarimetric SAR images will contain extended regions of apparently homogeneous clutter arising perhaps from areas of vegetation or uniformly driven expanses of water. Such regions may contain localized clutter variations which indicate the presence of features of interest. It is thus of interest to develop techniques which can discriminate localized clutter features from the background clutter. If the distribution parameter values are known for both background and feature then the likelihood ratio method can be used. Frequently, however, the feature parameter values are unknown, in which case one option is to use simply the background likelihood. In both cases, quadratic test statistics result which are analyzed to allow a comparison of theoretical performances. A second option is to introduce a probability distribution for the feature parameter values. Optimum performance will result if the assumed and true distributions match exactly but any mismatch may considerably reduce the performance. Simulations are used to investigate this effect. In conclusion, the paper assesses the various discrimination techniques in terms of complexity, prior knowledge requirements, and performance. (Author)

A96-20219 Speckle reduction of SAR images using neural networks. D. BLACKNELL, C. J. OLIVER, and M. WARNER (Defence Research Agency, Malvern, UK), *Synthetic aperture radar and passive microwave sensing; Proceedings of the Conference*, Paris, France, 1995 (A96-20201 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2584), 1995, pp. 179–187. 10 Refs. Documents available from AIAA Dispatch.

A CPU-intensive algorithmic noise removal process called simulated annealing has been successfully applied to both SAR intensity images and SAR texture images generated using a mean-normalized log texture estimator. To improve the execution time of the smoothing process, we have adopted a neural network based solution which emulates simulated annealing. A factorized neural network was chosen consisting of a vector-quantizer first stage which is used to select a specific multilayer perceptron from the second stage. This technique reduces both the training and run times for large neural networks. A further reduction in training times is achieved by the use of self-adjusting training algorithms. Statistical analysis of test data has shown that the network produces a good approximation to the estimated cross-section. Simulated annealing has the advantage of a much larger adaptive input window than the neural network, and a better comparison can be made by restricting simulated annealing to operate on a window with dimensions comparable with that of the neural network. (Author)

A96-20216 Optimum edge detection in SAR. C. J. OLIVER, D. BLACKNELL, R. G. WHITE (Defence Research Agency, Malvern, UK), and I. McCONNELL (N.A. Software, Liverpool, UK), *Synthetic aperture radar and passive microwave sensing; Proceedings of the Conference*, Paris, France, 1995 (A96-20201 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2584), 1995, pp. 152–163. 11 Refs. Documents available from AIAA Dispatch.

We derive the Maximum Likelihood (ML) criterion for splitting (or merging) two regions of single-look SAR imagery as a function of the mean intensity. Two distinct optimization criteria can be postulated: 1) maximizing the total probability of detecting an edge within a window; 2) maximizing the accuracy with which the edge position can be determined. Initially we derive the ML solution for the first criterion and demonstrate its superiority over an approach based on the Student t test when applied to intensity segmentation. Next we discuss the ML solution to determining the edge position. Finally, we propose a two-stage edge detection scheme offering near optimum edge detection and position estimation. (Author)

A96-20211 High resolution SAR clutter textural analysis and simulation. A. P. BLAKE, D. BLACKNELL, and C. J. OLIVER (Defence Research Agency, Malvern, UK), *Synthetic aperture radar and passive microwave sensing; Proceedings of the Conference*, Paris, France, 1995 (A96-20201 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2584), 1995, pp. 101–108. 7 Refs. Documents available from AIAA Dispatch.

Coherent images of natural scenes formed using SAR often possess textural properties associated with the clutter. Due to a recent improvement in the Defence Research Agency (DRA) X band SAR, very high resolution imagery is now available for analysis. This increase in resolution has visibly modified the textural properties of observed clutter forcing a reexamination of the statistical image properties. The results of this study is given. Areas of imagery that appear homogenous will have their single-point distribution properties measured. Comparisons with known distributions that often fit similar data are made and shown to give poor agreement. Reasons for poor agreement, such as inhomogeneity, are investigated through the use of clutter simulations. K and lognormal mixture distributions will be shown to offer good agreement with the observed distributions and also validate the premise of homogeneity for the regions considered. (Author)

A96-20209 Simulated images of urban areas using an extended GTD ray tracing model of the Synthetic Aperture Radar. S. TAJBAKHSH, M.-J. KIM, H. M. BERENYI, and R. E. BURGE (King's College, London, UK), *Synthetic aperture radar and passive microwave sensing; Proceedings of the Conference*, Paris, France, 1995 (A96-20201 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2584), 1995, pp. 80–88. 3 Refs. Documents available from AIAA Dispatch.

The exact solution to the SAR scattering problem from an urban scene, with its collection of object-length scales, requires the solution of Maxwell's equations for the combination of source and scattering objects present in the scene, which for any reasonable size target area is computationally too large to be realistic. The geometrical theory of diffraction (GTD) is based on the fact that the most important contributions towards the scattered field come from an area in the neighborhood of some critical points on the scattering surface. This gives an accurate result with a practical amount of computation. However, the range of problems to which GTD can be applied to is limited by the availability of the solutions to the canonical problems from which the diffraction coefficients of GTD are calculated. In this paper a physical optics version of GTD was used in conjunction with a ray-tracing approach to simulate the SAR scattering from a simulated urban scene. (Author)

A96-17541 The Global Positioning System as a passive integrated atmospheric water vapour sensing device. A. DODSON and P. SHARDIOW (Nottingham Univ., UK), *Atmospheric sensing and modeling II; Proceedings of the Conference*, Europto Series, Paris, France, 1995 (A96-17525 03-46), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2582), 1995, pp. 166–177. 37 Refs. Documents available from AIAA Dispatch.

The expansion of the International GPS Geodynamics Service network provides the possibility of near-continuous measurements of Integrated Precipitable Water Vapor anywhere on the Earth using GPS as a passive remote sensing tool. In this paper, the current status of atmospheric research using GPS is outlined and a project aimed at validating its use for meteroology using ground-based water vapor radiometers for validation is discussed. (Author)

A96-17460 Rectification, calibration and geo-referencing of SAR data for land-use applications. G. BRELSTAFF, A. SOWTER, and P. MEADOWS (National Remote Sensing Centre, Ltd., Farnborough, UK), *Remote sensing for agriculture, forestry, and natural resources; Proceedings of the Conference*, Europto Series, Paris, France, 1995 (A96-17421 03-43), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2585), 1995, pp. 386–392. 7 Refs. Documents available from AIAA Dispatch.

This paper describes the capabilities of the NRSC's TSAR processing system, that provides a flexible approach to precise rectification, calibration, and georeferencing of satellite SAR acquisitions. An overview is given of how the product of TSAR enables the exploitation of ESA's ERS SAR images for land-use applications in mountainous and hilly terrain. In particular land-cover monitoring and geological analysis are considered. (Author)