THE EARTH OBSERVER

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Editor's Corner

A Payload Panel meeting was held in Annapolis, Maryland on July 29-31. Unlike previous Payload Panel meetings, this one was prompted by the desire to articulate and prioritize the strategic directions of Mission to Planet Earth in the upcoming years, rather than by some imminent budget reduction or program restructuring. The Payload Panel first articulated the fundamental principles that set EOS apart, and which we consider to be self-evident. These are:

(i) integrated, comprehensive observations – an observing strategy that combines spectral, temporal, and spatial measurements to maximize the scientific return;

(ii) long-term measurements – a strategy that resolves seasonal and interannual variability to improve the scientific understanding and provide a firm starting point for assessing decadal and longer changes (e.g., 15+ year data sets for global change research);

(iii) calibration and characterization – provide adequate pre-flight and on-orbit calibration for climate and global change research to enable intercomparisons of measurements from different instruments and platforms;

(iv) validation – an end-to-end assessment of data product quality;

(v) product documentation – peer-reviewed algorithms are described in the open literature and accessible to the entire scientific and educational user communities;

(vi) data accessibility – all EOS data products are available to any user at the cost of filling the user request.

The Payload Panel also formed four task forces with the goal of developing white papers in the following areas: (i) strategy for the second series of missions (AM-2, Chemistry-2, etc.); (ii) the relationship between EOS and the National Polar Orbiting Environmental Satellite System (NPOESS); (iii) the insertion of new technology, including the role of the New Millennium Program (NMP) and Earth System Science Pathfinders (ESSP), among other instrument incubator initiatives, and (iv) EOSDIS and the emerging role of the federation, long-term archives, and DAAC certification.

I am happy to report that Dr. Yoram Kaufman has agreed to serve as AM Project Scientist, replacing Dr. Piers Sellers, who left Goddard at the end of July to join Johnson Space Center as an astronaut candidate. Dr. Kaufman is an internationally recognized scientist with an in-depth understanding of the scientific requirements and impact of the EOS AM mission. His special areas of expertise include: (i) the remote sensing of aerosols and clouds and their impact on global change; (ii) remote sensing of biomass burning, including the development of methods for satellite retrieval of fire characteristics, smoke aerosols, and trace gases; (iii) atmospheric correction of satellite observations; and (iv) validation campaigns involving aircraft, surface, and satellite observations. He is also a member of the MODIS Science Team with primary responsibility for the aerosol retrieval algorithm over land, and hence I am confident that he will make a very substantial contribution to the EOS AM Project and represent the Earth sciences community in an exemplary fashion.

In addition, Dr. Jon Ranson, who has a background in forestry and agronomy with a specialization in optical and microwave scattering from vegetation canopies, has agreed to serve as Deputy AM Project Scientist. Dr. Jim Collatz, a climate modeler and plant biologist, has agreed to serve as Assistant AM Project Scientist. These land scientists will complement Yoram Kaufman's strengths in atmospheric science.

Finally, our EOS Project Science Office Web address has been changed to http://eospso.gsfc.nasa.gov. A list of recently added items can be found on Page 28 of this issue.

—Michael King
EOS Senior Project Scientist

OPPORTUNITIES TO PARTICIPATE IN NASA'S MISSION TO PLANET EARTH EDUCATION PROGRAM
NRA-96-MTPE-07

Release Date: September 16, 1996

NASA announces the release of the Opportunities to Participate in NASA's Mission to Planet Earth (MTPE) Education Program NRA. The purpose of the announcement is to solicit unique and innovative proposals from a broad range of education and research professionals to develop and implement Earth system science education programs targeted for the pre-college, pre-service teaching community, and higher education student populations.

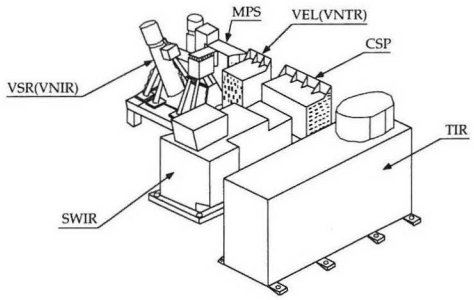
This NRA is available on the Mission to Planet Earth Home Page at http://www.hq.nasa.gov/office/mtpe/ under "MTPE Research Announcements," or via anonymous ftp at ftp.hq.nasa.gov/pub/mtpe.

Paper copies of the NRA are available to those who do not have access to the Internet by calling (202) 358-3552 and leaving a voice mail message including your full name, address, and telephone number.

Questions regarding this NRA can be addressed to NASA Headquarters, Code YM, Washington, DC 20546, Attn: Ms. Lisa Ostendorf, telephone (202) 358-0792, FAX (202) 358-2891, E-mail lisa.ostendorf@hq.nasa.gov.

ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) Science Team Meeting

— **Andrew Morrison** (andy@lithos.jpl.nasa.gov), Jet Propulsion Laboratory



The 11th ASTER Science Team meeting was held June 10-14, 1996, in Pasadena, California. The nearly 90 attendees represented Japanese and U.S. government, academia, and industry. The U.K. and Australia were also represented at the meeting. The Japanese contingent has grown by nearly a factor of three since the last meeting in the U.S. due to the growth of the Ground Data System (GDS) development activity in Japan.

A special session of the meeting was held Monday afternoon to address ASTER Instrument pointing stability. Meeting topics included pointing status summary, TDRSS Onboard Navigation System (TONS) performance, pointing (attitude stability) performance, and instrument boresight stability. H. Kieffer summarized the results of the meeting saying that: 1) the problems are much smaller than they appeared one year ago, 2) platform stability will not be a problem, and 3) the requirements for inter-telescope registration can be easily met.

Plenary I, Tuesday Morning, June 11

The Tuesday morning Plenary Session was opened by A. Kahle, U.S. ASTER Science Team Leader. She introduced M. Pniel, who has succeeded D. Nichols as ASTER Science Project Manager. She also reviewed the status of the Federation of EOSDIS, the Railroad Valley Experiment, several recent meetings, and the status of the ASTER/MODIS simulator (MASTER). She listed four topics that she hoped would receive particular attention during the meeting. They were:

- ◊ Quality Assurance,
- ◊ Science Team Acquisition Requests (STARs),
- ◊ Validation Plans, and
- ◊ Mission Operations/Scheduler issues.

H. Tsu, ASTER Science Team Leader, expressed his gratitude to the U.S. side for preparing and hosting the meeting. He said that he expects the Memorandum Of Understanding (MOU) signing process to be completed by the end of July 1996.

D. Williams, Landsat-7 Project Scientist, presented a Project update. He announced the names of the newly selected Science Team Leader and Science Team members (two of whom, K. Thome and F. Palluconi, were present at the ASTER meeting). He reported that in conjunction with Piers Sellers, he has arranged EOS funding for Landsat-7 Level-1 product processing at a level of approximately 100 products per day. He also announced that an MOU was completed with the EOS AM Project to fly AM-1 and Landsat-7 in synchronized flight. Landsat's new home page is http://geo.arc.nasa.gov/esd/esdstaff/landsat/landsat.html.

G. Geller summarized the QA-related events since the last meeting. He said that, from his perspective, the main objective of this meeting was to get a final approval of the QA Plan by the entire ASTER Science Team so that it can be submitted for review this summer by GSFC. He also reviewed the purpose and major decisions reached at the U.S. QA Workshop. He then introduced the QA plane concepts and asked the Working Groups (WGs) to discuss and refine first and second QA plane concepts as they related to each WG's products.

M. Pniel presented an update of the Product Generating System (PGS) status since the last meeting. He reviewed the product list, the toolkit status, and the

software development schedule. He also discussed beta version characteristics, reviewed the milestones that had been tracked during I&T, and presented the approach for Version 1.

H. Watanabe presented the ASTER Ground Data system (GDS) Development Status. He presented the major milestones achieved in the last year and talked about the major issues and decisions reached. There will be a single XAR server and access to it may be used to satisfy the U.S. request for query capability. He noted that there is a need at this meeting for the Operations & Mission Planning Working Group (OMPWG) to address the issue of generalized query of the XAR database. He reported that the GDS had received the beta versions of the atmospheric correction, de-correlation stretch, etc., software. The GDS has decided to use the U.S. atmospheric correction algorithm for a Standard Data Product. They are interested to know whether and how much MODIS/MISR data are needed, and whether MODIS/MISR data will always be available for atmospheric correction.

T. Kawakami summarized the OMPWG *ad hoc* meeting that was held in Tokyo in March. The main topics of the meeting included:

- ◊ Scheduling algorithm issues;
- ◊ Japan Instrument Support Terminal (IST) development;
- ◊ xAR input parameters and xAR status,
- ◊ Science Scheduling Support Group (SSSG) Operations Concept Document;
- ◊ Cloud forecast, and
- ◊ the Global Mapping prioritization map.

He proposed schedules for the development and review cycles of the alpha and beta versions of the Scheduler. The dates were adjusted to allow time for the U.S. Team to review the product and prepare Review Item Discrepanices (RIDs). Mr. Kawakami also reported that the U.S. and Japanese team members had come to agreement on most of the Data Acquisition Request (DAR) input parameters and those were sent to the GDS, which has since agreed to most of them.

H. Fujisada presented an ASTER Level-1 Algorithm and software development status update. His presentation included:

- ◊ algorithm development objectives and document status;
- ◊ algorithm and software development framework;
- ◊ development schedule;
- ◊ end to end algorithm flow;
- ◊ modules and data flow;
- ◊ machine environment for version 1 development—major features of version 1;
- ◊ version 1 performance test;
- ◊ the major differences between the beta version and version 1—future plans, and
- ◊ ASTER GDS hardware for Level-1 processing (He said that Version 1.1 is now completed—Version 2 is in preparation at this time.)

P. Slater, K. Thome, S. Tsuchida, S. Hook, F. Palluconi, and T. Matsunaga reviewed background and preliminary results and conclusions of the Railroad Valley and Lunar Lake calibration/validation deployments of May/June 1996.

Y. Yamaguchi presented the basic policies, Project flow, and Project schedule for the upcoming Japanese Announcement of Opportunity (AO) for investigators who wish to be authorized to submit ASTER DARs. Although authorization by NASA and the Ministry of International Trade and Industry (MITI) has not been made yet, the current ideas proposed by his presentations were:

- ◊ AOs will be issued annually for investigators who will each receive one-year rights to request data acquisition.
- ◊ Investigators will be required to publish their results—authorization does not include a grant.

D. Wenkert summarized a proposed U.S. ASTER authorization process that is currently being reviewed by NASA Headquarters. The proposed process would allow DARs to be submitted at any time during the mission and the proposals would be reviewed and authorized by a committee via a continuous process.

Y. Yamaguchi presented an update of the Global Data Set Prioritization Map plan and schedule. A color copy of Version 1 of the map was distributed that showed areas of priority A (33.3%), B (55.3%), and C (11.4%).

This version is a compilation of 9 layers submitted by 4 Working Groups. The statistics of the layer maps were presented.

I. Sato reported on the activities of the Higher-Level Data Products Working Group (HLDPWG). He said that, from his perspective, a key objective of this meeting is to achieve a final reconciliation of the two versions of the Higher-Level Data Product Specification to produce a single specification. He also said that QA is still the main area requiring definition—each WG was expected to be developing its own QA parameters and would meet at this meeting to finalize the definitions. He added that browse for higher-level data products is a major topic for the HLDPWG to address. He also presented a diagram showing a proposed process for generating the higher-level browse products in Japan.

The ASTER Instrument Project status was reported by M. Kudoh of Japan Resources Observation Systems Organization (JAROS). He said that the MOU, now called the Implementing Arrangement between MITI and NASA, is in its last phase. Regarding the instrument, he said that the ASTER subsystems are now in the final test phase of the Proto Flight Modules (PFM) —all of the subsystems have to be reviewed in the Post Qualification Review (PQR). He listed the steps and the schedule of the PQR. The TIR scanner PFM was delivered to the TIR subsystem in April 1996 and the Master Power Subsystem (MPS) PFM was delivered May 1996. The ASTER system entered the I&T phase. He also listed the remaining problem areas including:

- ◊ Interference spike noise in all the telemetry channels of the MPS delayed the delivery of the MPS to ASTER. This noise is satisfactorily reduced at this time.
- ◊ It is taking a great deal of time for the ASTER subsystems to meet NASA's Electric Magnetic Compatibility (EMC) requirement.
- ◊ NASA's requirement of eight thermal vac test cycles will extend each subsystem schedule.
- ◊ Output timing of the Spacecraft Checkout Station (SCS) High-Rate Data Test Equipment (HRDTE) of the EOS-to-ASTER Instrument Support Ground Science Equipment (ISGSE) cannot meet T2P (time required to transmit 2 data packets). This may affect VNIR-1, MISR, and MODIS transmission data zones. Further studies will be made.

The schedule of subsystem deliveries to the ASTER system and to the Local Message Metering System (LMMS) were presented. The updated master schedule of the EOS AM-1/ASTER was also presented. Representatives of NEC, MELCO, and Fujitsu presented updates on the VNIR, SWIR, and TIR subsystems, respectively.

The first Plenary Session was followed by a GDS/PGS meeting held at the Hilton and by demonstrations at JPL of the alpha version of the Scheduler (GDS), the alpha version of the IST (GDS), and the DAR entry tool (D. Noss).

Plenary II, Friday Afternoon, June 14

A. Gillespie reported that the Temperature-Emissivity (T-E) Separation Working Group (TEWG) had resolved a great many issues. Most importantly, he said, the Temperature/Emissivity Separation (TES) algorithm seems to be functioning and robust, and delivering good products. He noted that the T-E validation plan will require the pooling of resources between the U.S. and Japanese and between ASTER and MODIS.

J. Salisbury, Spectral Library Committee, reported on the acquisition of a database of spectra of man-made materials that is available at their FTP site. He also reported on the status of on-going Spectral Library Committee activities. Among them, that round-robin samples are circulating for lab measurements.

G. Geller said that the final version of the Level-1 Product Specification will be delivered to the GDS in August. He said that the Level-1 Working Group is proposing a policy for replacement of bad pixels by interpolation during 1B processing by a method TBD. He offered to any takers a tape copy of Version 1 of the Level-1 software that comes with a manual (in Japanese).

M. Pniel reviewed the main topics covered in the Operations & Mission Planning Working Group (OMPWG) meeting. These included:

- ◊ the Japanese and U.S. AO plans;

- ◊ plan for developing xAR and STAR databases
- ◊ justification of the frequent maneuver request (Japan will prepare a presentation addressed to the SWAMP on this topic and offer it to the U.S. Team for a response to determine if we can go into the SWAMP meeting with a unified position);
- ◊ automatic QA;
- ◊ IST generalized query capability; and
- ◊ Scheduling Algorithm and Scenario Generator development schedule and transitions between observing modes.

H. Lang, Digital Elevation Model (DEM) WG meeting, noted that Dr. Murakami is serving as Acting Co-chair of the DEM WG (Dr. Miyazaki is still the official Co-chair, but all communications should now go through Murakami). Mr. Lang said that the Standard Data Product Commercial Off The Shelf (COTS) RFP should be released in August 1996.

F. Palluconi presented the agenda and a summary of the Atmospheric Correction Working Group meeting. He reported on the schedule for ATBD reviews (revised ATBDs due August 16 at GSFC, followed by a second mail review, followed by a third verbal presentation in December), noted that a CERES request for 8000 ASTER scenes has been received, said that a common QA data plane agreement was reached, and reported that a joint (ASTER/MODIS/MISR) atmospheric campaign in 1997 received favorable consideration. In the meeting, P. Minnett (MODIS) discussed possible coordination between ASTER, MODIS, and shipboard SST measurements.

J. Schieldge reported that the Japanese Ecosystem WG has submitted some prioritized targets to the Global Map planning activity and has more in preparation. The U.S. Team has yet to submit their requests. He said that the WG will use Honda's new Ecosystem WG information bulletin board to improve intra-group communications.

L. Rowan summarized the highlights of the Geology WG meeting. The topics covered included:

- ◊ global mapping prioritization (a population density layer was added);
- ◊ regional monitoring (IDS input is needed to define volcano monitoring targets: gain settings for Global Land/Ice Monitoring from Space (GLIMS) was presented by Bruce Raup);
- ◊ d-stretch algorithm update (browse image was discussed: 400x400 recommended); and
- ◊ ASTER simulation data sets (a complete set of usable simulated data sets is needed).

S. Hook reported that there was no Airborne WG meeting associated with this Team meeting. Instead, he summarized the Thermal Infrared Multispectral Scanner (TIMS) data collected in 1996 for the ASTER Project at four sites and presented the several planned acquisitions for 1997. He also reviewed the current TIMS and MASTER status and proposed MASTER Project phasing. S. Rokugawa noted that no further flights of the ASTER Airborne Simulator (AAS) were scheduled for 1996.

T. Kawakami invited the attendees to the next ASTER Science Team meeting scheduled to be held December 2-6, 1996, at the Paciphico Yokohama in Yokohama, Japan. An splinter meeting is scheduled for October 7-9, 1996.

The meeting was closed by H. Tsu who called this a significant and productive meeting in which many issues were resolved in off-line splinter meetings as well as in the scheduled on-line meetings.

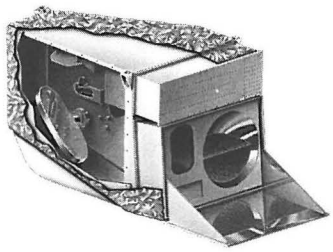
Kudos

Pamela Matson, NASA Ames Research Center, has been awarded a John D. and Catherine T. MacArthur Foundation Fellowship in the amount of $260,000. This award was given in recognition of her past achievements and to help further "her research into the causes and consequences of intensive fertilization in Mexico with the intention of finding alternative practices which would reduce nitrogen losses from the soil and reduce environmental costs at the same time."*

Matson is a co-investigator on the MTPE/EOS Biosphere-Atmosphere Interactions Interdisciplinary Investigation. The MTPE/EOS community wishes to congratulate Dr. Matson on this outstanding achievement.

**Global Change Newsletter*, No. 26, June 1996

Moderate-Resolution Imaging Spectroradiometer (MODIS) Science Team Meeting



— **David Herring** (herring@ltpmail.gsfc.nasa.gov), Science Systems and Applications, Inc.

Welcome and Meeting Overview

The May 1 - 3, 1996, MODIS Science Team Meeting was called to order and chaired by Vince Salomonson, team leader. Salomonson introduced and welcomed the new Science Team Members. (See the section below for details on the new members.)

Robert Murphy, MODIS project scientist, stated that the team needs to develop plans and increase efforts in the three following areas: 1) validation, 2) defining the characteristics of a technologically advanced MODIS, and 3) outreach. Murphy announced that a first draft of the MODIS Validation Plan is complete and will be revised over the next 3 months. He encouraged the team to put as much attention and energy into the MODIS validation efforts as possible.

Regarding plans for the advanced technology MODIS, Murphy reported that the EOS Program Office is discussing options. He said that we need to find ways of reducing the size and weight of MODIS. However, we need to also preserve and build upon the science of the current MODIS. Murphy asked the team to consider what lessons it has learned so far in the design and development of the current MODIS.

Murphy said there is a need for the MODIS Team to step up its outreach efforts. Specifically, it must work more closely with the general scientific community to help refine needs for its data products.

MODIS Project Reports

Richard Weber, MODIS project manager, reported that the integration and testing of the MODIS Protoflight Model (PFM) is underway. All optics and focal planes are assembled. By June 1996, Santa Barbara Remote Sensing (SBRS) will have the Spectroradiometric Calibration Assembly (SRCA), the Solar Diffuser Stability Monitor (SDSM), and instrument electronics assemblies in place. Weber stated that he expects the PFM to be delivered in December 1996; however, this assumes an "optimistic" schedule, with no major problems. He announced that the MODIS Flight Model-1 (FM-1) components are also being prepared now.

Tom Pagano, of SBRS, stated that some major events took place on the PFM since the last Science Team Meeting. SBRS realigned the optical system, completed vibration testing, and has almost finished integrating the onboard calibrators. Pagano proffered that MODIS has the most sophisticated focal planes for radiometry ever built in the remote sensing industry. (There may be detectors with higher resolution, but not with the combined dynamic range and sensitivity.) SBRS is currently working on characterizing the bidirectional reflectance distribution function (BRDF) of the solar diffuser.

Pagano reported that the PFM signal-to-noise ratio meets specifications for all bands. However, the dynamic range is a concern for the near-infrared detectors—their throughput is higher than specified and will affect the dynamic range. Pagano stated that the PFM meets specifications for radiometric accuracy, on board blackbody, and instrument internal temperature.

Pagano stated that the near-field response of MODIS compares very favorably with that of SeaWiFS, CZCS, and AVHRR. MODIS has an intermediate field stop that reduces far-field response over and beyond what its heritage sensors could do. Pagano stated that stray

light analyses show that contamination dominates at level 400; however, MODIS must maintain a clean-room condition at level 300.

SDST Status Reports

Ed Masuoka, Science Data Support Team (SDST) leader, reported that the MODIS beta software delivery was made by the January 1996 deadline. Focus has now shifted from integrating the software into the DAACs, to science integration—the code's ability to handle ancillary data.

Masuoka told the Team that the deadline for submission of Version 1 code is January 1997. The goals for that submission are to have the science algorithms implemented according to plans given in the ATBDs. Also, the code must use ancillary and Look-up Table data, and employ realistic resource usage, timing, and operations algorithms.

Masuoka stated that EOSDIS cost growth is a concern—it is currently $75 million over budget. Most of the extra cost is attributed to the cost of hardware for the "pull side"; i.e., robotics and storage media to support the user community. Masuoka hopes that better characterization of the "pull side" requirements will enable ESDIS to cut costs in areas where there will be lower demand. Also, SDST is working with ESDIS on ways to optimize MODIS code to improve its performance and lessen its processing requirements.

Al Fleig, of SDST, stated that it is the Science Team's responsibility to test the science content of their code, as well as perform its implementation. He stressed that not all testing will be done by SDST; most will be done by the Science Team members themselves. When the code is delivered to the DAAC, SDST will make sure that it runs properly in the DAAC environment. Fleig stated that SDST will write the software test plan, but it will need input from each Science Team member. The idea is to test all features of the science algorithms as an integrated process and as a total processing system.

Fleig said SDST plans to send the Science Team data sets that will stress their code in some ways. For instance, a data set will be provided in which each detector (there are 430 detectors on MODIS) is periodically labeled as a "bad detector." Algorithms will need to check for this label and decide what to do to compensate. Fleig also pointed out that the MODIS Characterization Support Team (MCST) plans to flag "noisy" detectors. So, in another of its test data sets, SDST will label some detectors as noisy, to which the Version 1 code is expected to be able to respond.

Fleig proffered that the quality assurance (QA) effort after launch will consume 20-to-50 percent of each algorithm's processing resource requirements. He said that the QA algorithms must be available at launch, so development is needed now. Fleig recognized that the QA effort will tremendously impact funding, and reminded the Team that the MODIS QA Plan is due this fall.

MCST Status Reports

Bruce Guenther, MODIS Characterization Support Team leader, reported that Version 1 of the Level 1B software has been delivered, and Version 2 will be delivered in early 1997. The file specification was updated on April 8, 1996, and is now frozen. The new file specification for Version 2 is in progress and will be frozen in December 1996. Guenther feels it will remain frozen until launch.

New Science Team Members

Janet Campbell, U. of New Hampshire, presented an overview of her proposed research efforts. Her goal is to develop the scientific and statistical basis for monitoring algal pigments and primary productivity in coastal, estuarine, and inland ecosystems using satellite data and complementary surface measurements. Campbell's primary research objective for MODIS is to establish a protocol for developing and validating regional or site-specific algorithms for estimating surface chlorophyll-a concentration and primary productivity, while accounting for the optical variability of other water constituents.

Bo-Cai Gao, U.S. Naval Research Laboratory, stated that his proposed research includes thin cirrus detection and correction, radiative transfer modeling, and airplane contrail cirrus studies. Gao's research on atmospheric corrections is primarily of interest to the MODIS Ocean and Land Discipline Groups. He showed sample image data taken over Coffeyville, KS, and pointed out that in the 1.375-μm channel, cirrus clouds and not surface features are seen. MODIS will

have the 1.375-μm channel for cirrus corrections. Gao proposes developing techniques for the operational removal of thin cirrus from MODIS data acquired over both ocean and land.

Ranga Myneni, Boston U., showed a 1995 data plot of average normalized differential vegetation index (NDVI) anomaly as compared to biospheric carbon and sea surface temperature. Myneni stated that, globally, there is some correlation between the three variables up until about 1990; afterwards, they do not appear as closely correlated. He hopes to perform more-intensive calculations of these variables using MODIS data, rather than produce more data plots. Specifically, he plans to derive leaf area index (LAI) and fraction of photosynthetic active radiation (FPAR) absorbed by green vegetation. Myneni will then develop a look-up table algorithm for estimating LAI and FPAR for a given MODIS scene. Ancillary data layers will include biome type, such as grasses and cereal crops, shrubs, broadleaf plants, needle forests, etc.

John Townshend, U. of Maryland, stated that he is interested in land cover characterization and monitoring land cover change. He noted that the currently planned MODIS land cover data set is based on multispectral and multitemporal data using a neural net approach. He proposes to enhance this product by making an at-launch product available using AVHRR data, and by creating additional planes of land cover characterizations depicting continuous fields, all based on the AVHRR sensor's data. Consequently, land cover change results will be available shortly after EOS AM-1 is launched, rather than during the second year after launch as was originally planned. Specifically, Townshend plans to monitor land cover change, showing where change occurs, and what sort(s) of change(s) occur, every 1 to 2 months.

Eric Vermote, U. of Maryland, presented an overview of his proposed land surface reflectance product. Vermote said that his algorithm will be used for atmospheric corrections; in turn, his products are heavily dependent upon the aerosol product. Vermote stated that his reflectance product will be an important input into many of the Land Group's algorithms—the quality of his product will influence the quality of products downstream in the processing flow. From a heritage perspective, Vermote points out that his product contains new features, such as aerosol correction, adjacency effect correction, and correction for BRDF-atmosphere coupling—all of which have never been included before in a surface reflectance product. Vermote also hopes to provide atmospheric correction for coastal water reflectance. His product will play an important role in validating the calibration of the MODIS reflectance bands.

Additionally, Vermote will work on development of the MODIS aerosol climatology product prior to launch. He feels that aerosol correction is the most important source of error in the surface reflectance algorithm.

University of Wisconsin's MODIS Synthetic Data Set

Paul Menzel, U. of Wisconsin, told the Team that he would like to take advantage of MODIS' 36 spectral bands but there is currently no adequate data set. So, his team at the University of Wisconsin-Madison is working to simulate MODIS using MAS (MODIS Airborne Simulator) data. (He noted that MAS has no water vapor absorption channels, which is a problem.) The purpose is to produce a synthetic data set to facilitate and enhance MODIS algorithm development. Menzel explained that the synthetic data sets will be used for testing algorithms and strings of algorithms. He plans to use real data where possible and approximate the co-registration of MODIS. Output data will be Level 1B and geolocated, and will provide the best possible radiometric calibration.

Menzel explained that the synthetic data set is being put together as if the 50-m MAS footprint equals a 250-m MODIS nadir footprint. In the first quarter of 1996, a data set of clear sky over water scenes was produced. In the second quarter, a cloudy scenes data set over water was produced and in the third quarter, clear scenes with limb-corrected infrared data will be produced at true MODIS spatial resolution. Production in the fourth quarter is still to be determined.

Quality Assurance

Al Fleig said that the Team needs to generate a QA Plan by September 1996. Fleig has agreed to produce a

draft document stating the purposes and objectives of the MODIS Quality Assurance Plan, as well as how QA will be used.

Temporal Compositing Periods and Spatial Grids

Robert Wolfe, of SDST, reported that progress has been made toward establishing the temporal compositing periods for MODIS data—consensus was for an 8-day period. There was some question as to whether the Team should simply resynchronize at the beginning of each month, or each year. Wolfe announced that the majority of Team members favored resynchronizing each year. That way, data users can compare the same periods for each year over a given region. Esaias stated that the Ocean Group favors the 8-day compositing grid, but it doesn't want the grid resynchronized ever.

Follow-On MODIS Sensor Considerations

Bill Barnes, MODIS instrument scientist, told the Team that there is interest in building a smaller, lighter version of MODIS for future missions. In scoping the new MODIS, he stated that emphasis will be on maintaining all of the requirements for the current MODIS. Barnes said he is putting together a specification for the follow-on MODIS sensor. This specification will include the same channels, radiometric requirements, and calibration requirements as the current MODIS; the difference will be in size and weight constraints.

Calibration Discipline Summary Statements

Phil Slater, Calibration Discipline Group leader, summarized discussions at the MODIS Calibration Working Group meeting. He stated that he is concerned about the truncated test and calibration schedule at SBRS. He suggested that they should endeavor to use any opportunities to study the long-term stability of MODIS in the pre-flight phase. He also feels that they should re-expand the thermal vacuum testing that was cut back to 15 days.

He said there is a need to accurately determine the BRDF of the solar diffuser. He pointed out that this test was canceled at SBRS, but feels that there is still a need to characterize the solar diffuser. Slater requested that SBRS measurements of BRDF be compared to those of other institutions.

Slater recommended that SBRS study the feasibility of measuring far-field stray light effects to validate a basis for determining Level 1B radiometric uncertainties. For the ocean color bands, Slater noted that Esaias's study shows that about 56 percent of "clear" ocean pixels will have a scene-dependent error greater than 1 percent. Slater suggested that MCST should study, in consultation with the Science Team, the provision of an estimate of the radiometric error for the Level 1B product.

Slater feels that SBRS should employ the SRCA more frequently during testing and calibration activities to check the long-term stability of the SRCA and MODIS as a whole. He said SBRS should also perform system-level tests of stray light when the SRCA is in use.

Slater announced the upcoming first joint vicarious calibration field campaign, to be conducted at Lunar Lake and Railroad Playa, Nevada, from May 30 to June 7. The purpose is to compare TOA (top of atmosphere) radiances predicted by the various participating groups when measuring the same playa area at the same time. Up to three such estimates will be made each day to simulate the acquisition times of the AM-1 platform sensors at the solstices and equinoxes. MODIS, MISR, and ASTER calibration scientists will participate in the campaign.

Team Leader Summary Statements

Salomonson said that the report from SBRS on MODIS development was exciting and positive. He thanked SBRS and the MODIS Project for their efforts. He noted that algorithm development is going well and that the beta and Version 1 code delivery experience has been positive. He told the Team to expect challenges in data processing and storage requirements in the coming months.

Salomonson announced that the dates for the next MODIS Science Team Meeting are October 9 - 11, 1996, at a site near Goddard Space Flight Center.

EOS PM-1 Advanced Microwave Scanning Radiometer (AMSR) Science Team Meeting

— **Elena Lobl** (elena.lobl@msfc.nasa.gov), Team Coordinator, Earth System Science Laboratory, University of Alabama in Huntsville

The second U.S. EOS PM-1 AMSR Science Team meeting was held 13 June 1996 at Goddard Space Flight Center. The agenda included hardware status from the EOS PM Project Office, and presentations on current research from team members. The afternoon was taken up by toolkit and HDF implementation discussions. C. Kummerow and F. Wentz showed a brief status of the Precipitation and Ocean Suite Algorithm Theoretical Basis Documents (ATBDs), for which they are the leads.

Roy Spencer started the meeting by welcoming the two new team members: Al Chang, GSFC, is developing the snow depth and snow water content algorithms; and Eni Njoku, JPL, is leading the land surface classification and surface wetness algorithm development. A short discussion about the ADEOS II AMSR Workshop revealed that our team representation would consist of Spencer, Chang, and Wentz, although all Team members were invited by NASDA to attend the workshop.

Bernie Graf, PM Project Office AMSR Instrument manager, reported on the EOS PM AMSR hardware status. Mitsubishi Electric Corporation (MELCO), the instrument builder, and TRW, the spacecraft vendor, have had an interface meeting, and agreed on the electrical interface and the power consumption; issues still exist with the thermal and mechanical subsystems. Frank Wentz, after defining the independent variables for retrieving brightness temperatures: salt water dielectric constant, wind-induced sea-surface emissivity, wind direction, oxygen absorption, water vapor, and liquid cloud and rain water absorption, discussed the ocean suite retrieval algorithm. The algorithm starts with an initial guess of the independent variable values, which are then used in an iterative process where the Sum of Squares (SOS), ratio of the square of the difference between the observed and the calculated T_Bs and the square of the noise temperatures, is minimized. With SSM/I data this process converges within 0.1 K in only four iterations. Peter Ashcroft, Remote Sensing Systems, is supporting F. Wentz in developing the Level-1c product algorithm. The first release of a simulated Level-1c data set is expected in March 1997; the data in this set will have real location information, but will have bogus T_Bs.

John Alishouse followed with some precipitation information obtained from SSM/I that can be used as verification data for the AMSR precipitation algorithm.

Don Cavalieri is working on improving current sea-ice algorithms and on developing new algorithms for extracting additional sea-ice information. Recent advances include the improved discrimination between sea-ice and weather effects and the development of two new sea-ice algorithms. Working with K. St. Germain at the University of Nebraska, a new method for deriving sea-ice temperature has been developed and is currently being tested using data from NOAA Arctic Ocean buoys and AVHRR imagery. The other new algorithm retrieves information on sea-ice drift. The technique is based on a wavelet analysis of SSM/I 85-GHz radiances. This work, being done in collaboration with A. Liu at Goddard Space Flight Center, is expected to provide daily sea-ice velocities for the entire Arctic and Antarctic regions.

Joey Comiso introduced his presentation with problem areas in validation. He also discussed the studies he is involved in for sea-ice concentration and type. The last topic presented from his research was the summer and

perennial ice cover; he showed images of melt onset, meltponding, freeze-up, and a comparison between multiyear and summer ice cover.

C. Kummerow presented the 'Goddard profiling' (Gprof) precipitation retrieval algorithm, which will be the basis of the AMSR team precipitation algorithm. He discussed briefly the overall structure of this algorithm and showed the plan for its development, such as sensitivity to input models, convective/stratiform cloud separation, latent heating, and error modeling. Other data planned to be used are global microwave from SSM/I, localized experimental rainfall data from AMPR, geostationary IR data, and rain gauge data.

Al Chang presented his plan for retrieval of snow parameters using AMSR data. His algorithm will be an improved SMMR snow algorithm. From the intercomparison studies conducted for snow cover and snow storage with ground observations, it was concluded that the SMMR algorithm underestimates the snow storage amount. Chang will make use of a Geographic Information System (GIS) to correct and improve this algorithm for use with the AMSR data.

Roy Spencer's research involves the temperature dependence of some of the AMSR retrievals. His work will point out any temperature cross-talk that the AMSR algorithms might have in time to correct the at-launch versions.

Two TRMM Science Data and Information System (TSDIS) members took most of the afternoon and discussed lessons learned from TRMM algorithm development.

The meeting closed with a tour of the laboratory where the TRMM spacecraft (including the TRMM Microwave Imager) is tested. The next AMSR meeting will be at the end of October, shortly before the ATBDs are due to the Project Science Office (November 15, 1996).

Earth System Science Pathfinder Announcement of Opportunity

The National Aeronautics and Space Administration (NASA) announces the release of the Earth System Science Pathfinder (ESSP) Announcement of Opportunity (AO) in support of the Office of Mission to Planet Earth (MTPE). This program is intended to identify and develop small science-driven missions to accomplish objectives in response to national and international research priorities that are not being addressed by current programs. ESSP will provide periodic "windows of opportunity" to accommodate new scientific priorities and infuse new scientific participation into the MTPE program.

This AO is available electronically via the Internet at the Mission to Planet Earth Home Page: http://www.hq.nasa.gov/office/mtpe/ under "MTPE Research Announcements" or via anonymous ftp at: ftp.hq.nasa.gov/pub/mtpe.

Paper copies are available by calling (202) 358-3552 and leaving a voice mail message. Please leave your full name and address, including zip code and your telephone number, including area code.

Questions regarding the AO can be addressed to NASA Headquarters, Code YF, Washington, DC 20546, attn: Mr. Kevin Niewoehner, telephone number (202) 358-0751, FAX number (202) 358-2769. Email address: kniewoeh@mtpe.hq.nasa.gov.

EOS Data Information System (EOSDIS) Panel Meeting

— **David M. Glover** (dglover@whoi.edu), Chair EOSDIS Panel, Woods Hole Oceanographic Institution, Woods Hole, MA

A meeting of the EOSDIS Panel was called before the May 1996 IWG to discuss "hot" issues surrounding EOSDIS development. The meeting was held at the Hughes facility in Landover, MD. Approximately half the panel attended the meeting plus members of ESDIS and NASA Headquarters.

This report will cover the election of the chair, a report from the Ad Hoc Working Group on Consumers (AHWGC), the latest federation plans (including a brief discussion of what transpired at the Working Prototype [WP]-Earth Science Information Partner [ESIP] workshop June 1996), a discussion of the future directions of the EOSDIS Panel, a brief update on the Community Cost Model (CCM) being worked on by Bruce Barkstrom, a briefing by Skip Reber on the formation of the EOSDIS Resource Management Board, and a report on the Independent Cost Evaluation (ICE). It was hoped that some of this discussion would help frame the issues and questions regarding EOSDIS at the Payload Panel meeting (29-31 July 1996).

Chair Election

Many requests for nominations were made via e-mail, but all replies indicated that the incumbent chair should stand another watch. Therefore, David Glover has, by acclamation, been re-elected chair of this Panel for two more years.

AHWGC Report

Dave Emmitt provided a summary of the AHWGC report that H. K. Ramapriyan (April 25, 1996) circulated via e-mail. Emmitt's summary was based on Matt Schwaller's analysis of the 2X (i.e., 2 times) resource limit presented to the ESDIS project in January 1996 and the AHWGC report. The main conclusion is that as Instrument and Interdisciplinary Science (IDS) Teams claims/demands go down, it looks as though 2X will be enough to satisfy the needs of the EOS community and is a reasonable initial design target. If you go outside of the EOS community, however, all bets are off since estimates vary from as high as 33X to the nominal 2X in addition to EOS community demands. This is important because in the "even reasonable to think about" range (2X to 64X) it comes in at $20-40M/X.

A lot of statistical analysis was applied to the data the AHWGC had collected about the "pull" side of the user model. But given that 90% of the pull is on 10% of the data (as expected), it was suggested that EOSDIS find some way to regulate the pull on the system. It was a conclusion of the AHWGC report that EOSDIS should begin planning now to manage demand that exceeds capacity. They further recommend access be handled through a "charge for timeliness" of delivery.

Among other "access" issues was the issue of the "standard" data format. This issue is being re-visited by ESDIS and a new policy was circulated by Ramapriyan in a July 8, 1996, e-mail message.

Federation Plans

Of the two recommendations from the National Research Council (NRC) to NASA about EOSDIS, the recommendation that EOSDIS be reconfigured "to transfer responsibility for production generation, publication, and user services to a competitively selected federation of partners in government, academia, and the private sector" has raised many concerns. Much of the activity NASA undertook to respond to this recommendation (and the NRC) is documented on a world-wide web (WWW) page (http://www.hq.nasa.gov/office/mtpe/eosdis/). There was concern that NASA was moving too rapidly towards a solution/response and the instruction from the NRC this spring to slow down was met with relief.

The Response Task Force (RTF) disbanded at the end of May 1996, its functions having been identified and farmed out.

At the EOSDIS Panel meeting and again later at the WP-ESIP workshop the topic of just what is being federated came up. As we understand it now, the federation of EOSDIS will be carried out in two phases, with none of the measurements from the suite of 24 core measurement types "federated" until after 1999. Earth Science Information Partners (ESIPs) will come in three varieties: Type-1 ESIPs will be those providing data whose product has high reliability, maintainability, availability (RMA); Type-2 ESIPs will provide data that's not available from Type-1 ESIPs due to its "not-ready-for-primetime" nature; and Type-3 ESIPs will be those providing data beyond the global change research community, potentially for profit. In Phase I, working prototypes of Earth Science Information Partners will be competitively selected, but only for Types-2 and -3. In 1999 there will be a competition for all three types of ESIPs. In the interim, DAACs will be recertified by a panel of outside reviewers with three possible outcomes: recertification, one-year probation, or phase out. A schedule for recertification, Cooperative Agreement Notice (CAN) for WP-ESIPs, and all-out competition for all data products is available at the above WWW site.

The purpose for these WP-ESIPs is to explore the possibilities of federation. How should (can) a Federation be formed? What issues should be on the table for their consideration? How will they adjudicate disputes within and with outside competition for resources? All of these, and many more, are important questions that need answers based on experience. Hence, it seems reasonable to explore the idea of working prototypes. In principle, these WP-ESIPs are testbeds so that lessons learned from these experiences can be transmitted to the actual, operational ESIPs of the next decade. But these WP-ESIPs must be *working* prototypes, they must support at least three things: real science, user services, and technological innovation. Real science is required because these WP-ESIPs will provide a real service to the global change research community by providing data products that are too developmental to be supported at a DAAC/Type-1 ESIP. At the time of this writing it is not known whether or not funds for the Type-2 ESIPs will be available to support this science. User services are required to explore ways in which the productivity of global change research, and other Earth Science data use activities, can be improved. Technological innovation is required to help NASA explore ways in which new technologies in data management and distribution can be used to bring down the cost of EOSDIS. All of these activities will be supported and encouraged through the formation of a federation. But, most importantly, it is imperative that these WP-ESIPs be allowed to fail. For without failure these ESIPs will be more of the same, and no new knowledge on how to form a database economy will be gained.

The Panel felt that the direction NASA is now pursuing, with this new federation of data providers, is actually closer to what we originally had in mind back during Phase B. Independent, competitive but cooperating data providers are the essence of what is required for an evolving, extensible, physically and logically distributed data system.

Future Directions for the EOSDIS Panel

At first the goal of the EOSDIS Panel was to ensure the establishment of a good architecture (extensible and distributed). With the arrival of the EOSDIS Core System (ECS) we feel that goal has been, to a large extent, accomplished. The ECS software delivered by Hughes is not dependent upon the somewhat logically centralized structure imposed upon the DAACs by funding realities of NASA. This should mean that, come what may (federation or whatever), the architecture of EOSDIS will survive into the next decade. How well it will be able to adapt (evolve) to changing conditions is something that only natural selection and time will be able to evaluate.

The goal the EOSDIS Panel sees before it now is the creation of a federation of data providers, much talked about but with little experience to go on. While we realize that we cannot singlehandedly create a federation and that a lot of work will necessarily be done by NASA and these WP-ESIPs, we wish to provide whatever insight and help that we can. During our meeting in Landover we tried to identify the key issues that we felt surrounded a successful establishment of a federation.

Primary among the issues discussed was the problem of how to bootstrap a federation into existence. What will be the "glue" that binds the separate and independent data providers together? The dictionary definition of a federation is "a group united by a common agreement under a central government or authority." Ignoring, for the moment, the fact that NASA will remain the central authority as long as it provides the money, what could/will this common agreement be? Absent from the draft CAN (reviewed at the WP-ESIP Workshop) was any clear mechanism to engender such an agreement. In short, the ESIPs have got to want to federate for reasons other than that they were told to.

Other issues were also discussed. What should the governance structure of this federation be? How shall they adjudicate resource allocation contention? What about innovative ideas that were not tried, or were cut due to budget pressures? Can this be a way to bring them back long enough to test them? Where do the ESIPs interface with ECS? Is it up to them? What sort of success criteria should be used and how does a negative result, i.e., failure translate into positive information (we'll know better not to try that next time). Plenty of questions and not a lot of answers, but the answers are what the WP-ESIPs are to find. The CAN needs to clarify the questions NASA is asking.

Cost Model Development

Bruce Barkstrom briefed the panel on the status of the Community Cost Model (CCM). During this briefing a discussion about an interface between the CCM and WP-ESIPs came up. It was suggested that proposers to the WP-ESIP CAN provide an input file to Barkstrom's CCM so that their system's cost could be compared against the current EOSDIS cost. This would provide a metric against which NASA could judge whether or not a WP-ESIP was really reducing costs. The CCM is currently up to chapter 19 and is available on the web at http://asd-www.larc.nasa.gov/cost_model/doc.html.

EOSDIS Resource Management Board

Skip Reber briefed the Panel on the formation of an EOSDIS Resource Management Board (ERMB) by NASA. In many respects the ERMB raises issues similar to the ones being investigated by the Ad Hoc Working Group on Production (AHWGP), but with an emphasis on coordinating and translating this information into real costs. The goal of the ERMB is to keep track of resource requirements for the generation of EOS data products, manage and allocate budget caps if necessary, and encourage Instrument Teams (ITs) to be more efficient with their processing scenarios to stay below any spending cap that may appear in the future. The ERMB was just in the early stages of being formed and discussions were held concerning of acceptable units for resource management (dollars, clock time, etc.), how to acquire an accurate assessment of resources required, what should the mechanism for resource allocation be, and longer term monitoring and management strategies.

Independent Cost Evaluation

In order to fit a 1.5-hour briefing into a half hour we were briefed by Rich Saad on only one DAAC (GSFC). The costs for the GSFC DAAC are right on target when compared to databases of very similar organizations. The results of the three subcontracts were reviewed in their assessment of flight operations, data capture, and science data processing and archiving. "Should costs" for these components were based on common industry practice with a yearly inflation rate of 3.5%. The overall results for GSFC showed that the Independent Cost Evaluation (ICE) was different from the NASA cost estimates by only -3%, the cost model they used had an error range of ± 10%.

There was some discussion that the "should cost" approach used by ICE was based on current industry practices and does not reflect any innovative strategies for reducing cost. Nevertheless, in a "business as usual" sense, the ICE report seems to indicate that EOSDIS costs no more than any other industry effort of similar size, scope, and nature.

Other Presentations

Additional presentations were made by H.K. Ramapriyan on the current federation plans, Joy Colucci on Hughes Science Office status, Paul Fingerman on ECS software reuse strategies, and Menas Kafatos on interfaces and tools for interdisciplinary science. Much of what Ramapriyan presented provided stimulation for what was discussed above. Colucci's presentation was basically an update on science software integration and test, AHWGP studies,

data migration to HDF, and incremental track progress. Fingerman made an abbreviated presentation (due to the lateness of the day) of how parts of ECS can be reused at other locations, demonstrating its flexibility. Kafatos presented "Interfaces and Tools for Interdisciplinary Science in EOSDIS," which was a description of the Virtual Domain Application Data Center (VDADC) engine. The VDADC is an outcome of the George Mason University (GMU) architectural study of 1994 and provides for specialized centers where user communities can access EOS and other Earth science data without overloading EOSDIS.

Physical Oceanography DAAC Users Working Group Meeting

— **Victor Zlotnicki** (vz@pacific.jpl.nasa.gov), Jet Propulsion Laboratory

The Users Working Group (UWG) for the Physical Oceanography DAAC (PO.DAAC) met July 9 and 10 at the Jet Propulsion Laboratory (JPL). Members present were Robert Evans (University of Miami), Ron Fauquet (NOAA/National Ocean Data Center), Michael Freilich (Oregon State University), David Glover (Woods Hole Oceanographic Institution, chair), C.-K. Shum (University of Texas), and Victor Zlotnicki (JPL, PO.DAAC Task Scientist). Members David Adamec (Goddard Space Flight Center), William Emery (University of Colorado, co-chair) and Tim Liu (JPL) could not attend. Also present were Mary Reph (GSFC, ESDIS Project), Joy Colucci (Hughes-EOSDIS Core System, ECS) and Glenn Shirtliffe (Hughes-ECS), as well as PO.DAAC personnel, including Don Collins (Task Manager), Elaine Dobinson (Deputy Manager), Tom Antczack (System), Robert Benada (Datasets), Sanda Mandutianu (Software), and Bill Stromberg (Operations).

The meeting agenda included a presentation and discussion of the proposed FY 97 PO.DAAC Work Plan, a discussion of UWG membership, and an update on the status of recompetition.

TOPEX/Poseidon (T/P) has been flying since August 1992. PO.DAAC will start reprocessing past T/P data by September 1996, while at the same time processing the current T/P data with new algorithms, thus running two processing streams at the same time, one with time-critical dependencies. Over the past months, PO.DAAC has implemented and tested the new algorithms, including a last-minute correction to the recently discovered clock-drift algorithm. The UWG felt that the experience gained in this task will be essential to other parts of EOSDIS, as this mode (reprocessing old data while keeping up with the new data the satellite collects) will be common in the EOS era. The UWG urged PO.DAAC personnel to share this experience in a formal manner with the ESDIS Project.

NSCAT was launched on August 17 (Japan time) onboard ADEOS-I. Much of the FY 97 effort is centered on reformatting, archiving, and distributing NSCAT

data, and helping users with any problems. PO.DAAC has made necessary changes to its internal software and passed readiness reviews with NSCAT personnel. M. Freilich pointed out that a proposed repackaging of NSCAT data required NSCAT Manager approval.

Hughes-ECS Version 1 hardware and software will arrive at PO.DAAC during FY 97. The added hardware and personnel and their space requirements were presented to the UWG. The issue of functions appearing in both ECS personnel plans and JPL personnel plans was discussed. The issue of personnel 'ramp-up' was discussed; people who need to be hired late in a fiscal year but whose funding in the following FY has not been specifically approved by ESDIS. It was recommended that ESDIS approve a personnel profile over 3 years.

Several Pathfinder data sets (reprocessed older satellite data under the NASA Pathfinder Announcement of Opportunity) will be processed or distributed by PO.DAAC during FY 97: AVHRR-oceans, with sea surface temperature; Special Sensor Microwave/Imager (SSM/I) with water vapor, wind speed, ice edge, etc; and altimetry, especially sea level from the ERS-1 satellite. The discussion on these data sets centered on the need to have sufficiently close relationships with the groups doing the processing, so that their data and all pertinent information would migrate smoothly to PO.DAAC and thus to users.

Seawinds is planned for a 1999 launch on ADEOS-II (Japan). There were concerns over the physical data path from Japan. ESDIS is responsible for bringing the data from this U.S. instrument, but since the spacecraft is non-U.S. it seems to fall through the organizational cracks. The UWG advised the PO.DAAC Manager to obtain written confirmation from the ESDIS Project on its responsibility for the physical data path from Japan and its plans to implement it. Another issue associated with Seawinds is the AMSR data; it is necessary for the Seawinds processing, except the 86-GHz channel, so these data will come to Seawinds/PO.DAAC. With the 86-GHz channel, the data are useful to the EOS PM MIMR Team, both to check algorithms and for science applications. The UWG advised PO.DAAC to clarify their needs and plans to use the ADEOS-II AMSR data, and plan for an additional effort on the Seawinds work.

Internal PO.DAAC software to maintain the Version 0 databases will be used for another 5 years, until the transition to Version 1 is complete. Their sustaining engineering and minor improvements are planned for FY 97.

Priorities: The UWG advised PO.DAAC that the following priority should be used in case of a funding shortfall: work on all current missions has higher priority than work on future missions. This specifically means Version 0 support of current missions, then Version 1 support of the same missions, then future missions. It was agreed that doing a bad job on supporting current missions should disqualify any DAAC from future work.

UWG Membership: The UWG accepted the resignations of Lee Fu and Bruce Douglas, and accepted Ron Fauquet as a new member. The UWG advised the PO.DAAC Scientist to invite a member of the EOS MIMR Team to be part of the UWG if the Team agrees for PO.DAAC to handle the ADEOS-II AMSR data. Co-chairs David Glover and William Emery expressed their intention to step down from the Chair, which the UWG accepted. The UWG agreed to the same term limits as other EOS panels (2 years, with another 2-year re-election) for the Chair. By mail vote, the UWG elected David Adamec as the new Chair, and Victor Zlotnicki as *ex-officio* Deputy Chair.

DAAC Recertification: The UWG recommended that the chairs of each of the DAAC UWGs be members of the Recertification Board.

The FY 97 Work Plan was circulated to the UWG for their comments by August 1 and delivered to the ESDIS Project August 9.

The next meeting is planned for January 1997, and will include a review of the Data Migration Plan.

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Merging Over-the-Horizon Radar with Satellite Oceanographic Data

— **T. M. Georges**, NOAA Environmental Technology Laboratory, Boulder, CO
— **J. A. Harlan**, Cooperative Institute for Research in Environmental Sciences, University of Colorado/NOAA, Boulder, CO
— **Paul Chang**, NOAA National Environmental Satellite, Data and Information Service, Camp Springs, MD

The ocean-remote-sensing capabilities of over-the-horizon (OTH) radar and satellite ocean sensors are obviously complementary. OTH radar looks at fixed ocean areas on demand, whereas satellites cover the globe in swaths dictated by orbital dynamics and sensor field-of-view. Furthermore, each of these instruments measures different ocean properties with varying reliability. The prospects of extracting improved products, specifically surface wind fields, by merging satellite and OTH radar data, prompted some tests, whose early results we describe here.

Both active (radar) and passive (radiometer) microwave sensors can be used to determine ocean surface wind speed, and active microwave instruments are also used to derive wind direction, though resolving directional ambiguities has been an ongoing issue. Additionally, recent airborne radiometer systems have demonstrated a capability of determining wind speed and direction using polarimetric and multi-look measurement techniques. Development and refinement of instrumentation and algorithms for ocean surface wind retrieval, and particularly wind direction, is an ongoing process for both active and passive sensors.

OTH radars measure surface wind directions with a two-fold ambiguity that is often resolvable by combining incidental surface observations with meteorological insight [Harlan *et al.*, 1994; Young *et al.*, 1996]. Wind speeds can also be measured in principle, but in practice, ionospheric distortions often severely limit coverage in space and time. Therefore, it seems reason-

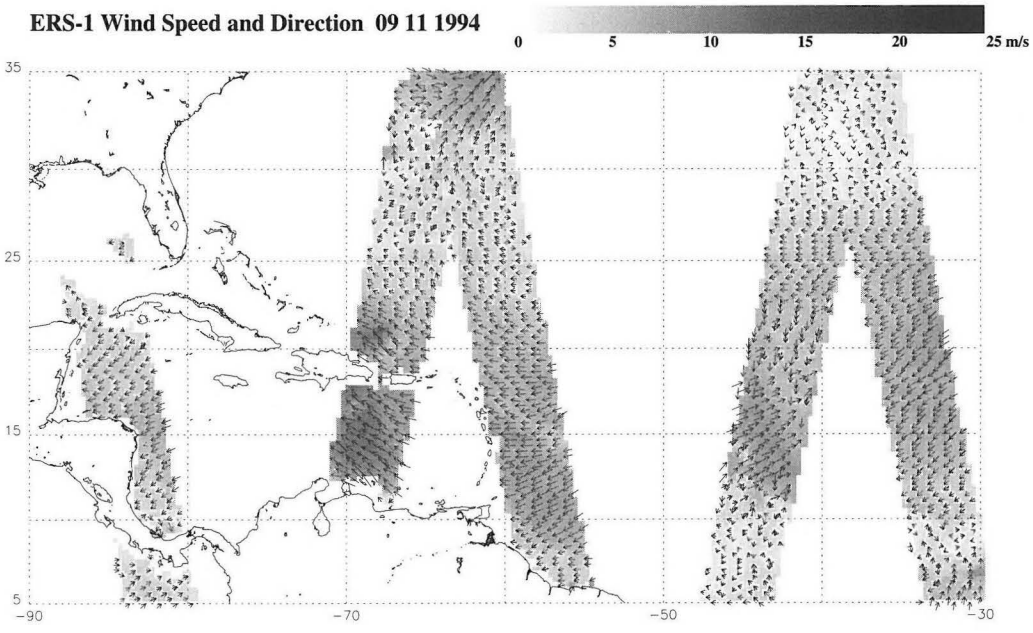

Figure 1. Ocean surface wind speeds and directions (arrows) at 10-m height, derived from 24 hours of ERS-1 scatterometer passes over the North Atlantic Ocean. This fast delivery product was provided by the European Space Agency.

able to combine wind directions derived from OTH radar with wind speeds provided by spaceborne radiometry and scatterometry.

During the 1994 hurricane season, we used the Air Force OTH-B radar system in Maine to map surface wind direction in the tropical Atlantic, for evaluation by the National Hurricane Center [Georges *et al.*, 1995]. We combined these wind directions with the surface wind speeds measured in the same region by the ERS-1 scatterometer and by the Special Sensor Microwave Imager (SSM/I) on the DMSP satellites. The merged products were made available daily on the World Wide Web. Figure 1 displays an example of ERS-1 ocean-surface wind speed (encoded in grey scale) and direction (shown as arrows) at 10-m height, as computed by the European Space Agency (ESA) and provided in their fast delivery product. The empirically-derived algorithm used by ESA to relate normalized radar cross-section to wind speed and direction is referred to as CMOD4 [Offiler, 1994]. The ascending and descending swaths shown represent 24 hours of coverage in the North Atlantic.

Figure 2 shows the same ERS-1 wind speeds encoded in grey scale, but with the wind directions replaced with those measured by the OTH-B in about one hour on the same day. The height to which OTH wind-direction measurements refer is the effective height of the boundary-layer winds that drive decametric ocean waves, within which direction does not change significantly. In this case, the OTH-B directional ambiguity was resolved by simply selecting easterly (rather than westerly) surface flow over the entire region. Within the area mapped by the OTH-B, the spaces between the satellite swaths are filled in with sufficient continuity that the synoptic flow pattern can be discerned. In some parts of Fig. 1, the wind directions given by the ESA fast delivery algorithm are inconsistent, particularly in regions where wind speeds are low.

Figure 3 shows ocean surface wind speed at 19.5-m height calculated from the SSM/I brightness temperature on the same day as Figs. 1 and 2. The SSM/I brightness temperatures used are calculated by the Navy at the Fleet Numerical Meteorology and Oceanography Center (FNMOC). The wind speed algorithm used was developed by Goodberlet et al. [1989]. Again, the OTH-B wind direction field is superimposed. The gaps within the satellite swaths are most likely due to sensor outages in regions of high liquid water content, which obscures the ocean surface. The wind speeds mapped by the active and passive satellite sensors are in reasonable agreement, where there is overlap.

When ambiguities are correctly resolved, scatterometer and OTH wind directions are also in reasonable agreement, although there is some evidence of a bias. Recently, Schollaert et al. [1996] compared OTH-B wind directions measured for 41 days in the tropical and subtropical Atlantic with the Freilich/Dunbar (FD) maximum-likelihood ERS-1 winds in an effort to evaluate the performance of the FD ambiguity removal

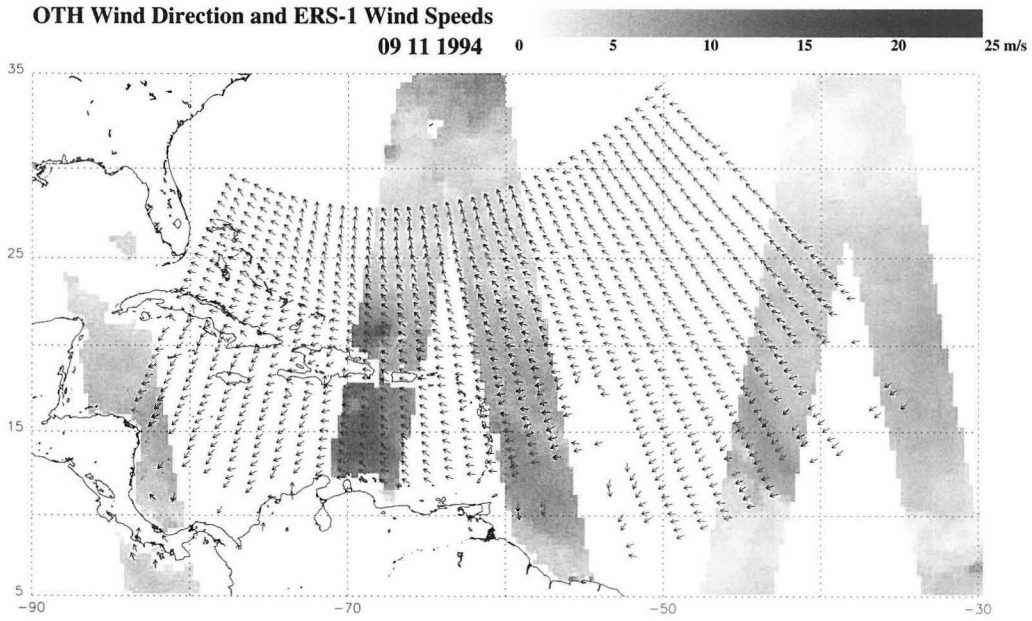

Figure 2. Same as Fig. 1, except that the surface wind directions are replaced by those measured by the U.S. Air Force over-the-horizon (OTH-B) radar in Maine in about one hour.

algorithm. When 1,143 data pairs were analyzed, and the closer OTH direction to ERS-1 was selected, the results of the comparison show that there was a mean directional offset, or bias, of approximately 10°, with the OTH value higher than, i.e., clockwise of, the ERS-1 value. The standard deviation was about 20°. It remains to be determined whether this bias has a geophysical explanation or points to errors in one or both wind-direction algorithms. One physical possibility is that long ocean waves, traveling at an angle with the surface wind, shift the direction of maximum wind stress (and the dominant direction of the short waves seen by the scatterometer) away from the surface wind direction. A consistent bias in the mean long-wave direction compared with the mean surface-wind direction in the region studied could explain the OTH-scatterometer direction bias. Wave climatology for the Atlantic is being studied to examine this hypothesis.

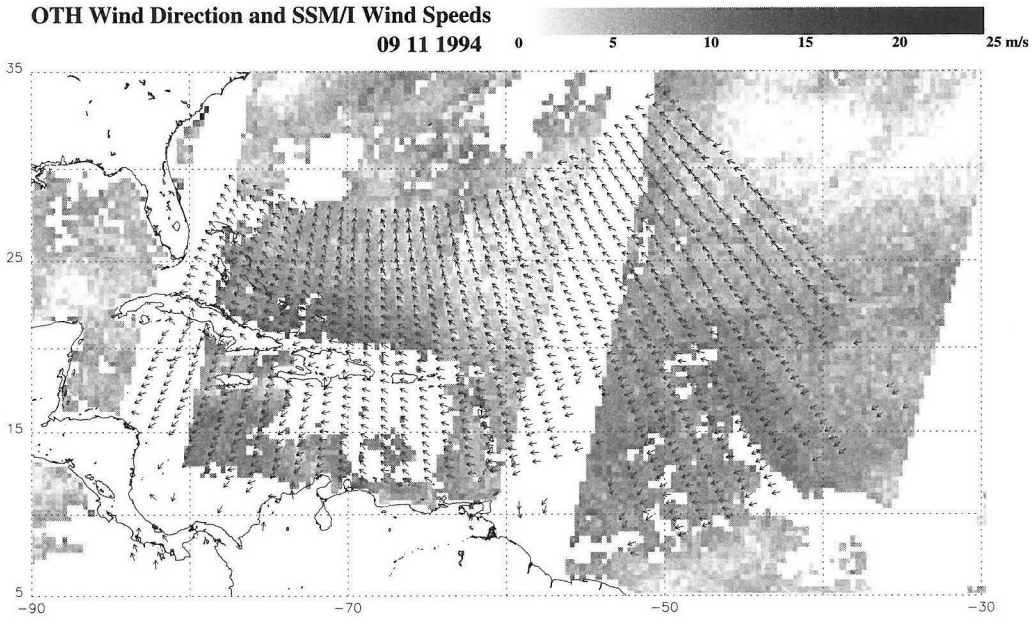

Figure 3. Ocean surface wind speeds at 19.5-m height measured by the SSM/I microwave radiometers aboard two DMSP satellites for the same day as Figs. 1 and 2. Wind directions from the OTH-B radar are superimposed, as in Fig. 2.

Multiple technologies for mapping ocean-surface winds are developing at such a rapid pace that it is premature to judge which will emerge in operational form. It is already clear, however, that existing experimental ground- and space-based techniques complement each other in space and time coverage and resolution, as well as in the reliability of speed and direction measurements. Further studies of merged products should lead to methods for reconstructing surface winds over the ocean with coverage exceeding that now available over the land.

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The VEGETATION Programme

— **Gilbert Saint** (gilbert.saint@cst.cnes.fr), VEGETATION Programme Scientist, CNES DPI/OT, 18 avenue E. Belin, 31055, Toulouse, France

The VEGETATION Programme was undertaken under a partnership between the European Commission, France, Belgium, Sweden, and Italy, to set up a system to monitor the biosphere at medium resolution, taking advantage of the SPOT satellite series with the capability to have simultaneous high-spatial-resolution acquisition with the same spectral bands. It will be ready for launch in December 1997.

Introduction

The overall objectives of the VEGETATION system are to provide accurate measurements of the basic characteristics of vegetation canopies on an operational basis:

- ◊ either for scientific studies involving both regional- and global-scale experiments over long time periods (for example, development of models of the biosphere dynamics interacting with climate models),
- ◊ or for systems designed to monitor important vegetation resources, like crops, pastures, and forests.

The VEGETATION system, consisting of a satellite-borne sensor and its associated ground segment, will provide long-term basic measurements adapted to biosphere studies. Opportunities for scale integration are provided by the combination with the main SPOT instrument (HRVIR) which allows high spatial resolution for detailed modeling activities or multilevel sampling procedures. Availability of data to different types of users is facilitated through the centralization of reception and archiving of global data sets. The launch date (nominally December 1997) and duration of the system (5 years of estimated life time for a first model and continuation on future SPOT satellites) are adapted to a systematic and extensive long-term monitoring of the biosphere.

Clearly, this system will benefit from detailed studies based on other systems that are dedicated to specific studies of the characteristics of remote sensing measurements or to their relationships with surface or process parameters. It must be envisaged that the evolution of the mission specifications will have to take into account results of such studies to provide improved characterization of the biosphere state and dynamics.

Mission Objectives

Surface parameter mapping: This is the basic requirement, especially for climate and meteorological studies, where boundary conditions have to be prescribed as in the case of General Circulation Models (GCMs) or forecasting models. Factors such as albedo, surface roughness, resistance to heat exchange (sensible and latent) are important variables for these models, and they can be either determined directly from the measurements or inferred from identification of land cover. The seasonal and long-term variations of such variables are related to vegetation dynamics. The capability to identify, through these variations, the physical characteristics of land cover is a key to accurate prescription of these variables. Scales addressed in GCM or forecasting models (typically about 100 km) require that land cover and its variability must be determined with a sampling of about 8 to 10 km: the basic spatial resolution needed for identification of land cover and its variability is 1 km.

Agricultural, pastoral, and forest production: Since the beginning of the land surface satellite remote sensing era (1972), important projects (for example LACIE, AGRISTARS for USDA, MARS for CEC, TREES for JRC/ESA...) have been set up to develop methodologies and strategies to use remote sensing data either for mapping of land use in anthropogenized or natural

ecosystems or for estimation of production potential. Their specific objective was to determine the evolution of production. This objective had to be adapted to the management of crop production for agricultural exporting countries, to the monitoring of pastoral resources and their dependence on meteorological evolution, to the evaluation of possible global impacts of deforestation, and more generally to the need for information related to political or social orientations and decisions.

Terrestrial biosphere monitoring and modeling: The contribution of the continental biosphere to the biogeochemical cycles (exchanges of carbon and other trace gases) and to water and energy exchanges is one of the objectives of the development of global models. Interaction with human activities is also one of the main points to be studied, because the effect of human pressure on the biosphere might be one of the means by which man is acting on climate in the long term. Biosphere processes and land cover characterization are the basis for quantification: estimates of land cover variables as well as the dynamics of these variables have to be made in order to obtain a good understanding of these processes upon which models may be built. Predictions of impact of climate change on the biosphere and of interactions of the biosphere with the climate (either due to natural factors or to human pressure) can only be inferred from quantification and formalization of the mechanisms by which vegetation cover and ecosystems function. Multilevel series of models have to be developed and linked, ranging from ground studies, local parameterization and exchange models to regional or global dynamics and interaction models. Remote sensing of the vegetation as shown above offers a unique tool for these developments, providing the specification of the systems be adapted to each particular need.

VEGETATION System Characteristics

Radiometry

Spectral characteristics:

Spectral bands	Wavelength	Surface reflectance range
BLUE	0.43 - 0.47 µm	0.0 - 0.5
RED	0.61 - 0.68 µm	0.0 - 0.5
NIR	0.78 - 0.89 µm	0.0 - 0.7
SWIR	1.58 - 1.75 µm	0.0 - 0.6

Radiometric resolution (NEΔρ):

BLUE	0.003 for the entire range
RED	0.001 up to reflectance of 0.10, linear increase up to 0.003 for reflectance of 0.5
NIR, SWIR	0.003 for the entire range

Intra-image consistency within an entire image, corresponding to a NEΔρ of 0.005 for any reflectance value.

Calibration accuracy:
Interband and Multitemporal: better than 3%
Absolute: better than 5%

Geometry

Spatial resolution:

- In both directions 1.15 km at nadir with minimum variations for off-nadir observations
- Field-of-view: maximum off-nadir observation angle of about 50.5° (~2200 km swath width)

Geometric accuracies:

Local distortion	less than 0.3 pixel
Multispectral registration	0.1 km desired, 0.3 km specified
Co-location with HRVIR	0.3 km for simultaneous acquisitions
Multitemporal registration	0.3 km desired, 0.5 km specified over one year
Location accuracy	better than 500 m desired, 1000 m specified

Spatial coverage:
About 90% of the equatorial areas are imaged each day, the remaining 10% being imaged the next day. For latitudes higher than 35° (North and South), all regions are acquired at least once a day.

Operation specifications:
Equator crossing time (descending node): 10:30 local solar time

Image transmission:
All spectral bands at full spatial resolution acquired on terrestrial areas will be stored on-board in a solid-state-memory, allowing the use of only one receiving station to which data will be transmitted in X band. All the spectral bands will also be transmitted in L band, for possible regional receiving stations.

VEGETATION Products

These standard products have been defined by the International Users' Committee. They are adapted to the particular missions described above and coherent as much as possible with the needs of existing projects. To illustrate the special characteristics of the instrument, high priority was given to design products that would allow direct multitemporal registration as well as simple superposition with simultaneously acquired high-resolution data.

VGT-P Products

These products are adapted for users for whom the physical quality of the data is important. They correspond to data which would have been acquired by an ideal instrument: they are corrected for system errors (misregistration of the different channels, calibration of all the detectors along the line-array detectors for each spectral band) and resampled to geographic projections for multitemporal analysis as well as for comparison with high-resolution data. The accuracies given above apply to this data level. Annotations giving full information on applied corrections (calibration information, geometric parameters taking into account attitude and position on the orbit), or for further non-system corrections ("standard" atmosphere parameters) are attached to the data sets.

VGT-S Products

These products are most probably the data sets which will be frequently used operationally: they correspond to VGT-P data to which corrections have been applied using the annotations and for which some syntheses are provided :

- ◊ A daily synthesis using all available measurements on one day for a specific location.
- ◊ A 10-day synthesis, based on the selection of the "best" measurement of the entire period. The selection could be based on the maximum Normalized Difference Vegetation Index (NDVI) value, as it is commonly accepted today, even if many problems associated with that selection are identified.

To adapt to the evolution of users' needs as well as to the validation of new algorithms, a procedure to regularly update the processing system is requested: it should provide capabilities to include new methods for data correction, synthesis, etc., as soon as they are commonly accepted by the user community.

Support to users will be provided to facilitate the use of VEGETATION data: a catalogue with browsing capability on the data quality (cloudiness) will be accessible through the usual networks. Validated software templates for the common operations for data handling and standard correction will be made widely available.

The Future

To prepare evolution and continuity on the long term, the design of the next system is already being considered, with the objectives:

- ◊ To ensure continuity of service with same basic principles:
  - end users' product availability
  - multiscale approach
  - accuracies (stability in the long term for both radiometry and geometry)
  - regional and global access
- ◊ To provide enhancements at the pace of users' needs: it has already been recognized that the first need for the next system is to improve ground reflectance determination:
  - correct atmospheric and directional effects
  - decrease gap between spatial resolutions (to be further analyzed)
  - characterize directional properties

The next instrument will be launched on SPOT 5, planned around 2002.

Detailed information can be found on the World Wide Web at URL : http://www-vegetation.cst.cnes.fr:8050/

CEOS Global Mapping Task Team Executive Summary — May 1996

— **Mike Botts** (mike.botts@atmos.uah.edu) Chairman of CEOS Global Task

Introduction

The Committee on Earth Observation Satellites (CEOS) is an international organization which aims to achieve coordination in the planning of satellite missions for Earth observation and to maximize the utilization of data from these missions worldwide. Nearly all major space organizations (NASA, European Space Agency (ESA), National Space Development Agency, Japan (NASDA), etc. are CEOS members and many major international scientific programs (IGBP, GCOS, WCRP, etc.) are CEOS affiliates.

The Global Mapping Task Team is a special task force originating out of the subgroup on auxiliary data (ADS) under the former CEOS Working Group on Data (WGD). While addressing global data sets, the ADS frequently encountered the problem that no international recommendations or standards regarding map projections exist to allow presentation of global measurements in a manner suitable for data interchange and intercomparison. Furthermore, it was recognized that the digital era of global mapping offers the potential for alternative mapping schema as the basis for processing, archiving, and distributing data. In particular, these include on-demand mapping capabilities, as well as mapping schema based on spherical tessellation of the Earth's surface rather than 2D flat map projections. The Global Mapping Task Team was established to:

- ◊ investigate the needs and directions for modern global mapping;
- ◊ facilitate the harmonization and standardization of global mapping technology; and
- ◊ chart a path for improved spatial and temporal global mapping within the next decade.

Major Objectives

- ◊ Increase awareness and provide guidance for improvement and harmonization of digital mapping for ongoing, planned, and future programs for Earth observation.
- ◊ Investigate, define, and establish a path for improved spatial and temporal global mapping of digital data within the next decade.

Tactical Plan

- ◊ Coordinate with other committees and agencies to help establish appropriate standards and promote relevant research and development activities.
- ◊ Gather advice from internal and external experts through specialized workshops and research.
- ◊ Gather and publish summaries of international information, data, and software relevant to global mapping issues.
- ◊ Provide reports on state-of-the-art for global mapping, and on needs and directions of global mapping in the next decade.
- ◊ Utilize modern electronic communication technology to maximize efficiency of gathering of information and dissemination of results.

Meetings

Auxiliary Data Subgroup - ADS-10
September 13-15, 1995
Fisherman's Wharf, San Francisco, California

At the ADS-10, the subgroup explored the issue of global mapping and determined that it would be beneficial to recommend to the CEOS Plenary that a Global Mapping Task Team be established, and that the following three areas of foci be considered:

- ◊ Standard 2D map projections
- ◊ Alternative grids based on spherical tessellation
- ◊ On-demand mapping directly from native satellite sensor space

Global Mapping Task Team - GMTT-1
February 28 - March 1, 1996
Global Hydrology and Climate Center, Huntsville, Alabama

The first workshop was directed toward establishing the major objectives, tasks, and tactical plan for the CEOS Global Mapping Task Team (as listed above), and for familiarizing potential task team members with the current state and potential directions for digital mapping.

It was recognized that we are in a transition period with global mapping, driven primarily by the rapid advancement of the digital age. The 2D flat map projection paradigm in global mapping has served us well for over 2000 years when the only medium for geographical studies was a paper map or image. The digital age has altered our tools and the media for distributing and studying geographical data. Perhaps many of the challenges we currently face with regard to mapping and the interuse of gridded data sets have arisen as a result of the use of an inappropriate traditional paradigm within the new digital media.

Two alternative paradigms that will be investigated and reported on by the Task Team include: (1) alternative "ideal" mapping schema based on spherical tessellation of the globe, and (2) on-demand mapping schemes which allow data to be retained and distributed within their native spatial and temporal domains. Examples of these paradigms were presented at the meeting, as were the roles that the task team should play in the investigation and evaluation of these paradigms, as well as the future encouragement and implementation of these schemes within the global mapping communities.

Still, it was felt that there were several areas within the traditional 2D map projection schema in which the task team should provide advice and assistance. These included:

- ◊ standardization of algorithms for map projection transforms;
- ◊ increased awareness and standardization in the use of various datum standards internationally;
- ◊ advice regarding the appropriateness of different projections for different applications and regions of interest;
- ◊ advice and assistance in the measurement and specification of angular, areal, and spatial distortions within map projections; and
- ◊ recommendations concerning requirements for complete and efficient descriptions of projections and grids within data descriptors, e.g., within headers, metadata, etc.

In addition, it was agreed that for all global mapping schema, the issue of resampling needed similar attention with regard to standardization of algorithms, the appropriateness of various methods within different applications, and the measurement and specification of the effects of resampling on the statistical characteristics of the data.

At the recommendation of the workshop participants, a WWW home page has been established for the activities of the CEOS Global Mapping Task Team: **http://vast.uah.edu/ceos/ceos.html**. Within this home page will be:

- ◊ organizational notes (terms of reference, meeting agenda, and notes, etc.);
- ◊ archive and bibliography of relevant publications and reports;
- ◊ archive of relevant URL links;
- ◊ advice, data, algorithms, and software for:
  - map projections
  - datum
  - resampling schemes
  - alternative mapping schema
  - on-demand mapping schemes;
- ◊ executable demos illustrating relevant concepts; and
- ◊ Java and CORBA scripts providing relevant distributed services

Participants:

Mike Botts, University of Alabama in Huntsville (UAH/GHCC)
Pete Conway, UAH/GHCC
Sam Goward, University of Maryland
David Hastings, NOAA-NGDC
Shaobo Huang, Shiba University
Susan Ingenthron, UAH/GHCC
Kent Lethco, USGS/EROS Data Center

Brian Motta, Hughes STX/MSFC DAAC
Peter Mueller, University College, London
Ron Phillips, UAH/GHCC
Achim Roth, DLR, German Remote Sensing Data Center
Gunter Schreier, DLR, German Remote Sensing Data Center.

The next meeting is scheduled for Sioux Falls, South Dakota, USA, the week of September 16-20, 1996.

For further information or if you are interested in participating in the activities of the CEOS Global Mapping Task Team, please contact *Mike Botts* (mike.botts@atmos.uah.edu), Chairman of the CEOS Global Mapping Task Team, or *Gunter Schreier* (schreier@dfd.dlr.de), Chairman of the CEOS Auxiliary Data Subgroup.

United States Department of the Interior
U.S. Geological Survey, Reston, Virginia 22092

Technical Announcement
National Mapping Division
U.S. Geological Survey

Intelligence Satellite Photos Released

— **Donna Scholz** (605) 594-6092

More than 300,000 satellite photographs collected by the U.S. intelligence community between 1960 and 1972 are now available from the U.S. Geological Survey (USGS). You can use the Internet to browse the entire collection on the World Wide Web (URL: http://edcwww.cr.usgs.gov/dclass/dclass.html), or stop by a USGS Earth Science Information Center to get a first-hand view.

This collection adds more than a decade worth of records to the Landsat collection that has been available for civilian use since July 1972. Declassification of these photo reconnaissance missions was authorized by an Executive Order, signed by President Clinton on February 23, 1995. The entire collection of more than 800,000 declassified photos is slated to incrementally reach USGS archives by the end of the summer of 1996.

An online catalog and image browse capability for the photo collection are accessible, at no charge, on the Internet through the U.S. Geological Survey's Global Land Information System (GLIS). For more information about Declassified Intelligence Satellite Photographs (DISP) and how to use the online GLIS catalog for data searching, refer to the World Wide Web DISP user guide at: URL: http://edcwww.cr.usgs.gov/glis/hyper/guide/disp.

For information on ordering Declassified Intelligence Satellite Photographs, contact any Earth Science Information Center or call 1-800-USA-MAPS. The cost of each photograph typically ranges from $12 to $24 plus $3.50 handling on each order.

For technical information on Declassified Intelligence Satellite Photographs contact:
U.S. Geological Survey
EROS Data Center
Customer Services
Sioux Falls, SD 57198
Tel: (605) 594-6151; FAX: (605) 594-6589
Email: custserv@edcmail.cr.usgs.gov

An Overview of the Minority Universities-Space Interdisciplinary Network (MU-SPIN) Resources and Training Sites (NRTS) and a Selection of Their Earth System Science Activities

— **Gloria Brown-Simmons** (gbrown@mica.jpl.nasa.gov), Mission to Planet Earth Program Office, Goddard Space Flight Center

MU-SPIN

The Internet plays a significant role in how NASA, academia, private industry, and other governmental agencies collaborate to achieve scientific, technical, and educational goals. Recognizing that the in-house expertise required to develop and support a campus local area network with an interconnect to the Internet was not common among Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs), NASA's Office of Equal Opportunity Programs created the Minority University-Space Interdisciplinary Network (MU-SPIN) Program in 1991 to improve electronic information exchange, and sharing of computational resources at HBCUs and OMUs participating in NASA-related research.

Since its creation, the MU-SPIN Program, with support from the NASA Headquarters Offices of Mission to Planet Earth (MTPE) and Space Sciences and managed by Goddard Space Flight Center (GSFC), has provided network access and conducted national and regional workshops to achieve these goals. OMUs are defined as Hispanic-Serving Institutions (HSIs), Tribally-Controlled Colleges, and institutions with significant enrollment of underrepresented minority or disabled students.

Institutional Research Awards (IRA)

The Institutional Research Awards (IRA) program provides a quality learning and research environment for underrepresented minorities. Minority institutions and researchers can enhance their research capabilities in NASA-related fields, providing the additional benefit of increasing their ability to enter the mainstream competitive research arena. During 1995, the NASA IRA solicitation provided opportunity for seven minority institutions to serve as Network Resources and Training Sites (NRTS):

Network Resources and Training Sites	*Principal Investigator*
City University of New York	Dr. Shermaine Austin
Elizabeth City State University	Dr. Linda Hayden
Morgan State University	Dr. William Lupton
Prairie View A&M University	Dr. John R. Williams
South Carolina State University	Dr. Donald K. Walter
Tennessee State University	Dr. Willard A. Smith
University of Texas at El Paso	Dr. Michael A. Kolitsky

The NRTS will be responsible for establishing and maintaining internet connectivity as an integral part of at least five other minority institutions and at least one predominantly minority-attended elementary or secondary school research and education activity.

A Selection of Recent Earth System Science Highlights from the NASA NRTS

Users of the City University of New York (CUNY) NRTS participated in the NASA/Goddard Institute for Space Studies (GISS), Institute on Climate and Planets. At the recent 1996 summer conference, students and faculty gave presentations on such topics as: "Climate, Crops and Cash: Applications of Climate Forecasts to Farm Management;" "Causes of Sea Surface Temperature Variability in the Tropical Atlantic;" "The Effect of Global Warming on Precipitation in the United States;" and "Validating Soil Moisture in the GISS GCM: How

Well Can We Predict Droughts and Floods?" A complete catalog of abstracts is available from Carolyn Harris, NASA/GISS.

In 1995, Elizabeth City State University (ECSU) acquired 639 acres of land in the Great Dismal Swamp from the Department of Health, Education and Welfare. The primary purpose of the property is to provide access to a pristine wetlands environment, and to promote public awareness of the crucial role played by wetlands in the coastal plain biome. Recently, the U.S. Department of Education, Title III Program, funded the construction of a half-mile-long boardwalk and observation tower. The U.S. Navy has licensed ECSU to construct 900 feet of the boardwalk over Navy wetlands in order to reach the University property. The boardwalk is accessed through the Navy Security Group Activity, northwest, located in northern Currituck County, NC. Contact Dr. Maurice Powers at ECSU for further information.

Central State University (CSU), Wilberforce, OH, is a partner of the Morgan State University (MSU) NRTS. Through this partnership, all participating NRTS faculty/staff and students can access advanced visualization hardware and software to conduct data analysis activities. During the last two years, faculty and students have spent summer internships at NASA/GSFC to further their knowledge of GSFC research. CSU established a Center for Scientific Visualization (CSV) in 1992 in which the primary research is the development of tools to analyze Earth systems data. Diane Love, Director of the CSV and the Water Resources Management Program at CSU, can be contacted for further information.

Timely technological transfer of Earth system programs and data to the NASA NRTS will help to enable widespread public use of MTPE data and further the process of systematic change in the area of Earth system science in educational institutions. The basic objective of the MTPE Strategic Enterprise Plan is *to foster the development of an informed and environmentally aware public*, which can be, in part, achieved through this process.

MTPE ON THE WORLD WIDE WEB

To make maximum use of the Internet, a Mission to Planet Earth Informal Education Committee has been established to research ways to make the World Wide Web a viable tool for disbursing Mission to Planet Earth information. The Committee recognizes that numerous homepages have been developed concerning various areas of MTPE from science and instruments to the EOSDIS, so one of the first actions is to gather all of the URLs so that they can be properly linked to the Mission to Planet Earth and the EOS Project Science Office homepages.

If you have developed a homepage, or if you know about one that has been developed, please send the URL to: Charlotte.Griner@gsfc.nasa.gov.

Your cooperation in this endeavor will benefit the entire science community.

What's New.....

Check out the latest items on our "What's New" World Wide Web Page:

- Understanding Our Changing Planet: 1996 MTPE Fact Book — URL: http://eospso.gsfc.nasa.gov/eos_publications/fact_book/fact_toc.html
- Payload Panel Report on the GSFC Chem-1 Study — URL: http://eospso.gsfc.nasa.gov/payload/Payload_toc.html
- EOS Calibration Web Page — URL: http://eospso.gsfc.nasa.gov/calibration/calpage.html
- EOS Validation Web Page — URL: http://eospso.gsfc.nasa.gov/validation/valpage.html
- Research Announcement Selection Results — URL: http://www.hq.nasa.gov/office/mtpe/nraselections.html

Ocean Winds and Ozone to be Measured by U.S. Instruments Aboard Japanese Earth Observation Satellite

— **Douglas Isbell**, Headquarters, Washington, DC. (Phone: 202/358-1753)
— **Allen Kenitzer**, Goddard Space Flight Center, Greenbelt, MD. (Phone: 301/286-8955)
— **Mary Hardin**, Jet Propulsion Laboratory, Pasadena, CA. (Phone: 818/354-5011)
— **Patricia Viets**, NOAA/National Environmental Satellite, Data, and Information Service, Suitland, MD. (Phone: 301/457-5005)
— **Hideo Hasegawa/Hiroyuki Ikenono**, National Space Development Agency of Japan, Tokyo (Phone: 81-3-5470-4127)

Excerpts from RELEASE: 96-165

Japan's Advanced Earth Observing Satellite (ADEOS) is carrying the NASA Scatterometer (NSCAT) and Total Ozone Mapping Spectrometer (TOMS) instruments, designed to measure global ocean surface winds and atmospheric ozone content, as part of an international climate change research mission that began with the ADEOS launch from Tanegashima Space Center in Japan on August 17.

"ADEOS is the first in a series of major collaborative efforts between NASA and the National Space Development Agency of Japan in the area of Earth remote sensing," said William Townsend, Acting Associate Administrator for NASA's Office of Mission to Planet Earth. "As such, it is a superb example of increasing international cooperation between the United States and other spacefaring nations of the world in generating a better understanding of our planet and its complex climate."

Taking advantage of the natural reflection, or "backscattering," of radar pulses by wind-driven ripples in ocean waves, NSCAT will make 190,000 measurements per day of the speed and direction of winds within about 1.5 inches of the ocean surface. These winds directly affect the turbulent exchanges of heat, moisture, and greenhouse gases between the atmosphere and the ocean. These air-sea exchanges, in turn, help determine regional weather patterns and shape global climate.

"NASA researchers will use the data to understand the interface between the Earth's two great fluids: the oceans and the atmosphere," said Jim Graf, NSCAT project manager at NASA's Jet Propulsion Laboratory, Pasadena, CA. "Understanding and characterizing this interface is critical to better scientific understanding of global warming, the El Niño phenomenon, and other studies of the Earth as a total system. In addition, seafaring organizations that transport goods and passengers across the oceans can use the data from NSCAT to steer their ships more safely and economically."

Covering more than 90 percent of the globe every two days, NSCAT will provide more than 100 times the amount of ocean wind information currently available from ship reports, according to Graf. Since NSCAT is a radar instrument, it is capable of taking data day and night, regardless of sunlight or weather conditions.

The launch of a TOMS sensor aboard ADEOS will help extend the unique data set of global total column ozone measurements begun by a TOMS carried aboard NASA's Nimbus-7 satellite in 1978. "TOMS/ADEOS will continue this global mapping, while the NASA TOMS Earth Probe satellite, launched into a lower orbit in July, will compensate for cloud-covered regions and provide higher-resolution measurements of tropospheric aerosols and pollutants," said Phil Sabelhaus, manager of the Total Ozone Mapping Spectrometer Project at NASA's Goddard Space Flight Center, Greenbelt, MD.

Data from both NSCAT and TOMS/ADEOS "will be very valuable to the National Weather Service," said Susan Zevin, Deputy Director for the National Weather Service, an agency of the National Oceanic and Atmo-

spheric Administration. The ocean surface wind measurements, used in numerical models, will help local weather forecasters more accurately predict the path and intensity of hurricanes, winter storms, and other weather systems that form over the oceans. The ozone data will be used by the National Weather Service to monitor volcanic ash in the atmosphere to improve aviation safety, and to help generate a daily forecast of ultraviolet exposure levels to help reduce peoples' overexposure to the Sun's rays.

Other science instruments on ADEOS provided by agencies in Japan and France will study ocean chlorophyll production and ocean temperature, land vegetation distribution, the vertical profile of atmospheric gases such as carbon dioxide, methane, and water vapor, and the polarization and direction of solar energy reflected by the Earth.

Thematic Guide on The Use of Satellite Remote Sensing to Study the Human Dimensions of Global Environmental Change

— **Mitchel K. Hobish** (mkh@sciential.com)

The Consortium for International Earth Science Information Network (CIESIN) is pleased to announce the availability of its thematic guide titled *The Use of Satellite Remote Sensing to Study the Human Dimensions of Global Environmental Change*. This is the latest in a collection of thematic guides to key issues in the area of human dimensions of global environmental change published by CIESIN. The guide can be reached at the following universal resource locator (URL):

http://www.ciesin.org/TG/RS/RS-home.html

The purpose of this guide is to help you find selected key documents and data sets vital to understanding the use of satellite remote sensing to study the human dimensions of global environmental change. Satellite remote-sensing technology and the science associated with evaluation of its data offer potentially valuable information for assisting human dimensions research studies. This guide contains an overview and five subsections that offer in-depth information and on-line references for the following topics:

- ◊ Satellite Remote Sensing and Its Role in Global Change Research
- ◊ Uses of Satellite Image Data for Assisting Human Dimensions Studies of Global Environmental Change
- ◊ Satellite Sensors Useful for Human Dimensions Research
- ◊ Systems for Archiving, Managing, and Distributing Satellite Image Data
- ◊ Collections of Satellite Image Data Developed for Global Change Research with Utility for Human Dimensions Studies

For additional information about this thematic guide, contact User Services at ciesin.info@ciesin.org or call (517) 797-2727 between 8 a.m. and 5 p.m. Monday through Friday.

Science Calendar

October 9-11	MODIS Science Team Meeting - University of Maryland, University College Conference Center. Contact Barbara Conboy, tel. (301) 286-5411, Email: BARBARA.CONBOY@GSFC.NASA.GOV.
October 17-18	SWAMP Meeting - Location (TBD). Contact: Francesco Bordi, tel. (301) 464-7478, Email: fbordi@pop400.gsfc.nasa.gov
October 18	SEC Meeting - Chicago O'Hare International Airport, Chicago, IL Contact: Eric Barron, tel. (814) 865-1619, Email: eric@essc.psu.edu
October 22-23	AMSR Science Team Meeting - NASA/Goddard Space Flight Center. Contact Elena Lobl, tel. (205) 922-5912, Email: ELENA.LOBL@MSFC.NASA.GOV.
October 29-31	AIRS Science Team Meeting - University of Maryland, Baltimore Campus. Contact George Aumann, tel. (818) 354-6865, Email: HHA@AIRS1.JPL.NASA.GOV
October 29-31,	TES Science Team Meeting - Doubletree Inn, Pasadena, CA. Contact Reinhard Beer, tel. (818) 354-4748, EMAIL: beer@caesar.jpl.nasa.gov
November 4-5	Polar DAAC Group (PoDAG) Meeting - CIRES, University of Colorado, Boulder, CO. Contact: Koni Steffen, tel. (303) 492-4524, Email: koni@seaice.colorado.edu
November 5-7	LPDAAC Science Advisory Panel Meeting - EROSData Center. Contact G. Bryan Bailey, Email: G.=Bryan=Bailey%ssb%EDC@edcserver1.cr.usgs.gov
November 6-7	Data System Working Group Meeting/QA Workshop -Greenbelt Area. Contact: Skip Reber, tel. (301) 286-6534, Email: reber@skip.gsfc.nasa.gov
December 2-6	12th ASTER Science Team Meeting - Pacifico Yokohama Conference Center, Yokohama, Japan. Contact H. Tsu, tel. 011+81-3-3533-9380, Email: TSU@ERSDAC.OR.JP, or Anne Kahle, tel. (818) 354-7265, Email: ANNE@ASTER.JPL.NASA.GOV.

Global Change Calendar

October 27-30	Geological Society of America Conference, Denver, CO. Contact Matt Ball, tel. (303) 447-2020, FAX (303) 447-1133, Email: MBALL@GEOSOCIETY.ORG, WWW: http://www.geosociety.org.
November 4-7	ECO-INFORMA '96 — Global Networks for Environmental Information: Bridging the Gap Between Knowledge and Application, Lake Buena Vista, FL. Contact Robert Rogers, tel. (313) 994-1200, ext. 3234, FAX (313) 994-5123. In Europe, contact Otto Hutzinger, tel. (49) 921 552 245 or 155.
December 15-19	AGU 1996 Fall Meeting, San Francisco, California. Contact Karol Snyder, tel. (202) 939-3205.
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January 26-30	Space Technology and Applications International Forum, Albuquerque, NM. Contact Professor Mohamel S. El-Genk, tel. (505) 277-2813/0446/4950, FAX (505) 277-2814/5433.
February 3-6	AMS 77th Annual Meeting, Long Beach, California. Contact Monica Tolson, Tel. (202) 682-9006.
February 13-18	AAAS Annual Meeting and Science Innovation Exposition, Seattle, WA. Contact Dee Velencia, tel. (202) 326-6417, FAX (202) 842-1065.

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