Earth Observing System

THE EARTH OBSERVER

September/October 2001 Vol. 13 No. 5

In this issue

EDITOR'S CORNER

Michael King
EOS Senior Project Scientist

I'm pleased to report that the Appropriations bill that provides funding to the Veterans Administration, Department of Housing and Urban Development, and Independent Agencies (including NASA) for FY2002 has been submitted to the President for approval. The bill appropriates $14.79B for NASA for FY 2002, which is $540M more than the FY 2001 budget. The bill allocates $1.573 billion for Earth science programs, an increase of $58.5M to the budget request.

The Earth science budget includes $40.5 M in specific earmarks, which includes an increase of $23.5M for the Synergy program to develop additional uses for EOS data, and an increase of $6M for the EOSDIS Core System to expand its data processing and distribution capabilities. The allocation of some earmarks to account for a $17.5M general reduction in the FY02 initial operating plan was not finished at the time of printing, and may impact the overall budget for the Earth science program.

The EOS Investigators Working Group meeting was held October 30 - November 1 at the Adam's Mark Hotel in San Antonio, Texas. The EOS IWG meeting is the primary forum for sharing information on NASA's Earth science program and its scientific accomplishments. Several EOS Program Managers and Project Scientists presented updates on strategic planning, current and future missions, and the EOS Data and Information System. The format of the science portion of the meeting followed the ESE science research strategy, which is based on questions (variabilities, forcing, response, consequence, prediction) rather than science themes (e.g., atmosphere, ocean, etc.). Specifically, separate sessions were organized around long-term variabilities in the biosphere, their geophysical forcings, and the process-oriented campaigns (or responses) designed to study them. A final session on numerical weather and climate predictions addressed new climate model capabilities and data assimilation. This format represents a broader view of Earth system science, and stimulates thought on individual contributions to the overall EOS Science plan. In addition to the plenary sessions, several science team

(Continued on page 2)

meetings and posters session were also held. Look for a detailed description of the meeting in the next issue of *The Earth Observer*.

The Earth System Science Pathfinder (ESSP) program has approved six proposals for potential ESSP missions, each with a specific scientific objective. Two missions have been accepted to address passive and active microwave measurements of soil moisture, and one each for studying natural hazards, carbon dioxide, ocean topography, and ocean salinity. This is the first step in a two step mission selection process, which will be narrowed to three or four proposed missions undergoing design reviews, followed by two final selected missions funded at $125M each not including launch services.

The Ozone Monitoring Instrument (OMI) Algorithm Theoretical Basis Document (ATBD) review originally scheduled for November 5 has been postponed to January or February of 2002. The postponement was necessary due to recent travel restrictions imposed on the Dutch-led OMI Science Team. Four algorithm documents have been prepared describing the instrument and Level 1B data processing; ozone product; cloud; aerosol and radiation product; and trace gas product. A written review of these documents is currently underway. OMI is part of the Aura payload, which includes three other atmospheric chemistry instruments.

Finally, I'm happy to report that the SAGE III Instrument and Test Team have completed testing with the Meteor 3M spacecraft in Russia, and the mission is scheduled to launch on December 5, 2001. This joint U.S.-Russia mission has faced many technical and logistical challenges over the past several months, including significant disruptions in the wake of the events of September 11. SAGE III will continue important measurements of atmospheric chemistry and aerosols obtained from the SAGE I and SAGE II missions, and provide a continuous data record of these parameters through the EOS Aura mission currently scheduled for July 2003.

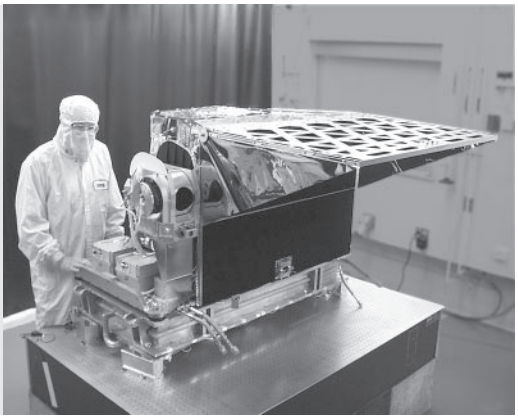
KUDOS

The William Nordberg Memorial Award for Earth Science is given annually to a Scientist of the Goddard Space Flight Center who best exhibits the characteristics of Dr. Nordberg's career: broad scientific perspective, enthusiastic programmatic and technical leadership on the national and international levels, wide recognition by peers, and substantial research accomplishments in understanding Earth System processes. This year's award is presented to Dr. Michael King for his outstanding leadership as the Senior Project Scientist for the NASA Earth Observing System (EOS) and his scientific contribution in the field of radiative transfer and its application to ground-based, airborne, and satellite remote sensing techniques of clouds and aerosols.

In his position as the EOS Senior Project Scientist, Dr. King skillfully orchestrated the day-to-day interfacing of the Earth Science community with NASA's Earth Science Enterprise. This is probably one of the most difficult tasks in NASA with tremendous responsibility and complexity which, therefore, earned him the admiration of the Earth science community. In parallel to this leadership role, Dr. King continued to lead outstanding research into radiative transfer through aerosols and clouds, development of mathematical methods to retrieve atmospheric properties from remote sensing data, development of instruments for remote sensing, and design of field experiments. Many of his numerous scientific papers are cornerstones in the community with more than 100 citations.

Summary of the AIRS Science Team Meeting June 19-21, 2001, Pasadena, CA

— George Aumann (aumann@jpl.nasa.gov), Jet Propulsion Laboratory



George Aumann presented an overview of AIRS Hardware, Level 1B Status, the Data Assimilation Workshops, Title/Authors for the EOS-Aqua Pre-launch IEEE papers, Validation Support lead scientists and proposal titles, and the high-level timeline from the EOS Aqua launch until launch + 18 months.

Session 1. Team Exercise Results

The second team exercise during the last week of May 2001 was designed to test key capabilities of the Product Generation Software (PGS) and the validation support software at JPL. Mike Gunson gave an overview of the objectives: clear field identification, matchup software, and bias estimation.

Details of the cloud generation algorithm used to simulate the data (based on the December 15, 2000, NCEP forecast) were presented by Evan Fishbein.

a) Clear Flag and Cloud-Clearing: While the AIRS T(p), q(p) retrieval algorithm works under clear and cloudy conditions, the evaluation of (observed-calculated) statistics where the truth is known requires the identification of clear fields of view. An AIRS field-of-view (FOV) is defined as "clear" if the effect of clouds on the observed radiances is less than the instrumental noise, i.e., significantly less than 0.5 K. This definition corresponds to about 1% high clouds in the FOV. Catherine Gautier presented details of the VIS/NIR clear filter algorithm, which has been refined using MODIS Terra data to simulate AIRS data. In addition, the algorithm uses the AMSU and AIRS thermal IR surface to select surface type-dependent thresholds. Hofstadter showed results of this algorithm using representative granules of AIRS simulated data from the team exercise. Mitch Goldberg discussed improvements in the "Clear FOV" identification algorithm that works at day and night and detects less than 2% clouds. Shortwave windows channels are more sensitive to clouds than longwave window channels because the Planck function is non-linear under partly cloudy conditions. At night, shortwave and longwave windows for overcast conditions are similar. However, during day time the reflected solar radiation allows detection of clouds, since the predictor coefficients are derived from clear data.

Joel Susskind described the algorithm and performance of the "Clear flag," which is integrated into the first pass cloud clearing algorithm. It detects 1% cloud cover, but it cannot be used reliably early on, since it is sensitive to the accurate knowledge of the

radiative transfer, i.e., the (observed-calculated) statistical properties for clear cases have to be known. Since the systematic bias correction algorithm will not be ready until about launch + 5 months, he is working on an "early data" version of the "clear flag" algorithm. Susskind then discussed the performance of the cloud-clearing algorithm and the T(p), q(p) retrieval under clear and cloudy conditions. The algorithm works under clear conditions and with a single cloud formation, but additional work is required to get acceptable performance in the presence of multiple cloud formations.

Dave Staelin reported that he experienced difficulties with cloud-clearing data from the NAST I/M Andros Island 1998 CAMEX III ER-2 flight. Bob Atlas (DAO) pointed out that in the meteorological community "clear" is defined as less than 10% visual cloud cover reported by the surface observer.

b) Bias Estimation: Reliable estimation of bias in calculated-observed statistics (using clear data) and bias elimination in the Level 2 software ("tuning") is key to achieving accurate retrievals. Larry McMillin presented the status of the software. The bias estimation software uses conventional (routinely launched) radiosondes, ACARS reports, ARM data with multiple sensors and well characterized accuracy, buoys, surface observations, ozone soundings, and GPS water vapor. The tuning software, which applies the bias during the retrieval process, has not been tested. Ed Olsen presented results of matching up routine RAOBs with the December 15, 2000, simulated data as part of the bias estimation effort. Current matchup analysis is L2-retrieval oriented, i.e., it assumes that retrieval algorithms are "ready" under clear and cloudy conditions. There appear to be quality control problems with the "quality controlled" PREQC files: dubious quality radiosondes are leaking in, such as truncated profiles and profiles containing discontinuities. Of the 2,265 collocations with AIRS overpasses (3-hour, 100-km window) there were 728 invalid profiles (all temperatures nonphysical). Eric Fetzer presented results of match-up of AIRS to ARM CART Soundings and AVN Grids within a ~25 km / 1-hr window in the simulated data. In order to achieve the best estimate of the state of the atmosphere during ARM CART overpasses, the meteorological conditions have to be stable (and preferably clear). Supplemental information about the synoptic state (e. g., satellite imagery, model analyses) is needed to identify these desirable conditions.

The Sea Surface Temperature (SST) will be used for the early assessment of instrumental bias validation of the Level 1b (under clear conditions), and later for the validation of the Level 2 retrieved surface temperature under clear and cloudy conditions. Denise Hagan presented the status of SST information. The primary source of SST information is floating buoys. Hagan showed that use of the NCEP_TSurf_Forecast over ocean is an attractive alternative. For December 15, 2000, and over tropical ocean, NCEP_TSurf_Forecast-buoy has a mean of zero and about 0.5 K standard deviation.

Mike Gunson summarized the results from the May 2001 team exercise: 1) the RAOB and AVN matchup capability, which is the first step to "tuning," has been demonstrated. However, 2) tuning still needs to be implemented and tested. As a result, 3) without tuning the Level 2 software rejected the data, i.e., no successful retrievals were made with biased radiances without tuning. Larrabee Strow found the exercise very valuable for analysis software development: 1) not many radiosonde matches, particularly under clear conditions and over water (where the surface emissivity is simpler than over land); 2) simulated bias did not mimic the likely patterns due to radiometric or spectroscopy errors; 3) absence of the cirrus in the data may be misleading the algorithm development in the 10 μm window area.

Session 2. Data Validation and Quality Assessment

Mike Gunson summarized the AIRS Validation Plan between launch and launch + 12 months. The presentation clarified JPL's role in support of the Science Team validation activities, including: zeroth order check on all data within 24 hours to ensure important fields are filled within reasonable bounds; and check QA flags set in processing, match-up truth with observed data, data archiving, and the analysis of bias trends. The time resolution of the Validation Plan with respect to specific analysis activities at JPL and by science team members not at JPL has to be improved to allow efficient and rapid validation to meet the launch + 12 month scheduled start for the release of validated data products from the DAAC. Eric Fetzer presented an update to the AIRS Data Quality Assessment Plan (V.2.0), AIRS automatic QA, manual QA, and QA trending. The AIRS Science team is ultimately responsible for setting data release criteria; the QA indicators assist

this process. The TLSCF Data System (TDS) supports access to the Level 1b data (first year only) and all QA data for the lifetime of AIRS at JPL. The TDS hardware has been assembled in a 20 x 15 ft computer room (with special fire suppression, power backup, etc). Quentin Sun's presentation provided details about the file-structure and access methods.

Mitch Goldberg plans to make use of the NOAA-16 validation support system already set up at NESDIS for AIRS validation. The NOAA-16 orbit is very similar to the Aqua orbit. The NOAA-16 operational matchup files are available every day. As an example: of the 351 NOAA-16 matchups for May 25, 2001, 316 also match the AIRS window. He also plans to compare AIRS/AMSU/HSB retrievals with ATOVS retrievals. Larry McMillin's validation effort at NOAA/NESDIS will make use of all truth data available to AIRS: routinely launched radiosondes, ACARS reports, ARM data with multiple sensors and well characterized accuracy, buoys, surface observations, ozone soundings, and GPS water vapor soundings.

In order to evaluate the accuracy of the AIRS temperature and moisture profile retrievals, the true state of the atmosphere at selected locations, like ARM/CART, has to be measured significantly more accurate than 1 K/1 km for temperature and 10%/2 km for moisture. This accuracy is achieved by using the combined analysis of research grade radiosondes launched at the EOS Aqua overpass, uplooking AERI, microwave radiometers, Lidar, and GPS. Bob Knutsen reported on the status of the data transfer and analysis of ARM/CART data to be collected during the AIRS intensive validation campaign and the type of data analysis activity planned at the University of Wisconsin for AIRS data. Dave Tobin's estimate of the state of the atmosphere (measuring T(p), q(p), etc.) as part of an AIRS overflight is expected to be significantly more accurate than the AIRS single profile accuracy requirement, but does require stable weather conditions to obtain the data. Data obtained by the SHIS during SAFARI 2000 validation campaign were used to illustrate the various AIRS validation activities planned at the University of Wisconsin.

Bob Atlas, GSCF DAO, has been funded to support the AIRS validation effort via the EOS Aqua Validation NRA. His team will start with the global evaluation of calculated DAO analysis - observed for clear conditions as soon as the AIRS instrument has stabilized in orbit (about launch + 3 months). They will then progress to the evaluation and ultimate assimilation of cloud-cleared radiances and T(p), q(p) retrievals. The early assessment of the impact of AIRS data on the forecast will be based on improvements in the six-hour forecast of RAOBs and the 500 hPa height.

Roberto Calheiros discussed the status of the AIRS Validation support effort in Brazil. The direct validation data sites are now set up: nine weather radar sites, seven RAWIN sites (including the island of Trinidad, about 1100 km east of Rio de Janeiro), and one GPS site. Collaborations between Brazil and Chile (Easter Islands, about 4000 km west of Santiago, Chile), Peru, and Paraguay have not been finalized. The data analysis effort in Brazil will focus on the HSB soundings and HSB precipitation results.

Peter Schlussel presented details of the support provided by the two AIRS Validation sites recently selected by EUMETSAT: Garmisch (Germany) and Tolouse (France). Characterization of the atmospheric state with an accuracy of 0.5 K in temperature and 10% in absolute humidity at a vertical resolution of 0.5 km is expected and is consistent with the 1 K/1 km; 10% moisture/2 km retrieval accuracy achievable with AIRS.

Session 3. Level 2 Workshop

The Level 2 workshop dealt with the details of the Level 2 Product Generation Executive (PGE) and the validation and analysis support software. This is summarized in the presentation by Sung-Yung Lee and the action item list.

The next AIRS Science Team meeting is scheduled for November 6, 7 and 8, 2001, in Pasadena. The focus point will be specific analysis activities at the TLSCF and by the various science team members during the first 3 months after launch.

Multi-angle Imaging SpectroRadiometer (MISR) Science Team Meeting

— *David J. Diner (David.J.Diner@jpl.nasa.gov), MISR Principal Investigator, JPL*

The MISR Science Team met in June 2001 at the Sheraton Pasadena Hotel. The MISR Principal Investigator, Dave Diner of JPL, welcomed the meeting participants and outlined the meeting objectives, which were to prioritize the next phase of work toward completing the project's basic commitments; agree upon product maturity definitions (alpha, beta, provisional, validated); agree upon transition criteria for key parameters; establish practical ways to maximize team interactions and communication; and establish practical ways to maximize MISR's impact and relevance to the scientific community and the public.

Graham Bothwell, the MISR Project Manager at JPL, reviewed the status of MISR instrument operations and the MISR science data system. Overall the instrument has been performing superbly. A new flight software load was put in place on May 22, 2001, to enable keeping the cameras powered while on the night side of the orbit, but keeping data flow inhibited. Having the cameras continuously powered significantly reduces thermal cycling and associated stresses on circuit boards within the camera support electronics. Various upgrades and patches to the ground data system to improve robustness and performance were described. Transition of most products from beta to provisional status is envisioned for late 2001 or early 2002. Jeff Walter of the NASA Langley DAAC presented the data processing operations status at the Atmospheric Sciences Data Center. Level 1 data have been in routine production since June 2000 and Level 2 since February 2001. Level 3 production is undergoing testing. Owing to various upgrades and fixes, a factor of two improvement in production performance was achieved in the December 2000 time frame. These presentations were followed by Mark Apolinski of JPL, who discussed the status of the MISR data product quality assessment (QA) system.

Representatives Charlene Welch and Nancy Ritchey of LaRC DAAC User Services discussed the status of MISR data distribution. Organizations in many different states and countries have been receiving MISR data and the image CD-ROM prepared by the DAAC. Licenses for misr_view software have also been widely distributed. Robin Pfister of GSFC accepted feedback from the MISR team on issues regarding the EOS Data Gateway.

The capabilities of several MISR data handling software packages were discussed next. Jeffrey Hall and Charles Thompson of JPL described recent upgrades to the misr_view tool, which is used to display and analyze MISR Level 1B2 and Level 2 data products. Brian Rheingans of JPL showed examples of a reprojection tool he developed that takes MISR Space Oblique Mercator data and resamples the data to a large number of other map projections and enables the generation of image mosaics in GeoTIFF format.

Status and performance of Level 1 software were presented by Kyle Miller of JPL. Several specialized patches to the software have been put in place to deal with various idiosyncrasies of the MISR instrument and the spacecraft data system. Carol Bruegge of JPL described the work of the radiometric calibration team. A number of independent data sources has been examined in order to establish the absolute radiometric scale; the on-board detector-based approach has not worked as well as hoped due to suspected incorrect prelaunch compensation for out-of-band radiation, so greater reliance has been placed on vicarious techniques. However, most of the on-board calibration photodiodes have been very stable since launch and thus provide a good measure of camera response as a function of time. Veljko Jovanovic of JPL next described geometric calibration. Georectification has been accurate to within 1 pixel, with the exception of the most oblique aft camera, where the errors are about twice as large. The reasons are being investigated and implementation of reference orbit imagery, which was planned prior to launch and is in the process of generation, is expected to reduce these errors to better than 1 pixel for all cameras.

Larry Di Girolamo of the University of Illinois summarized the Terra Cloud Mask Workshop which was held in Madison, WI, on May 8-9, 2001. That meeting was a good opportunity for interchange among scientists from various Terra teams. MISR will participate in the Terra Cloud Mask Intercomparison Project. With regard to specifics of the MISR cloud masks, Di Girolamo described how the Band Differenced Angular Signature does an excellent job of distinguishing clouds from snow and ice. Analysis of the Stereoscopically Derived Cloud Mask led to a recommendation to change the threshold that distinguishes cloud from surface terrain.

Science presentations were made by a number of MISR team members and their associates. These included Tom Ackerman and Roger Marchand of PNNL; Eugene Clothiaux of Penn State; Roger Davies and Catherine Moroney of the University of Arizona; Peter Muller of UCL; John Martonchik, Jim Conel, and Ralph Kahn of JPL; Chris Borel of LANL; Juri Knyazikhin of Boston University; Michel Verstraete and Jean-Luc Widlowski of JRC; and Anne Nolin of NSIDC/CU. Science results making use of MISR data that were discussed included distinguishing spherical from non-spherical aerosol particles, differentiating ice types, detecting subpixel heterogeneity in vegetation canopies, and assessing three-dimensional radiative transfer effects in cloud property retrievals. Don Frank of the GSFC Data Assimilation Office discussed plans to assess the impact of MISR cloud heights and cloud-tracked winds on the DAO numerical analyses. A new format of short (15 minute) presentations followed by informal, interactive poster presentations was tried. This enabled a number of individuals not directly affiliated with the MISR team to display posters on their analyses of MISR data and comparisons with other sensors, such as MODIS and ground-truth data.

Data product maturity definitions (alpha, beta, provisional, validated) were reviewed by the team. A set of definitions was agreed upon and it was decided that they would be published on the MISR web site (www-misr.jpl.nasa.gov). Criteria for transitioning data products from beta to provisional, and from provisional to validated were reviewed by the team. Susan Paradise and Kathleen Crean of JPL described the current status of the Level 2 Top-of-Atmosphere/Cloud and Aerosol/Surface products, respectively, and Bob Vargo and Earl Hansen of JPL assisted in moderating the discussions regarding product maturity transitions. It was agreed that the criteria would be published on the MISR web site.

Plans for building a user base and constituency for multi-angle data were discussed, including preparations for a special section of IEEE Transactions on Geoscience and Remote Sensing devoted to MISR, and participation in the third International Workshop on Multiangular Measurements and Models, to be held in Steamboat Springs, CO, in June 2002 (cires.colorado.edu/iwmmm-3/).

Methods of dealing with the large volume of MISR data were discussed, including presentations on the status of Level 3 products from Amy Braverman and Mike Smyth of JPL. Level 3 products are planned to be of two types: component products, which contain means, variances, and covariances derived from individual Level 1 and Level 2 products; and joint products, which contain global data summaries that involve parameters from multiple Level 2 products. Additionally, the joint products use an entropy-constrained vector quantization approach for data compression. Dennis DeCoste of JPL described the application of data mining techniques to MISR data.

Veljko Jovanovic presented the status of AirMISR data processing. Discussion among the team placed the highest priority on achieving accurate georectification and registration, with the next priority being the generation of an atmospherically corrected Level 2 product that can be used as a link between field-scale bidirectional measurements from PARABOLA and coarser scales from MISR.

Action items from the meeting were recorded and summarized by Graham Bothwell. Following an agreement to hold the next meeting near the time of the next AGU meeting (December 2001), the meeting was adjourned.

MODIS Land Rapid Response: Operational Use of Terra Data for USFS Wildfire Management

— *Rob Sohlberg (rsohlber@geog.umd.edu), MODIS SCF, Department of Geography, University of Maryland*
— *Jacques Descloitres (jack@ltpmail.gsfc.nasa.gov), Rapid Response System Manager, NASA Goddard Space Flight Center*
— *Tom Bobbe (tbobbe@fs.fed.us), Center Manager, Remote Sensing Applications Center, USDA Forest Service*

Background

Wildfire incidences in 2000 and 2001 have been larger, more frequent, and more numerous than those seen in the conterminous United States during recent years. The sheer number of these events during the peak of the fire season has severely taxed federal and state wildfire management resources. Near real-time Terra data are now being used by the federal wildfire community to assist in the strategic allocation of assets and in post-fire rehabilitation efforts.

Here we describe a new system, MODIS Land Rapid Response, that delivers a range of time-critical data to the USDA Forest Service (USFS), the National Interagency Fire Center (NIFC), and other federal and state users. This project has been made possible through a unique collaboration between staff at NASA Goddard Space Flight Center (Code 922), the Department of Geography at the University of Maryland (UMD), and the USFS Remote Sensing Applications Center (RSAC).

The project is rooted in the 2000 wildfire season, when scientists from the MODIS Land Discipline Group (MODLAND) created a series of hand-crafted imagery products in the aftermath of multiple large fires in the Idaho/Montana border region. The team assembled included members of Chris Justice's MODIS Fire group, Yoram Kaufman's Smoke and Aerosol group, and Wei Min Hao at the USFS Fire Science Lab (FSL). During this exercise, it became apparent that there was a significant contribution that Terra data could make to wildfire suppression and rehabilitation–but time was of the essence. In fact, for the purposes of active fire management, any data that are more than 24 hours old are of very limited value.

To address this need, Tom Bobbe's group at the USFS-RSAC initiated an effort to explore options for obtaining and processing MODIS data within hours of sensor acquisition. A partnership was forged including MODLAND scientists at NASA and UMD, as well as researchers at USFS facilities in Salt Lake City (RSAC) and Missoula (FSL).

Goals & Objectives

The overall goal of the Rapid Response system is to meet science and application user needs with respect to MODIS data when the application in question requires that the data be delivered to the user within hours of sensor acquisition. One such important example is the application of MODIS data in federal efforts to manage wildfire. Another important application is the outreach effort of the Terra team, where Rapid Response currently provides a daily feed of global image products to the Earth Observatory (earthobservatory.nasa.gov) and other public affairs users.

The MODLAND team has undertaken this work with other federal agencies in an effort to broaden utilization of Terra data, and to gain recognition and support for the Earth Observing System. This work will continue to evolve beyond the needs of the USFS. There are currently discussions underway with other units of USDA to address the needs of agricultural monitoring analysts. We have also conducted outreach to international users, and are providing Rapid Response data feeds to scientists in Brazil and Southeast Asia under the auspices of the Global Observations of Forest Cover program.

It is important to note that this Rapid Response approach is not part of the core production system. It does not replace the capabilities of MODAPS and the DAACs. Rather, it complements these existing capabilities. Rapid Response provides the quickest data products possible, but not necessarily the most advanced for science applications. These efficiencies are achieved in part by eliminating toolkits and external dependencies such as the assimilated climate and post-processed geolocation data used by the core system.

System Design, Implementation, and Products

The approach used has been to develop a stream-lined and low latency processing system using commercial off-the-shelf

hardware/software. We have also implemented a distributed computing model with data processing and distribution occurring at GSFC, USFS, and UMD facilities. Where possible we have reused existing resources and expertise. The process is fully automated at all sites. The design has also been user-driven. We have endeavored to form the basis for a long-term partnership with the USFS and NIFC, to understand existing structures and procedures, to ascertain unmet needs, and to use this knowledge to cooperatively develop new products.

The high-level data flow is shown in Figure 1. Terra transmits its data via the EDOS system to GSFC. Here we utilize a feed via the NOAA bent-pipe to acquire Level 0 granules. These are then processed by the Rapid Response system to produce Level 1B radiance counts. A simplified atmospheric correction is applied to generate corrected reflectance products at 250 m and 500 m spatial resolution. The MODIS fire algorithm is applied to produce 1 km active fire detections. A JPEG image with pseudo true-color corrected reflectance is generated for all granules with the pixel boundary of the active fire detections superimposed upon the image. For a selected subset of the global data stream, a reprojection is performed to eliminate the bow-tie effect and to map the image data to a local projection. An example of the end product is shown in Figure 2.

The image data are then made available via the internet for download (see rapidfire.sci.gsfc.nasa.gov). The fire locations are ingested by a spatial database server at UMD. These data are polled by an automated map production system at the USFS-RSAC. Finally, image data are sent from GSFC to UMD and the

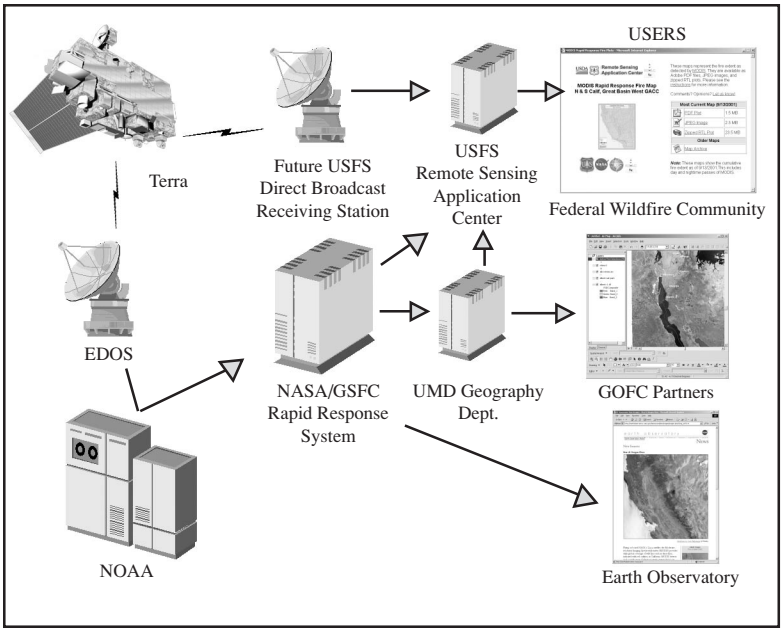


Figure 1. High-level data flows for Rapid Response. Input data flow from sources on the left of the figure, with processing in the center segment, and delivery to end users at the right.

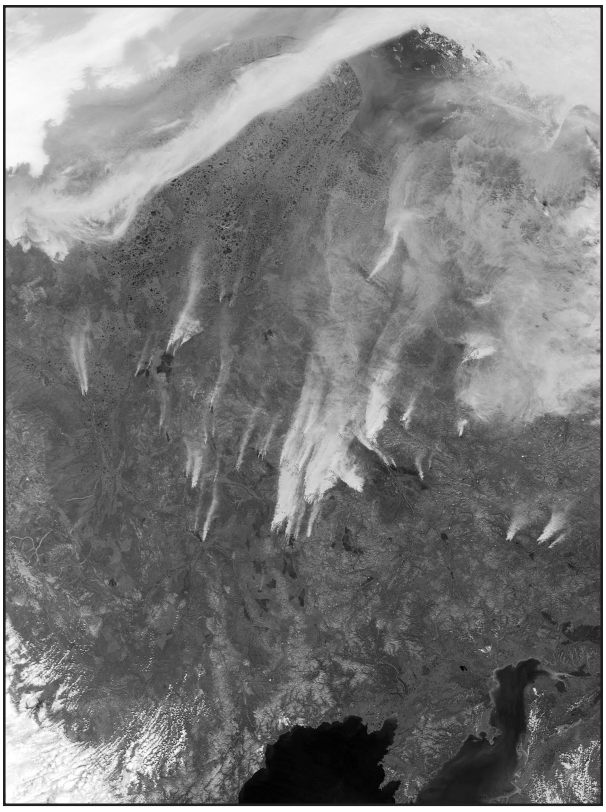


Figure 2. Massive wildfires in Siberia on August 4, 2001. Active fire detections are seen as vectors superimposed upon the image. In many locations, the detections were made despite heavy smoke.

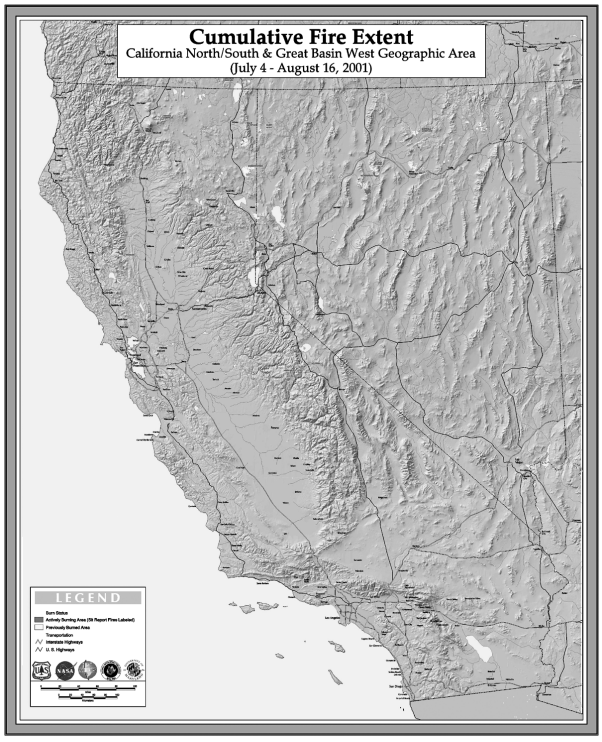


Figure 3. Example of an RSAC fire map covering one of multiple NIFC coordination regions. These products are delivered daily for all regions along with an overview map covering the entire western U.S.

RSAC. These image data are provided to Burned Area Emergency Rehabilitation (BAER) teams for use in remediation efforts. The purpose of the BAER effort is to mitigate the encroachment of noxious species and to preserve water quality by controlling erosion in the post-fire landscape.

The RSAC generates active fire maps on a daily time-step. The maps, illustrated in Figure 3 on the previous page, show both cumulative fire detections from previous days as well as those detected during the most recent satellite overpass. The base map shows topography, transportation infrastructure, and urbanized areas for reference. These maps are then used by NIFC for daily stand-up meetings where strategic decisions are made regarding the allocation of wildfire management assets. The production schedule is coordinated so that these maps are available by 6 a.m. local time. Typically, data passes completely through the production system within 4 to 6 hours from the time of acquisition. These maps are available on the web at www.fs.fed.us/eng/rsac/fire_maps.html and www.nifc.gov/firemaps.html.

In an additional application interface, the University of Maryland has developed a system to demonstrate how active fire and other data products can be made available via the internet using a geographic information system, allowing users to interact with and customize the data products to their specific needs. A web-based map server at UMD allows the user to query active fire detections spatially and temporally. These can then be compared with land cover and other thematic data layers interactively. This system can be found at rapidresponse.umd.edu.

The Rapid Response system is designed to be clone-able, and one is currently being implemented at UMD. This capacity will be used to expand the number of re-projected images that can be produced, especially to support ongoing science and field activities. Two systems are also being installed at the USFS locations in Salt Lake City and Missoula. These will be used to process MODIS data directly from Direct Broadcast dishes that are coming online by the end of 2001.

The software system is written in C with no dependencies on ECS toolkits. Dell PowerEdge multi-CPU servers running the Linux operating system are used to power the Rapid Reponse system. We have utilized EIDE-to-SCSI RAID units for online storage, which are available at a very competitive price of approximately $6500 for 0.5 terabytes of usable disk space. By using hardware sold to the public in large quantities, a basic processing system can be built for under $20 K. Depending upon the quantity of data to be processed, the system is fully scalable. UMD utilizes ESRI's Internet Map Server for web mapping, and the RSAC uses ESRI's ArcInfo for map production.

Into the Direct Broadcast Domain

An important aspect of the project is that the Rapid Response system can be used to generate products from multiple sources of input data. These include Level 0 granules from either EDOS or from a Direct Broadcast dish. The USFS has committed its agency resources to building two receiving stations, one at the RSAC in Salt Lake City and the other at the FSL in Missoula. The RSAC station will be online in early November 2001, with the FSL following in late December. These two systems will then feed the on-site Rapid Response systems to produce products directly from the down-link data. This will reduce the latency from the order of hours (using the current EDOS feed) to minutes (using the Direct Broadcast feed). The NASA/UMD segment will continue to provide data to the USFS for the eastern U.S. and Alaska.

All of the software written as part of the Rapid Response project has been developed under an "open source" paradigm. It is the intention of the team to make this software available at no cost to any Direct Broadcast user. As part of this program, the USFS has contributed needed resources to package the code for broader distribution. Additional assistance has been provided by the Direct Readout Lab at GSFC.

It is expected that in the future, other Level 2 MODLAND products will be added to the Rapid Response package. This will allow Direct Broadcast users to run the same standard algorithms that have been developed by the MODIS Science Team.

Future Direction

During 2001, the Rapid Response effort was driven by getting the core capabilities functioning as quickly as possible so as to have the system operating by the beginning of the wildfire season in the American west. Pathfinding activities were also undertaken and will result in new products to be available in 2002. These include products for burn severity and smoke modeling. The burn severity product builds upon the MODIS Vegetative Cover Conversion algorithm by directly generating severity classes used by the USFS's BAER teams. The new smoke dispersion product will build upon the work of Kaufman at GSFC and Hao at the FSL.

(Continued on page 14)

July 2001 User Working Group Meeting: ORNL DAAC for Biogeochemical Dynamics

— Robert B. Cook (cookrb@ornl.gov), and Larry D. Voorhees, Oak Ridge National Laboratory, and
— Curtis Woodcock, Boston University

The User Working Group of the Oak Ridge National Laboratory DAAC met on July 31, 2001, in Baltimore, Maryland. This meeting was devoted primarily to discussions of the FY 2002 activities of the ORNL DAAC.

The User Working Group provides guidance to the ORNL DAAC on data archival activities, including prioritizing its activities to ensure that EOS and the Earth Science Enterprise are appropriately supported by the DAAC. One of the key ways the User Working Group provides guidance is to review future work plans.

The User Working Group has implemented a committee structure to augment the User Working Group's efforts to provide guidance to the DAAC in specific areas of importance (Table 1). These subcommittees (ecosystem modeling, field campaigns, land validation, and technological developments) met via teleconferences prior to the July 2001 meeting, which facilitated the discussion of FY 2002 DAAC tasks.

Background

The ORNL DAAC supports the Earth Science Enterprise (ESE) and the Earth Observing System (EOS) by providing data and information about the dynamics between the biological, geological, and chemical components of the Earth's environment. These biogeochemical dynamics are influenced by interactions between organisms and their physical surroundings, including soils, sediments, water, and air.

Sources of data held by the DAAC include NASA funded field campaigns (such as BOREAS, LBA, and SAFARI 2000), selected relevant measurements from EOS satellites, as well as other biogeochemical dynamics data useful to the global change research community. In addition, the ORNL DAAC acquires, archives, and distributes data related to biogeochemical cycling that facilitates interpretation, processing, and validation of EOS remote-sensing measurements and data products. The DAAC supports EOS validation by providing data from FLUXNET and Land Validation field activities (Table 2).

The data at the DAAC are useful for developing and improving process-based models of biogeochemical dynamics, for verifying classifications based on remotely-sensed information, and for validating ecosystem model outputs. Integration of these data is important to understand and predict how Earth systems function. By linking data about climate, atmospheric trace gases, and biological processes, we can better understand how global changes may impact ecosystems.

DAAC Activities in FY 2001

DAAC accomplishments in FY 2001 were reviewed, laying the basis for FY 2002 plans.

Data Archiving

During FY 2001 the DAAC began distributing the following data products:

- Global Gridded Surfaces of Selected Soil Characteristics (IGBP-DIS) (CD-ROM).
- VEMAP 2 monthly and annual climate data sets in full-grid net-CDF format for the conterminous United States.
- 11 new NPP data sets: (1 grassland, 2 boreal forest, 1 tropical forest, 2 tundra, 2 tropical, and 3 multi-biome data sets).
- FLUXNET data, including 100-site years of gap-filled records, and EUROFLUX data from 13 sites, and an on-line relational data base system.
- Test data from a MODIS cutout exercise (7-km x 7-km cutouts of selected MODIS products for several tower sites in ASCII format). Eventually 7 MODIS products will be posted for 52 tower sites as they become available.
- Jornada PROVE (PROtotype Validation Experiment) data, a field

campaign that was conducted in May 1997 at the Jornada Experimental Range near Las Cruces, New Mexico.

- Complete archival of 284 data sets from the BOREAS project plus added viewers for BOREAS images.

Finding Regional and Global Data Sets at other Data Centers

Regional and global biogeochemical dynamics data can be located and acquired through a metadata search system at the ORNL DAAC. Climate, hydroclimatology, soil, and vegetation data held by data centers around the world are available through a system called "Mercury." Mercury is a distributed, Web-based system for metadata search and data retrieval. It works with metadata residing on a central web server and organizes the metadata with Internet search engine software. Users search the index at ORNL and can be connected to the data by a hypertext link. (see mercury.ornl.gov/ornldaac).

The data sets indexed in Mercury were chosen by the ORNL DAAC's User Working Group as important to the global change research community for understanding the function of terrestrial ecosystems and for examining patterns across temporal and spatial scales.

Systems Activities

Key computer systems activities in FY 2001 included:

- Beginning design and development of Mercury-EOS, the ORNL DAAC's alternative to the EOSDIS ECS system.
- Formalizing security procedures.
- Making Web site changes to become compliant with the American Disabilities Act.

DAAC Activities Planned for FY 2002

The User Working Group recommended that the DAAC perform the following activities during FY 2002:

- Respond to user requests for data and information offered through the online system-wide and local interfaces and the User Services Office.
- Maintain and operate the local ORNL DAAC custom online interfaces.
- Complete the development of Mercury-EOS, which will improve the DAAC's ability to serve users and position it strategically for the future.
- Archive and distribute BOREAS Follow-on project data sets at the DAAC. Some of these data sets have been provided on a six-disk CD-ROM set as follows: Derived Surface Parameters, Flux Data, Hydro-met Data, and Gridded Meteorological (Mesonet station) Data. These data sets and other BOREAS Follow-On data (AVIRIS and GOES Level 2) will be made available via the DAAC's online system during the first half of FY 2002.
- Provide data management support to the SAFARI 2000 project, which has chosen the DAAC's Mercury metadata search and data retrieval system to share data. A version of Mercury has been established for SAFARI 2000 at the following URL: mercury.ornl.gov/safari2k. DAAC staff will assist SAFARI 2000 investigators in preparing data sets to share and archive.
- Archive and distribute LBA-Ecology data that are archive-ready.
- Provide data management support to the FLUXNET science community by compiling new data and metadata from regional flux tower networks, compiling additional site characteristics information from literature and PIs, and processing and posting cutouts of selected MODIS products for selected towers.
- Support EOS Land Validation by continuing to post subsets of selected MODIS products for Core Sites, allowing the Mercury system to enable registry and access of field data, and compiling additional site characteristics information from literature and PIs.
- Archive and distribute data sets that are important to understanding global cycle processes and projecting future effects; data sets identified by the User Working Group include soil respiration (Raich and Schelsinger), NPP and model driver data compiled for Ecosystem Model - Data Intercomparison Project, litter data (Holland, Matthews, Post), and root data (Jackson).
- Work with the User Working Group's Regional and Global Data Subcommittee to identify important raster and point-based data sets and register those data sets in Mercury.

End Note

John Vande Castle, who is a charter member of the User Working Group and has served since 1994, attended his last User Working Group meeting. Curtis Woodcock (User Working Group Chair) thanked John for his long and conscien-

tious service. Jim Ehleringer, Mike Goulden, and Sue Trumbore have served three years and are rotating off of the User Working Group. We also thank them for their advice and service to the ORNL DAAC and its user community

Table 1

ORNL DAAC User Working Group Members and Subcommittee Assignments.

Curtis Woodcock (Boston University) is the Chair of the User Working Group, Diane Wickland (NASA/HQ) is the ORNL DAAC Program Scientist, and Howard Dew (NASA/GSFC) is the ORNL DAAC Systems Engineer.

Subcommittee Members

Land Validation

Tom Gower, University of Wisconsin
Jeff Privette (lead), NASA/GSFC
Sasan Saatchi, NASA/JPL
Curtis Woodcock, Boston University
Dick Olson (ORNL DAAC Representative)

Field Investigations

Jim Ehleringer, University of Utah
Bev Law, Oregon State University
Sue Trumbore (lead), University of California-Irvine
Mike Goulden, University of California-Irvine
Larry Voorhees (ORNL DAAC Representative)
Regional and Global Data, Jon Foley (lead), University of Wisconsin
Mac Post, ORNL
Hank Shugart, University of Virginia
Ruth DeFries, University Of Maryland
Bob Cook (ORNL DAAC Representative)

Technical Innovations

Charlie Vorosmarty, University of New Hampshire
Phil Teillet, Canada Centre for Remote Sensing
John Vande Castle, University of New Mexico
Tim Rhyne (ORNL DAAC Representative)

Table 2

ORNL DAAC for Biogeochemical Dynamics: An Overview
www.daac.ornl.gov

Field Campaign Data

NASA's Terrestrial Ecology Program sponsors field campaigns that combine ground-based, aircraft-based, and satellite-based measurements of biogeochemical features in specific ecosystems. Field campaigns are focused on a particular problem or set of problems and are crucial to providing an integrated understanding of biogeochemical dynamics that can be extended across spatial and temporal scales. The ORNL DAAC archives the data from six field campaigns that include climate, radiation, vegetation, soil, hydrology, and atmospheric measurements.

- Boreal Ecosystem-Atmosphere Study (BOREAS), 1994-1996
- First ISLSCP (International Satellite Land Surface Climatology Project) Field Experiment (FIFE), 1987-1989
- Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA), ongoing
- Oregon Transect Ecosystem Research (OTTER), 1990-1991
- SAFARI 2000, Southern African Regional Science Initiative, 1999-2001
- Superior National Forest (SNF), 1983-1984

Land Validation Data

The ORNL DAAC supports the comprehensive assessment of land-based EOS science data products by compiling data, such as leaf area index (LAI) and net primary productivity (NPP), to compare with satellite-derived products. The locations include global core test sites, which are unique in having ground-based observations coincident with satellite data.

- FLUXNET—Measurements of carbon dioxide, energy, and water vapor fluxes from towers throughout the world are available for 1990 to the present.

- EOS Land Validation—Ground-based and airborne measurements from 24 (soon to be 26) worldwide sites used to assess EOS instruments, and algorithms used to generate remote sensing images. Data are available through the Mercury system.

Regional and Global Data Archived at the DAAC

The ORNL DAAC compiles, archives, and distributes regional and global data that may be used to improve our understanding of the structure and function of terrestrial ecosystems and to enable prediction across temporal and spatial scales.

Climate—Holdings include U.S. climate data, regional and global climate model scenarios, and long-term global climate data. Dates of the seven historical data sets range between 1753 and 1999.

Hydroclimatology—U.S. precipitation and streamflow data, as well as global river discharge data are available. Dates of the data sets range between 1807 and 1991.

Soil—U.S. and global data about soil properties include depth, texture, conductivity, chemical content, pH, and temperature. Dates of the data sets range between 1940 and 1996.

Vegetation—Global data on vegetation, biomass, net primary productivity (NPP), historical leaf area index, and results from the Vegetation-Ecosystem Modeling and Analysis Project (VEMAP), which examines the conterminous U.S. Dates of the data sets range between 1895 and 1996.

Regional and Global Data Via Mercury—The ORNL DAAC's User Working Group recommended that the DAAC make additional regional and global data held at various data centers around the world available through Mercury. Mercury is a Web-based system that allows searching of metadata files to identify data sets of interest and directs the user to them (mercury.ornl.gov/ornldaac).

There are 100 data sets currently registered in Mercury in the following categories:

- Vegetation - 15 data sets
- Land Use - 16 data sets
- Soil - 15 data sets
- Climate - 18 data sets
- Hydrology - 23 data sets
- Gas Exchange - 7 data sets
- Human Dimensions - 5 data sets
- Models - 1

(Continued from page 10)

MODIS Land Rapid Response: Operational Use of Terra Data for USFS Wildfire Management

A field support program is also being developed that will take USFS and MODLAND scientists directly into the field to support rehabilitation efforts for a half dozen major incidences in 2002. This will include the use of MODIS and other instruments from the EOS and Landsat programs as well as commercial high resolution data.

Additionally, the cooperation between agencies is making possible new validation opportunities. The MODLAND team will be working with the USFS to evaluate the results of MODIS algorithms using data gathered by NIFC airborne instruments in ground-based GIS datasets.

Finally, there will be additional work in improving and expanding the suite of MODLAND products available from the Rapid Response system and the user interface for querying and manipulating the data sets. It is expected that in 2002 we will begin public distribution of the source code for the system.

Acknowledgements

The Rapid Response team would like to thank several NASA officials for their support of these efforts. Martha Maiden and the NASA Earth Science Information Partnership program supported the MODIS 250-m System — this technology provided the basis for the Rapid Response system. Vince Salomonson has provided data storage capacity to enhance flows of data to public affairs and outreach users. Ed Masuouka assisted by providing facilities and system support for the project. Pat Coronado has provided the expertise of the Direct Readout Laboratory to assist with questions related to Direct Broadcast data feeds. The University of Wisconsin has provided access to the IMAPP Level 1B processing system. We also thank NOAA for providing access to real-time Level 0 granules.

Report from the GOFC - Fire: Satellite Product Validation Workshop, Gulbenkian Foundation July 9 - 11, 2001, Lisbon, Portugal

— J. Morisette (jeff.morisette@gsfc.nasa.gov), C. Justice, J. Pereira, J.M. Grégoire, and P. Frost

The objective of the Global Observation of Forest Cover (GOFC) project is to improve the quality and availability of observations of forests at regional and global scales. GOFC has currently established two primary implementation teams: Forest Cover and Forest Fire.

The Forest Fire Implementation Team is responding to a critical need by scientists, fire management authorities, international agencies and policy makers at national, regional and global levels, for accurate and timely information regarding wildfires in forest land and other vegetated areas. A number of satellite-derived fire products are now available to meet these needs. To help move forward on the accuracy assessment and validation of global fire products, a workshop on "Fire Satellite Product Validation" was held jointly between GOFC-Fire and the Committee on Earth Observation Satellites (CEOS) Land Product Validation (LPV) Working Groups at the Gulbenkian Foundation, Lisbon, Portugal, July 9-11, 2001. The Workshop was organised by the Instituto de Investigação Científica Tropical, in collaboration with the Space Applications Institute, Joint Research Centre, National Aeronautics and Space Administration (NASA), the European Space Agency/European Space Research Institute (ESRIN), and the Department of Geography, University of Maryland. The objectives of the GOFC-Fire Satellite Product Validation Workshop were:

- to provide an update on developments within GOFC and to review and refine the GOFC-Fire Implementation Goals;
- to provide a forum for presentation of recent developments and results on satellite fire product validation, and to explore opportunities for international validation coordination; and
- to establish a fire validation group jointly with the Committee on Earth Observation Satellites Land Product Validation (CEOS LPV) subgroup and to develop an agenda for LPV fire activities.

The initial session of the Workshop included presentations on the purposes of the GOFC-Fire; the work of the Interagency Task Force Working Group on Wildland Fire, of the United Nations (UN) International Strategy for Disaster Reduction; the interaction between GOFC-Fire and the newly formed CEOS Land Product Validation Working Group; and a perspective on the needs of the research communities working on the global carbon cycle and atmospheric chemistry, in particular the emission of aerosols, for satellite-derived fire products.

This was followed by a technical session with presentations on the status and results of active fire product validation activities, which covered some of the major ongoing global initiatives, such as the Joint Research Centre (JRC's) World Fire Web, and European Space Agency (ESA's) World Fire Atlas. Initiatives based on the Defense Meteorological Satellite Program (DMSP), Moderate Resolution Imaging Spectrometer (MODIS), and Tropical Rainfall Measuring Mission (TRMM) sensors were also presented, as well as validation and data comparison exercises for Brazil, Africa, and the boreal forest biome. Table 1 summarizes the currently available global fire products presented at the meeting.

A second technical session addressed the current status of product development and validation results for burned area products. Presentations were structured around major international initiatives [Global Burned Areas (GBA) 2000, Southern African Regional Science Initiative (SAFARI) 2000, Globscar], and

Table 1: currently available global fire products

Product	Sensor	Agency	URL
Global Fire and Thermal Anomalies	MODIS	NASA	modis-fire.gsfc.nasa.gov/
Global Fire Detection	DMSP OLS	NOAA	www.ngdc.noaa.gov/dmsp/fires/globalfires.html
World Fire Atlas Project	ERS-2 ATSR-2	ESA	shark1.esrin.esa.it/ionia/FIRE/
World Fire Web	AVHRR	JRC	www.gvm.sai.jrc.it

also covered other product development and validation work being done in North America and Australia. Overviews of the main objectives and validation strategies for these initiatives were complemented by case studies covering tropical biomes in Africa, Australia, and Brazil, and boreal biomes in Siberia and Canada.
From the technical sessions it was clear that there are multiple agencies generating products on active fires, developing burn-scar products, and considering fire-emissions products. To date, no consistent protocol for validation of these global products has been developed and adopted. There is a critical need to organize a concerted international effort to develop, test and document protocols for validating satellite-derived fire and burned area products.

> The technical sessions reinforced the need for a coordinated and concerted international effort to develop, test, and document protocols for validation of satellite derived fire and burned area products.

Following the technical sessions the meeting broke out into in-depth working group sessions to discuss the following topics:

1. Defining CEOS Land Product Validation & GOFC Fire activities, namely the development of a global network of fire validation sites, and the development of active fire and burned area validation protocols and reporting guidelines.

2. Refining GOFC-Fire goals and implementation steps.

3. Assessing progress on recommendations from previous meeting, and developing recommendations from the Lisbon meeting.

Fire Validation Site Network

The purpose of developing a global network of fire-product validation sites is to provide a focus for satellite, aircraft, and ground data collection for the validation of active fire and burn scar products. In addition these sites would be used for comparing detection algorithms and development and testing new or improved sensing systems and fire products. The network will engage in long-term fire monitoring in support of algorithm development, testing and validation. It is meant to facilitate access to and sharing of existing continuous data sets, and the development of new ones, for time series analyses of fire occurrence. Such a network of sites will provide international cost-sharing opportunities. The selection of network sites is aimed at getting representative coverage of biomes with significant fire activity. To this end, it will rely as much as possible on existing regional and thematic networks, such as the World Fire Web partner institutions, the World Fire Atlas validation participants, the MODIS fire validation sites and national fire inventories. Data collected at the network of validation sites will be particularly useful if it can provide a "one-stop-shopping" opportunity for those interested in fire product development and evaluation. This requires developing a minimum set of guidelines for reporting and validating fire data. Future deliberations for establishing this network will include: the data suite required for fire product validation, the size of validation areas and minimum mapping unit, the desired accuracy levels of reference data, and the statistical measures and analysis for product comparison and integration methodologies.

Refining GOFC-Fire Goals

Revision of the goals for GOFC-Fire highlighted the key issue of improving the links to users. It is important to improve the quality, scope, and utility of GOFC-Fire inputs to the various user communities through:

- gaining a better understanding of the range of users of fire data, their needs for information, how they might use such information if it was available, and with what other data sets such information might be linked;

- increasing the awareness of users of the potential utility of satellite products for global change research, fire policy, planning, and management; and

- developing enhanced products based on ongoing interaction with representatives of the various user communities.

Emerging opportunities to implement such objectives were identified through interaction with, or involvement in, various international programs. Development of a consensus on methodologies and procedures for documenting and reporting fire at a range of scales may be pursued in collaboration with the Inter-agency Task Force on Disaster Reduction through the establishment of a common network of regional nodes. Food and Agriculture Organization (FAO's) Forest Resource Assessment 2010 will benefit from improved fire data and products in order to better analyze the role of fire in changing forest cover. Long-term trends and implications of changing fire regimes are of interest to the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report, and to the United Nations Environment Programme

(UNEP's) Global Environment Outlook initiative. Future scientific goals should consider the role of changing fire regimes and the impact on the global carbon cycle.

Recommendations from Meeting

The current status of recommendations from the previous GOFC-Fire Meeting, held at the Joint Research Centre, in Ispra, Italy, in November 1999, was assessed, and new recommendations were formulated. The overall focus of the meeting was on future activities that can enhance the production and use of fire-related products. Based on successful experiences in Brazil, Canada, Portugal, Russia, and the Association of Southeast Asian Nations (ASEAN), several recommendations were made to the GOFC-Fire implementation team:

- Promote the development and testing of prototype operational algorithms for active fire detection and burned area mapping, and the pre-operational testing of these algorithms in various fire regimes through the GOFC Regional Networks and partners.

- Assess the advantages and disadvantages of different sensors and products for fire monitoring and make this information widely available to the fire data user communities.

- Develop targeted activities in the GOFC Regional Networks to enhance the flow of fire data between producers and GOFC Regional data brokers and fire data users.

- Develop metadata and product standards to build consistent global products.

Based on the technical sessions and participants' understanding of future plans, the following were decided as recommendations to the space agencies and fire-product producers:

- Support fire management and global change research efforts by ensuring that requirements for fire monitoring, as specified by the user community, are included in the criteria for the design of future operational systems (e.g., National Polar-orbiting Operational Environmental Satellite System [NPOESS] and the Meteorological Operational polar satellites [METOP] of the European Organisation for the Exploitation of Meteorological Satellites [EUMETSAT]), and that information on fires (detection and mapping of active fires and burn scars, and estimates of aerosol and gas emissions) is provided as operational products.

- Support the maintenance of historical ("heritage") Earth observation time-series data, improve their accessibility to potential users, and encourage the use of these data in support of long-term global change research.

- Support the development and maintenance of a global network of fire validation sites, incorporating standard procedures and protocols for fire product validation and the timely publication of accuracy assessments for all the various fire products.

- Provide the satellite data necessary to achieve the goals of GOFC-Fire in determining the accuracy of fire products, promoting informed use of satellite fire data, and developing improved product suites based on user requirements.

It was recommend that the coordination of the latter two activities be undertaken through the CEOS Land Product Validation Group.

Finally, regarding the GOFC-Fire implementation team and its interaction with the general user community, it was recommended that GOFC-Fire:

- Increase efforts to develop direct collaboration and invite participation and inputs from the three targeted user communities, i.e., natural resource managers, global change researchers (atmospheric chemistry, carbon, ecosystem disturbance), and policy makers.

- Better define operational requirements for future fire-monitoring aspects of planned systems, such as the NPOESS Preparatory Project - Visible/Infrared Imager Radiometer Suite (NPP-VIIRS) (U.S.) , Satélite de Sensoriamento Remoto [Remote Sensing Satellite, Brazil] (SSR) (Brazil), and "FOCUS" instrument on the International Space Station (ISS); and satellites such as FUEGO and others, based in part on experience gained from previous operational and experimental systems such as Advanced Very High Resolution Radiometer (AVHRR), GOES, DMSP, MODIS, Système Probatoire d'Observation de la Terre (SPOT) Vegetation, and Along Track Scanning Radiometer (ATSR).

- Define specifications for enhanced product suites combining satellite and *in situ* data and model outputs on fire emissions, for example linking satellite burned area data with data on fuel loads, moisture content, fire intensity, fire severity, fuel consumption, flaming-versus-smoldering

combustion, fire damage, emission factors, and emissions rates.

- Arrange future workshops aimed specifically at refining the requirements of: 1) the fire emissions modeling community, and 2) the fire management community.

- Together with the Inter-Agency Task Force for Disaster Reduction (ITFDR) encourage individual countries to establish mechanisms for collating national information on fire and assessing its significance.

- Facilitate further development through identifying appropriate technologies and products and helping to articulate needs to funding agencies.

- Help build capacity in and transfer technology to developing countries to assist them to access, utilize, and share fire data and compile national greenhouse gas inventories in a consistent and transparent manner.

The Meeting endorsed a proposal to hold the next Annual GOFC-Fire Workshop at the University of Maryland in the summer of 2002 on the topic of Atmospheric Emissions from Biomass Burning: Modeling and Comparisons with Satellite, Ground, and *In Situ* Observations.

6,000 See ESE Electronic Theater October 16-17, 2001, in Madison, WI

The NASA/NOAA/AMS Earth Science Electronic Theater presentations at the AMS Satellite Conference during the week of October 15 in Madison, WI, came very close to living up to the advance billing.

Presentations were made to a total audience of 5500 middle and high school students from all over Wisconsin in four daytime presentations, Tuesday and Wednesday, October 16 and 17, and a little under 500 AMS Satellite Conference attendees, University of Wisconsin students, and area residents, Wednesday evening.

This was the first time that the American Meteorological Society has sponsored a program that reaches out to the local community as part of a conference. Thanks to the efforts of the University of Wisconsin Space Science and Engineering Center and the Monona Terrace Convention Center, the school outreach program was a huge success. The presentation was made on the huge AMS 18 foot by 72 foot IMAX size screen using the latest computer graphics, HDTV, and projection technology in the main exhibit hall of the Frank Loyd Wright-designed Monona Terrace Convention Center. The Space Science and Engineering Center, NASA, and the Convention Center provided five video projectors including a 10,000-lumen super-projector for the high-definition television display

Fritz Hasler, NASA/GSFC, and students at the AMS Satellite Conference. ▷

Meeting of Federation of Earth Science Information Partners

— George A. Seielstad (gseielst@aero.und.edu), University of North Dakota

Martha Maiden, NASA HQ, Program Manager for the ESIP Federation, and Karen Moe, NASA GSFC, study the crops grown on the Wagner Farm. In the background, another farmer applying satellite imagery to precision agriculture, Pete Carson (facing), St. Thomas, ND, explains his practices to Santhosh Seelan (left) and Soizik Laguette (back to camera) of the University of North Dakota.

Gary Wagner explains to the ESIP Federation how he uses satellite imagery supplied by the Upper Midwest Aerospace Consortium's ESIP on his farm in Minnesota. Meeting attendees witnessed the end of the value chain from satellite data to decision-support information.

Saxon Holbrook, University of Montana, tries out the cab of John Deere's latest computer-rich tractor at the Wagner Farm.

The full assembly of the Federation of Earth Science Information Partners (ESIP Federation) held its seventh meeting at the University of North Dakota, July 24-26, 2001. Ninety-three people represented the various ESIPs. The main objective of the meeting was to reach consensus on the next phase of the Federation's evolution. That objective was realized: the Federation will continue its collective efforts of providing Earth science products and services to the full spectrum of users as the framework upon which new data and information systems and services (NewDISS) can be built. It agreed to use its resources to fund prototype NewDISS projects, competitively selected from among the Partners.

A second major accomplishment was agreement to create an ESIP Foundation. The Foundation is a non-profit organization that can administer funds for the Federation, as well as cultivate sources of funding other than NASA. In the months following the meeting, the ESIP Foundation was incorporated in Washington, DC.

Background

NASA's Associate Administrator for Earth Sciences, Ghassem Asrar, opened the business session via a video conference link from Headquarters. He delivered news so fresh that he himself had had little time to digest it. The news was that the Senate committee for appropriating NASA funds had removed all ESIP Federation funding from the 2002 fiscal year budget. The House version of the bill left the funding fully intact, in accordance with the President's budget submission. Asrar indicated his support for the Federation and advised not to let the news distract it from its vision. His hope was that, before a final bill was passed by both houses of Congress, funding for the Federation would be restored. During the subsequent two and one-half days, members of the Federation committed themselves to a vigorous effort to ensure continued funding for an experiment that appeared to be successful.

Jack Kaye, Director of the Research Division of NASA's Earth Science Enterprise, also appearing via video conference, summarized ESE's future science plan. He called for linkages among ESE's Research Goal, Applications Goal, and Technology Development, so that the three steps, Characterize/Understand/Predict (CUP), can be accomplished.

U.S. Senator Byron Dorgan then appeared over satellite communications from the Capitol. His hope for NASA was that it gather information in such a way as to make it useful for people, in fact, for all Americans.

Membership

The Federation admitted three new partners: (1) NOAA's National Climatic Data Center, an ESIP Type 1, (2) the University of Montana's Numerical Terradynamic Simulation Group, an ESIP 2, and (3) TERC, an ESIP 3 dedicated to K-12 science education. These three bring the membership to 41 partners. Representation is balanced reasonably among the types who specialize in data acquisition, processing, and management (ESIP 1s), scientific research (ESIP 2s), and applications development (ESIP 3s). What is more important than the number of individual organizations belonging is the synergies that have emerged from their working together. Every step in the conversion of data to practical useful information—or better yet, societal wisdom—is equally important. No organization can accomplish them all. Only through the collaborations that have spontaneously arisen with the Federation can Partners forge the pathways that serve their target communities.

Continuing growth from the originally selected 24 ESIPs is a sign of how positively the Earth science community is assessing the Federation. New members join because of the advantages they perceive and the services they wish to contribute; none is funded any extra to become a Partner.

Entity Formation

Upon the advice of a National Research Council committee, NASA created the ESIP Federation as an experiment to determine how well a distributed, decentralized, heterogeneous, bottom-up organization could serve the comprehensive needs of the scientific community and the general public. The original ESIPs received funding for participation, as did the Federation as a whole. NASA's commitment has been the bedrock upon which an organization was built. Other federal agencies and private businesses are also involved in Earth science research and applications. A goal of the Federation has been to include them as major partners (Type 4), and has financial contributors as well as beneficiaries of the Federation's products and services. A first step toward that goal is to form a legally recognized, non-profit organization to which funds can be contributed. That step has now been taken. As noted, a Foundation of Earth Science Information Partners has been incorporated.

The MODIS Cluster

In keeping with the bottom-up design of an effective organization, Federation Partners organize themselves into clusters. These are groupings of people with common interests who come together to address significant issues. They persist only as long as the cluster's members decide it is needed. One such cluster whose accomplishments were highlighted at the meeting is the MODIS Cluster. Not all the MODIS sensor's products are mature yet. Not all the data can be processed quickly after acquisition. Handwringing and finger-pointing are unlikely to improve the situation. This particular cluster, therefore, has made itself part of the solution. An impressive list of projects undertaken by ESIPs was presented. Various ESIPs have concentrated on particular user communities, and because and only because they belong to the Federation, they have been able to weave the strands that exist among other ESIPs into a fabric that meets their users' needs. As a next step, the MODIS Cluster proposes functioning as an online broker for which each ESIP serves as a redistribution point. Later, it may be possible to create a federation of MODIS DODS servers, which would function as a gigantic MODIS processor.

NewDISS, a Goal toward which the Federation Is Evolving

Steve Wharton, NASA Goddard Space Flight Center, presented a progress report on the work of the NewDISS Program Formulation Team he heads. The basic principles of a heterogeneous, distributed, decentralized organization were the same as those upon which the ESIP Federation was founded. Attendees to the Federation's meeting thoroughly discussed the future of their organization. The central message from the discussion was that the Federation is doing now what NewDISS is proposing to do. Not yet on as grand a scale, but certainly it is an appropriate model with a three-year headstart toward implementation. Invaluable lessons learned were exchanged with the Formulation Team. So committed was the Federation to helping build NewDISS that it set aside roughly a third of its funds to support innovative experiments in NewDISS prototyping.

Landsat Data Continuity Mission

Most, if not all, ESIPs are relying heavily on Landsat data. The presentation by Jeff Masek on the Landsat Data Continuity Mission was, therefore, particularly welcome. Attendees were invited to comment upon the RFP before its release.

New Officers

The full assembly of Earth Science Information Partners elected its new officers for the forthcoming year. Bruce Caron will serve as President and Michael Goodman as Vice President. Committee chairs will be Doug Kliman, Finance and Appropriations; Menas Kafatos, Partner-

(Continued on page 26)

Alaska SAR Facility (ASF) User Working Group Meeting

— *Harry Stern (harry@apl.washington.edu), Co-chair, ASFUWG, University of Washington,Seattle*

A meeting of the Alaska SAR Facility (ASF) User Working Group (UWG) took place in Seattle on October 8-9, 2001. Attendance included ten members of the UWG, ASF management, and two program managers from NASA Headquarters. A summary of the meeting follows.

ASF has been doing well in terms of delivering data to users. ASF received praise from National Oceanic and Atmospheric Administration (NOAA)/National Ice Center (NIC), from the JPL/Radarsat Geophysical Processor System (RGPS) team, and from Level 0 users. Processing of data for the Modified Antarctic Mapping Mission (MAMM) is going well. The group felt that ASF is operating better now than it has for several years.

There was much discussion about the future of ASF. The current five-year contract ends in March 2003. In the absence of U.S. participation in future Synthetic Aperture Radar (SAR) missions, the ASF budget is expected to decline, with ASF becoming just a data archive. NASA would continue to support ASF and the needs of the data users through maintenance of the archive and servicing of data requests. If ASF wants to sustain a higher level of funding, then it must find the means to do so, for example through selling its services to government or commercial interests.

The director of ASF resigned at the end of September, at about the same time that a new deputy director was hired. The search for a new director must be a top priority at ASF. With a target date of March 2002 for the new director to take over, the next meeting of the User Working Group should be in late spring or summer, 2002, in Fairbanks.

Some of the recommendations made by the UWG to ASF and NASA are:

- Investigate business models that will position ASF to acquire new SAR missions, including continued pursuit of the Advanced Land Observing Satellite (ALOS) data node for the Americas.
- Investigate the operating model of NSIDC, in which scientists are on the Distributed Active Archive Center (DAAC) staff.
- While NASA is not participating in RADARSAT-2 because of its commercial aspects, NASA should pursue involvement with RADARSAT-3 while it is still on the drawing board.

More information, including notes from past meetings and current contact information, is available at the Alaska SAR Facility User Working Group web site: psc.apl.washington.edu/ASFUWG/

SAGE II V.6.1 data set is now publicly available

— *Joe Zawodny (j.m.zawodny@larc.nasa.gov), NASA Langley Research Center*

The SAGE II version 6.1 data set is now publicly available. SAGE II continues to operate and nearly 17 years of ozone, aerosol extinction, nitrogen dioxide, and water vapor profile data are available. This release includes several new products—aerosol surface area density, effective radius, and neutral density. The data can currently be obtained by anonymous ftp at: ftp-rab.larc.nasa.gov from the /pub/sage2/v6.10 directory. Sample software to read the data files can be found in a zipped tar file in the same directory or as individual files under the /pub/sage2/readers directory. You can learn more and also access the data via your browser at: www-sage2.LaRC.NASA.gov/.

This site will be kept up to date with information on known limitations of the data set and other quality related information as well as new data. In the very near future, these data will be available through the EOSDIS system and on a 2-disk set of CD-ROMs.

LIS and OTD Gridded Re-analysis Data Sets Released

— *Steve Goodman (Steve.Goodman@msfc.nasa.gov), Marshall Space Flight Center*

The Lightning Imaging Sensor (LIS) Science Team (thunder.msfc. nasa.gov) released four new LIS/OTD gridded reanalysis datasets in September 2001. These datasets can be ordered from the Global Hydrology Resource Center (GHRC) using:

a. HyDRO (ghrc.msfc.nasa.gov/ghrc/search.html), or

b. from the Earth Observing System (EOS) Data Gateway: (ghrc.msfc.nasa.gov:3333/~imswww/pub/imswelcome/plain.html).

Below are the dataset names and a short description of each dataset. You can find more information about these datasets at ghrc.msfc.nasa.gov/.

1. LIS/OTD 0.5 Degree High Resolution Full Climatology (HRFC)

   This product provides a single 0.5° x 0.5° gridded composite map of total (IC+CG) lightning bulk production, expressed as a flash rate density (fl/km^2/yr). Individual climatologies from the 5-yr OTD (4/95-3/00) and 3-yr LIS (12/97-11/00) missions are included, as well as a combined OTD+LIS climatology (having the total observations from both the LIS and OTD instruments) and supporting base data (flash counts and viewing times). Best-available detection efficiency corrections and instrument cross-normalizations, as of the product generation date (8/1/01), have been applied.

2. LIS/OTD 2.5 Degree Low Resolution Full Climatology (LRFC)

   This product provides a single 2.5° x 2.5° gridded composite of total (IC+CG) lightning bulk production, expressed as a flash rate density (fl/km^2/yr). Individual climatologies from the 5-yr OTD (4/95-3/00) and 3-yr LIS (12/97-11/00) missions are included, as well as a combined OTD+LIS climatology (having the total observations from both the LIS and OTD instruments) and supporting base data (flash counts and viewing times). Best-available detection efficiency corrections and instrument cross-normalizations, as of the product generation date (8/1/01), have been applied.

3. LIS/OTD 2.5 Degree Low Resolution Annual Climatology (LRAC)

   This product provides 365 daily 2.5° x 2.5° gridded composite maps of total (IC+CG) lightning bulk production, expressed as a flash rate density (fl/km^2/day). Individual climatologies from the 5-yr OTD (4/95-3/00) and 3-yr LIS (12/97-11/00) missions are included, as well as a combined OTD+LIS climatology (having the total observations from both the LIS and OTD instruments) and supporting base data (flash counts and viewing times). Best-available detection efficiency corrections and instrument cross-normalizations, as of the product generation date (8/1/01), have been applied.

4. LIS/OTD 2.5 Degree Low Resolution Diurnal Climatology (LRDC)

   This product provides 24 (local hour) 2.5° x 2.5° gridded composite maps of total (IC+CG) lightning bulk production, expressed as a flash rate density (fl/km^2/hr). Individual climatologies from the 5-yr OTD (4/95-3/00) and 3-yr LIS (12/97-11/00) missions are included, as well as a combined OTD+LIS climatology (having the total observations from both the LIS and OTD instruments) and supporting base data (flash counts and viewing times). Best-available detection efficiency corrections and instrument cross-normalizations, as of the product generation date (8/1/01), have been applied.

GHRC User Services Office
Global Hydrology Resource Center
320 Sparkman Drive
Huntsville, AL 35805
Phone: 256-961-7932/FAX: 256-961-7859
E-mail: ghrc@eos.nasa.gov

Regional GOFC Workshop

Remote Sensing of Forest Cover in Western Russia and Fennoscandia

— Garik Gutman (ggutman@hq.nasa.gov), NASA Headquarters
— Olga Krankina, Oregon State University
— John Townshend, University of Maryland

This workshop was a follow-up from the Novosibirsk Global Observation of Forest Cover (GOFC) Boreal Forest Workshop (August 2000), which recommended a series of more focused workshops to be convened within different regions of the boreal forest to address the issues specific to those regions. The regional workshop for the Western Russia-Fennoscandia region was held in St. Petersburg, Russia, on June 25-27, 2001, at the Center for International Environmental Cooperation (INENCO) of the Russian Academy of Sciences. GOFC management (John Townshend, David Skole, and Chris Justice) attended the workshop and helped guide the workshop deliberations. Several global, regional, national, and local programs are active in the region and were represented at the workshop (i.e., GOFC, NASA, European Space Agency (ESA), Russian Academy of Sciences, Forest inventory (Russia), EFI and others). The workshop location enabled a large participation by the Russian scientific and forestry community.

The general theme of the workshop was the integration of satellite and *in situ* observations for monitoring forest and land cover. Within this general theme the workshop addressed three main objectives: (i) review current uses of remote sensing in studies of forest cover in the region; (ii) examine data requirements and information needs at global, regional, and national scales; (iii) identify mechanisms for improved coordination among scientists, in particular assess the need for a regional network that would address information needs unique to the region.

Recent and current research projects were presented and discussed during days one and two of the workshop. They addressed primarily two GOFC themes: "Forest Cover Characteristics and Change" and "Forest Biophysical Processes." The third theme, fires, was addressed at an all-Russia scale because it is of relatively minor significance for the Western Russia–Fennoscandia region where fires are largely controlled. The results of ongoing projects indicate that the region has distinct characteristics that set it apart from other boreal forest regions. The distinctive features include:

- ***significant direct human impact throughout the region.*** There are very few remaining intact landscapes, and the natural disturbance regime has been replaced by logging for many decades. There is great interest in the region in conservation measures and in monitoring the remaining intact forests.

- ***active forest management for timber production and recreational use of forests.*** This creates a large group of current and potential operational users of remote sensing.

- ***large areas of aggrading forests likely result in a major carbon sink.*** Monitoring carbon accumulation is important for the global and regional studies of carbon exchange.

- ***extensive knowledge base, research infrastructure, forest inventory, and monitoring systems*** can provide a wealth of *in situ* data for interpretation and validation of remotely sensed observations.

Studies in the region developed methods and experience with integration of remotely sensed and *in situ* observations. In several projects, Landsat, Resurs, ERS, and SPOT imagery were integrated with *in situ* data to map vegetation types and forest biomass. Geographic Information Systems (GIS) were developed for operational forest management and fire monitoring. Multiple studies examined the impact of pollution, urban development, and logging on the hydrological network. *In situ* data sets and models are being developed for projecting the future dynamics of water run-off, soil organic carbon, and peatland growth. Biophysical properties of forest ecosystems are analyzed with a combination of flux tower measurements and modeling. The review of ongoing projects in the region included 24 oral and poster presentations. The abstracts are available at www.inenco.org.

Several long-term research priorities were identified for the region:

Further development of methodologies to address the following user needs:

a. assessing and mapping carbon stocks and annual deposition at regional and national levels based on integrated use of remotely sensed and forest inventory data;

b. detecting changes in vegetation cover with spatial resolution of 10-100 m and annual–decadal temporal resolution;

c. detecting biomass change due to forest growth and non-clearcut timber harvest; and

d. assessing the capabilities of MODIS, MERIS, ASAR, and other instruments for improved mapping of major categories of forest lands, tree species and age composition of forests and the detection of forest decline. Appropriate algorithms will have to be developed.

Development of inter-disciplinary research:

a. increasing affiliation with social sciences for better understanding of driving forces and consequences of land-use change; and

b. integrating studies to advance understanding of interaction between hydrological processes and carbon cycling.

Harmonization of forest cover mapping between countries that make up the region.

The workshop participants discussed options for improved coordination and information exchange among scientists and operational data users in the region. The roles of GOFC and regional networks were presented by J. Townshend. The experience with SEARIN (South-East Asia Regional Information Network) and two African networks (Miombo Network – Southern African Woodlands) and OSFAC (Central African Network – Rainforest) was reviewed based on presentations by D. Skole and C. Justice. It was decided that a regional network for Northern Europe would address the regional needs for coordination and information exchange. It would also promote collaborative projects and region-wide harmonization of forest cover mapping. Covered by the network will be the forest zone of Western Russia – Baltic countries – Scandinavia, roughly North of 55º N. A separate Siberia-Far East network should be considered to include the eastern part of Russia, Mongolia, China, Korea, and Japan.

As the first step towards organization of the North-European Regional Information Network (NERIN) the following activities were recommended:

- Inventory of ongoing and planned projects in the region and associated datasets. The information will be collected from workshop participants and other interested professionals and posted at INENCO web site. Victorov of INENCO Center and Krankina of Oregon State University (OSU) will take the lead on compiling this information.

- Form a coordinating committee to plan the development of the regional network, identify research priorities and benefits for users, and define information and data distribution system. A. Isaev and T. Hame agreed to co-chair this committee. Krankina will coordinate its work with GOFC and NASA. Additional members will be invited to join this committee as needed.

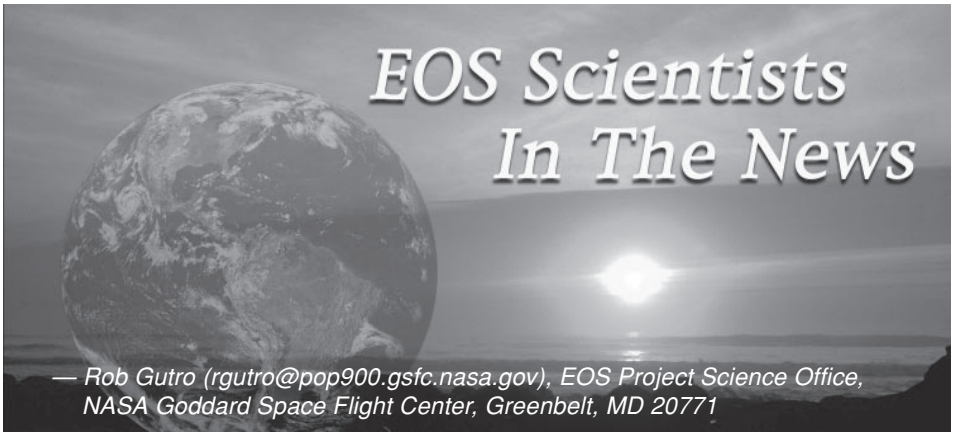
- Convene a follow-up meeting possibly in Finland in June of 2002. This next meeting should include space agencies, forest inventory organizations, and other established networks (European Forest Institute [EFI], IUFRO). Hame will contact EFI Director, Paivinen, with a request to host the next workshop.

- In preparation for this next workshop scientists active in the region are invited to propose to the coordinating committee their ideas for pilot/demonstration projects to help cement the newly established network.

Conclusions

The western part of the Former Soviet Union and Fennoscandia represent a distinct region within the boreal forest with common land-use history and forest types, controlled fires, and active forest management for timber production playing an important role in local economies. Strong evidence was presented to indicate that the region has been an active carbon sink in the past decades. Countries within the region share many common challenges in land and forest resource management. The systems for collection of *in situ* observations, in particular the forest inventory systems, are extensive and well maintained. The proposed development of the regional information network will help integrate these and other extant data sets into the framework of GOFC. The network will promote international cooperation and coordination within the region and advance the GOFC goal to improve the quality and availability of satellite

(Continued on page 26)



— Rob Gutro (rgutro@pop900.gsfc.nasa.gov), EOS Project Science Office, NASA Goddard Space Flight Center, Greenbelt, MD 20771

Major EOS hotspots in the news this period include the Northern Hemisphere becoming a "Greener Greenhouse," and tracking changes in ozone, ice, dust, hurricanes, and stratospheric winds.

"Advancing Weather Prediction" (October 19) United Press International - Mark Baldwin of Northwest Research Associates discussed his study, funded in part by NASA, that indicates that shifting winds in the stratosphere during the winter may be used to make better weather predictions on the Earth's surface.

"NASA Experiment Sheds Light on Hurricanes" (October 5) United Press International - The CAMEX-4 experiment flew over Hurricane Humberto and took radar, temperature, and wind measurements, which may lead scientists to better hurricane predictions. This article spotlighted efforts by Gerry Heymsfield, Scott Braun, and Jeff Halverson, all of NASA's Goddard Space Flight Center.

"Icelandic Weather System May Explain Melting Arctic Ice" (October 3) Scientific American on-line, United Press International - New research by Claire Parkinson (NASA GSFC) indicates largely natural fluctuations in a semi-permanent low pressure system over Iceland has contributed to decreases in sea ice in the Arctic over the last two decades.

"Ozone Lost in Waves" (September 26) Nature, The Weather Channel - Paul Newman and Eric Nash (NASA/GSFC) used 22 years of satellite-derived data and confirmed a theory that the strength of "long waves," bands of atmospheric energy that circle the Earth, regulate the temperatures in the upper atmosphere of the Arctic, and play a role in controlling ozone losses in the stratosphere.

"Dust Forecasts Could Help Breathing, Fishing" (September 21) The Weather Channel and weather.com - Mian Chin (NASA/GSFC) discussed how a new atmospheric computer model could help predict future arrivals of airborne dust linked to respiratory problems and red tide blooms in the United States.

"El Niño and La Niña Linked to Polar Ice Shifts" (September 20) The Weather Channel and weather.com - New findings by David Rind of NASA's Goddard Institute for Space Studies suggests for the first time that El Niño and La Niña are behind shifts in ice at the South Pole.

"It's Back and Big" (September 7) ABCnews.com - Paul Newman (NASA/GSFC) noted that conditions are ripe for a large ozone hole over the Antarctic this year.

"Northern Hemisphere is a Greener Greenhouse" (September 4) Washington Post, Reuters, Associated Press, and hundreds of media outlets world-wide - Compton Tucker (NASA/GSFC) and Ranga Myneni (Boston University) say that, according to satellite data, the Northern Hemisphere has been getting greener as a result of greenhouse gases.

"Dust From Africa Linked to Red Tide" (August 31) MSNBC, Associated Press, New York Times - New NASA-funded research by Jason Lenes and John Walsh (Univ. of South Florida) shows that Saharan dust clouds that contain iron help to set the stage for blooms of toxic red tide algae in the Gulf of Mexico.

Attention EOS Researchers:
Please send notices of recent media coverage in which you have been involved to:
Rob Gutro, EOS Project Science Office
Code 912.1, NASA/GSFC
Greenbelt, MD 20771
Tel. 301-286-4044; fax (301) 441-5607
E-mail: rgutro@pop900.gsfc.nasa.gov

(Continued from page 20)

Meeting of Federation of Earth Science Information Partners

ship; Dave Etter, Community Engagement; Michael Goodman, Constitution and By-laws; Steve Kempler, Products and Services; Rob Raskin, Interoperability; and Doug Kliman, Commercial Development. The Federation will be well served by these leaders.

Special Events

The ESIP Federation exists so that enhanced understanding of the global environment and humankind's impacts upon it will lead to more benevolent treatment of our home planet. It was, therefore, fitting that the Summer 2001 meeting was opened and closed by a Native American leader, Dennis Bercier, Senator in North Dakota's legislature and senior administrator in Turtle Mountain Community College on a Chippewa reservation. Dennis conveyed information from the residents of the environment in which the meeting was held who have the longest history living in it.

Gary Wagner and his brothers hosted a Prairie Farmer's Breakfast (translation, a more than ample breakfast) to show one end product of the Earth Science Enterprise. Gary uses images from a variety of satellite and aerial sensors to manage his farm in such a way as to maximize income and minimize environmental impact. Morning coffee was sweetened with American Crystal sugar, the cooperative to which Gary delivers sugar beets for processing. Those who acquire the data, then others in the chain of adding value to them, saw the end result of all their efforts.

Professor Vaclav Smil, University of Manitoba, reminded us why our work is important in his keynote address about the environmental history of Earth since 1950.

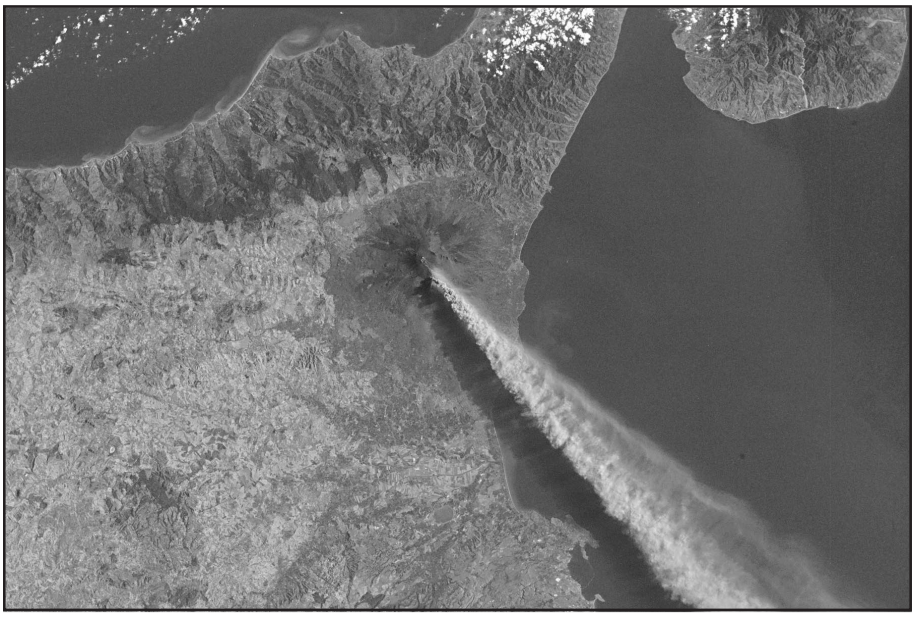
Tragic Footnote

Less than two months after the meeting concluded, Charles S. Falkenberg, his wife, and their two children were aboard the plane that terrorists crashed into the Pentagon on September 11. All were killed. Charles was a valued member of an ESIP team. The Federation has established a Charles S. Falkenberg Award to be presented annually to an outstanding young Earth scientist. Contributions to the Award fund are welcome. Make checks payable to AGU. Indicate on them, "Charles S. Falkenberg Award," and send them to American Geophysical Union, 2000 Florida Avenue, NW, Washington, DC 20009-1277, USA.

(Continued frompage 24)

Remote Sensing of Forest Cover in Western Russia and Fennoscandia

observations of forests at regional and global scales and to produce useful, timely, and validated information products from these data for a wide variety of users. The network will synthesize and update the region-specific requirements for observations and products, work with government agencies to improve access to data, and help coordinate regional research agendas with the global remote sensing community.



When this southward-looking photograph was taken by the Expedition 2 crew aboard the International Space Station, the city of Catania (in shadow, ~25 km SSE of the volcano) was covered by a layer of ash and Fontanarossa International Airport was closed. On that day an ash cloud was reported to have reached a maximum height of ~5.2 km. Plumes from two sources are visible here—a dense, darker mass from one of the three summit craters and a lighter, lower one.

The record of historical volcanism of Mt. Etna is one of the longest in the world, dating back to 1500 BC. Two styles of activity are typical: explosive eruptions, sometimes with minor lava flows, from the summit craters, and flank eruptions from fissures. (Digital photograph was taken on July 22, 2001 from Space Station Alpha and was provided by the Earth Sciences and Image Analysis Laboratory at Johnson Space Center. Additional images taken by astronauts and cosmonauts can be viewed at the NASA-JSC Gateway to Astronaut Photography of Earth.)

Global Change Calendar

December 5-7
MISR Science Team Meeting, Pasadena, CA. Contact Dave Diner, e-mail: david.a.dinner@jpl.nasa.gov.

December 17-19
MODIS Science Team Meeting, BWI Airport Marriott, Baltimore, MD. Contact Barbara Conboy, e-mail: barbara.conboy@gsfc.nasa.gov.

2002

January 21-23
CERES Science Team Meeting, Brussels, Belgium. Contact: Jennifer Hubble, NASA Langley, e-mail: j.m.hubble@larc.nasa.gov.

January (Date TBD)
ASTER Science Team Meeting. For further information contact Anne Kahle, ASTER U.S. Science Team Leader, e-mail: anne@aster.jpl.nasa.gov, tel. (818) 354-7265.

February 26-28
Science Data Processing Workshop, Martin's Crosswinds, Greenbelt, Maryland. Contact: Mike Seablom, tel. (301) 286-2406, Mary Reph, tel. (301) 286-1006 or visit Website at that.gsfc.nasa.gov/gss/workshop2002/index.html. Send e-mail to sdpworkshop2002@majordomo.gsfc.nasa.gov.

March 4-6
AIRSAR Earth Science and Applications Workshop, NASA Jet Propulsion Laboratory. Contact David Imel, e-mail: imel@jpl.nasa.gov. For detailed information see Website at airsar.jpl.nasa.gov.

July 22-26
The International Tropical Rainfall Measurement Mission (TRMM) Science Conference, Honolulu, Hawaii. Contact: Robert Adler, e-mail: robert.adler@gsfc.nasa.gov.

October 14-19
COSPAR Scientific Commission A, Houston, TX. Contact Robert Ellingson, e-mail: bobe@metosrv2.umd.edu, tel. (301) 405-5386.

Global Change Calendar

2002

January 13-17
American Meteorology Society Annual Meeting, Orlando, FL. For detailed information see URL at www.ametsoc.org/AMS/.

January 21-23
Non-CO_2 Greenhouse Gases (NCGG-3) scientific understanding, control options and policy aspects, Maastricht, The Netherlands. Contact Dr. Joop van Ham. e-mail: j.vanham@plant.nl; tel. 31-15-285-2558; Fax: 31-15-261-3186; URL: www.et.ic.ac.uk/Dept/Local/News/greenhouse.htm.

February 14-19
American Association for the Advancement of Science, Boston. Contact: AAAS Meetings Dept. 1200 New York Ave. NW. Washington, DC 20005, tel. (202) 326-6450; e-mail: aaasmeeting@aaas.org; Website at www.aaasmeeting.org.

March 5-8
Oceanology International 2002, Excel, London, UK. Contact Kari Jaeobson, e-mail: kjaeobson@pgi.com, URL: www.oceanologyinternational.com.

April 7-12
29th International Symposium on Remote Sensing of Environment "Information for Sustainability and Development," Buenos Aires, Argentina. Call for Papers. Contact Secretariat, e-mail: 29isrse@conae.gov.ar, URL: www.symposia.org.

April 22-26
2002 American Society of Photogramentry and Remote Sensing Annual Conference, Washington, DC. See Website at www.fig2002.com/.

May 28-June 1
American Geophysical Union (AGU) 2002 Spring Meeting, Washington DC. See Website at www.agu.org/.

May 20-22
Seventh International Conference Remote Sensing for Marine and Coastal Environments, Miami. Call for Papers. Contact Nancy Wallman. e-mail: nancy.wallman@veridian.com; URL: www.erim-int.com/CONF/marine/MARINE.html.

June 11-13
Third International Symposium on "Remote Sensing of Urban Areas," Istanbul, Turkey. Call for Papers. Contact Assoc. Prof. Filiz Sunar Erbek, e-mail: fsunar@srv.ins.itu.edu.tr, URL: www.ins.itu.edu.tr/rsurban3.

July 7-10
2nd Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) Science Conference, Manaus, Brazil. Contact Flavio Luizao of the National Institute for Space Research (INPE), Manaus, Brazil, e-mail: luizao@cptec.inpe.br.

July 9-12
2002 Joint International Symposium on GeoSpatial Theory, Processing and Applications, Ottawa, Canada. Call for Papers. For details, tel. +1 613 224-9577; e-mail: exdircig@netrover.com; URL: www.geomatics2002.org.

September 2-6
ISPRS Commission V Symposium, Thessaloniki, Greece. Call for Papers. Contact Prof. Alexandra Koussoulakou, e-mail: kusulaku@eng.auth.gr.

September 3-6
Pan Ocean Remote Sensing Conference (PORSEC) 2002, Bali, Indonesia. Contact Bonar Pasaribu, e-mail: bonarpp@indosat.net.id, URL: www.porsec2001.com.

October 26-28
3rd International Symposium on Sustainable Agro-environmental Systems: New Technologies and Applications, Cairo, Egypt. Contact Prof. Derya Maktax, e-mail: dmaktav@ins.itu.edu.tr.

Code 900
National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

Official Business
Penalty For Private Use, $300.00

PRSRT STD
Postage and Fees Paid
National Aeronautics and
Space Administration
Permit G27

The Earth Observer

The Earth Observer is published by the EOS Project Science Office, Code 900, NASA Goddard Space Flight Center, Greenbelt, Maryland 20771, telephone (301) 614-5559, FAX (301) 614-6530, and is available on the World Wide Web at http://eos.nasa.gov/ or by writing to the above address. Articles, contributions to the meeting calendar, and suggestions are welcomed. Contributions to the Global Change meeting calendar should contain location, person to contact, telephone number, and e-mail address. To subscribe to *The Earth Observer*, or to change your mailing address, please call Hannelore Parrish at (301) 867-2114, send message to hannelore_parrish@sesda.com, or write to the address above.

The Earth Observer Staff:

Printed on Recycled Paper