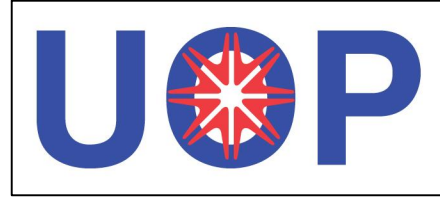


15 September 2006



MEMORANDUM: UCAR Board of Trustees
UCAR Member Representatives
UCAR University Relations Committee Members
UCAR Academic Affiliates

FROM: Jack D. Fellows, UOP Director
SUBJECT: 2006 UCAR Office of Programs Report

Over the past year, UOP senior management have worked hard to explore how various UOP, NCAR, and community efforts can partner together to better address important issues facing our community and the nation. The purpose of this report is: (1) to introduce the new UOP Strategic Plan that has come out of that exploration, and (2) to summarize UOP activities over the past year.

Introduction. UOP was created in 1992 to manage a number of programs outside of NCAR that were specifically requested from the broader UCAR community (e.g., several federal agencies or governments with a common need, a complex UCAR and non-UCAR community partnership, etc).

For example, COMET began when community members (universities, the National Weather Services, etc) asked UCAR to develop a program for training our nation's operational weather forecasters through a single program managed in UOP. In all these efforts, UOP has proven to be extremely flexible and responsive to community and sponsor needs and an effective home for these novel and integrating partnerships.

Today, there are eight UOP programs that successfully partner with the community to achieve specific goals and objectives (see Community Contributions box). UOP programs are typically more service-oriented than research oriented. A major focus for UOP is making sure that community and NCAR science gets transferred in novel ways to the broader community and beyond. Thus, most UOP efforts include some type of partnership with community and NCAR programs and scientists.

Recent UOP Community Contributions

- Providing over 160 colleges and universities with real-time meteorological data and the software to access, manage, and visualize these data (Unidata).
- Building and launching a low-cost, novel six-satellite constellation to measure atmospheric parameters (COSMIC).
- Training our nation's operational weather forecasters via state-of-the-art distance and traditional learning approaches (COMET).
- Teaching over a million children in over 100 countries to take environmental measurements, share them over the web, and apply them to pressing environmental issues (GLOBE).
- Nurturing the next generation of scientists by placing visiting scientists and postdoctoral students in labs and universities across our nation to work on cutting-edge science problems (VSP).
- Building digital libraries to provide broad access to scientific research and education materials (DLESE and NSDL).
- Providing outstanding program support to community efforts (JOSS).

UOP Strategic Plan. Each of the UOP programs has its own strategic plan, assessment metrics, and community governance approach that have served their respective communities well (see Community Comment box). Individual UOP programs move forward fairly independently of each other based on the needs expressed by their individual constituencies and sponsors. However, this past year, UOP senior management developed the first integrated strategic plan in over a decade. This Plan focuses on how the UOP programs can work together to further improve their service to the community. The Plan was approved by the UCAR Board of Trustees in May 2006 and can be viewed on UOP's website (www.uop.ucar.edu). A major focus of the Plan is the recognition by UOP senior management that users need more help in incorporating the complex scientific knowledge and information our community generates. That would be true for a K-12 teacher struggling to integrate a complex distance learning object into the constraints of local and national science standards; for an emergency manager who knows our science is important to his decisionmaking, but doesn't have the tools to use this information; or a young professor faced with the daunting task of incorporating into a low-tech classroom environment the many terabytes of data, complex models, and computationally demanding visualization tools that our community produces.

Community Comments about UOP Programs from the 2005 UCAR Community Survey

"The COMET program should be strongly supported— it is an incredibly useful entity that benefits a broad range of our community."

" It would not be an exaggeration to say. . .DLESE has revolutionized the way I teach Earth science. "

"Great help with program support and travel arrangements! They are terrific. [JOSS]"

"Unidata is an outstanding success, and has played an important role in making high level operational research a possibility in smaller university settings. Excellent program! One of the best if not the best at UCAR/NCAR."

"These programs are absolutely crucial to our nation's future leadership in climate research. [VSP]"

2006 UOP Activity Summary and Highlights. *Education, Service, Community Building, and Innovation* continue to be hallmarks of UOP. UOP prides itself on:

- being a trusted, high quality resource to get things done quickly, economically, and well;
- bringing the right people and tools together to address problems that members of our community can't easily solve on their own; and
- developing innovative solutions for challenges in research and education at the local, regional, national, and global scale.

To meet the UOP vision and mission (see mission/vision box), UOP focuses on the following five goal areas:

1. Provide premier leadership in building and hosting community projects that advance the national and international scientific and educational agenda.
2. Provide innovative next-generation education and training services.
3. Develop and transfer technologies to meet critical societal and community needs.
4. Provide effective, state-of-the-art data services.
5. Deliver reliable and cost-effective support to meet diverse programmatic needs in the UCAR community.

- **Vision.** *Bring communities together to address large-scale, integrated research and education issues.*
- **Mission.** *Provide leadership, services, and innovation in support of UCAR community education and research goals.*

The following are some highlights from the past year relative to these five goal areas. This is just a brief snapshot of all the exciting UOP activities, so please read the full report below after this brief highlights summary.

1. **Building and Hosting Community Projects.** All the UOP programs are community initiated and community lead. COMET and UNIDATA are great examples of this, because they provide outstanding data services and state-of-the-art training in areas defined by their respective communities. The two digital library efforts, NSDL and DLESE, are UOP's most recent community efforts hosted by UOP. NSDL continues to make substantial progress in building this important library. Unfortunately, NSF has decided to not continue funding for the DLESE community and have asked the DLESE Program Center (DPC) at UCAR to phase out the DLESE activities and look for a long-term host for the current library. The DPC is exploring new ways to serve the UCAR community, including developing tools and services to support science learning. Many UOP programs are helping community efforts address NSF's Criterion Two (broader impacts) – in particular the DPC and GLOBE.

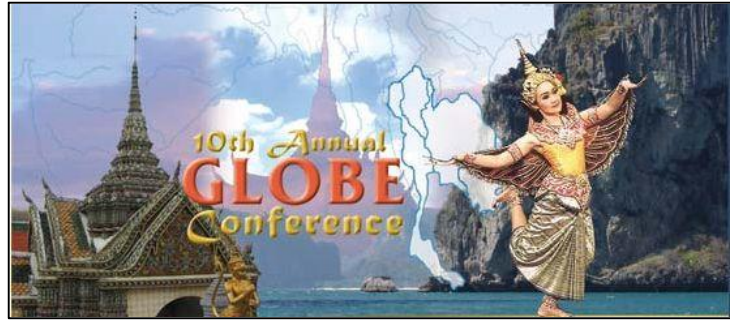
2. **Education and Training Services.** The use of COMET modules has continued to grow. The program has expanded its satellite training portfolio over the past year, including NOAA's NPOESS polar orbiting satellites and a partnership between COMET and COSMIC that teaches how to best utilize the exciting new COSMIC occultation data set. Other new COMET modules include how to work with hydrologic data, flood forecasting, an introduction to ocean times, and an introduction to Skew-T diagrams. Many of the COMET modules are being translated into Spanish. COMET received the 2006 American Geophysical Union (AGU) Excellence in Geophysical Education Award. DLESE and NSDL have worked with partners across the nation on how to assign educational standards to electronic learning resources, improved metadata harvesting and discovery techniques, and developing new architectures for indexing, managing, and accessing complex information. NSF recently designated NSDL as a recommended dissemination tool and repository within selected grants. NSDL partnered with the National Science Teacher Association (NSTA) to produce monthly web seminars for teacher professional development. The May 2006 NSDL-NSTA seminar featured DLESE and focused on the topic of hurricanes. Unidata's July 2006 Users Workshop focused on expanding the use of atmospheric models as educational tools. Participants got hands-on experiences on how to use models like Weather Research and Forecasting (WRF) model in the classroom.



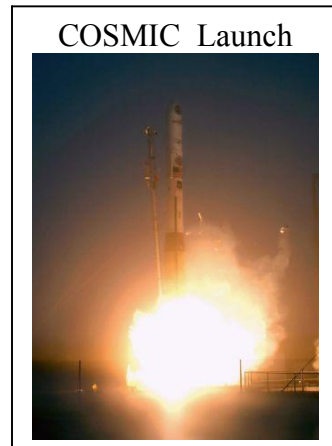
GLOBE is now entering its fourth year of operation at UCAR. During the past year GLOBE and NASA (with NSF consultation) mutually agreed to modify the original cooperative agreement to: (a) place a greater emphasis on student's "doing science" by collecting, analyzing, sharing, and reporting data from local and regional Environmental investigations, (b) build stronger connections between students, teachers and scientists around the world by linking GLOBE schools to cutting-edge Earth System Science (ESS) research projects, and (c) support the creation of

six, semi-autonomous “Regional Consortia” (Africa, Asia-Pacific, Europe, Latin America-Caribbean, Near East and North America), who share common geographic, cultural, and environmental interests and work toward programmatic sustainability in their respective regions. These ESS research projects include student oriented investigations of: (1) watersheds, (2) seasons and biomes, (3) the carbon cycle, and (4) the deep ocean environment. GLOBE also produced two important products: (a) Understanding GLOBE student data, and (b) Elementary GLOBE (five story books for grades K-4 students).

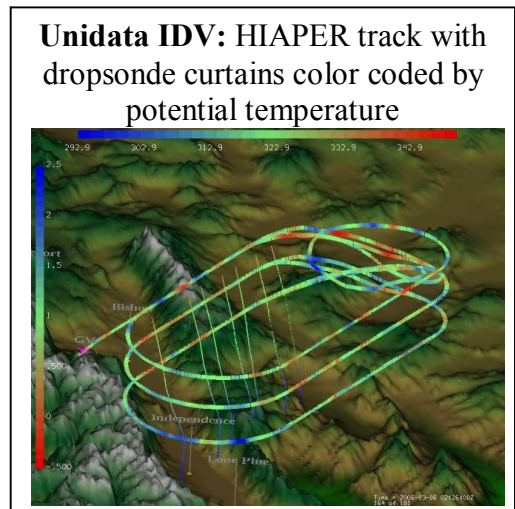
GLOBE also sponsored “GLOBE at Night” during March 2006 to study light pollution around the world -- over 18,000 people participated in this study worldwide. The GLOBE program held its annual community meeting in Thailand with over 25 countries represented.



- 3. Technologies Transfer.** The COSMIC six satellite constellation was launched in April 2006 and this important new data set is available via the COSMIC webpage (www.cosmic.ucar.edu). The six spacecraft are transitioning over the next six months to their final orbits. Thus, only roughly half of the 2,500 daily soundings are now available, but are already proving important for both research and forecasting. COSMIC’s breakthrough on new GPS tracking technique (Open Loop Tracking) is permitting record numbers of soundings to penetrate all the way to the ground. The first COSMIC Data workshop will be held October 16-18, 2006 in Boulder. COMET’s Outreach Programs continue to help transfer important ideas and concepts through partnerships between universities (+70) and operational weather forecasters and similar users (+100). This past year, COMET awarded 17 new one-year projects.

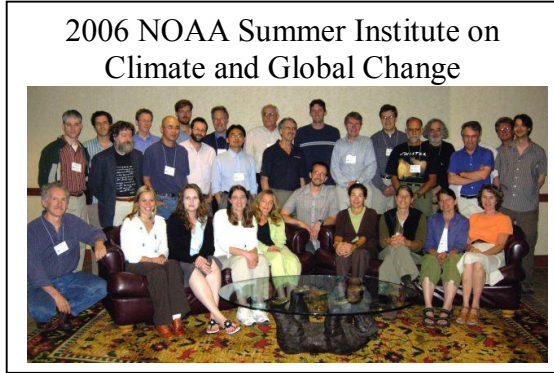


- 4. Data Services.** Unidata has continued to develop reliable and hardened data services for the education and research community – distributing a record volume of data to the community this past year via Internet 2. The Unidata Local Data Manager was selected for THORPEX Interactive Grand Global Ensemble project’s data collection tool. Unidata has made substantial progress on simplifying the discovery and use of scientific data and is allowing scientist to reference data in scientific papers through the Thematic Real-time Environmental Distributed Data Service (THREDDS). Unidata is also working with community partners to develop a Common Data



Model that will substantially improve the handling of data. The Unidata platform independent analysis and visualization software, Integrated Data Viewer, is being broadly adopted. It was downloaded nearly 3,000 times last year from users in 65 countries. It was also selected as the visualization tool for the Terrain-Induced Rotors Experiment (T-REX). Glowing community testimonials abound for these Unidata tools!

5. **Community Support.** JOSS and VSP have continued throughout the year to provide important services to the community, including travel and workshop support. JOSS supported the travel for over 1,100 community members and a broad range of workshops and community projects. VSP made 80 graduate students, postdoc, and visiting scientist appointments over the past year. VSP hosts a biennial summer institute as a component of the NOAA Climate and Global Change Postdoctoral Fellowship program. This year's institute brought together current postdocs, program alumni, science leaders, and sponsors to discuss the future of climate research.



End of UOP Report Summary and Highlights

FULL UOP REPORT

Cooperative Program for Operational Meteorology, Education and Training (COMET®)

Program Director: Dr. Tim Spangler www.comet.ucar.edu

Mission. Serve as a premier resource to support, enhance, and stimulate the communication and application of scientific knowledge in the atmospheric and related sciences.

Education and Training. COMET provides education in environmental sciences through innovative methods to disseminate scientific knowledge and by supporting related applied research. COMET produces and delivers online professional development materials and courses that serve as resources for a variety of users. The COMET Program offers advanced meteorological education in a classroom and forecasting laboratory environment for agency and community personnel. These offerings are designed to provide new scientific knowledge and demonstrate its operational relevance.

MetEd Website (<http://www.meted.ucar.edu>). The MetEd site is an internationally recognized education and training online facility that hosts Web-based education and training created by the COMET Program, other training organizations, universities, and research institutions. Figure 1 shows the growth in the use of the COMET MetEd site from 2000 through 2005 using adjusted numbers that represent actual monthly visits to the Website.

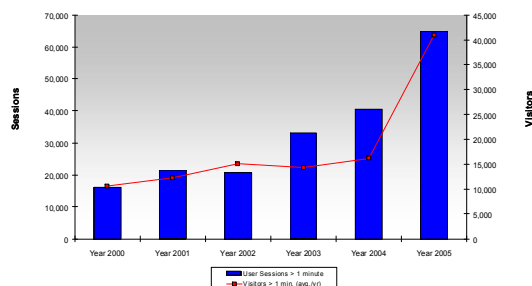


Figure 1: COMET/MetEd Averaged Monthly Usage

When an individual elects to register in the MetEd Registration and Assessment system, an electronic certificate will be sent to them upon successful completion of a module or course. Registrants can elect to have their module completion information sent to a supervisor, training officer or other designated individual. As of 24 August 2006, there are 4,031 registered users and 13,509 quizzes have been completed. COMET sponsors have requested that COMET develop a mandatory registration system to capture a more complete picture of the MetEd user community. The new system will be implemented over the course of the next year. COMET is working to minimize the impact of this system on users.

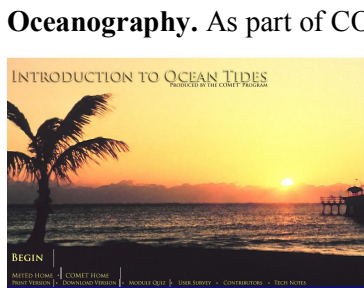
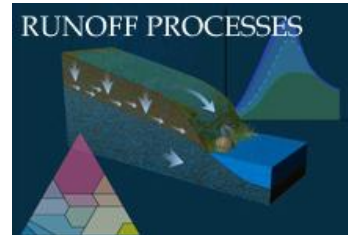
Some COMET Distance Learning Highlights:

Satellite Meteorology. This year the COMET Program has seen the expansion of satellite-related training from a purely domestic satellite foci to inclusion of web-based materials highlighting the promise of the COSMIC mission as well as on the new EUMETSAT Polar System (EPS). COMET also continued to educate and prepare forecasters to better use satellite imagery and products in the forecast process via a series of other satellite-related publications including: “Microwave Remote Sensing Overview”, “Advances in Microwave Remote Sensing: Ocean Wind Speed and Direction”, “Dynamic Feature Identification: The



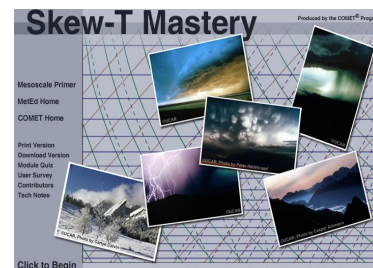
Satellite Palette”, and most recently, “Microwave Remote Sensing: Clouds, Precipitation, and Water Vapor.” In 2007, COMET plans to include several new modules, revisions to pre-existing materials to reflect changes in the NPOESS program, holding of our annual user’s workshop, and development of a prototype Satellite Matrix patterned after their popular Operational Numerical Weather Prediction (NWP) Models Matrix.

Hydrometeorology. This introductory course is aimed at non-hydrologists who work with hydrologic data and have flood forecasting responsibilities. The 10-12 hour distance learning course will cover eight foundation topics and several case studies with a combination of richly-illustrated interactive web modules, webcasts, and teletraining sessions. Topics covered include the basic hydrologic cycle, runoff processes, unit hydrograph theory, flash flood processes, stream flow routing, flood frequency analysis, river ice processes, and snowmelt processes. The case studies will focus on both river forecasting and small stream forecasting. All eight foundation topics and the river forecasting case study will be published by January 2007. Teletraining sessions, including a course orientation and the small stream forecasting case studies, will be delivered in late winter/early spring of 2007.



Oceanography. As part of COMET’s expansion into other geoscience topics, this past year a new oceanography module, “Introduction to Ocean Tides”, was developed and published. This interactive module covers basic tidal forcing mechanisms, terminology, and tide prediction methods and products. Special effort was invested in developing 3-D visualizations to explain otherwise complex lunar and solar tidal-forcing concepts. In 2007, COMET expects to publish other ocean science modules covering ocean currents, littoral oceanography, and the air/sea interface.

Skew-T Mastery. The COMET Program has developed the initial version of a web-based interactive Skew-T, log-p module for meteorology education and training. They anticipate a great deal of interest in this module from the academic community. The distance learning module contains a basic introduction and description of the Skew-T diagram, followed by a parameters section that defines and demonstrates techniques for determining important meteorological quantities. The module also includes a stability section that covers the basics of parcel processes and stability types as well as processes that change stability. A forecast applications section highlights use of the Skew-T diagram in a variety of forecast scenarios, ranging from determination of precipitation type to forecasting hail size in severe thunderstorms. Throughout the module, rich graphical animations are used to illustrate procedures, complemented by conceptual diagrams depicting meteorological processes. The cornerstone of the module is the interactive Skew-T diagram, which displays a plotted sounding, along with various sounding parameters. It features a click and drag capability whereby a user may edit/modify the sounding. The diagram is frequently used in the interactive exercises imbedded throughout various sections of the module.



Translations. COMET has begun an active translation program, working with the National Weather Service, International Affairs Office to provide Spanish translations of selected modules. In addition, COMET is working with the Meteorological Service of Canada (MSC) to provide French translations of selected modules. As COMET gains access to translations of COMET modules from other countries they are also making those available on the MetEd Website. In September 2006, COMET developed a translations resource page to make all translated materials available in one location.

COMET Classroom Highlights:

- **Faculty Multimedia Workshop:** In July 2006, COMET hosted a NSF sponsored Summer Faculty course on the Effective Applications of Multimedia to Teaching in Atmospheric Science. The primary goal for this workshop was to help university faculty make greater and more effective use of multimedia in their teaching at their home institution. Twenty faculty members attended with four international participants and four faculty lead instructors.
- **Virtual COMAP Boundary Layer Symposium:** COMET will offer its first virtual course in September 2006 as the program converts a very popular boundary layer meteorology symposium to be offered at a distance. A “virtual” course is a real-time, synchronous event delivered at distance. It has the same time-frame and schedule of activities and presentations as a residence course would.

Outreach Program. The Outreach Program creates partnerships between the academic research community and weather forecasters that allow the exchange of ideas and concepts to the benefit of both groups. Since its inception, the Outreach Program has provided monetary support for over 250 Research Projects. These projects have involved more than 70 different universities with over 100 NWS, Department of Transportation (DOT), Navy and AFWA Forecast offices. COMET received an increase in funding in the spring of 2006 and issued an RFP for Partners proposals, resulting in 17 new one-year projects being awarded.

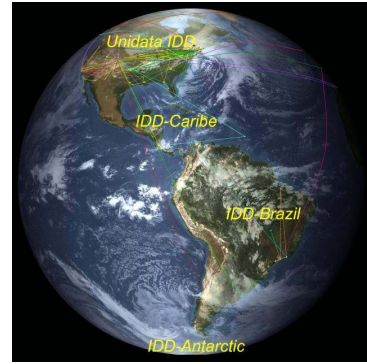
UNIDATA

Program Director: Dr. Mohan Ramamurthy <http://www.unidata.ucar.edu>

Mission. Providing data, tools, and community leadership for enhanced Earth-system education and research.

The past year was another highly successful year for the Unidata Program. Unidata not only continues to fulfill its core mission to provide data, tools and community leadership for the atmospheric science and related communities, but is also developing new and enhanced capabilities to serve a broader and more diverse community. While Unidata’s primary mission is to develop reliable and hardened data services for the education and research community, many of its technologies and tools are also widely used by a broad range of users in government and private sectors. The rich portfolio of Unidata’s diverse cyberinfrastructure activities, coupled with broad community acceptance and the ubiquitous use of its services, demonstrate the value of NSF’s sustained investments in a community-based facility within UCAR. Unidata has come to be regarded as a forward-looking, national resource, and often viewed as a trusted and knowledgeable partner by its stakeholders on data and cyberinfrastructure matters. During the past year, there were many accomplishments that had a positive impact on the community across the breadth of the program, a few of which are highlighted below:

Data Distribution. Unidata distributed a record volume of data to the community far and wide on five continents during the past year. In fact, there has been a 50% increase in data volume transmitted via Internet 2, largely due to the growth in the size of output from operational models. Currently, there are about 350 hosts in 171 network domains running the latest version of the Unidata Local Data Manager (LDM) and reporting real time statistics in the Internet Data Distribution system. The figure to the left shows internet Data Distribution in the Western Hemisphere.



The LDM was selected this spring for data collection activities in the THORPEX Interactive Grand Global Ensemble (TIGGE) project. When fully implemented, the LDM will be used to move operational model grids from ten international operational weather prediction centers to NCAR, ECMWF, Reading, and CMA, Beijing. Already data from ECMWF, UK Meteorological Office, and Japan Meteorological Agency are flowing to the TIGGE archive at NCAR in the initial phase of this project, and soon a full suite of data from NCEP GFS operational ensemble output will be flowing to the university community via the Unidata-managed CONDUIT datastream.

THREDDDS. The THREDDDS (Thematic Realtime Environmental Distributed Data Services) project is developing middleware to bridge the gap between data providers and data users. The goal is to simplify the discovery and use of scientific data and to allow scientific publications and educational materials to reference scientific data. The mission of THREDDDS is for students, educators and researchers to publish, contribute, find, and interact with data relating to the Earth system in a convenient, effective, and integrated fashion. Just as the World Wide Web and digital-library technologies have simplified the process of publishing and accessing multimedia documents, THREDDDS is building infrastructure needed for publishing and accessing scientific data in a similarly convenient fashion.

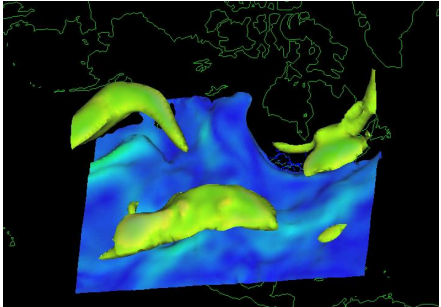
The past year saw the first release of the THREDDDS Data Server, a web server that provides metadata and data access for scientific datasets, building on and extending a number of existing technologies: THREDDDS Dataset Inventory Catalogs are used to provide virtual directories of available data and their associated metadata. These catalogs can be generated dynamically or statically. The associated NetCDF-Java library reads NetCDF, OPeNDAP, and HDF5 datasets, as well as other binary formats such as GRIB and NEXRAD into a "Common Data Model" (CDM). The CDM is an abstract data model that the netCDF (Unidata), HDF5 (NCSA) and OPeNDAP (University of Rhode Island) developers are using to converge their respective data models towards. The CDM also adds "Georeferencing Coordinate Systems" and specialized "Scientific Data Type" layers, which provides the semantics needed to convert datasets to other protocols and formats such as those required by GIS systems. In addition to other capabilities, the TDS provides data access through the OpenGIS Consortium (OGC) Web Coverage Service (WCS) protocol for any "gridded" dataset whose coordinate system information is complete.

Geoscience data providers around the world are deploying THREDDS technologies, including the Community Data Portal at NCAR and the National Climatic Data Center (NCDC). The following comments exemplify the value of Unidata’s cyberinfrastructure work at NCDC: “The National Climatic Data Center uses Unidata software and formats (NetCDF) in many different ways. Much of our processing and access is moving towards Unidata-developed architecture. By providing free and open-source software, Unidata has encouraged the community to move towards open standards and interoperability. This is revolutionary from the perspective of the user and data provider. Thank you Unidata!”

Analysis and Visualization Tools.

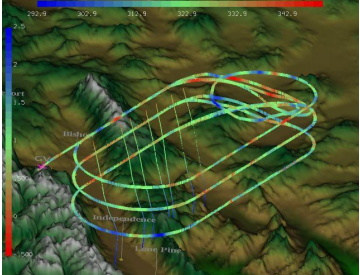
Integrated Data Viewer. Community adoption and use of the Integrated Data Viewer (IDV), Unidata’s platform-independent analysis and visualization software, is growing as both new and traditional users find innovative applications for the software package. During a 12-month period, this particular package was downloaded 2,836 times from users in 65 countries. During this past summer, on average, the IDV was used approximately 200 times each work day by users.

Three-dimensional visualization using the IDV (“I just love creating animated, continental and global 3-D jet stream visualizations with a 3-D temperature surface plotted below it. It does just what I'd hoped it would do when I wrote a 'use case' for it back in the beginning stages of the IDV's development!” – Dave Dempsey, SFSU



The IDV was selected as the visualization tool for the Operations Center for the Terrain-Induced Rotors Experiment (T-REX). It was used to display model output, aircraft flight tracks and dropsondes, satellite imagery and field upsondes. Below is a visualization of the HIAPER aircraft track superimposed on dropsonde curtains in the vicinity of the T-REX Project area.


Unidata IDV: HIAPER track with dropsonde curtains color coded by potential temperature



A new version of the IDV, Version 2.0, was released in August 2006, which included a new Dashboard Window. The Dashboard Window significantly improved the user interface and experience, as indicated in these initial responses: “I like v2 – much easier to use and it does seem quicker...the ‘plug-in method is straightforward.” “I like the dashboard controls...makes the process of using IDV simpler...”

GEMPAK, another Unidata-supported visualization tool, provides the community with a comprehensive analysis and display package comprised of data decoders and tools to manipulate data from a wide variety of sources. Unidata leverages development efforts within NCEP and NWS to provide users access to operational and research capabilities for both classroom and research efforts. GEMPAK, with its use in over 200 institutions, continues to be the most widely used

GEMPAK-generated satellite image of Hurricane Katrina just before its landfall in Louisiana

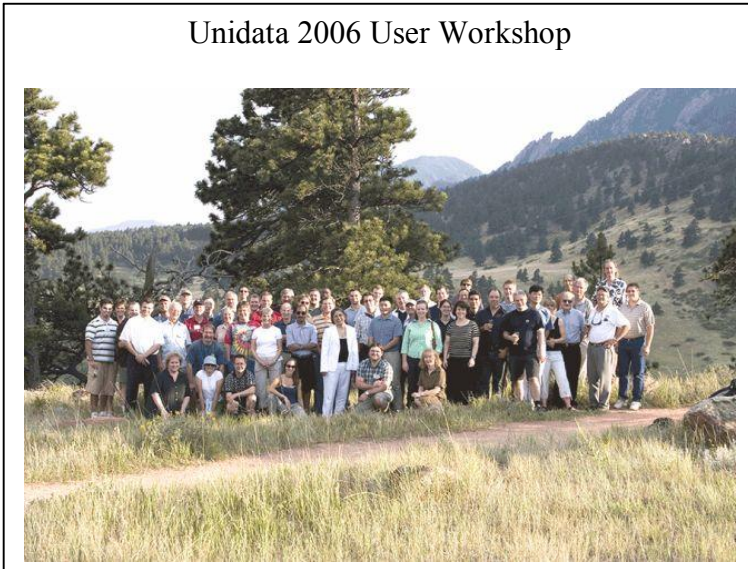


analysis and display tool from Unidata. It is the mainstay in most weather analysis and forecasting courses and laboratories at universities.

2006 Users Workshop. The highly successful Unidata Users Workshop was held 10-14 July, 2006 at the UCAR Center Green facility. While this year's edition of the workshop, *Expanding the Use of Models as Educational Tools in the Atmospheric & Related Sciences*, followed the pattern of others held in years gone by, it was different in that a separate computer was available for each participant for use during lab sessions. What that meant was that each person had the opportunity to have a unique learning experience. There were 72 registered attendees, including nine graduate students who received special fellowship to participate in the workshop.

The "hands down" engaging aspect of Unidata's Users workshop was the "hands on" use of models in the lab sessions. The workshop provided an opportunity for the first large-scale demonstration of LEAD (Linked Environments for Atmospheric Discovery), a large, multi-institution Information Technology Research Project. LEAD developers guided workshop participants through a series of hands-on activities designed to show them how LEAD is democratizing model

and data use. Participants were able to select a region of interesting weather and submit WRF model prediction runs to the TeraGrid using two different approaches being developed by LEAD. The idea is that through LEAD technologies anyone can make high resolution mesoscale forecasts over the domain of their choosing on demand. These complex and computationally intensive jobs were orchestrated by systems on the LEAD grid at Indiana University, NCSA at the University of Illinois, and Unidata, and were completed quickly by using TeraGrid resources.



The workshop attracted a larger-than-usual number of university students, mainly because the topics were particularly relevant to this generation of students who have most likely never encountered a teaching or learning environment that did not include the use of models as a pedagogical tool.

Though traditional approaches still have their place, the workshop demonstrated that model use in the classroom is an important tool. More specifically, models to teach complex as well as simple concepts, while not a magic wand, are an indispensable tool in today's educational environments. Such use is here to stay.

Exit surveys confirmed what workshop planners had observed throughout the week: the workshop had generated a lot of enthusiasm, energy, and excitement and could rightfully be termed a great success. The following comments were typical of the participant response to the week's activities:

- “Fantastic workshop. I have so many ideas for my courses...”
- “Learned a lot”; “Very worthwhile...”
- “A very useful and thought-provoking workshop with plenty of real-world applications to take home.”
- “Many brilliant thoughts and ideas, in addition to the software and projects presented! Some, I am sure, will inspire me personally in my work.”
- “Sharing data/models, democratization of data and models were the highlight of the workshop.”

Community Equipment Awards. The Unidata Program continued its Community Equipment Awards program, the primary purpose of which is to encourage new academic members from diverse disciplinary backgrounds in the geosciences to join the Unidata community, and for existing members to continue their active participation so as to enhance the community process. The program also benefits institutions who have participated actively in the past but need system upgrades to meet the standards currently recommended for deploying Unidata systems; and to assist organizations from disciplines outside of the atmospheric community who can provide important and relevant datasets and tools to the Unidata community. Over the past four years, Unidata has made a total of 30 such awards to academic institutions totaling approximately \$460,000.

This year special consideration was given to proposals submitted by investigators in new disciplines and departments outside of those traditionally active in the Unidata community. The aim of this focus is to give the broader Unidata community access to new tools and datasets that could be relevant to their teaching and research.

Lead Goals

To democratize the availability of advanced weather technologies for research and education, lowering the barrier to entry, empowering application in a grid context, increasing the realism of how technologies are applied, and facilitating rapid understanding, experiment design, and execution.

To improve our understanding of and ability to detect, analyze, and predict mesoscale atmospheric phenomena by interacting with weather in a dynamically adaptive manner.

For the 2006 Equipment Awards, Unidata provided \$100,000 funding to the following institutions:

Institution	Project Title
University of Alaska-Fairbanks	Automating a Volcanic Ash Forecast System with Improved Visualization Tools for Increasing Public Accessibility
University of Nebraska	WAHTER: Integrating Meteorology Data in Hydrology Research and Education, and Expanding the University of Nebraska's IDD Capabilities
George Mason University	Equipment for Fire and Remote Sensing Data Processing and Distribution Between EastFIRE Lab at GMU and the Unidata Community
University of Northern Colorado	Advancing Education and Research in Meteorology at UNC Using the Unidata IDD

The following comments by Prof. Steven Businger at the University Hawaii and a recipient of the 2005 Equipment Award typify the value of such awards: “In summary, the UH VisionLab has undergone a major renovation promoted by the funds received from the Unidata Equipment Award Program. VisionLab capitalizes on state-of-the-art Unidata software and the real-time datastream from Unidata to foster a resurgence of geophysical data in the Meteorology Program at the University of Hawaii. The students are loving it” As another example of its impact, this program provided funding to the Iowa Environmental Mesonet of Iowa State University to increase its capacity thirty-two fold to serve Unidata-provided datasets via web services and in GIS formats to the expanding GIS user base within the Unidata community.

International activities. Increasingly, the conduct of science requires strong international scientific partnerships and sharing of knowledge, information, and other assets. This is particularly true in the geosciences where the highly coupled nature of the earth system and the need to understand global environmental processes and their regional linkages have heightened the importance of strong collaborations across national and continental boundaries. The climate system, for example, is far too complex a puzzle to be unraveled by individual nations. As science becomes increasingly global in nature, it is critical that focus is placed on full, open, and timely access to and sharing of earth system science data. Beginning as a collection of US-based, mostly atmospheric science departments, the Unidata community transcends international boundaries. The primary reason for the community broadening, which has in large part occurred organically through the free and open exchange of near real-time geo-scientific data and related software, is a recognition that most of today’s formidable scientific problems in the geosciences are inherently multidisciplinary and global in character. The Unidata Program recognizes the benefits of a global cyberinfrastructure and the power of networked communities as institutions and people exchange knowledge, ideas, and resources. Over the past

International participants at the Unidata-led session at the AGU Joint Assembly in May 2006.



several years, Unidata has developed a growing portfolio of international outreach activities, conducted in close collaboration with academic, research and operational institutions on several continents, to advance earth system science education and research. The portfolio includes provision of data, tools, support and training as well as outreach activities that bring various stakeholders together to address important issues, all toward the goals of building a globally-engaged community of educators and researchers in the geosciences. Real-time atmospheric science data delivered to Latin America has helped initiate teaching innovations in multiple geoscience disciplines in Argentina, Brazil, Chile, and Costa Rica. The IDD system is also providing important benefits to the Antarctic meteorological community. Because of communication and logistical difficulties, the provision of data to Antarctic researchers, educators and forecasters has been a significant challenge, and these challenges are being overcome by the Antarctic-IDD, which carries surface and upper air observations, satellite imagery, and forecast model output to an increasing number of participating nodes, including one at the US McMurdo Station. The availability of observations from polar areas is especially crucial for documenting the nature and extent of climate change, for those are the very regions that are projected to experience the most significant warming in climate simulations and as such most vulnerable from an Earth system science perspective.

Linked Environments for Atmospheric Discovery (LEAD). LEAD is aiming to create an integrated, scalable framework in which meteorological analysis tools, forecast models, and data repositories can operate as dynamically adaptive, on demand, grid-enabled systems. For more information see <http://lead.ou.edu/>.

The LEAD effort at Unidata includes:

- Maintenance of a test bed for software development and deployment, as well as data storage. This includes:
 - Running automatically steered WRF jobs
 - The provision of a four month data archive for the seven LEAD-defined canonical datasets.
 - Storage for data and other information generated via LEAD orchestrations
- Development of the THREDDS Data Repository, a storage archive that integrates with the THREDDS Data Server to provide easy access to data, which includes:
 - Data movement into and out of an archive
 - Support for a variety of storage media, including mass storage
 - Generation and/or enhancement of metadata
- Development and maintenance of a crosswalk that translates THREDDS metadata into LEAD metadata
- Installation and testing of existing assimilation packages and forecast models on the Unidata LEAD test bed as well as hosts at other institutions such as supercomputers at NCSA
- Ensuring integration across relevant Unidata technologies: especially LDM, TDS, and IDV
- Providing an interface between the Unidata community and LEAD and leveraging our community building skills to help LEAD to develop its own community
- Providing expertise in successful software development and deployment to help LEAD succeed

Unidata Seminar Series. Unidata seminars are a mix of staff presentations, presentations that highlight important activities taking place within UCAR/NCAR, and presentations on activities of relevance taking place outside the UCAR/NCAR umbrella. These seminars are webcast live to

the community, as well as recorded and archived for later viewing. The community clearly values these presentations and our efforts to webcast and archive them. A viewer had the following comments about one of our recent seminars: “As always, a great seminar by Stefano! Thanks for webcasting it. I'd hate to have missed it. Unfortunately, several of my colleagues are on travel and they did miss his seminar. I'll point them to the webcast when you announce it's available.” Another community member remarked: “Very nice, it was great to see this presentation, thanks. Really nice to be able to sit in on this.”

Community Meetings. The UPC continues to be actively involved in the organization of special sessions on earth science/geoscience informatics at AGU, AMS and EGU meetings. The organization of these sessions to bring the community together to address cyberinfrastructure/informatics issues, especially in the data & tools area, is becoming an important activity for Unidata. These sessions have been well attended and are gaining prominence. With funding from NSF (ATM and OISE) and in collaboration with Prof. Elen Cutrim, a community member, a special session was organized at the AGU 2006 Joint Assembly that was held in Baltimore, MD on 23-26 May 2006: *Earth and Space Science Cyberinfrastructures: Data, Tools, Distribution and Forecast Systems for International Collaboration*. The goal of the session was to help build a stronger and broader space and Earth science cyberinfrastructure community through international collaboration. This session was the second most popular section of the Earth and Space Science Informatics program of the Joint Assembly. Collectively, these meetings represent Unidata's increasing commitment toward facilitating community dialog on issues surrounding cyberinfrastructure and information technology.

Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC)

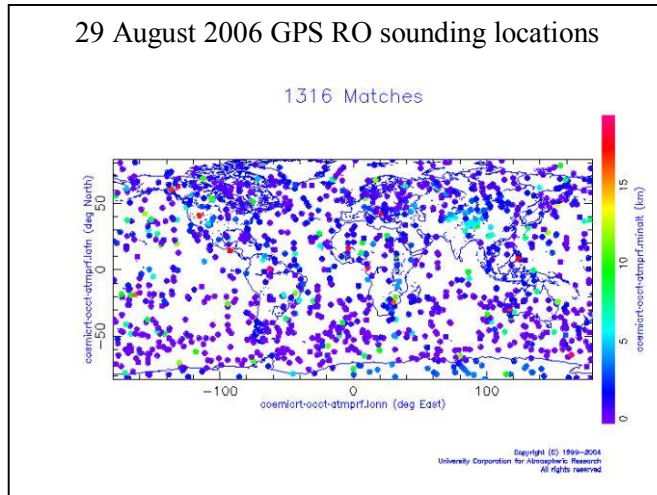
Program Director: Dr. Bill Kuo www.cosmic.ucar.edu

Mission: Ensure a successful collaborative science project between UCAR, several US federal agencies, and Taiwan for the launch of a constellation of six micro-satellites to collect atmospheric remote sensing data for weather prediction, climate, and ionospheric research.

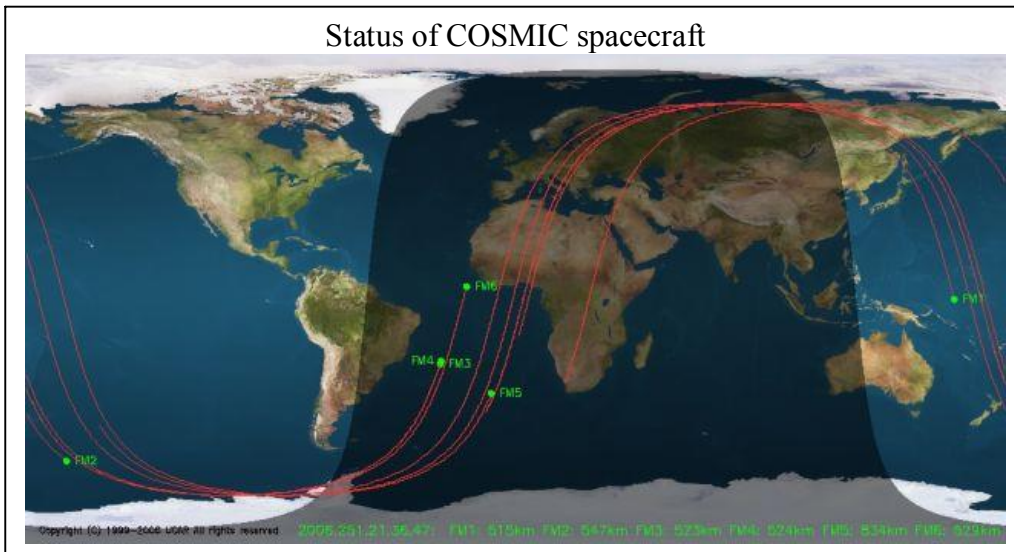
The COSMIC satellite constellation was successfully launched at 6:40 p.m. on 14 April 2006 from the Vandenberg Air Force Base. All satellites are working properly and providing excellent quality initial data. During the first part of the mission the satellites will use a technique known as “differential precession”: to maneuver them into six different orbital planes for optimal global coverage. As of the end of August 2006, COSMIC is producing more than 1300 GPS radio occultation soundings per day. This will increase into an estimated 2500 per day when the satellites have been fully deployed to their designated orbits in about 1 year.



The figure to the right shows the location of each GPS RO sounding from COSMIC on 29 August 2006. The different colors of the dots represent the “termination point” (lowest point) of the sounding. As you can see most of the soundings (even over the tropics) are deep blue in color (indicating that they reach below 1 km). This is a key improvement of COSMIC over previous radio occultation missions and is achieved with a new GPS tracking technique called “Open Loop Tracking”. UCAR/COSMIC scientists have recently been awarded a patent on this tracking technique.

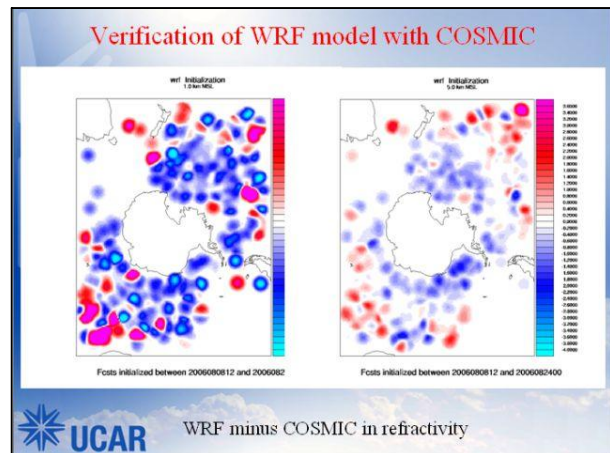


During this early orbit phase of COSMIC, the GPS RO soundings are lustered together, resulting in many collocated soundings from multiple satellites. This is providing a unique opportunity to assess the potential impact of high-density GPS RO soundings, and to validate model predictions with COSMIC soundings.



Some preliminary work being done over the Polar Regions is already showing some interesting results. An evaluation was done using COSMIC soundings with the WRF model over Antarctica. Antarctica is traditionally a data void region, with few observations over the Southern Oceans. As a result, the model’s performance has been hard to evaluate.

A plot of the difference between WRF and COSMIC (WRF minus COSMIC), in terms of

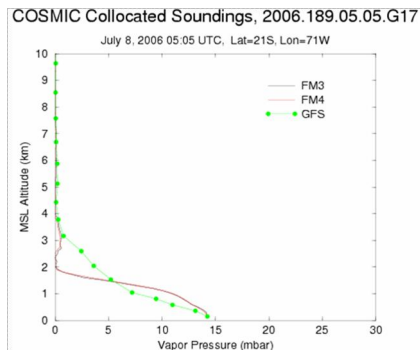
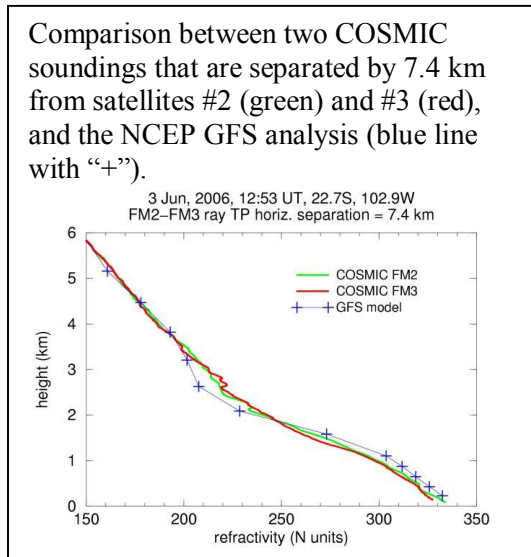


atmospheric refractivity, reveals that there is a major bias on the Southern Ocean (immediately outside the Antarctic continent). This shows that the model's refractivity is biased low at both 1 km and 5 km, and the biases keep increasing with time. Low refractivity bias indicates that the model is too warm.

The reason for the model failure is that, in the southern winter, Antarctica is "bigger than in the summer" with sea ice forming to surround the Antarctic continent. The WRF model needs to be upgraded with "polar physics" -- better handling of the sea ice - in order to correct this significant model bias. This study shows that COSMIC is already proving very useful for research and operation.

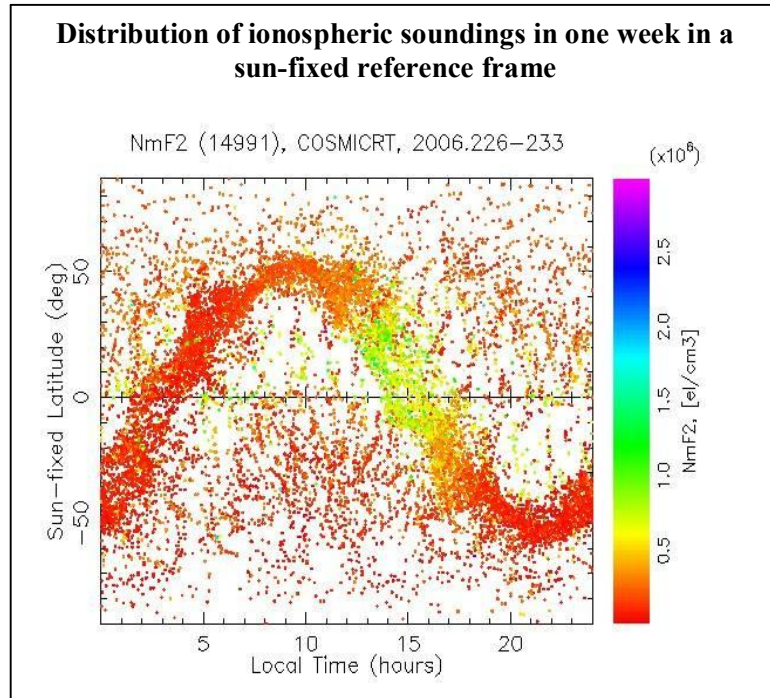
COSMIC data are already being closely studied by some of the leading weather centers, at NCEP, ECMWF and the Taiwan Central Weather Bureau. Initial feedback from the European Center indicates that the data are considered of very high quality.

This example profile to the right shows a comparison between two COSMIC soundings that are separated by 7.4 km from satellites #2 (green) and #3 (red), and the NCEP GFS analysis (blue line with "+"). In addition to the good agreement between the profiles this figure also shows that the COSMIC soundings can be used to detect tropical planetary boundary depth (which is indicated by the change of the refractivity gradient or the "break point" of the profile). This example also shows that NCEP's GFS analysis puts the boundary height too high compared to the two COSMIC soundings. Radio occultation is the only space based sensing technique that, due to its high vertical resolution and accuracy, allows detection of the boundary layer from space.



The panel to the left compares the moisture profile deduced from COSMIC soundings, obtained in close proximity and at almost the same time, with satellites #3 and #4. It shows that #3 and #4 are producing almost identical profiles. Both profiles indicate a sharp drop in moisture near the top of the boundary layer. However, the NCEP GFS analysis does not capture a sharp moisture drop. As a result, it is too dry below 1.5 km, and too wet above that height.

COSMIC also provides a rich data set in the ionosphere. Already we are obtaining 2500 daily electron density profiles and over 3000 total electron content arcs. The figure to the right shows the distribution of ionospheric soundings in one week in a sun-fixed reference frame. The color-coded dots show the electron density at the peak of the F2 ionospheric layer. The results show that high electron density on the F2 layer can be found on the Equator at the local time of 15 hours. Most sounding occur along the densely sampled belt because the



orbital planes of the six satellites are still closely spaced. Once the satellites are distributed more evenly a more uniform global coverage can be expected.

COSMIC also worked with COMET to produce an education module. This will enable students and the research community to better utilize the COSMIC data. The module covers the basics of GPS radio occultation science, and its various science applications. It also provides a good description of the COSMIC mission. It can be viewed or downloaded at <http://www.meted.ucar.edu/COSMIC/>

The first Formosat-3/COSMIC Data Users Workshop will be held October 16-18, 2006, in Boulder, CO. The agenda will include a poster session, and discussions on such topics as:

- Status of the Mission + Status of Data processing
- Reports from the processing centers
- Processing results - neutral atmosphere (RO); ionosphere (RO); ionosphere (TIP + TBB)
- Reports from data users
- Data assimilation - numerical weather models, ionospheric models
- Science results
- Validation, Campaigns, Project

Use of COSMIC data requires registration on the web. All COSMIC data is open to the public, and freely available. More than 239 users from all over the world have already registered and massive amounts of files and data are continuously downloaded from the COSMIC data processing center.

GLOBE Report 2006

Program Director: Dr. Ed Geary <http://www.globe.gov>

Mission: GLOBE is an international education and science program that brings together students, teachers, and scientists to: (1) improve student achievement in science, (2) increase environmental awareness, and (3) contribute to understanding Earth as a System.

Introduction: GLOBE is an on-going international education and science program that unites students, teachers, and scientists in the study of Earth as a System. Students participating in GLOBE engage in inquiry-based scientific research of their local environment. GLOBE students collect, analyze, share, and report their data and findings with other students and with scientists from around the world via the GLOBE Web site and database. Students benefit from GLOBE through a better understanding and appreciation of Earth System science and improved achievement and interest in science. Teachers benefit from GLOBE through professional development workshops and educational materials that support the integration of inquiry-based scientific investigations into their curricula. Scientists benefit from GLOBE through access to quality ground truth data from around the world that is unavailable by other means and through their interactions with teachers and students. Communities and countries benefit from GLOBE through enhanced awareness of and attention to, local and regional environmental problems and through the building of cross-cultural relationships.



As of September 2006, over 35,000 teachers and over 1 million students have participated in GLOBE worldwide. They have collectively contributed over 15 million environmental measurements in the areas of Atmosphere, Hydrology, Soils, Phenology, Biometry, and Land Cover. In North America the number of GLOBE Partner institutions has grown during the past year to 143 with ten of these being UCAR Member Universities.



The Next Generation of GLOBE

During the past year, GLOBE began implementing its Next Generation of GLOBE (NGG) plan developed over the past two years with the guidance of the GLOBE community and its NASA and NSF sponsors. The vision of the NGG is of a Program working in close partnership with NSF and NASA Earth System Science Projects (ESSPs) to give the worldwide GLOBE community access to top scientists in the world, and expose them to programs on the cutting-edge of Earth System science research. To achieve this vision, GLOBE is promoting and supporting students, teachers, and scientists to collaborate on inquiry-based investigations of the environment and the Earth System. The Next Generation of GLOBE increases the capacity for UOP to serve the (atmospheric/geoscience) community in the areas of environmental awareness, public education, and scientist-educator-student partnerships.

NGG differs from earlier GLOBE work in that it places greater emphasis on educational outcomes, student research, more opportunities for student-teacher-scientist collaborations around cutting-edge Earth System science projects, and a greater focus on internationalization and long-term program sustainability. There is less of an emphasis on scientific publications using GLOBE data, rapid program growth, and the development of new scientific measurement protocols. However, NGG still retains the Program's essential elements of being both education and Earth System science, a bridge between these two international communities, a worldwide collaborative community of practice, and a program that employs inquiry-based educational activities that involve students in "authentic" hands-on science, and the use of scientifically-tested protocols.

Recent NGG materials and activities developed over the past two years include: (a) Understanding GLOBE Student Data, a set of activities that help teachers and students explore and use the GLOBE database, (b) various resources for Partner implementation including the GLOBE Learning Communities Resource Guide and the Higher Education Resource Guide (c) Elementary GLOBE, a set of five books for early primary students that integrates science and reading literacy, and (d) GLOBE at Night a citizen science activity held in March 2007 in collaboration with the National Optical Astronomy Observatory and ESRI.



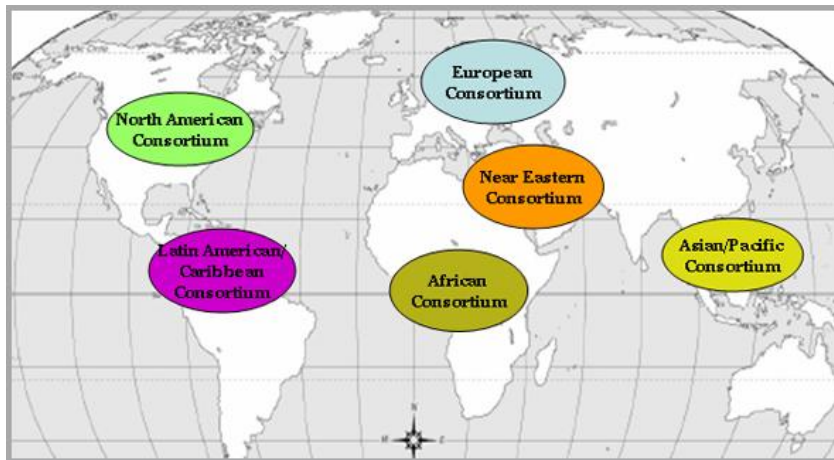
New Earth System Science Project Partners

In June 2006, NSF announced four new Earth System Science Project (ESSP) partners for GLOBE that will provide foci for student research and help the projects with their education and outreach efforts. These projects are: (a) The GLOBE Carbon Cycle project led by the University of New Hampshire partnering with North American Carbon Cycle scientists, (b) From Local to Extreme Environments, a deep ocean project led by Pennsylvania State University in partnership with RIDGE and InterRIDGE scientists, (c) The GLOBE Monitoring Seasons project, led by the University of Alaska at Fairbanks in partnership with scientists from the International Arctic Research Center (IARC), the International Polar Year (IPY), and NASA satellite missions, and (d) the GLOBE Watersheds Project led by Northwestern University in partnership with Consortium of Universities for Advancement of Hydrologic Science (CUASHI) scientists. These four projects were introduced to the worldwide GLOBE community at the 10th Annual GLOBE Conference in Phuket, Thailand, 29 July-4 August, 2006. Over the next four years, the GLOBE Program Office (GPO) will work to connect these Earth System Science projects with GLOBE's international network of partners, schools, and GLOBE learning communities.

To implement the NGG plan and to support these new areas of Earth System investigation, GLOBE has begun the process of adapting and enhancing its Professional Development programs, Web site, database, and data visualization and analysis tools to better support inquiry-based student research. A parallel effort is also underway to realign the GLOBE Program Office management structure, work flow, and budget processes to support these changes. The broad spectrum of Earth System concepts embedded in these projects will provide new opportunities for UCAR programs (e.g. DLESE, NSDL, SOARS, Comet, Unidata), UCAR partner institutions and UCAR-NCAR scientists to engage with and support primary and secondary students in their communities and around the world.



New Regional Consortia



In 2005, GLOBE Europe became the first official Regional Consortia involving 38 countries. Workshops and meetings held during the past year have led to incipient Regional Consortia groups coming together in Africa, Asia-Pacific, Latin America-Caribbean, the Near East and North America

(Canada and the U.S.). In addition, during the past year, a new GLOBE International Advisory Committee (GIAC) was formed and held its first meeting in Thailand at the Annual conference. The GIAC will provide input to the GPO and to NASA and NSF about the needs of GLOBE's international constituents and will help to share information and engage international schools in ESSPs. Over the next 2-3 years, the GPO, will continue to support the GIAC and these emerging Regional Consortia through workshops, trainings, and the development of materials that can be accessed online.

By embracing the GLOBE program, UCAR solidifies its role as a leader in catalyzing and supporting inquiry-based student research. This role includes support for scientist-educator-student partnerships and the engagement of diverse and/or traditionally underrepresented populations.

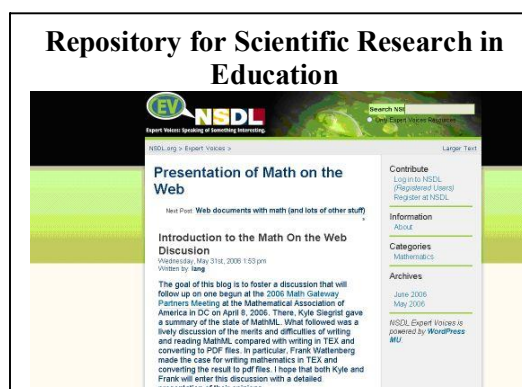
National Science Digital Library (NSDL)

Program Director: Dr. Kaye Howe <http://nsdl.org>

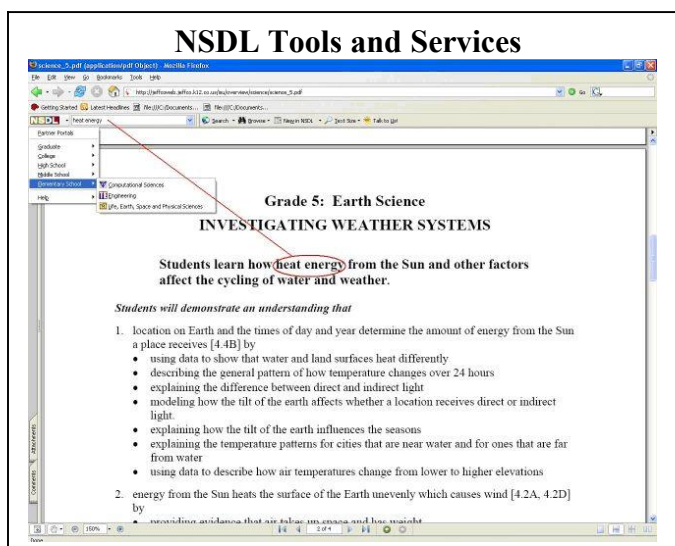
Mission. The National Science Digital Library (NSDL) was created by the National Science Foundation to provide organized access to high quality resources and tools that support innovations in teaching and learning at all levels of science, technology, engineering, and mathematics education and research.

Enhancing Educational Cyberinfrastructure. NSDL accomplishments in 2006 emphasize strengthening the library's service infrastructure and its strategic partnerships in the education and research communities. These activities allow NSDL to contribute to national cyberinfrastructure building efforts in a role which provides social and resource networks that both enhance and are enhanced by underlying technical systems.

- **A Repository for Scientific Research in Education.** Through its diverse interdisciplinary collections, NSDL has established itself as a central access point for data, reports, lesson plans, and other resources generated by the scientific and educational research communities. In addition to NSDL's ongoing collection development work, these efforts are advanced by the National Science Foundation's recent inclusion of NSDL as a recommended dissemination tool/repository within selected grant solicitations. The most recent solicitations for the Teacher Professional Continuum and the Course, Curriculum, and Laboratory Improvement Programs encouraged awardees to use the tools and services of NSDL to disseminate the broader impacts of their work.



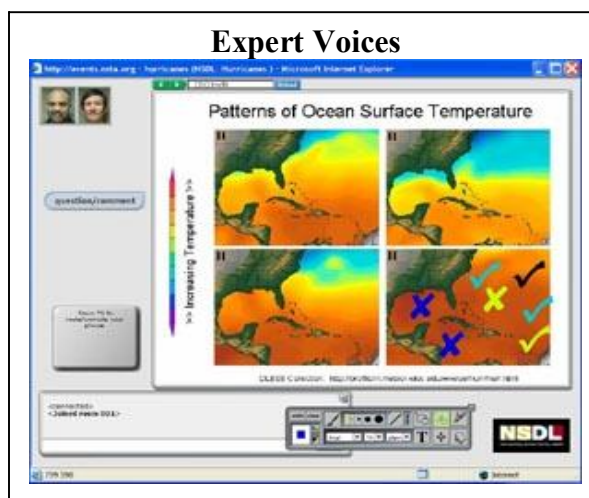
- **Tools and Services for Resource Organization, Discovery, and Contextualization.** As educators discover resources online and use them for teaching and research, they need to be able to place the resource in context and relate one resource to another. In response, NSDL has been developing a new architecture for indexing, managing, and accessing complex information about NSDL resources. A new metadata repository is currently being



built on the open-source program FEDORA (Flexible Extensible Digital Object Repository Architecture) to maintain multiple relationships between resources and facilitate their repackaging and reuse. These improvements will enrich user services including search functions, the ability to attach comments to a resource, and the alignment of a resource with educational standards. As another enhancement to users' search and discovery of resources through NSDL, the library released a customized toolbar in August, 2006 that allows users to place the NSDL search box and links to selected partner libraries into their Internet browsers (<http://nsdl.org/toolbar/>). During the first month that the toolbar was available, 200 people downloaded the program for use with Internet Explorer and Firefox browsers.

- Partnership Networks of Resource Providers and Educational Users.** NSDL Pathways are an increasingly important part of NSDL, created through partnerships with professional societies and other leading education and research organizations. Pathways focus on the needs of specific discipline or educational level communities by providing resources, tools, services, and professional development for their target audiences. NSF began funding Pathways projects in 2004, and as of Fall 2006 these partner libraries cover Biological Sciences, Chemistry, Computational Science, Engineering, Materials Science, Mathematics, Physics and Astronomy, Middle School, K-12 Rich Media, and Community and Technical Colleges. The newest Pathway project grant was awarded to the Journal of Chemical Education (JCE) Digital Library and the American Chemical Society (ACS) for the creation of the ChemEd DLib. The American Chemical Society is the largest scientific professional society in the world (158,000 members), with a strong Education Division, and is a major publisher of scientific research in the chemical sciences. The project leverages the considerable resources of JCE in its existing digital library collections, established volunteer community, and its expert staff.
- Online Learning Environments.** NSDL has partnered with the National Science Teacher Association to produce a monthly series of web seminars under the umbrella of NSTA's professional development programs (http://institute.nsta.org/web_seminars.asp). Each seminar features a Pathway or other partner presenting information on a particular content topic by modeling the use of digital resources in the classroom. The pilot seminar in May 2006 featured teaching resources from the Digital Library for Earth Systems Education (DLESE) and focused on the topic of hurricanes.

Throughout 2006, NSDL has been piloting *Expert Voices*, an interactive community tool based on weblog technology that is designed to support collaborative conversations among content experts, scientists, educators, resource specialists, and learners. With the full launch planned for Fall 2006, moderated conversations will be centered on teams of experts providing diverse perspectives on a given topic, but will also enable readers to post comments and questions. Expert Voices (EV) will serve as an educational tool, as well as a community forum, with an emphasis on bringing scientific research to classrooms and informal learning environments. NSDL is creating



this blog platform with the additional intention of creating context around NSDL resources. EV authors will be encouraged to draw from NSDL's rich catalog of multimedia and text-based resources to support information and idea exchange, and in turn, the discussions around these resources will annotate metadata records in the NSDL data repository thereby becoming discoverable through the main NSDL website at nsdl.org.

DLESE Program Center

Program Director: Dr. Mary Marlino <http://www.dpc.ucar.edu/>

Mission: The mission of the Digital Library for Earth System Education (DLESE) has been to provide support and leadership to the broad Earth System community in addressing the national reform agenda for science education, scientific literacy, and scientific discovery. The DLESE Program Center supports this mission by serving as integrator for distributed core service and community efforts and providing program continuity and stable library operations within the distributed library network. It performs these dual functions through the development and operation of educational cyberinfrastructure that underpins library operations and the provision of tools and services supporting the management and sharing of educational assets. DLESE also serves as the geoscience member library of the larger National Science Digital Library (NSDL) effort. The DLESE user base continues to grow, with approximately 1.5 million visits this past year.

The DLESE Program Center has been informed by NSF/GEO that they will no longer support DLESE after October 1, 2007. The DPC has been awarded a final year of funding (FY 2007) to develop and implement a sustainability plan to maintain open community access to the DLESE collections beyond the life of this grant. Building on the considerable expertise that it has developed over the past 6 years of operating DLESE, the DPC staff is exploring how best to continue its service to the geoscience education community through the provision of tools and services to support science learning in a connected world.

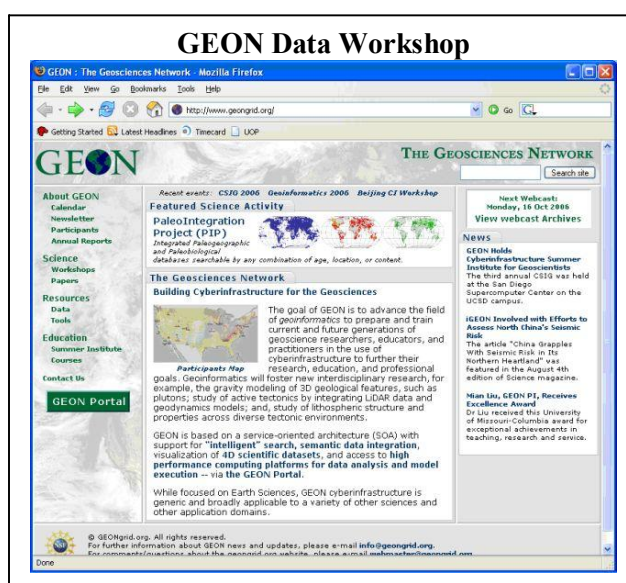
NSDL funded collaborations. The DPC has initiated work with NSDL-Core Integration to integrate certain DLESE functionality into the NSDL infrastructure. The project includes integrating AAAS strand maps into the NSDL, DLESE interoperability with the new NSDL Data Repository (NDR), and customization of the DLESE Collection System for NSDL use.

- **WGBH Teachers Domain.** DPC Staff continued their collaboration with the WGBH (public broadcasting group) Teachers Domain project, funded as a Pathway to the NSDL. Year 2 work involved creating an on-line professional development course for middle school teachers teaching out of their area of expertise. The course consists of four 2-session modules covering a wide range of Earth system science topics, integrating media rich learning objects and providing a balance of content as well as pedagogy. The course will be available fall 2006. <http://www.teachersdomain.org/>
- **Center for Natural Language Processing.** Collaborations are continuing with the Center for Natural Language Processing at Syracuse University, working to integrate technology that assists digital library developers and users in assigning educational standards to electronic learning resources. A demonstrator version of the DLESE Cataloging System (DCS) integrated with the Content Assignment Tool (CAT) was released in the winter of 2006. The system assesses resource content and selected metadata, and suggests standards to associate with the resource. It allows digital library catalogers to assign National Science Education Standards to resources at the more

detailed (and useful) 4th level of hierarchy. This work provides proof of concept for an efficient means of cataloging this complex set of standards, as well as the eventual goal of supporting state standards associations in DLESE and NSDL. A ReadyTalk demonstration of the system is available at <http://commserv.comm.nsd.org/tooltime/2006-03-16/lib/playback.html>. Work will continue in 2007 to complete an evaluation of the appropriateness of the standards suggested by the tool and to explore integrating state standards more fully into DLESE discovery systems.

NSF/GEO ITR collaborations. The DPC continues to provide leadership for the educational components of LEAD and GEON, sharing educational cyberinfrastructure and lending expertise to the development of learning environments. Over the next year, DPC staff will be involved in usability testing of the *LEAD to Learn* educational modules produced by the LEAD project, and in the evaluation of their educational impact.

GEON Data Workshop. DPC staff helped organize and participate in the GEON Data workshop, held at UNAVCO in Boulder in February, 2006. DPC worked with UNAVCO to address the workshop themes and provided liaison to the LEAD ITR project in order to bring LEAD into the workshop. The GEONGrid node at DLESE was updated to include searching of GEON-related resources in DLESE (<http://geon01.dlese.org/>). DPC staff also conducted usability testing, including the creation of all test instruments, and a usability workshop for GEON that resulted in recommendations for significant enhancements to this community portal (http://www.dpc.ucar.edu/projects/geon/final_report.pdf).



Community Projects and Partnerships:

COMET Collaboration . A DPC staff member was the project leader and instructional designer for the webcast “Introduction to the EUMESAT Polar System,” which was produced for EUMETSAT (Germany).

GLOBE collaboration. DPC staff created the interface design and graphics for the “GLOBE at Night” website, and created the graphics for the section menus for the next version of the GLOBE website.

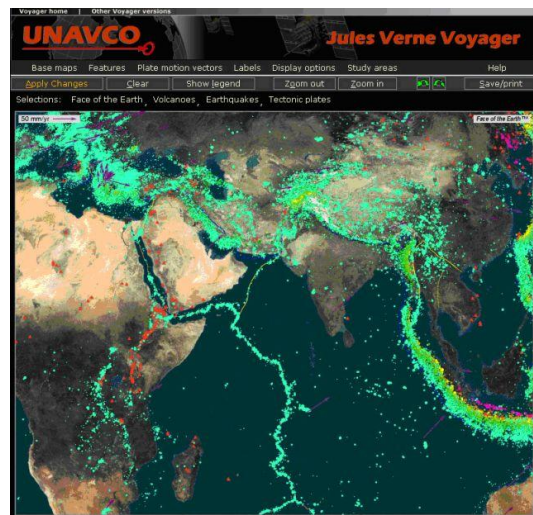
jOAI Software Developments. In response to a request from the World Meteorological Association, DPC staff completed enhancements to its jOAI software. jOAI is a free Java-based OAI software application developed by DPC staff that provides a simple way to harvest or provide metadata using the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). This fall, the WMO will test proof-of-concept using jOAI/OAI for distributed meteorological metadata uploading and mirroring across multiple WMO centers; the WMO's request for the jOAI software to accommodate incremental updates will be used during the

testing. The tests are being conducted as part of the WMO Weather Information Systems (WIS) initiative to enhance the capabilities for distributing metadata across centers in a timely and reliable fashion.

GEPON Workshop. Working with the University of California Museum of Paleontology (UCMP), the DPC convened the Geoscience Education and Public Outreach Network (GEPON) workshop in March, 2006. The primary goals of this workshop, hosted at UNAVCO's Boulder facility, were to examine the feasibility of establishing GEPON, to identify the services the network ought to provide, and to formalize recommendations to the NSF and the geoscience community for network implementation, support and sustainability. Thirty-eight scientists and EPO professionals from 17 states and the District of Columbia met over a two and a half day period to address these goals. Common to all participants was the recognition of the importance of Broader Impacts initiatives to increase public support for scientific research, to encourage students to consider careers in science, and to improve the level of scientific literacy among the broad citizenry. The work resulted in recommendations for five key initiatives that target two audiences: the geoscience research community and those who assist that community with their broader impacts efforts. The recommendations are to: (1) provide community assistance to NSF, (2) showcase Broader Impacts exemplars, (3) provide a venue for information exchange, (4) support an annual meeting, and (5) increase appreciation of broader impacts programs. The complete report and recommendations to NSF can be accessed at <http://gepon.org/workshop2.html>.

Global Earthquake Explorer (GEE). GEE, supported by an NSF ITR grant to the University of South Carolina and the DLESE Program Center, is an education and outreach tool for seismology that aims to make it easy for non-seismologists to retrieve, display and analyze seismic data. It is intended for use in a classroom setting as a supplement to textbook material. This past year's accomplishments include completing the design and testing of the Rapid Earthquake Viewer, a browser-based environment for viewing recent seismic data, and the development of lesson plans that make use of the REV tool.

EarthScope. DPC staff continued working with UNAVCO to create a new version of the Jules Verne Voyager interactive, geophysical, map visualization tool. Chief among the year's accomplishments were the creation of the design and structure for the new tool and the development of supporting materials. JVV enables scientists, educators, and students to study global-scale geodynamic processes and visualize the relationships between and among processes, natural Earth structures, features, and science measurements.



ASMET. DPC staff worked with the ASMET (African Satellite Meteorology Education & Training) team to complete the ASMET 4 module on forecasting tropical cyclones. The team is midway through developing ASMET 5, a series of case studies that help forecasters use new MSG information to better forecast weather phenomena over Africa (duststorms, etc.).

**Joint Office for Science Support
(JOSS)**

Program Director: Gene Martin www.joss.ucar.edu

Mission: To provide exceptional staffing and infrastructure support in order to facilitate activities in the atmospheric and related sciences community.

JOSS strengthens and supports professional interactions between UCAR member institutions and the broader community, including Federal agencies and foreign organizations. JOSS provides efficient, cost effective, high quality services which allow for academia, government and industry to gather to define and collaboratively address issues of global importance. These events help communicate to the public and policy makers the value and results of research and education.

The administrative and technical specialists that make up JOSS collaborate extensively with geophysical scientists at their home institutions helping to plan, organize, and conduct research by supporting scientific planning, collaborative workshops, and scientific project office administration. Through its unique and broad set of skills, JOSS enables the member universities to conduct program planning and research that is often beyond the capabilities of an agency or university department.

Science Support. JOSS activities this past year have included event planning, logistics, and/or on-site support for over 400 domestic and international scientific events, including:

- 11th US Japan Workshop on Global Change in Yokohama, Japan;
 - The U.S. Climate Change Science Program (CCSP) Workshop where high level scientists and government officials addressed the capability of climate science to inform decision making and prepare scientific syntheses and assessments on key climate science;
 - Annual Joint Meeting of NOAA, NSF/NIEHS and Centers for Oceans and Human Health; and
 - CLIVAR Summer Summit in Breckenridge, CO.
- During the past year, JOSS provided travel support services to over 1150 travelers, including 575 scientists from almost all the UCAR member institutions.



Off-site Project Offices Support. Through distributed funding, JOSS off-site office administration assists US agencies in responding to the needs of the academic and

research communities. JOSS administers the following off-site project offices:

- United States Global Change Research Program (USGCRP/CCSP);
- International Panel on Climate Change (IPCC) Technical Support Unit to Working Group I;
- US CLIVAR Project Office;
- US Climate Office staffing and activities; and
- Oceans and Human Health Initiative Office (OHHI).

Education and Outreach. JOSS supported a range of education and outreach activities, most notably the GLOBE Program, where JOSS supported 18 international and domestic workshops for GLOBE science teachers this year, including the Annual Conference in Phuket, Thailand. This Annual Conference brings together teachers, scientists, academics, program managers, and

government officials from across the world regions to address the key ideas for improving education through GLOBE.

Recently, JOSS has assumed a more proactive stance to increase community awareness of JOSS's expert services and their benefits to the community. A new, modern brochure has been created and distributed to spread the word, staff training in the applied uses of new technology is increasing, and JOSS is already beginning to see an increase in requests to support activities that provide important information to a much greater number and wider range of participants. The new interactive JOSS website will also be live soon at: www.joss.ucar.edu.



Visiting Scientist Programs (VSP)

Program Director: Meg Austin <http://www.vsp.ucar.edu>

Mission: Help the community by providing cost-effective and efficient program management and administrative services to:

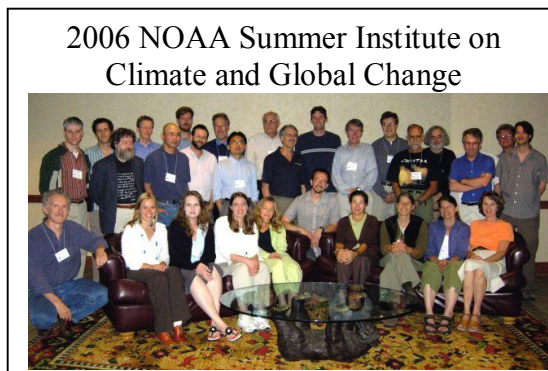
- Faculty
- Postdoctorates
- Graduate students
- Federal program sponsors
- Foreign scientists

VSP partners with U.S. universities and government agencies to promote education and research opportunities in atmospheric, climate, geosciences, and related science areas. Competed appointments are made to graduate students, postdoctoral, and experienced scientists. Appointments are hosted at universities and federal research labs throughout the U.S. VSP also provides organization and support for educational workshops and colloquia.

Education and Research. During the past year, VSP made approximately 80 graduate students, postdoctoral and visiting scientist appointments. VSP also manages several scientific appointments that support long-term science initiatives. The government agencies that sponsor these programs include many different NOAA labs, the Naval Research Lab, and the Air Force Research Laboratory. Numerous universities are involved with our visitor programs through host arrangements and service on steering committees.

Community Meetings.

The NOAA Summer Institute is a biennial workshop that VSP organizes and supports as a key component of the *NOAA Climate and Global Change Postdoctoral Fellowship Program*. The Institute is designed to bring together the current postdoctoral fellows (distributed across the U.S.), program alumni,



their hosts, and other science leaders with the ultimate goal of stimulating climate research. Participants learn of the wide range of disciplines covered in this program, develop professional contacts, and in an informal setting take part in lively discussions throughout the week. The Institute has become known as a valuable barometer of where the climate research field is headed.

Space Weather Week (SWW). is an annual conference sponsored by NOAA that brings together about 300 participants from industry, academia and government agencies for the purpose of bridging these communities of researchers. VSP has provided the administrative support for SWW since 1998, as it has grown from a small workshop into the nation's leading conference on all issues relating to space weather.



CEDAR (Coupling, Energetics and Dynamics of Atmospheric Regions). VSP collaborated with NCAR/HAO to provide administrative support for this workshop in June 2006. The workshop was held in Santa Fe for a week, and there were over 300 participants, of which 189 were from universities and there were 120 supported students. University participation totaled 189. The purpose of the workshop is to develop the capability of ground-based instruments to measure the upper atmosphere and to coordinate instrument and model data that will benefit the science community.



31st Annual Climate Diagnostics and Prediction Workshop. VSP is providing administrative support for the 31st annual NOAA Climate Diagnostics Workshop in Center Green 1, October 23-27, 2006. This year's gathering will focus on three themes:

- (i) climate predictions/predictability,
- (ii) understanding and attribution of climate variability, and
- (iii) the NOAA Climate Test Bed.

The workshop will combine invited presentations and posters on existing, as well as recent advances, in scientific understanding and capabilities with discussions on requirements for decision support.



Joint IAI/ASP Colloquium. This colloquium, "Policy Planning and Decision Making Involving Climate Change and Variability," was held September 11-22, 2006, in the Damon Room. VSP assisted the NCAR Advanced Studies Program by providing administration support and travel arrangements for the participants, the majority from South American Countries.

Solar Cycle 24 Prediction Meeting. The NOAA Space Environment Center will convene a scientific task force to examine differing forecast scenarios for the amplitude and phase of solar activity during Solar Cycle 24. This task force will be charged with determining a consensus

forecast, including confidence limits, to be published for community consumption. VSP will provide administrative support for this meeting, which will be held, October 2-6, 2006, at Center Green 1. This meeting is funded by NASA.

NASA Living With a Star*. VSP will collaborate with NCAR/HAO in providing administrative support for the Living With a Star workshop, which will take place in the Fall of 2007 in Boulder, CO. This scientific workshop that will focus on the magnetic couplings and plasma interactions from the solar interior to interplanetary space, on solar irradiance variations, and on geospace and atmospheric scientific topics relevant to the LWS program. It is expected to bring together approximately 300 active scientists and students from all branches of Heliophysics.

Space Weather Enterprise Forum (tentative for April 2007). Supported by NASA and NOAA, the goal of this forum will be to discuss the policies, politics and issue facing space weather research. VSP will provide on-site administrative support.