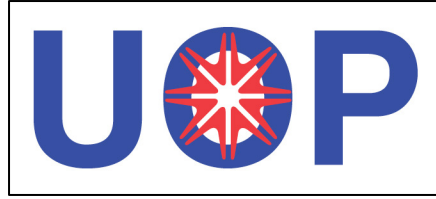


29 September 2008



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

FROM: Jack D. Fellows, UOP Director
SUBJECT: 2008 UCAR Office of Programs Report

The purpose of this report is to summarize UOP activities over the past year. Please read the full report below, but the following are brief highlights of a few of the many exciting UOP activities:

1. **Cooperative Program for Operational Meteorology, Education and Training (COMET Director Tim Spangler, www.comet.ucar.edu).** You may recall from last year's report that COMET initiated a registration process and had over 25,000 registered users in 175 countries. In 2008 COMET produced distance learning modules in satellite meteorology, tropical meteorology, hydrometeorology, oceanography, fire weather, aviation, and numerical weather prediction. Many of these modules have been translated into Spanish. 2008 saw substantial progress on the online "*Introduction to Tropical Meteorology*" textbook. Authors Dr. Arlene Laing and Dr. Jenni Evans published two new chapters of great interest and need, Chapter 6 entitled "*The Distribution of Moisture and Precipitation*" and Chapter 10, "*Tropical Cyclones*". Each chapter of the book offers many features including quizzes, links to additional information, animations, and robust print versions. COMET created the Environmental Satellite Resource Center, a searchable database to help the community gain access quickly to satellite information, education and training materials. In partnership with the National Environmental Education Foundation, COMET continues to develop education modules for broadcast meteorologists. In 2008 these modules focused on weather and health (due out Nov 2008) and communicating about climate change (due out in early 2009). COMET's Outreach Program continues to provide funding for applied research projects that involve university faculty and students working collaboratively with operational weather forecasters. Since its inception, the Outreach Program has provided a total of almost \$10 million to support over 300 research projects. These projects have involved more than 90 different universities. In 2008 COMET funded 12 one-year Partners Projects and 5 two-year Cooperative Projects. An RFP for new cooperative projects will be issued this fall.
2. **Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC Director Bill Kuo www.cosmic.ucar.edu).** COSMIC's six satellites continue to provide 1,500-2,000 GPS radio occultation soundings each day. Roughly 90% of these are processed and delivered to operational weather prediction centers around the world within three hours. In collaboration with Unidata, the COSMIC soundings are provided in a real time data stream to the university community. In addition to being used in operational weather

forecasting, these data are being used for boundary-layer, radiosonde calibration, and ionospheric studies. With some advancement in tracking techniques, more than 70% of the COSMIC soundings now penetrate below 1km over the tropics and more than 90% over higher latitudes. COSMIC is also deploying ground-based GSP stations in the Caribbean to improve hurricane intensity forecasting. These data are available from the COSMIC SuomiNet web page. The COSMIC program will host a workshop on October 27-29, 2008 to discuss the potential scientific questions that could be addressed using high precision GPS instrumentation on ocean platforms (ships, oil rigs, buoys, etc). The list of topics that will be discussed includes how GPS observations could be used to measure water vapor over ocean surfaces, study atmosphere/ocean interactions, calibrate satellite observations, detect tsunamis, and monitor changes in sea level. A key objective of this workshop will be to identify parties interested in developing a strategy to pursue this topic on a national and/or international scale. COSMIC encourages representatives from UCAR member institutions to register and attend this workshop.

3. **Unidata (Director Mohan Ramamurthy www.unidata.ucar.edu).** In April 2008, the UPC submitted a five year proposal “Unidata 2013: A Transformative Community Facility for the Atmospheric and Related Sciences” to the NSF to continue and enhance Unidata’s role as a foundational facility. Following a successful review, Unidata is currently negotiating the terms of the award. Unidata's vision for the next five years calls for providing comprehensive, well-integrated, end-to-end data services. These include an array of functions for collecting, finding, and accessing data; data/content management tools for generating, cataloging, and exchanging metadata; and submitting/publishing, sharing, analyzing, visualizing, and integrating data. When this vision is realized, users — no matter where they are, how they are connected to the Internet, or what computing device they use — will be able to find and access a plethora of geosciences data, experience how all these services work together, and use Unidata-provided tools and services both productively and creatively in their research, education, and outreach activities. Even as Unidata embarks on this plan to enhance and adapt its tools and services to meet the needs of an evolving community, the program remains deeply committed to meeting its responsibilities to the core atmospheric science community. Unidata continued its annual workshops and community equipment awards through 2008. Many of the workshops were oversubscribed, another signal of the importance of Unidata to our community. The NWS impending moratorium on further N-AWIPS development is expected to impact GEMPAK users. In response, Unidata is working with N-AWIPS and AWIPS-II developers on strategies for a smooth transition plan for GEMPAK users. In the near term, the UPC will continue support of GEMPAK’s use in universities. With approval from the UCAR Board of Trustees, David Fulker was appointed Unidata Director Emeritus, a status bestowed on people who have provided sustained leadership and impact on the UCAR organization. It clearly fits Dave who has served in various capacities within UCAR for over 38 years, including 18 years as the founding director of Unidata. Dave retired in 2005 and has continued to offer his time unselfishly to UCAR.
4. **Global Learning and Observations to Benefit the Environment (GLOBE Director Ed Geary www.globe.gov).** The GLOBE Program is a unique, hands-on, school and community-based education and science program. GLOBE brings together students, teachers,

and scientists in field and classroom based settings to learn about and conduct research on Earth's environment. Since its inception in 1994, GLOBE has grown to encompass 109 countries, over 40,000 teachers, and has reached more than a million students. GLOBE finished its first five-year cooperative agreement period in 2008 and underwent a favorable review by an external NASA review committee. The external review took place in December 2008 and GLOBE-UCAR was asked to submit another five-year cooperative agreement proposal to NASA for 2009-2013 funding. As part of that process, GLOBE developed a new strategic plan focused on: (a) sustainability of the UCAR's GLOBE Program Office and the worldwide GLOBE program by 2013, and (b) becoming a world leader in the development of new products and services that support student research. Over 500 GLOBE students, teachers, scientists, partners and guests from 51 countries attended the GLOBE Learning Expedition in South Africa in June 2008. The GLE was very successful and is a demonstration of the importance of GLOBE in developing environmental leaders of the future. GLOBE is planning a 2011-2013 Student Research on Climate Change Campaign. The campaign's goals are to: (a) involve over 1,000,000 students in Climate Change Research; (b) enhance environmental and climate literacy for millions of people around the world; (c) empower students, teachers, and community members to take action on climate-related environmental issues; and (d) create a compelling model for 21st century environmental science education based on grade-level appropriate research and learning experiences. To achieve these goals, GLOBE is engaging its worldwide network of Partners, teachers, scientists, alumni, schools and countries; leveraging its rich set of scientific protocols, educational materials, and data; and enlisting the support of some of the world's leading climate change scientists, internationally recognized education and outreach experts, businesses, foundations, and policy makers. This is something that we hope the UCAR universities will become involved in. See: <http://www.globe.gov/r/html/climatechange>

5. **National Science Digital Library Core Integration Group (NSDL Director Kaye Howe, www.nsdlib.org).** In partnership with Cornell and Columbia universities, the UCAR National Science Digital Library Core Integration program continued to build an online library of exemplary teaching and learning resources for science, technology, engineering, and mathematics education. However, in spring 2008, NSF announced its intentions to restructure NSDL and released an open competition for two new centers for the library: a Technical Services Provider (TSP) focused on underlying digital library infrastructure and a Resource Center (RC) focused on communications, outreach, and evaluation. UCAR's NSDL group won the RC competition and UCAR's Digital Learning Services is partnered with the University of Colorado and Cornell University to be the TSP. One element of the RC's plans is to work with the Cooperative Institute for Research in Environmental Sciences (CIRES) program at the University of Colorado, the Climate Literacy Network, and the American Association for the Advancement of Science to develop an online interactive tool that will allow educators and learners to navigate through a set of recommended Climate Literacy concepts, and identify materials from NSDL and other sources that support learning of those concepts.
6. **Digital Learning Sciences (DLS Director Karon Kelly <http://dlsciences.org/>).** Over the past year, DLS has focused on the creation of a "Personalized Learning Collaboratory" designed to improve learning outcomes and learner engagement via cost-effective software

tools that are based on cutting edge human cognition and language processing research. In recognition of this challenge, the National Academy of Engineering recently named personalized learning as one of 14 Grand Challenges for the 21st century, along with providing energy from fusion and developing carbon sequestration methods. DLS is working with Denver Public Schools (DPS) to develop these personal learning tools. With funding from the NSF, DLS is developing the Curriculum Customization Service (CCS) to support multiple curriculum units spanning one semester of Earth science instruction at both the middle and high school levels. Ultimately, the CCS will replace the paper-based district curriculum guides currently in use with an interactive environment supporting customization and ongoing professional learning. This fall, ten DPS Earth Science teachers will pilot the CCS prototype in their classrooms. While this demonstration will focus on Earth science, the CCS will be extensible across the entire middle and high school science curriculum.

7. **Visiting Science Program (VSP Director Meg Austin www.vsp.ucar.edu).** VSP administered ~100 research and post doc appointments during the past year, serving over 20 different program sponsors. VSP has managed the Climate and Global Change Postdoctoral Fellowship Program for the NOAA for 18 years. There have been a total of 146 appointments since inception. Eleven new appointments were made in March 2008 and are listed below. The 2009 application deadline is January 15. In partnership with the US CLIVAR community, VSP is managing a new postdoctoral program that is designed to build the pool of scientists qualified to transfer advances in climate science and prediction into climate-related decision frameworks and tools (Climate Predictions Applications Postdoctoral Program). Two additional CPAPP appointments will be made in 2009. The deadline is 15 December 2008. In July, VSP organized and supported the second year of the *Heliophysics Summer School* that is sponsored by the NASA Living With A Star program. This is a 3-year school that will provide training in this fast-developing area of science to approximately 120 students and 40 teachers.
8. **Joint Office for Science Support (JOSS Director Gene Martin www.joss.ucar.edu).** In 2008 JOSS supported over 400 events and arranged travel for more than 1,400 scientists, about half of which were affiliated with UCAR member universities. The number of events and travelers supported increased this year by 16% and the number of JOSS staff supported on-site events by 43%. JOSS has also contributed extensive Program Development Funds and physical support to assist three programs within UCAR's Office of Programs:
 - a. The NSDL Science Literacy Maps Service workshop designed to gather a focus group of educators to assess the NSDL collection of resources as well as develop methods to support awareness and use of the collection in classrooms.
 - b. The COSMIC Ocean Platform Workshop to identify a number of key science questions, evaluate current observational capabilities, discuss logistical considerations, and measure the level of interest in pursuing a possible deployment of GNSS equipment on ocean platforms.
 - c. The Unidata Latin American Data Workshop to promote scientific interactions among the U.S. education and research community and its counterparts in Latin America.

End of UOP Report Highlights

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

Program Director: Dr. Tim Spangler

www.comet.ucar.edu; www.meted.ucar.edu

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

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. The MetEd site (<http://www.meted.ucar.edu>) 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 Total Sessions by Topic Area for Education and Non-Education registrants.

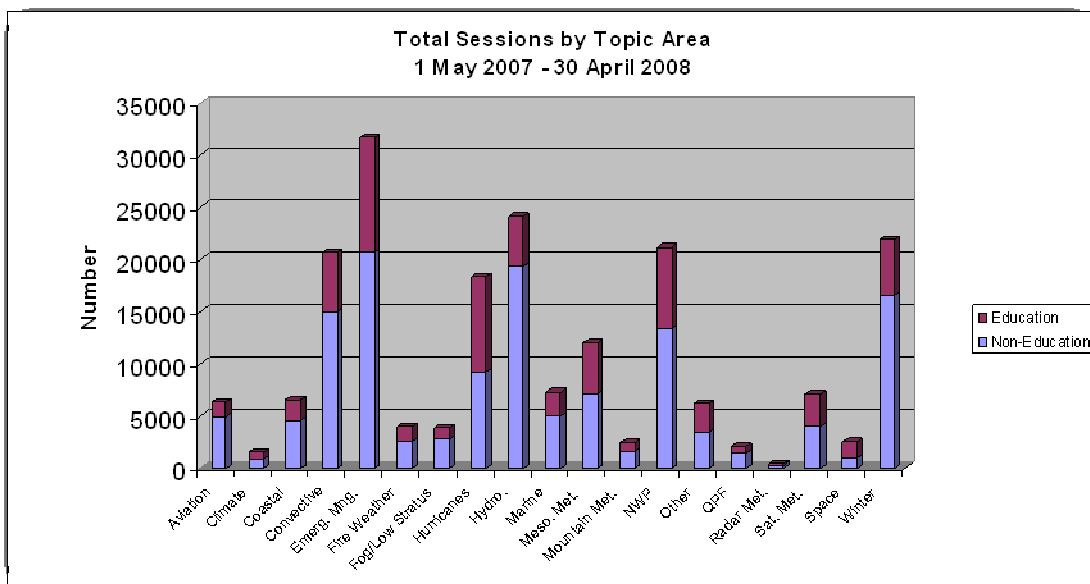


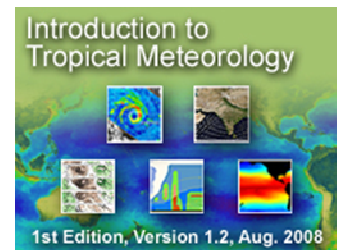
Figure 1: Total Sessions by Topic Area

COMET Distance Learning Highlights:

Satellite Meteorology. In partnership with NESDIS, NPOESS, and GOES-R Programs; as well as EUMETSAT, the COMET Program continues the expansion of satellite-related training. The Environmental Satellite Resource Center (ESRC) is a database driven searchable website. This has been created in response to a coordinated community request for a repository to find easy access to a wide range of useful information, education, and training about low-earth orbit and geostationary satellites. Other publications during the year included new self-paced modules entitled “*Creating Meteorological Products from Satellite Data*,” and “*Microwave Remote Sensing: Land and Ocean Surface Applications*”, which is the final module in the Microwave Remote Sensing module series. Spanish translations of several satellite titles were developed as well.

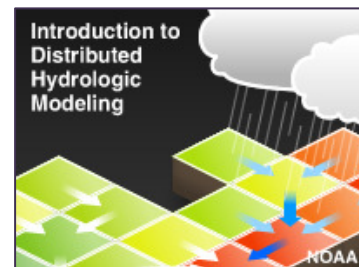


Tropical Meteorology. 2008 saw substantial progress on the online "Introduction to Tropical Meteorology" textbook. Authors Dr. Arlene Laing and Dr. Jenni Evans published two new chapters of great interest and need: Chapter 6 entitled “*The Distribution of Moisture and Precipitation*” and Chapter 10, “*Tropical Cyclones*”. Each chapter of the book offers many features including quizzes, links to additional information, animations, and robust print versions. Spanish translations of Chapter 6, and the previously published Chapter 3 “*Tropical Remote Sensing Applications*” were also completed and made available during the past year.



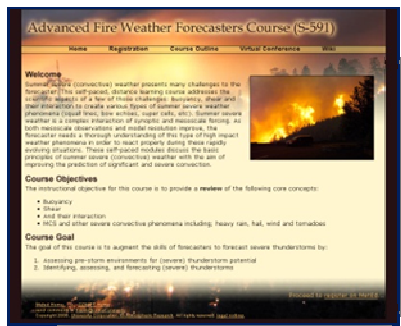
Hydrometeorology. Hydrology training and education projects are accomplished in partnership with the National Weather Service Forecast Decision Training Branch. New modules published in this area include:

- *Dams and Dam Failure - Module 1: Terminology and Open Channel Hydraulics*
- *Dams and Dam Failure - Module 2: St. Venant Equations, Modeling, and Case Study*
- *Introduction to Distributed Hydrologic Modeling*
- *Introduction to Verification of Hydrologic Forecasts*



Oceanography. COMET continues to develop distance learning offerings designed to better understand and forecast ocean processes. The distance learning course “*Introductory Topics in Oceanography*” highlights the fundamentals of ocean tides, currents and models. A module on north wall effects examines the occurrences of high wind and waves along the north edge of warm western boundary currents such as the Gulf Stream.

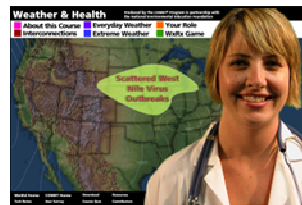
Fire Weather Meteorology. Fire Weather has been a major focus area for COMET over the past year. COMET converted the Advanced Fire Weather (S-591) 30-hour residence offering to a 15-hour distance learning course, which covers extensive details of Fire Weather Forecasting. Topics covered include: Application of weather forecasting specific to wildfire management, Background of Fire Behavior, Fire Danger, and Numerical Fire Models. This material supports both meteorology and forestry courses. In addition, COMET held its first virtual conference on fire weather in April 2008. Building upon this effort, COMET is now embarking on the conversion of the Intermediate Wildland Fire Behavior (S-290) course. Employing a mix of case-based, interactive modules and webcasts, the course will be completed by the end of 2009. This course will cover basic topics on Fire Weather with more advanced information on Fire Behavior.



Aviation. The effort continues to develop modules aimed at improving skills of operational aviation forecasters in producing Terminal Aerodrome Forecasts (TAF) for various weather phenomena, taking into account impacts of the forecast on aviation customers. The module “Writing TAFs for Winds and Low-Level Wind Shear” utilizes a case-based approach to teach specialized tools and techniques aimed at producing a Practically Perfect TAF (PPTAF) for winds and episodes of wind shear. Emphasis is placed on effective communication techniques and timely updates of the TAF product.

Numerical Weather Prediction (NWP). COMET continues to provide updates on model characteristics with new operational model implementations via the Operational Models Matrix. Recent matrix updates include changes to the NAM model as well as the addition of the GEM Global model. This past year we have also developed webcasts on wave ensembles, the North American Ensemble Forecasting System, and the use of high resolution models, and have archived teletraining presentations on the effective use of warm and cool season ensembles. We are beginning a multi-year effort to develop a new distance learning course entitled: “*Effective Use of NWP in the Forecast Process.*”

Environmental Education. The COMET Program continues its partnership with the National Environmental Education Foundation (NEEF) to provide education courses for the broadcast meteorology community. These courses compliment NEEF's Earth Gauge program which provides broadcasters climate/weather/environmental impact information linked to three day forecasts. New materials in development include:



- "Weather and Health" will be published in November, 2008. The goals of this course are to broaden broadcast meteorologists' understanding of the impacts of weather, climate, and climate change trends on public health and to facilitate broadcast meteorologists' efforts to establish and strengthen the public's understanding of the connection between weather and

health at the local level.

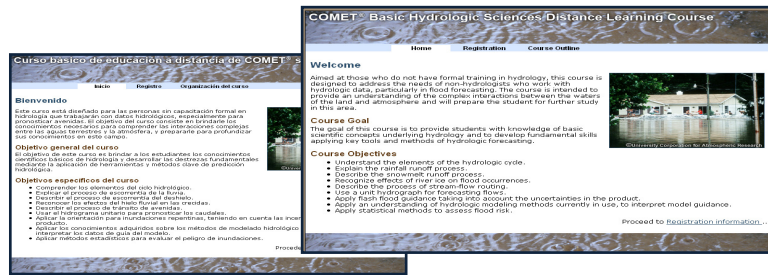
- “Communicating about Climate Change” is currently in development and will be published early in 2009. This will be a two hour course that provides broadcasters a better understanding of climate change science and information and resources they can use to address FAQs from the public about climate change.

International. COMET works closely with the National Weather Service, the World Meteorological Organization, EUMETSAT, and other organizations to provide education and training for the international community. Projects include modules and workshops, along with a significant effort to provide Spanish translations of COMET modules and courses. In partnership with the University of Costa Rica, COMET has translated 25 modules into Spanish in the last 12 months.

The Bureau of Meteorology of Australia is working with COMET to produce two projects this year: one on fog forecasting and another on radar interpretation. EUMETSAT has funded the development of two projects on the European environmental satellite system.

In 2007, COMET helped deliver a course on NWP in South Africa and is completing development of Webcasts of lectures delivered

at that event. In addition, COMET will produce Webcasts from lectures delivered at a WMO Regional Training Course in Argentina, and will provide a DVD collection to participants in the “GEOSS in the Americas” Symposium in Panama City, Panama.



COMET Classroom Highlight. The three-week International Hydrometeorology Analysis and Forecasting class, sponsored by NOAA, took place in the COMET classroom in June 2008, with 27 students from 24 different countries. The course included laboratory exercises and field trips, both of which augmented course topics including hydrology programs, hydrometeorology, river hydraulics, climate change, and disaster planning.

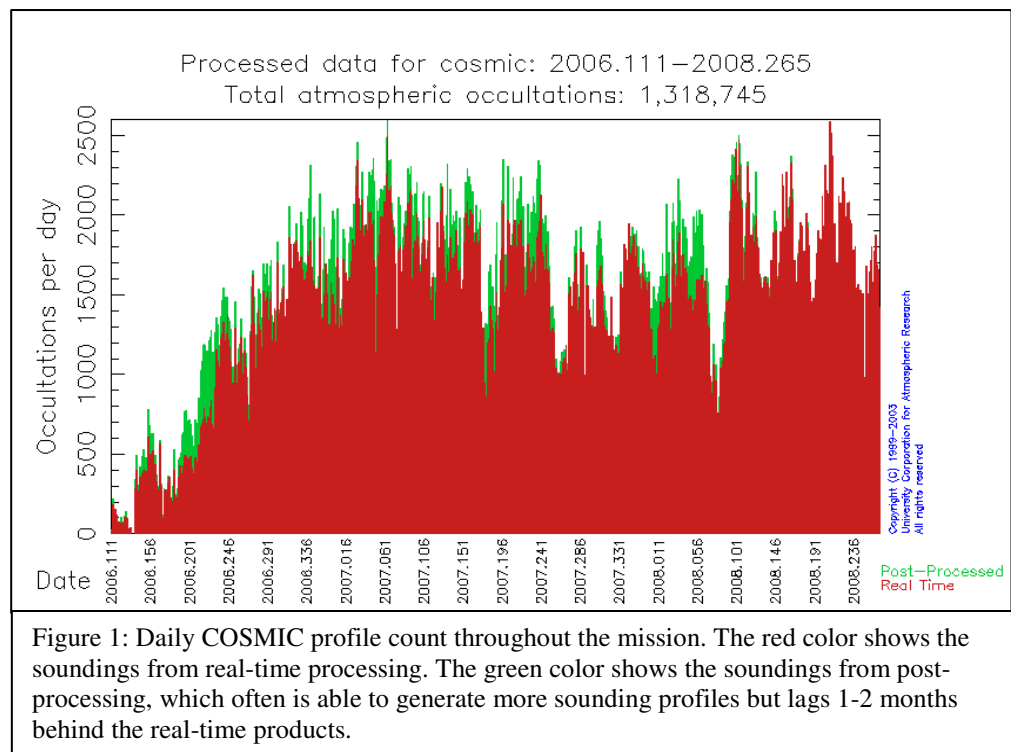


Outreach Program. The Outreach Program provides funding for applied research projects that involve university faculty and students working collaboratively with operational weather forecasters. Since its inception, the Outreach Program has provided a total of almost \$10 million to support over 300 research projects. These projects have involved more than 90 different universities with over 150 NWS, Department of Transportation (DOT), Navy and AFWA offices. In 2008 COMET funded 12 one-year Partners Projects and 5 two-year Cooperative Projects. An RFP for new cooperative projects will be issued this fall.

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

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

Overview. Since the launch of the six-satellite constellation in April 2006, COSMIC has provided GPS radio occultation (RO) data to support research and operations. All six satellites are operating and providing data. To date, COSMIC has provided over 1.3 million neutral atmospheric sounding profiles, and over 1.5 million ionospheric profiles. Figure 1 shows the number of neutral atmospheric profiles generated per day throughout the mission. On average, COSMIC produces from 1,500 to 2,000 GPS RO soundings per day. 90% of these are processed and delivered to operational centers within 3 hours. Major global weather prediction centers, including ECMWF, NCEP, UK Met Office, Meteo France, and Environment Canada, are using the data for their operations. They all have reported significant positive impacts. COSMIC is now supporting 855 registered users from 46 countries. In collaboration with UNIDATA, COSMIC soundings are now provided in a real time data stream to support the university community. COSMIC has received funding from U.S. agencies and Taiwan to continue its operation through April 2011.



Boundary-layer study. With the use of an 'open-loop' tracking technique, COSMIC GPS RO soundings can penetrate through the atmospheric boundary layer. In line with pre-launch expectations, the statistics since launch indicate that more than 70% of COSMIC soundings penetrate below 1 km over the tropics, and more than 90% over high latitudes. In comparison, earlier satellite missions (e.g., CHAMP), which use phase-locked-loop tracking, have fewer than 10% of soundings penetrate below 1 km over the tropics. This provides an opportunity for the first time to use GPS RO soundings to study the atmospheric boundary layer and its variations. Figure 2 compares the atmospheric boundary layer (ABL) heights between summer of 2007 (left panel) and winter of 2006/2007 (right panel). This shows a lower ABL height off the coast of California in the summer, compared with that over the Great Plains. In the winter, the situation

is reversed, with shallower ABL height over land than that over the oceans (e.g., California coastal waters, and Gulf of Mexico).

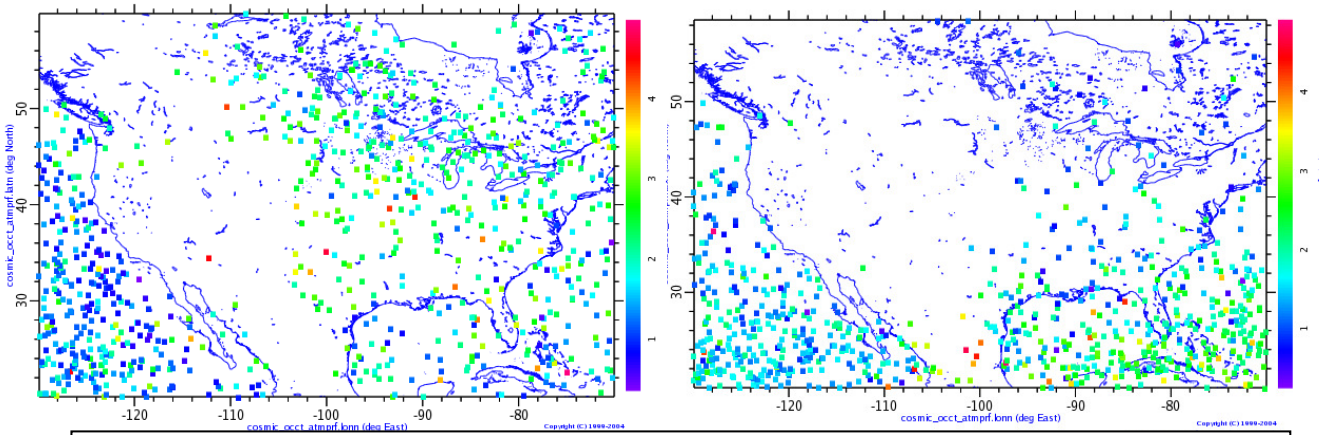


Figure 2. The atmospheric boundary layer height as estimated by COSMIC GPS RO soundings during the summer and winter. The height of ABL is color-coded following the color scale on the right. Left panel is for the summer months (Jun – Aug 2007) and the right panel is for the winter months (Dec 2006 – Feb 2007).

Use of COSMIC Soundings to Identify Radiative Biases Radiosondes. GPS RO measurements have many important attributes that make them uniquely suitable for climate monitoring. These include: (i) no satellite-to-satellite bias, (ii) no instrument drift, and (iii) not affected by clouds and precipitation. The fact that COSMIC GPS RO soundings require no bias correction has been shown to offer great advantages for operational weather prediction. This provides the possibility of using COSMIC GPS RO soundings to calibrate other traditional IR and microwave

sounder data, making these data more useful for operational weather prediction. In addition, because the quality of COSMIC GPS RO data are not affected by the surrounding environment (e.g., geo-location, day and night, etc.), COSMIC data are very useful to identify the possible radiative biases of radiosonde, where sensor characteristics vary considerably in times and locations for different sensor types. As an illustration on how COSMIC data can be used to

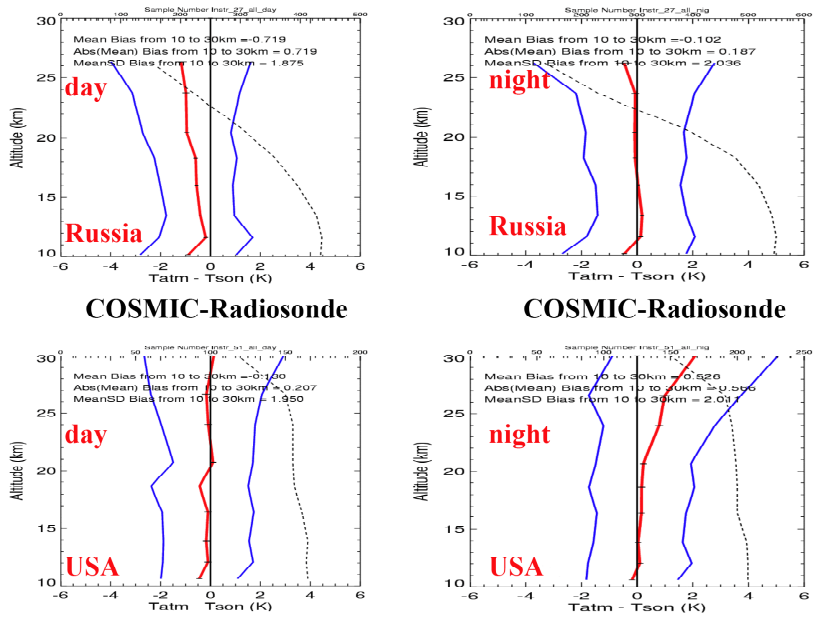


Figure 3. Comparison between COSMIC and radiosonde observations from Russia and U.S.A. during day and night times. It shows different biases of radiosonde systems.

assess the observation biases from different radiosonde sensor types, we show a comparison of COSMIC GPS RO soundings with Russian and U.S. radiosondes for day and night time soundings (Figure 3). The results indicate that the Russian radiosondes (using the AVK-MRZ system) have a distinct warm bias during the day from 10 km and above. The warm bias is substantially reduced during the night. Meanwhile, the U.S.A. system (VIZ-B2) has little bias during the day. On the contrary, it shows a distinct cold bias above 20 km in the night time. This shows that we need to carefully identify the radiative bias for observations from different radiosonde sensor types before we use them for climate studies, and COSMIC data are well suitable for such calibration.

Ionspheric Studies. The electron density profiles produced by COSMIC are an important data source for ionspheric studies. One interesting application is to derive the neutral winds and to compare the results with numerical models. The neutral winds in the thermosphere (near 300 km) can be derived from COSMIC data by measuring changes in the height of the peak of the F2-layer (hmF2), which are caused by winds pushing ions up and down the magnetic field lines. Luan and Solomon (2008) compared COSMIC wind measurements to modeling by the TIEGCM. The results show that the wind fields as simulated by the TIEGCM is weaker than the COSMIC derived wind fields. Such study is useful for validating models, and helping to advance the capability for space weather prediction.

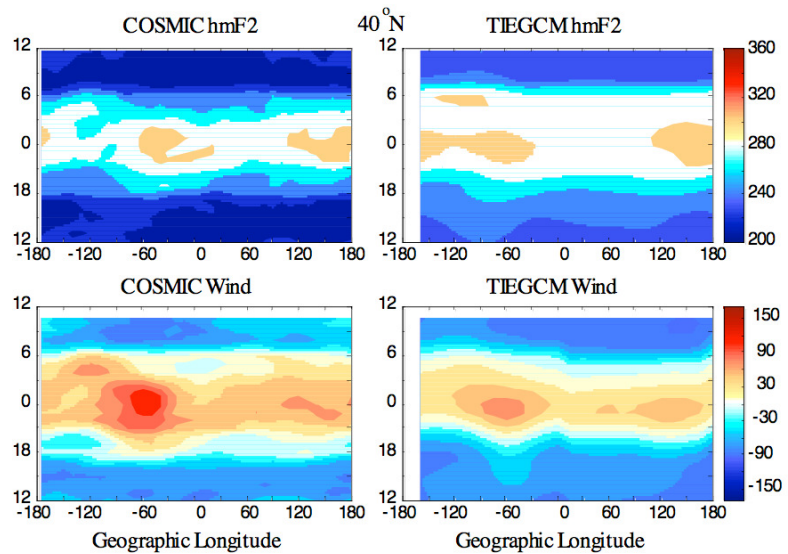
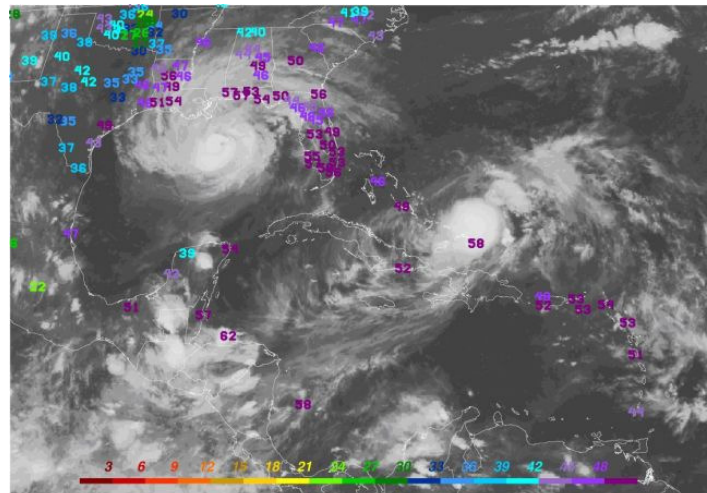


Figure 4. Comparison of neutral winds derived from COSMIC measurements with those simulated by TIEGCM (from Luan and Solomon, 2008)

Caribbean GPS Network for Hurricane Intensity Research. Ground based GPS stations are now being used to improve forecasts of hurricane intensity. With funding from the NSF, the COSMIC program has installed a network of GPS stations in the Caribbean to measure column integrated atmospheric water vapor, also called precipitable water vapor (PW). These data are processed with data obtained from collaborating groups (NOAA, NGS, and other international agencies) to produce continuous and all weather estimates of atmospheric PW. These data are available from the COSMIC SuomiNet web page (www.suominet.ucar.edu), and available for automated distribution using LDM. Data from this network have been used to identify a wet bias in the GFS analysis fields, and were also used to improve the intensity forecast of hurricane Dean in 2007.

Figure 5 shows the GPS PW estimates overlaid on a GOES Infrared Channel 4 (IR4) image as hurricane Gustav approaches Louisiana and tropical storm Hanna intensifies over Grand Turk. Assimilation impact studies during the 2008 hurricane season are currently underway.



SUOMINET PRECIPITABLE WATER VAPOR 080901/0245

Workshop on High Precision GPS Observations from Ocean Platforms.

The COSMIC program, with funding and logistical support from JOSS, will host a workshop on October 27-29 to discuss the potential scientific questions that could be addressed using high precision GPS instrumentation on ocean platforms (ships, oil rigs, buoys, etc). The list of topics that will be discussed includes how GPS observations could be used to measure water vapor over ocean surfaces, study atmosphere/ocean interactions, calibrate satellite observations, detect tsunamis, and monitor changes in sea level. A key objective of this workshop will be to identify parties interested in developing a strategy to pursue this topic on a national and/or international scale. COSMIC encourages representatives from UCAR member institutions to register and attend this workshop. More information can be found at the meeting webpage:

http://www.joss.ucar.edu/joss_psg/meetings/Meetings_2008/ocean_workshop/index.html



Figure 6. A GPS antenna is deployed on the spar buoy adjacent to the Harvest oil platform west of San Diego. Data from this experiment were used to calibrate the satellite altimeter onboard the TOPEX/POSEIDON satellite.

Digital Learning Sciences (DLS)

Program Director: Karon Kelly <http://www.dlsciences.org>

Mission: Digital Learning Sciences develops systems and services that enable science and educational organizations—school districts, universities, libraries, and publishers—to organize, manage, comprehend, and enrich online resources to improve learning outcomes and learner engagement.

Digital Learning Sciences (DLS) is a collaboration between UCAR and the Institute of Cognitive Science at the University of Colorado at Boulder. With its partners, DLS develops advanced learning tools and investigates how cognitive tools, computational algorithms, and user-centered interfaces can improve learning and learner engagement.

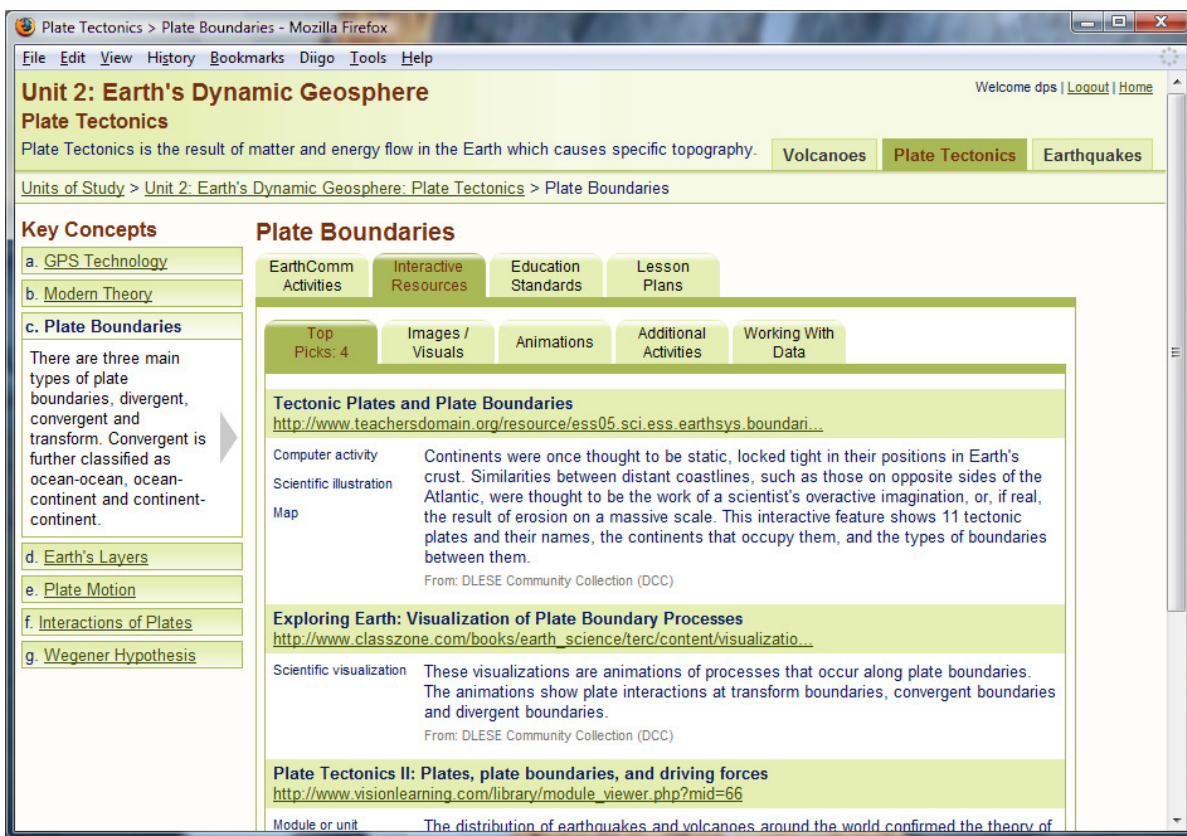
Over the last year, DLS has focused on a suite of projects that are directed at the creation of a “Personalized Learning Collaboratory.” The aim of these projects is to improve learning outcomes and learner engagement through scalable, cost-effective software tools supporting personalized learning, informed by cutting edge learning science research on human cognition and language processing. This research, and the experiences of many teachers, has repeatedly demonstrated that one-size-fits-all models of instruction and learning are not effective. Effective instruction is tailored to meet learners’ specific needs and builds on their current understandings and abilities. An increasingly diverse student population brings a wide range of knowledge, abilities, motivations, life experiences, and cultural backgrounds into the classroom, including an increased expectation that technology play a significant role in learning, making personalized instruction both more important and more challenging. In recognition of this challenge, the National Academy of Engineering recently named personalized learning as one of 14 Grand Challenges for the 21st century, along with providing energy from fusion and developing carbon sequestration methods.

Curriculum Customization Service. Through a unique partnership between DLS and Denver Public Schools (DPS), we have a “real world learning laboratory” for demonstrating the impact of digital educational content and tools on personalized learning in both formal and informal settings. Like many large school districts, DPS is facing a new urgency in science education. Classrooms are becoming increasingly diverse, a new generation of digital learners is not being engaged with current instruction methods, and there is increasing teacher turnover in classrooms. DPS is seeking new ways to energize student and teacher learning with exciting, interactive educational resources, and to focus instructional and professional development resources to provide the highest impact on learning. With funding from the National Science Foundation, DLS is currently developing the Curriculum Customization Service (CCS) framework and operationalizing the service to support multiple curriculum units spanning one semester of Earth science instruction at both the middle and high school levels. Ultimately, the CCS will replace the paper-based district curriculum guides currently in use with an interactive environment supporting customization and ongoing professional learning.

The project’s goals and work objectives were collaboratively developed with leaders from the DPS Department of Technology Services and Department of Curriculum and Instruction (who

are co-PIs on the project), and it has been formally approved by the DPS Chief Academic Officer. Built into the project is significant teacher involvement in system design and evaluation, as well as the design of attendant professional development practices and policies to encourage and support system use. As part of this award, we are selecting open access resources from the National Science Digital Library (NSDL) and aligning them with DPS curriculum. This software web service will enable DPS science teachers to (1) customize curriculum with open educational resources, formative assessments, and district-developed materials to aid student learning and (2) share their customizations as part of a district-supported online learning community and professional development program.

This fall, ten DPS Earth Science teachers will pilot the CCS prototype in their classrooms; their use and evaluation will insure the tool is ready for the Fall 2009 deployment via the district portal and evaluated with all 110 DPS middle and high school Earth science teachers. While this demonstration will focus on Earth science, the CCS will be extensible across the entire middle and high school science curriculum and portable to other districts.



Prototype Curriculum Customization Service user interface

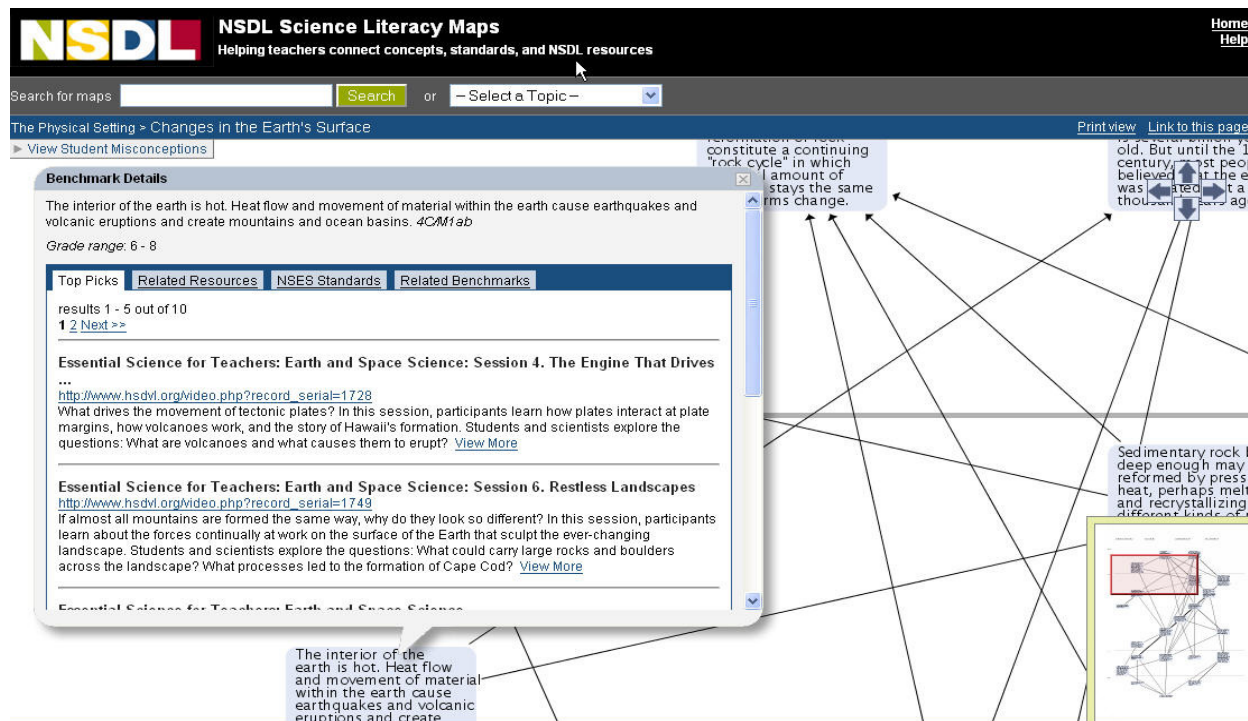
Other projects supported by NSF and IMLS. With NSF/CISE and EHR funding, DLS is investigating how cognitive tools, computational algorithms, and user centered interfaces can improve learning outcomes and learner engagement. Two projects are examining how machine learning and natural language processing algorithms can contribute to creating engaging,

personalized learning environments, and supporting scalable curation of content in large-scale digital repositories. These projects will inform future DLS work with the NSDL.

Work continues with the Syracuse University Center for Natural Language Processing on the integration of three digital library tools and services to create a new system (Metadata Assignment and Search Tool, MAST) that will enable libraries and museums to efficiently describe and disseminate their digital materials. This body of work, funded by the Institute of Library and Museum Services, builds on prior work by our two organizations to use natural language processing technologies to aid in the assignment of educational standards to learning resources and the automatic correlation of national standards to state standards to support discovery of standards information in NSDL.

Collaborations with NCAR and other UOP Programs:

National Science Digital Library (NSDL). During the last year, DLS continued to be involved in NSDL technical development activities, developing key tools and services for use with the NSDL Digital Repository (NDR). DLS has contributed tools and services for discovery, creation, and organization of resources using the NDR, including the NSDL Collection System (NCS) which can now be used to manage a collection in the NDR and supports the assignment of educational standards. There have been a number of enhancements to the Strand Map Service which provides an interactive graphical user interface that helps K-12 teachers and students understand the relationships between science concepts and to find associated educational resources. Based on the learning goals from the AAAS *Benchmarks for Science Literacy* and the visualizations from Volumes 1 and 2 of the AAAS *Atlas of Science Literacy*, the service demonstrates the connectedness of ideas and skills that students should develop over time.



Strand Map Service in NSDL.org

Future NSDL Collaborations. DLS will play a significant role in NSDL's new Technical Network Services (TNS) at Cornell University. This four year award will support the following activities: (1) maintenance and upgrades of the NSDL technical infrastructure; (2) technical support for NSDL tools and services (NCore); (3) contributions by Pathways, Integrated Services, and other projects; (4) discussions to identify priorities for new services; (5) development of a business model to sustain infrastructure after the award ends; and (6) expansion beyond NSDL grantees to position NSDL as premier cyberlearning infrastructure.

DLS also has a key role in supporting evaluation activities for NSDL's new Resource Center (RC), led by Kaye Howe in the UCAR Office of Programs. DLS will work closely with the RC staff to conduct evaluation activities to inform improvements and future programmatic developments, assess progress on library growth and use, determine community resource and collections contributions to NSDL, benchmark community satisfaction with the RC's products and services, and gauge end-user assessment of the value of NSDL collections and services. DLS/TNS will work with the RC to develop a data collection strategy and to instrument library systems to support this data collection automatically.

NCAR Library. The NCAR Library recently started an initiative to develop a digital preservation strategy and an Institutional Repository (IR) for UCAR. Two initial projects related to this are the NCAR Technical Notes collection and the Warren Washington Archive. DLS is directly supporting these efforts, initially by migrating the NCAR Technical Notes from a vendor-based system to the open-source Digital Collection System (DCS) developed by DLS under previous NSF grants (DLESE & NSDL). This software may underpin future IR development.

Global Learning & Observations to Benefit the Environment (GLOBE). DLS staff provided management and technology consulting to the GLOBE Program Office (GPO) senior management team during their 4-year program review and subsequent strategic planning efforts. In addition, DLS staff have participated in GLOBE's efforts to develop a student research collaboratory, supplying user-centered design and usability expertise to the planning process. DLS staff will also support a new GLOBE student research campaign scheduled to kick off this fall.

Cooperative Program for Operational Meteorology, Education & Training (COMET). DLS has provided meteorological and instructional design consulting to COMET to support the development of three education modules for the Air Force Weather Agency (AFWA). Work includes the development of new science content and recommendations for new instructional approaches that will best support AF weathercasters.

Community Projects and Partnerships:

LEAD and GEON. DLS continued to provide leadership for the educational components of the Linked Environments for Atmospheric Discovery (LEAD) and Geosciences Network (GEON) projects, sharing educational cyberinfrastructure and lending expertise to the development of learning environments. DLS concluded its work with the LEAD project in June 2008. DLS

created a prototype of a three-phase instructional module on *Investigating the Parameters that Identify Fronts* which integrates aspects of the current LEAD educational portal; the prototype, for use in undergraduate education, was designed to support future formative usability testing.

DLS concluded its work with GEON in March 2008. Educational resources from GEON participants, UNAVCO, Discover our Earth, and the Paleobiology Database, are available in the Digital Library for Earth System Education (www.dlese.org). These activities relate to the growing cross-community engagement between the digital library research community and the eScience research community: two members of GEON contributed to a special issue of the International Journal of Digital Libraries (Springer) on "Digital Libraries and eScience". Mike Wright of DLS co-edited this special issue which was published in October 2007.

Project GEE (Global Earthquake Explorer). Through a collaboration with the University of South Carolina and IRIS (Incorporated Research Institutions for Seismology), DLS led the development of online learning materials using the Rapid Earthquake Viewer (REV). Six new activities have been added to the *Living in Earthquake Country* Teaching Box (<http://www.teachingboxes.org/>). Teachers from two Denver area school districts tested and evaluated the new activities that utilize data and images from the Rapid Earthquake Viewer <http://rev.seis.sc.edu/>. REV is an education and outreach tool for seismology that aims to make it easy for non-seismologists to retrieve, display and analyze seismic data. Teaching Boxes are classroom-ready instructional units created by collaboration between teachers, scientists, and designers. Incorporating the REV tool into these dynamic, classroom-ready instructional units provides an excellent opportunity to extend the access and use of the tool within a pedagogical context. These efforts are expected to facilitate the use and integration of live data in the classroom, which many experts see as integral to improving science literacy.

EarthScope. With funding from the EarthScope Voyager grant, DLS helped to create a suite of interactive map tools and support materials that enable students and researchers to study the relationship between geophysical and geological processes, structures, and measurements using high-precision GPS data. Each tool provides access to a wide variety of maps, satellite images, and geophysical data about the earth. Users select base maps and overlay geographic and geophysical features, such as velocity vectors. The map tools include Jules Verne Voyager (<http://jules.unavco.org/Voyager2/Earth>) and two derivative programs intended for the middle and high school levels: Voyager Jr (<http://jules.unavco.org/VoyagerJr/EarthScope>) and EarthScope Voyager.

**National Science Digital Library
(NSDL)**

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

Mission. The National Science Digital Library (NSDL) is funded by the National Science Foundation as an online library of exemplary teaching and learning resources for science, technology, engineering, and mathematics education at all levels. NSDL facilitates collaboration and engages stakeholders across public, private, K-12, university, and government organizations to provide effective management and delivery of digital resources, tools, and services.

Building NSDL has focused on creating both technical and organizational capacities including: developing sophisticated technologies to support the organization, description and dissemination of STEM education resources; building effective networks of partners to leverage existing efforts and extend the reach and impact of NSDL; using both traditional and cutting edge dissemination methods to engage NSDL users; and building an organization capable of managing the breadth of such distributed activities.

New Leadership Structure. In Spring 2008, NSF announced its intentions to restructure the central coordinating entity for NSDL, known as Core Integration, on which UCAR has been partnering with Cornell and Columbia Universities since 2001. The 2008 solicitation for NSDL was released with an open competition for two new centers of operations for the library – a Technical Services Provider focused on underlying digital library infrastructure and a Resource Center for the NSDL community focused on communications, outreach, and evaluation. UCAR submitted proposals related to both aspects of the RFP:

- ***The NSDL Center for Sustaining Broader Impacts.*** UCAR will be the sole institution running the new NSDL resource center. Kaye Howe will continue as the program’s Director and Susan Van Gundy will serve as Deputy Director. Mary Marlino, Director of the NCAR Library, will manage the evaluation activities for the Center. The Center will support the community of NSDL grantees in its pursuit of shared goals for improving STEM education and widening the pipeline for STEM professions, including the need to increase usage, leverage resources effectively, demonstrate impact on target audiences, and sustain and grow impacts over time. Rather than focusing efforts on making user connections to NSDL one researcher, librarian, or teacher at a time, the Center’s approach will be to invest in relationships with organizations and coalitions of decision-makers and system-wide influencers that can geometrically amplify NSDL’s reach. The Center will build upon partnerships, services, tools, and processes we’ve been successfully developing over the past several years.
- ***The NSDL Technical Network Services Provider.*** UCAR’s Digital Learning Sciences will partner with the University of Colorado and Cornell University to operate the technical systems upon which the library is built, develop new technical tools as needed by the community, and research the potential of NSDL as a cyberlearning platform. Further details appear in the DLS portion of this report.

New Partnerships to Promote Climate Literacy. One element of the Resource Center’s plans is to work with the Cooperative Institute for Research in Environmental Sciences (CIRES) program at the University of Colorado, the Climate Literacy Network which represents a range of organizations including UCAR, and the American Association for the Advancement of Science (AAAS) to develop an online interactive tool that will allow educators and learners to navigate through a set of recommended Climate Literacy concepts, and identify materials from NSDL and other sources that support learning of those concepts. This initiative is based upon the previous work of DLS and NSDL on the NSDL Science Literacy Maps service (<http://strandmaps.nsdl.org>), which is grounded in the AAAS Project 2061 Atlas for Science Literacy, one of the seminal documents supporting K12 STEM education reforms. This work

will be funded through grants from several sources including the NOAA Environmental Literacy program (proposal pending) and NSDL's operational budget. A series of workshops focused on formative evaluation with stakeholders and alignment of relevant resources to climate science concepts is being generously supported through an intra-organizational grant of NOAA education funds through JOSS.

Visiting Scientist Programs (VSP)

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

VSP Mission: VSP develops, manages, and implements postdoctoral fellowship and visiting scientist programs that will:

- Lead to advancements in research,
- Develop the next generation of scientists, and
- Provide an efficient mechanism to facilitate collaboration and exchange of ideas.



VSP administered nearly 100 research appointments during the past year, serving over 20 different program sponsors. Our office also organized and supported 10 workshops and colloquium. This report highlights some of VSP support during the year, but is not a comprehensive list of all activities. The newly designed VSP website: <http://www.vsp.ucar.edu> provides additional information about VSP.

Climate Predictions Applications Postdoctoral Program (CPAPP). In partnership with the US CLIVAR community, VSP is managing a new postdoctoral program that is designed to build the pool of scientists qualified to transfer advances in climate science and prediction into climate-related decision frameworks and tools. Postdoctoral applicants vie for fellowships to research and develop tools that will apply climate prediction information to climate-impacted decisions. In each fellowship, the work is conducted under the specification and direction of institutional partners that are chosen annually by a UCAR steering committee. Dr. Galina Guentchev is the first CPAPP fellow. She is co-hosted with the Bureau of Reclamation Lower Colorado Region, in Boulder City, Nevada, and the NOAA Western Water Assessment, University of Colorado/CIRES. She will be working to transfer her climate science knowledge to the decision-makers who are dealing with the impacts to regional water management for the western U.S.

In 2009 two additional CPAPP appointments will be made: one in water resources and the other in public health. The deadline for postdoctoral applications is December 15, 2008.

Climate and Global Change Postdoctoral Fellowship Program. VSP has managed this program for the NOAA Climate Programs Office for 18 years. There have been a total of 146 appointments since inception. Appointments are made in a broad area of research topics that focus on observing, understanding, modeling, and predicting the climate system on seasonal to centennial time scales. Postdoctoral fellows are hosted at universities and research labs across the U.S. mentored by host scientists in an area of mutual interest. Every other year, the program hosts a week-long summer institute to bring the current fellows, alumni and their hosts together for the purpose of building community, making contacts and learning about the broad science areas represented through this program. The 2009 application deadline is January 15. Eleven new appointments were made in March 2008 and are listed below.



Louisa Bradtmiller

Topic: marine paleo empirical
PhD, Columbia University, Geochemistry
Host: Woods Hole Oceanographic
Institution, Laura Robinson



Mariah Carbone

Topic: soil respiration and carbon
PhD, University of California, Irvine,
Earth System Science
Host: UC Santa Barbara, Chris Still

William D'Andrea

Topic: paleo FW empirical
PhD, Brown University, Geological
Sciences
Host: University of Massachusetts, Ray
Bradley





Ian Eisenman

Topic: sea ice
PhD, Harvard University, Earth &
Planetary Sciences
Host: University of Washington, David
Battisti

Mariam Freedman

Topic: atmospheric composition
PhD, University of Chicago, Physical
Chemistry
Host: University of Colorado, Margaret
Tolbert



Yi Huang

Topic: spectral OLR and climate change
PhD, Princeton University, Atmospheric
& Oceanic Sciences
Host: Harvard, James Anderson

Yohai Kaspi

Topic: atmospheric jets—storm track
PhD, Massachusetts Institute of
Technology, Physical Oceanography
Host: California Institute of Technology,
Tapio Schneider



Vasilii Petrenko

Topic: ice core chemistry
PhD, Scripps Institution of Oceanography,
Geosciences
Host: University of Colorado, INSTAAR,
James White

Ryan Sriver

Topic: tropical cyclones
PhD, Purdue University, Earth &
Atmospheric Sciences
Host: Pennsylvania State University,
Michael Mann



Samuel Stechmann

Topic: clouds and convection
PhD, New York University, Applied
Mathematics
Host: UCLA, B. Stevens & D. Neelin

Rebecca Terry

Topic: paleo ecology
PhD, University of Chicago, Paleobiology
Host: Stanford University, Elizabeth
Hadly



Training workshops, schools and colloquiums.

In July 2008 VSP organized and supported the second year of the ***Heliophysics Summer School*** that is sponsored by the NASA Living With a Star program. This is a 3-year school that will provide approximately 120 students and 40 teachers training in this fast-developing area of science. The field of heliophysics embraces all aspects of the Sun-Earth connection and many astrophysical processes that are found throughout the



universe. Drs. Karel Schryver and George Siscoe are the school leaders and are also taking the lead in publishing a series of 3 textbooks on Heliophysics. VSP has developed and maintains a website for the school: <http://www.vsp.ucar.edu/HeliophysicsSummerSchool/>



Space Weather Workshop is an annual conference, organized and supported by VSP, which brings industry, academia, and government agencies together to discuss space weather. What began in 1996 as a conference for the space weather user community, Space Weather Workshop has evolved into the Nation’s leading conference on all issues relating to space weather. The Workshop has about 250 participants.



CEDAR Workshop (Coupling, Energetics and Dynamics of Atmospheric Regions). This is an annual Global Change program sponsored by the National Science Foundation (NSF) to enhance the capability of ground-based instruments to measure the upper atmosphere and to coordinate instrument and model data for the benefit of the scientific community. The 2008 CEDAR Workshop, organized by VSP, was held in Midway, Utah at the Zermatt Resort in June. A significant number of the attendees are undergraduate and graduate students.

UNIDATA

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

Mission: To provide the data services, tools, and cyberinfrastructure leadership that advance Earth system science, enhance educational opportunities, and broaden participation.

Vision: Unidata recognizes that an integrated approach that transcends discipline and geographic boundaries is needed to understand and address socially important problems such as weather prediction, El Nino-Southern Oscillation, climate change, and the water cycle. The success of the geosciences enterprise depends heavily on the availability of a state-of-the-art, robust, and flexible cyberinfrastructure, transparent access to high-quality data from diverse sources, and requisite tools and services to use the data effectively.

Unidata's vision for the next five years calls for providing comprehensive, well-integrated, end-to-end data services. These include an array of functions for collecting, finding, and accessing data; data/content management tools for generating, cataloging, and exchanging metadata; and submitting/publishing, sharing, analyzing, visualizing, and integrating data. When this vision is

realized, users¹ — no matter where they are, how they are connected to the Internet, or what computing device they use — will be able to find and access a plethora of geosciences data, experience how all of the aforementioned services work together, and use Unidata-provided tools and services both productively and creatively in their research, education, and outreach activities.

A related element of that vision is that a user will be able to work within his or her own community data system, but will seamlessly be able to find, access, and use data from the systems of the other disciplines without having to learn entirely foreign interfaces to get at the data and without having to learn and employ a host of new data formats and conversion programs.

Introduction. Unidata had another productive year with numerous contributions in the data services area toward the advancement of education and science, and many significant accomplishments, including a successful review of the Unidata core-funding proposal by a distinguished panel appointed by the National Science Foundation.

We were extremely proud to learn earlier this year that Unidata’s founding director, Dave Fulker, is the recipient of this year’s AMS Cleveland Abbe Award for his “visionary foresight, creative leadership in community building, and pioneering information technology contributions to advance meteorological data use in education and research.”



Also, this year saw Dave’s appointment as Unidata Director Emeritus, with approval from the UCAR Board of Trustees. Emeritus status is bestowed on people who have provided sustained leadership and impact on the UCAR organization. It clearly fits Dave who has served in various capacities within UCAR for over 38 years, including 18 years as the founding director of Unidata. Dave retired in 2005 and has continued to offer his time unselfishly to UCAR.

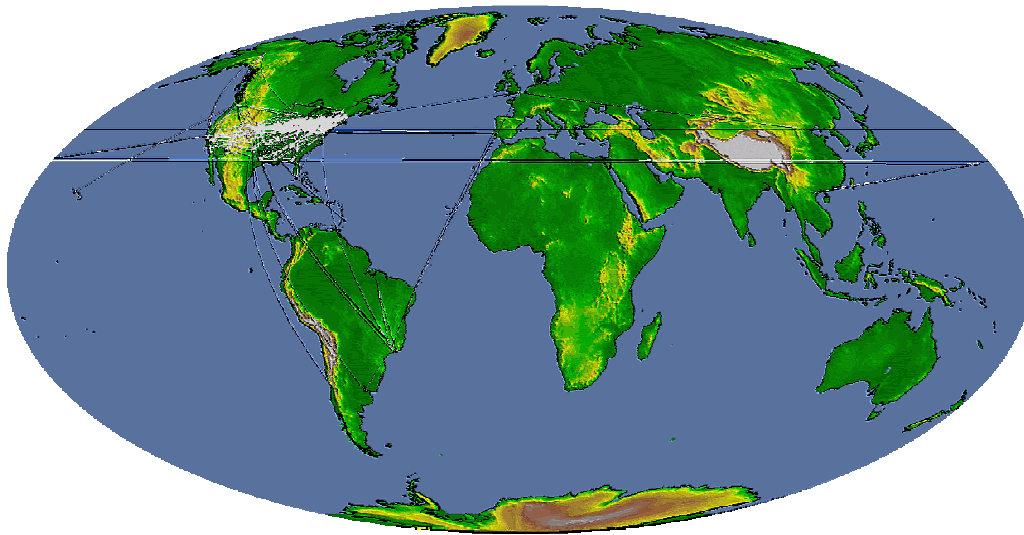
¹ Unidata is also developing services so a program or service can be at the other end, not just a “user.”

Major activities of Unidata focused on continued efforts in community engagement and broadening, facilitation of integrated data services, provision of new data streams, development of platform-independent software, and deployment of Unidata technologies in diverse environments.

Adequately summarizing the vast array of activities across the breadth of Unidata is a challenging task. This report provides an update on some of the salient activities of the Unidata program during the last year, highlighting its important accomplishments.

Background. The university community conceived and established Unidata, sponsored primarily by the NSF, nearly a quarter of a century ago to acquire and distribute real-time weather data and related software to U.S. universities.

Today, over several hundred institutions worldwide participate in the Unidata data sharing network and use Unidata tools and technologies in education, research, and operations, and in the process solving a range of complex environmental problems facing science and society. While Unidata's primary mission of serving the academic community remains unchanged through the years, the user base has broadened considerably, and its activities and responsibilities have grown as community needs have evolved.



As the enabler of a broad community, the Unidata Program Center (UPC):

- Acquires and distributes mostly real-time meteorological data for education and research
- Develops software for accessing, managing, analyzing, visualizing, and effectively using geosciences data
- Provides comprehensive support to users
- Conducts annual training workshops on Unidata software packages
- Facilitates advancement of standards, conventions, and interoperability
- Provides leadership in geosciences cyberinfrastructure and fosters technological change
- Assesses and responds to community needs

- Advocates on behalf of the university community on data issues and negotiates data agreements
- Fosters community interaction and engagement to promote sharing of data, tools, and ideas
- Grants equipment awards to universities to enable and enhance participation in Unidata

Unidata's hallmark has been democratizing access to data and tools by serving both large and small institutions in higher education. The program benefits from the diversity of its user community, spanning the technological, educational, and scientific spectra. Unidata-provided cyberinfrastructure has enriched university courses, enhanced productivity of students and researchers, and transformed the culture in atmospheric science departments.

Unidata has experienced a gradual but natural evolution from a program focused primarily on synoptic scale meteorology to one that serves a broader geosciences community. Unidata has attracted a broader community because it has been successful in providing tools and services that are interoperable, extensible, platform independent, and free. The robustness and quality of Unidata tools and services have resulted in their use beyond a community of several hundred universities, by organizations such as the NW²S and other weather agencies around the world, NOAA laboratories, NASA, NRL, and ECMWF, as well as many companies in the private sector. In the process, Unidata has matured into a cornerstone facility upon which the university geosciences community and other stakeholders have come to rely.

As a facility for the university community, Unidata focuses on being responsive to current and anticipated user needs of academia and aims to be efficient and nimble in doing so. To achieve that, Unidata has emphasized a community-driven, consensus-building process that provides a shared vision and the ability to address evolving community needs.

By providing data, advancing its software suite, organizing opportunities to facilitate exchange of ideas, and making cyberinfrastructure contributions, Unidata has become a foundational facility for the atmospheric sciences community. Unidata's value as a cornerstone facility has been amply demonstrated by a sustained record of innovation, a rich portfolio of tools and services, an actively-engaged community, strong governance, mutually-beneficial collaborations, and the ubiquitous use of its services in all sectors.

Successful Review of the Core Funding Proposal to Sustain the Unidata Program. In April 2008, the UPC submitted a five year proposal "Unidata 2013: A Transformative Community Facility for the Atmospheric and Related Sciences" to the NSF to continue and enhance Unidata's role as a foundational facility (see http://www.unidata.ucar.edu/staff/mohan/Project%20Summary_V2.pdf)

The proposal offered a bold vision and a realistic plan to extend the successes of a national facility that empowers the community and enables transformative advances in the geosciences. To that end, a 5-year plan for achieving the vision was provided through six overarching themes that were shaped by pertinent scientific and education drivers, consistent with community trends and needs, and aligned with the NSF priorities:

² Acronyms are described at <http://www.unidata.ucar.edu/publications/acronyms/glossary.html>

1. Broadening participation and expanding community services
2. Advancing data services
3. Developing and deploying useful tools
4. Enhancing user support services
5. Providing leadership in cyberinfrastructure
6. Promoting diversity by expanding opportunities

The proposed plan and endeavors therein were guided by the results of a comprehensive strategic planning effort over the past year that included strong input from and leadership by Unidata's governing committees and feedback from the broader community. The resulting strategy (<http://www.unidata.ucar.edu/2007stratplan/Unidata.pdf>) builds on the successes of the present program, its capabilities and core competencies, and its unique niche in providing robust, reliable, and comprehensive data services and tools to geoscience users.

Even as Unidata embarks on this plan to enhance and adapt its tools and services to meet the needs of an evolving community, the program remains deeply committed to meeting its responsibilities to the core atmospheric science community. The quality of services that the core community has come to expect will be maintained and enhanced as a result of the new partnerships and synergies.

Following a successful review of the proposal, the UPC is currently in negotiations with the NSF on the terms of the award and a stand-alone Cooperative Agreement for funding the program. The UPC will keep its community informed on the progress of its plans and activities as it engages users and stakeholders to shape its future plans.

Meanwhile, the following sections summarize our activities and accomplishments during the past year.

Research enabled by Unidata. Data and software provided by Unidata have contributed to numerous scientific studies and discoveries, as evidenced by the citation of Unidata and its offerings in 139 peer-reviewed and 277 conference papers in the last 5 years. The following list represents a cross-section of research enabled by Unidata:

- Climatology of mid-latitude cyclones and anticyclones over the United States
- Studies of tropical cyclone and hurricane life cycle and intensity estimation
- Variability of North American monsoon rainfall over complex terrain
- Studies of mesoscale convective vortices, tornadoes, and squall-lines
- Studies of fronts, cold-season precipitation events, and cold-air damming
- Validation of outgoing longwave radiation estimations with the GOES sounder
- Assessment of the ECMWF model cloudiness and surface radiation fields

Based on a March 2008 survey of a dozen doctoral programs in atmospheric sciences, it is estimated, *conservatively*, that more than half of the graduate students used Unidata systems in their research. Unidata's impact on research extends also beyond the atmospheric sciences. For instance, Unidata systems and technologies are integral parts of community projects such as

SuomiNet in the GPS applications arena, GEON and EarthScope in solid earth studies, and the multidisciplinary International Polar Year activities.



Latin American Data Workshop. Unidata, with funding from UOP's JOSS program and in conjunction with the Universidade de São Paulo's (USP's) Instituto de Astronomia, Geofísica e Ciências Atmosféricas (IAG), hosted a Latin American Data Workshop on August 21-23, 2008 in the IAG facilities on the USP campus in São Paulo, Brazil. The goals of the workshop were to:



- Foster scientific partnerships for exchanging knowledge and expertise among U.S. and Latin American educators and researchers
- Promote greater Latin American participation in free-and-open sharing of Earth System data
- Inform Latin American workshop participants of the wide variety of data available through the Abstract Data Distribution Environment (ADDE) and Thematic Real-time Environmental Distributed Data Services (THREDDS) servers (TDS)
- Inform Latin American workshop participants of the suite of freely-available analysis and display applications available through Unidata

The workshop was structured to include a combination of plenary, break-out and hands-on/demonstration sessions that focused on:

- Use of the Unidata LDM to connect to the IDD/IDD-Brasil data sharing networks
- Use of Unidata's TDS and McIDAS' ADDE capabilities for remote serving-of and access-to data
- Availability of real-time GOES imagery (imager and sounder), especially South American coverage from GOES-10
- Availability of high resolution, global GFS model data in the IDD CONDUIT datastream
- Availability of COSMIC global radio occultation (limb sounding) data by the LDM
- Availability of global observational data in the IDD IDS|IDDPLUS datastream
- Strategies for sharing of locally-held datasets of general interest

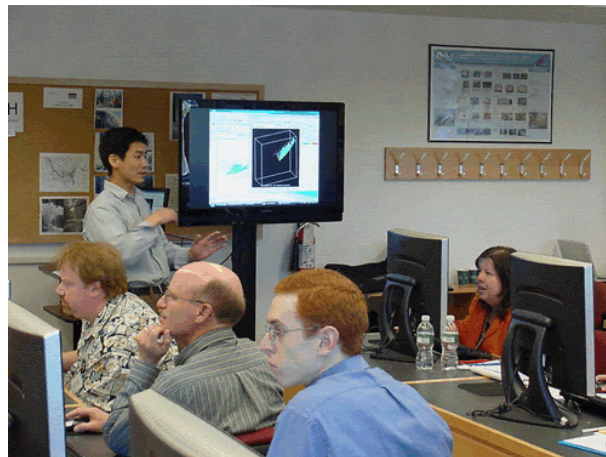
The 45 workshop participants came from 18 organizations in 6 countries in South, Central, and North America. The workshop was as a resounding success and the attendees' enthusiasm was evident as many of them stayed around until well after the scheduling ending time on a Saturday evening.

Unidata Regional Workshop at Plymouth State University. The Judd Gregg Meteorology Institute at Plymouth State University recently hosted a successful Unidata Regional Workshop. From May 18 – 20, 2008 over 25 participants representing 13 different educational institutions from 8 states across the U.S. met at the Boyd Science Center. Unidata software engineers Don Murray, Jeff McWhirter, and Yuan Ho provided hands on instruction with the Integrated Data Viewer (IDV), a visualization tool that provides the ability to perform three dimensional analyses of meteorological and other environmental data sets. Guest speakers from the National Oceanic and Atmospheric Administration (NOAA), Lyndon State College, and the U.S. Geological Survey at Woods Hole Oceanographic Institute provided presentations on using the IDV in teaching and research.

Feedback from the workshop was positive: “This software should take care of my requirements for visualizing radar data,” said Sam Miller, a faculty member at Plymouth State. When asked whether the workshop met expectations, one participant wrote, “Yes, I learned a lot and became a much more comfortable IDV user.”

Computers used during the workshop were obtained with funding from a recent Unidata Equipment Award combined with cost matching funds provided by Plymouth State.

They are being used in a variety of meteorology courses throughout PSU's undergraduate and graduate programs, and they provide the next generation of visualization technology for PSU's students.



The new systems made an impact on Plymouth State well before the workshop. “Our graduate students in Applied Meteorology have utilized the workstations for thesis based research on topics such as air quality monitoring and evaluation of road weather information systems in New Hampshire,” said James Koermer, Director of the Judd Gregg Meteorology Institute and Graduate Program Coordinator. He added, “The research performed with the new equipment also helps us satisfy our mission requirements as a regional public university by serving the people of the granite state.” Undergraduate students have benefited from the new technology as well by using it to perform research on such diverse topics as forecasting winds in the Gulf of Maine to seasonal frequency of fronts in the Great Lakes.

Community Equipment Awards. The Community Equipment Awards program funds new geoscience departments to join the Unidata community and to allow existing members to continue and enhance their participation. It is often regarded by the community as one of the best mechanisms for Unidata to promote diversity, as past awards tend to favor small institutions. Each year, the UPC sets aside \$100K to fund the Unidata Community Equipment Awards program. Since the UPC took over the program from NSF in 2003, this grants program has provided funds for equipment purchases to 40 universities. The program continues to receive strong support from NSF and the community and the UPC almost always is strongly encouraged to continue the grants. This year’s program had a lower profile year but received another group of quality proposals. This year special consideration was given to proposals that further the use of Unidata tools and systems (e.g., THREDDS, NetCDF, IDV, GIS connections) to support education and research on various aspects of climate (e.g., diagnostics, change and impacts), including upgrades to existing classroom and laboratory equipment or procurement of new computers to support climate studies. Additionally, to enhance participation and advancement of underrepresented populations, proposals submitted by investigators in Community and Baccalaureate colleges and minority serving institutions were encouraged. After careful review by a panel that included members of the Unidata Users Committee, the following three projects were funded in 2008:

- Embry-Riddle Aeronautical University, Dr. Christopher G. Herbster – “The Creation of a Community Resource for Weather Case Studies and Innovative Real-Time Weather Data for the IDD”
- Jackson State University, Loren D. White – “Unidata Equipment Proposal to Upgrade the JSU Meteorology High-Performance Computing Lab”
- Rutgers, The State University of New Jersey, Steven G. Decker - “Upgrading the Rutgers Weather Center to Meet Today’s Needs”

Russell L. DeSouza Award. The Russell L. DeSouza award, presented annually, honors a Unidata community member whose energy, expertise, and active involvement enable the Unidata Program to better serve geoscience. Honorees personify Unidata's ideal of a community that shares data, software, and ideas through computing and networking technologies. This year’s award was presented to Dr. Mark J. Laufersweiler, University of Oklahoma, for working tirelessly to promote the use of computing technology both in and out of the classroom. His advocacy on behalf of Unidata tools and data and his entrainment of dozens of students through that advocacy have provided a robust cadre of new Unidata community members. Mark served on the Unidata Users Committee for three years (2001-2004) and has encouraged students to attend Unidata users and training workshops. Mark co-chaired the 2003 Unidata Users

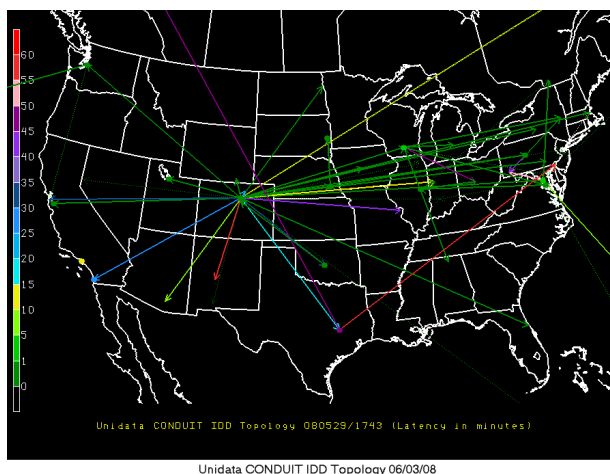
workshop, Expanding Horizons: Using Environmental Data for Education, Research, and Decision Making. He helped organize a regional workshop on the IDV at the University of Oklahoma in September 2007.



2008 Training Workshops. As it does each year, the UPC will conduct software training workshops from 30 October through 13 November at UCAR facilities. The workshop features Unidata's display and analysis packages McIDAS, GEMPAK, and the IDV, data access and management tools, the Local Data Manager (LDM), the Network Common Data Form (netCDF), and the THREDDS software for cataloging, browsing, and accessing remote data and metadata. Unidata's training workshops are developed and presented by the software developers and support staff for each package, so users can be sure to get their questions answered. At this writing, there are a total of 56 registrants for the 2008 workshops. These registrants come from all over the world, while the majority is from the United States with 42; participants are coming from China, the Netherlands, Spain, Finland, Germany, South Korea, and Mexico. These registrants represent a wide array of organizations, with 18 working for a government agency, 12 for a university, 2 for the military, 21 for a research organization, and 3 from the private sector.

The Integrated Data Viewer (IDV) class has been extremely popular this year with a total of 29 people registered, and an oversubscription of 11 people. With the total class size being 18, this prompted the instructors to come to the decision to hold two 4-day sessions of the IDV course in order to accommodate all of the registrants. The THREDDS Data Server (TDS) course is also oversubscribed but with only one extra, the instructor will be able to ensure everyone will be able to attend the class. The overall breakdown of classes are as follows: Integrated Data Viewer (IDV) 29, THREDDS Data Server (TDS) 19, Network Common Data Form (netCDF for Developers) 27, and Local Data Manager (LDM) 14.

Data flows. During the past year, several update releases of the LDM were made to improve its performance and reliability as well as to fix bugs in the software. With the LDM advances and the broadening of the users community, 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 significant increase in data volume transmitted via Internet 2, largely due to the growth in the size of output from operational models and higher resolution data from the NEXRAD network. During the last year the Unidata IDD system delivered approximately 39 terabytes of data to approximately 250 educational, governmental, and commercial sites.



COSMIC Data Available on the LDM. During the year, the UPC made available GPS Radio Occultation data, using LDM technology, to the university community. This important addition to the Unidata-provided streams was made possible through a collaborative arrangement with UOP's COSMIC program, and Taiwan's Formosa Satellite Mission. The data provides up to 2,500 radio occultation observations on vertical profiles of atmospheric air density, temperature, and water vapor as well as ionospheric electron density per day. COSMIC data provides unparalleled spatial and temporal resolution of sounding data. At this writing, over 20 universities are receiving the data. Ben Cotton, Purdue University, is enthusiastic about the addition of COSMIC data to Unidata's Internet Data Distribution system: "...acquiring the data via the LDM means we can use our existing infrastructure instead of having to set up a new system for retrieving and storing the data. A few quick edits to the LDM configuration files is all it takes to get the data flowing, and since we're just adding another data feed, no additional tasks or resources are needed to maintain and monitor the feed. We're able to provide a whole type of data to our students and instructors at the cost of a few minutes of initial configuration."

Community Highlights. Luis M. Farfán is an atmospheric scientist at CICESE (Centro de Investigación Científica y de Educación Superior de Ensenada) in Mexico and an active member of Unidata's community. He is a GEMPAK user, who plans to implement an LDM connection to receive regional-scale information during the summer months.

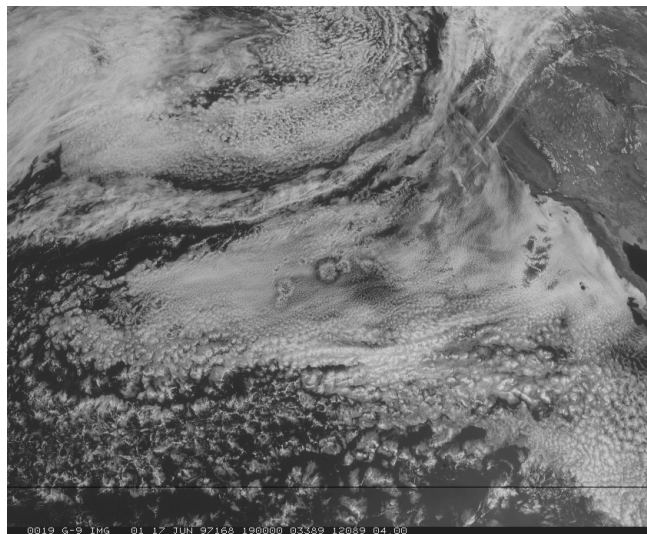
The weather on the southern Baja California Peninsula (where CICESE is located) is mild and dry most of the year. During the summer, humid air masses that move northward in the eastern Pacific Ocean provide favorable conditions for the development of localized, convective systems that result in rainfall episodes. Eventually, there are tropical cyclones that approach the northwest coast of Mexico. These systems tend to occur late in the summer and, upon landfall, they generate heavy precipitation and strong winds that cause significant property damage to the local population.

XII AYUNTAMIENTO DE LA PAZ
Dirección de Comunicación Social

BOLETÍN DE PRENSA 1617 21 de Septiembre del 2007

Support to local, emergency managers

Ante el debilitamiento del huracán "Ivo" a tormenta tropical y por la tarde del sábado a depresión tropical, según el reporte del meteorológico nacional, su llegada a tierra de la península sólo podría dejar lluvias benéficas para la producción agrícola y ganadera; afirmó Luis Farfán Molina -doctor investigador y especialista en meteorología del CICESE- durante la segunda reunión del Consejo de Protección Civil Municipal presidida por el alcalde Victor Castro Cosío.



The Department of Meteorology at the University of Utah has actively participated in the Unidata program in a number of ways since its inception. In 1997, an equipment grant from the National Science Foundation's Unidata Grant Program, provided workstations for our student computer laboratory. However, despite periodic updates, the core infrastructure had become complicated, cumbersome, and obsolete. In addition, installation of new equipment and maintenance of existing equipment had overwhelmed our in-house information technology staff.

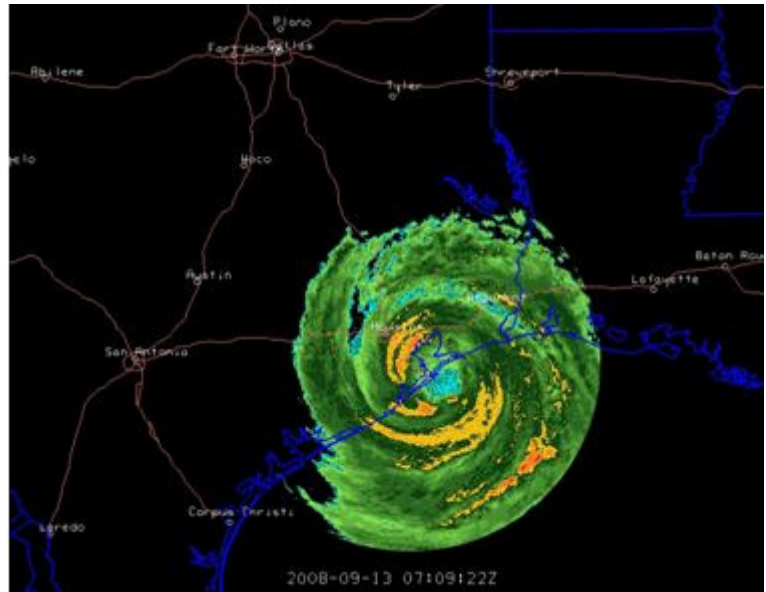
Support from the Unidata 2007 Equipment Grant program, now administered by Unidata and renamed the Equipment Award program, provided the spark for a complete redesign of the department's computational infrastructure during the past year. Integrating automated surface observations from as many sources as possible with analysis and forecast model output, as well as satellite and radar imagery, using data and tools from Unidata, is critical for students to visualize and understand the impacts of weather where it matters, the Earth's surface. Access to surface observations from mesonets is particularly useful for assessing such weather impacts.

Analysis and Visualization Tools. Unidata's reputation is most strongly linked to software tools that are used to access, analyze, visualize, integrate, interpret, and explore geoscience data. Unidata currently develops and maintains three tools for analysis and visualization: GEMPAK, McIDAS, and IDV. These tools are being employed widely (300 institutions for GEMPAK and 200 for IDV) in education and research as well as operational meteorology. The IDV is also being used in hydrology, oceanography, and other geosciences.

As part of its software development philosophy, Unidata emphasizes object-oriented, platform-independent, and open-source approaches to tool development, and use of open standards. Some tools (e.g., IDV) are developed at the Unidata Program Center, while others (McIDAS and GEMPAK) originate elsewhere, but are modified, maintained, and supported by the UPC. Each application has its strengths and limitations and a community of users, but all three packages have become mainstays in university classrooms and labs. Typically, Unidata sites use a combination of GEMPAK, McIDAS, and IDV to meet different needs.

The NWS is embarking on a project to develop the next generation Advanced Weather Interactive Processing System, AWIPS-II, to be completed in 2011. An important component of AWIPS-II is integration of N-AWIPS functionality to AWIPS-II. Because of the development of the migrated N-AWIPS the current N-AWIPS package was frozen in summer 2008.

The impending moratorium on further N-AWIPS development is expected to impact GEMPAK users. In response, the UPC is working with N-AWIPS and AWIPS-II developers on strategies for a smooth transition plan for GEMPAK users. In the near term, the UPC will continue support of GEMPAK's use in universities. In the long term (3-5 year time frame), the UPC will announce a transition away from GEMPAK, while providing support for the final NCEP release until a replacement is available for the university community. GEMPAK users will be encouraged to transition to the IDV by enhanced user training and the addition of GEMPAK-like capabilities in the IDV. Simultaneously, the UPC will work with the NWS and NCEP to investigate the possibility of bringing AWIPS-II to the university community and providing support for it. Given its expected capabilities, the academic community is likely to be interested in using AWIPS II. The UPC will seek guidance from our governing committees and input from our users in making decisions on AWIPS-II support.



Synergistic activities that complement the core effort. To maintain a vibrant program, the UPC, from time to time, participates in certain research and development projects that are tied to its overall mission but funded separately from the core program. Such synergistic activities are both essential and complementary to the core effort, and both the Policy Committee and NSF encourage them. The UPC undertakes non-core projects only after careful analysis of their merit and benefits to the community and upon endorsement by the Policy Committee.

Such projects have played a vital role in advancing the program in new directions, creating new capabilities for the community, enhancing interoperability of Unidata software, providing new datasets to the community, and entraining and diffusing innovative ideas and technologies into the community. Almost always, synergistic projects leverage ongoing activities in the core program, are conducted in collaboration with other partners, and allow the UPC to offer its technologies and expertise for the greater benefit of the community (e.g., CADIS, an IPY project). In addition to their intrinsic merit, the projects have also helped to relieve pressure on the ATM-funded portion of the overall Unidata budget. Over the past five years, such projects have been kept to a modest level of about 15% of the overall effort. Below we highlight a few examples of synergistic activities that have greatly benefited the Unidata community.

The THREDDS project began as a separately sponsored non-core effort, with funding from the NSF EHR's NSDL program. The project develops middleware and infrastructure to bridge the gap between data providers and data users. Today, THREDDS is an integral part of the UPC portfolio and an important community resource. Similarly, the effort to merge netCDF and

HDF5, a capability long desired in the atmospheric science community, was possible only with funding from NASA. That effort also provided the motivation for developing the CDM, a key underpinning for a new version of the netCDF software and the TDS.

Linked Environments for Atmospheric Discovery (LEAD) is a collaborative, NSF-funded Information Technology Research (ITR) grant. LEAD involves nine institutions that bring different expertise (e.g., meteorology, computer science, grid computing, pedagogy, and data services) to develop a new paradigm for on-demand weather prediction. To that end, LEAD is creating an integrated, scalable framework in which meteorological analysis tools, forecast models, and data repositories can operate as dynamically adaptive, on-demand, grid-enabled systems. In addition to providing many of the technical underpinnings like LDM, THREDDS, and IDV, Unidata is playing a pivotal role in LEAD's deployment in the meteorological community. The Unidata LEAD testbed has become a valuable community resource, providing a 180-day archive of many IDD-delivered data sets. The LEAD use cases have provided opportunities for enhancement of tools like the IDV and TDS. And most importantly, Unidata universities have begun to use the LEAD system for making on-demand weather predictions for a number of different applications.

In summary, the UPC recognizes the mutual benefits of synergistic activities that harness the strengths of innovative projects that are funded outside the core program through targeted opportunities. Unidata will continue to pursue such opportunities as they arise during the period of performance of this proposal, but as always, any new activity will be reviewed and carefully balanced against the core effort.

Joint Office for Science Support (JOSS)

Program Director: Gene Martin <http://www.joss.ucar.edu>

In 2008, JOSS supported over 400 events and arranged travel for more than 1,400 scientists, about half of which are affiliated with UCAR member universities. While the number of events and travelers supported rose this year an average of 16%, the number of JOSS staff

supported on-site events increased by 43%. Many of these events were generated by new programs and new funding sources, so we're encouraged that our reputation for excellent support is spreading by word of mouth in the scientific community.

| | |
|---|--|
|  | <p>You handle the science. JOSS handles the support</p> <p>The Joint Office for Science Support (JOSS) of the University Corporation for Atmospheric Research (UCAR) is a team of professional and skilled technical and administrative specialists whose mission is to serve and support the scientific community. JOSS collaborates closely with scientists and research managers to plan, organize and conduct scientific programs in the most productive, efficient and cost-effective ways. JOSS supports logistics for planning efforts, research programs and field experiments worldwide.</p> |
|---|--|

We are focusing this year on new education and outreach activities which include support to the Earth Science Women's Network which is a peer-mentoring network of women in the Earth Sciences, most of whom are in the early stages of their careers. They have over 600 members

spanning at least 19 different countries and represent most major universities, government agencies, and research organizations in the U.S. and abroad.

JOSS has also contributed extensive Program Development Funds and physical support to assist three programs within UCAR's Office of Programs:

1. The National Science Digital Library (**NSDL**) Science Literacy Maps Service workshops intends to gather a focus group of educators to assess their collection of resources as well as develop methods to support awareness and use of the collection in classrooms. In addition, a second group will meet to identify and catalog existing climate education materials for K-12 science education.
2. **COSMIC**'s Ocean Platform Workshop will identify a number of key science questions, evaluate current observational capabilities, discuss logistical considerations, and measure the level of interest in pursuing a possible deployment of GNSS equipment on ocean platforms.
3. **UNIDATA**, in conjunction with the Universidade de São Paulo's (USP's) Instituto de Astronomia, Geofísica e Ciências Atmosféricas (IAG) hosted a Latin American Data Workshop in August at the IAG facilities on the USP campus in São Paulo, Brazil. The goal was promoting scientific interactions among the US education and research community and its counterparts in Latin America.

Global Learning and Observations to Benefit the Environment (GLOBE)

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

The GLOBE Program is a unique, hands-on, school and community-based education and science program. GLOBE brings together students, teachers, and scientists in field and classroom based settings to learn about and conduct research on Earth's environment. Since its inception in 1994, GLOBE has grown to encompass 109 countries, over 40,000 teachers, and has reached more than a million students.

GLOBE is an interagency program funded by the National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF), supported by the U.S. Department of State, and implemented through a cooperative agreement between NASA and the University Corporation for Atmospheric Research (UCAR) in Boulder, Colorado.

GLOBE Vision. A worldwide community of students, teachers, scientists, and citizens working together to better understand, sustain, and improve Earth's environment at local, regional, and global scales.

GLOBE Mission. To promote the teaching and learning of science, enhance environmental literacy and stewardship, and promote scientific discovery.



GLOBE Goals. GLOBE brings together students, teachers, scientists, and citizens to achieve the following:

- *Increase* student achievement across the curriculum with a focus on student research in environmental and Earth system science;
- *Enhance* awareness and support activities of individuals and groups throughout the world to benefit the environment;
- *Contribute* to scientific understanding of Earth as a system; and
- *Inspire* the next generation of global scientists.

The GLOBE Program Office (GPO) has identified four major work areas that will help achieve the GLOBE vision: (a) support **student research** through collaborations with large scale Earth System Science Projects (ESSPs) and local and regional community projects, (b) catalyze the development of six **Regional Consortia** in Africa, Asia-Pacific, Europe, Latin America-Caribbean, Near East, and North America, (c) enhance long-term GLOBE and GPO **sustainability** through the formation of an international GLOBE foundation and diversification of the GPO funding base, and (d) continue to provide quality and timely **core services** to the GLOBE community.

Table 1 summarizes the status of current GPO goals, related to student research, regionalization, sustainability, and core services. “Green” indicates a goal has been achieved or is on target for being achieved. “Yellow” indicates the goal is behind schedule or has encountered difficulties.

Table 1: GLOBE Program Office Goals and Status Check

| Goal | Status of Progress Toward Goal |
|---|---------------------------------------|
| 1. Enable successful student research on the environment | Green |
| 2. Enhance education and outreach activities of sponsor-supported Earth system science projects | Green |
| 3. Facilitate program implementation by Partners, teachers, students, scientists, and collaborating organizations | Green |
| 4. Promote the development of a self-sustaining GLOBE regions and programs | Green/Yellow |
| 5. Provide effective management of GLOBE’s technical and administrative infrastructure | Green |

As the table and this report will show, the GPO has made significant progress in each of these goal areas. Work is on track with respect to student research, support for Earth system science projects, the development of viable regional consortia, and the enhancement of core services. The Green/Yellow designation related to the sustainability goal reflects both progress and the inherent challenges involved in trying to create and implement an effective long-term sustainability plan for both GLOBE and the GPO. The GPO is now poised to move forward with its Earth System Science Project partners, the GLOBE community, and its program sponsors to

make environmentally-focused “student research” a hallmark of the GLOBE Program around the world.

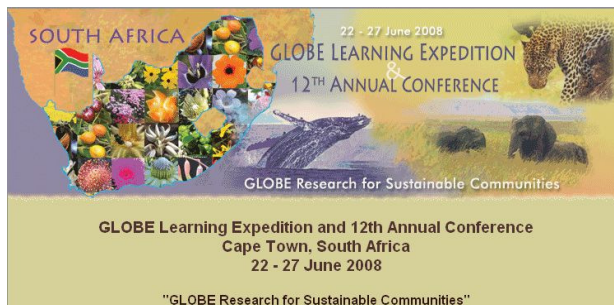
Significant Accomplishments: 2007-2008

1. 2008 GLOBE Learning Expedition.

The 2008 GLOBE Learning Expedition took place from 22-28 June in Cape Town, South Africa. Co-hosted by the GLOBE Program Office, the GLOBE Africa Consortium and GLOBE South Africa, this landmark event brought together 507 GLOBE students,

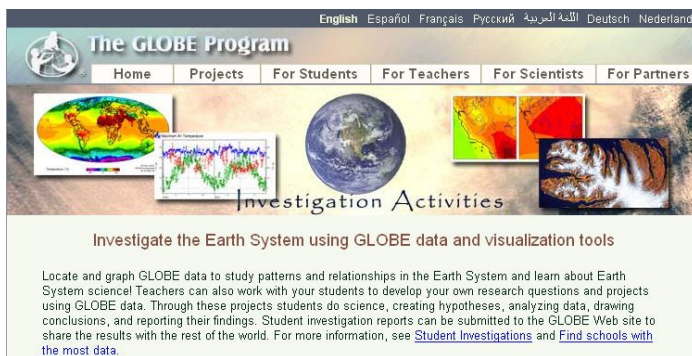
teachers, scientists, partners and guests from 51 countries. You can learn more about this GLE (overview of events, photos, student blogs, etc) at

http://www.globe.gov/fsl/html/templ.cgi?gle08_index&lang=en&nav=1



2. External Review and Cooperative Agreement Renewal.

The external review took place in December 2008 and GLOBE-UCAR was asked to submit another five-year cooperative agreement proposal to NASA for 2009-2013 funding.



3. **Strategic Plan.** The new GLOBE program office strategic plan focuses on two strategic intents: (a) sustainability of the GPO and the worldwide GLOBE program by 2013, and (b) becoming a world leader in the development of new products and services that support student research. GLOBE partnered with the University of Colorado business school to develop an “actionable” strategic plan that includes clear and measurable goals.

4. **Earth System Science Projects.** The second year of work with the ESSPs has gone well. There has been a great deal of progress in developing, refining, and conducting learning materials and professional development activities. The GLOBE Pole to Pole videoconference in April 2008, brought together scientists from UCAR, NSF, and the International Arctic Research Center with teachers and students in Alaska and Argentina to participate in International Polar Year research.



5. **Climate Change.** Planning for the upcoming Student Research on Climate Change (2011-2013) is underway. Our goals are to: (a) involve over 1,000,000 students in Climate Change Research; (b) enhance environmental and climate literacy for millions of people around the world; (c) empower students, teachers, and community members to take action on climate-related environmental issues; and (d) create a compelling model for 21st century environmental science education based on grade-level appropriate research and learning experiences. To achieve these goals, GLOBE is engaging its worldwide network of GLOBE Partners, teachers, scientists, alumni, schools and countries; leveraging its rich set of scientific protocols, educational materials, and data; and enlisting the support of some of the world's leading climate change scientists, internationally recognized education and outreach experts, businesses, foundations, and policy makers. See: <http://www.globe.gov/r/html/climatechange>

6. **Regionalization** has been a major success during the past two years, with five regions (Africa, Asia-Pacific, Europe, Latin America-Caribbean, Near East) establishing Regional consortia, creating associated governance documents, and assigning specific responsibilities to member countries.



7. **GLOBE at Night** has been a popular citizen science event. It was conducted in both March 2006 and 2007 with over 60 countries participating. 4,500 observations were submitted in year one and 8,500 observations in year two.

8. **GLOBE alumni** created their own organization in 2005, developed an organizational charter in 2006, and now have representatives in all six GLOBE regions. Alumni participated in the March 2007 Seasons and Biomes workshop and are now “ambassadors” to their regions supporting Country coordinators and teachers in learning about Seasons and Biomes and IPY activities.

9. **Web site redesign:** Version one is complete and the Beta version was launched on June 27, 2007. The new Web site provides greater search capabilities, easier navigation, and has a new look and feel. Versions 2 and 3 of the Web site will include new content management features, the GLOBE student research portal, and a more flexible information architecture.

10. **Collaborations** with DLESE, NSTA and ESSEA now provide GLOBE teachers with quicker access to high-quality digital resources and professional development opportunities. Collaboration with the World Meteorological Organization (WMO) provides GLOBE schools around the world with scientific and technical support for program implementation. In addition, NCAR scientists contributed to the review and selection of five student projects from across the United States to be presented at the June 2008 GLOBE Learning Expedition in South Africa.

11. **GLOBE Annual Conference in San Antonio.** The GLOBE Annual Conference brought together teachers, scientists, academics, program managers, and government officials from around the world to address key issues related to the continued recognition and growth of GLOBE as the world's preeminent, hands-on primary and



secondary school science and education program. This year's annual meeting focused on the progress of the ESSPs and the timetable for their rollout and integration into the worldwide GLOBE community. GLOBE representatives came from across the world — 44 countries and 35 U.S. states and Washington D.C. — to participate in the 11th GLOBE Annual Conference in San Antonio, Texas, making this the largest and most internationally diverse GLOBE annual meeting ever.

12. **Sustainability** materials to support partners have been drafted and an online course in grant-writing for partners and teachers is planned for completion in summer 2008. UCAR has also made it possible for non-government sponsors to contribute to GLOBE.

END OF UOP REPORT