



Unidata 2013:
A Transformative Community Facility
for the Atmospheric and Related Sciences

Annual Report for Award No. 0833450
for period 12/1/2010-11/30/2011

November 2011

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1 Introduction

After 27 years of growth and change, the Unidata program remains committed to its core mission of providing data services, tools, and cyberinfrastructure leadership for the Earth system science community. Guided by the concepts laid out in its most recent five year core funding proposal, Unidata has been proactive in finding and distributing new types of data, efficient in managing the distribution of ever-greater volumes of data, and productive in enhancing and supporting its software tools, all while bringing new institutions into a broadening user community.

This report highlights Unidata's activities and accomplishments during the last year.

Unidata's Mission:

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

Unidata's Strategic Vision:

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.



Unidata's model of community participation brings perspectives from across the Earth system science research and education communities

To fulfill our mission and serve our broad community, the Unidata Program Center (UPC):

- Acquires and distributes real-time meteorological data for education, research, and outreach
- Develops software for accessing, managing, analyzing, visualizing, and effectively using geosciences data
- Provides comprehensive training and support to users of its products and services
- Facilitates advancement of standards, conventions, and interoperability
- Provides leadership in cyberinfrastructure and fosters adoption of new technologies
- Assesses and responds to community needs, fostering community interaction and engagement to promote sharing of data, tools, and ideas
- Advocates on behalf of the university community on data issues and negotiates data agreements
- Grants equipment awards to universities to enable and enhance participation in Unidata

2 Data Services

2.1 Real-Time Data Distribution

The bread and butter of Unidata's mission is helping researchers and educators acquire and use real-time meteorological data. Unidata is not a data archive center, but rather a facilitator; by participating in Unidata's Internet Data Distribution (IDD) system, educators and researchers can subscribe to one or more of the 30 streams of current data that interest them. The IDD system comprises over 500 machines at 250+ sites running Unidata's Local Data Manager (LDM) software to receive (and in many cases retransmit) real-time weather data.

On average, the IDD system ingests about 250,000 products (7 Gigabytes) each hour, with peak volumes approaching 15 Gigabytes per hour. Computers operated by the Unidata Program Center push in excess of 6 Terabytes of data to more than 650 downstream systems on an average day, making Unidata one of the largest users of both the UCAR/NCAR and Internet 2 networks.

(Note that there are several organizations and projects using the LDM to move substantial amounts of data without reporting statistics to Unidata.)

In addition to real-time data distribution, Unidata provides mechanisms for accessing some archived data sets and case studies. Some Unidata member sites also archive our data streams in raw, encoded form.

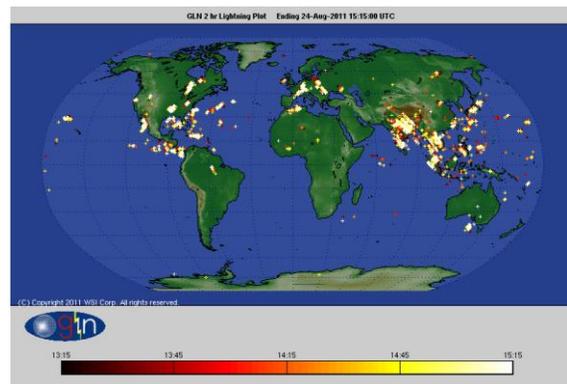
2.2 New Data Stream: Global Lightning Data

The academic community has been requesting for some time that global lightning data be made available via Unidata data distribution systems for research and education use. To respond to that community need, WSI Corporation and Unidata began making global lightning data available to members of the Unidata community at the beginning of 2011.

WSI Corp.'s Global Lightning Network (GLN) provides high quality real-time and archive lightning stroke data to clients throughout the world. Lightning sensors are located at more than 150 international hosting partner sites in addition to the detectors that make up the North American Precision Lightning Network.

Kim Rauenzahn, Lightning Product Manager for WSI Corp., says that "WSI appreciates the opportunity to expand our provision of lightning data to the Unidata community.

Serving the educational and research institutions is very important to WSI with, we feel, mutual benefits for all involved. We look forward to working with organizations interested in global lightning research."



3 Software Tools and Support

3.1 Enhancements to Existing Products

UPC developers are continually enhancing Unidata software packages. The following updates were released in the past year:

- GEMPAK: Version 6.4.0
- IDV: Versions 2.9u1, 2.9u2, 2.9u3, and 3.0
- LDM: Versions 6.8.1 through 6.10.1
- NetCDF: Versions 4.1.2beta and 4.1.3
- NetCDF-Java: Versions 4.2.5 through 4.2.27
- RAMADDA: Became an Open Source project in December 2010
- THREDDS Data Server: Versions 4.2.0 through 4.2.9
- UDUNITS: Version 2.1.22

Ongoing enhancements to Unidata software packages provide new functionalities and capabilities for accessing, analyzing and visualizing new types of data that the UPC routinely makes available for use by the education and research community.

3.2 Migration from GEMPAK to AWIPS II

As noted in previous reports, the National Weather Service's National Center for Environmental Prediction (NCEP) is developing the next generation Advanced Weather Interactive Processing System, AWIPS II. When completed in FY 2013, AWIPS II will integrate the functionality of existing N-AWIPS software (also known as GEMPAK). As a result, the NWS has announced its termination of development and support for GEMPAK.

Because many Unidata member universities rely heavily on GEMPAK, the UPC is working with the N-AWIPS and AWIPS II developers at NCEP and NWS on strategies to smooth the transition from GEMPAK to other software packages. In the near term (the next 2-3 years), the UPC will continue to support university users of GEMPAK. In the longer term, the UPC will announce a transition away from GEMPAK, while providing support for the final NCEP GEMPAK release until a suitable 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. Simultaneously, the UPC will work with NCEP to make the AWIPS-II package available to the university community and provide support for it. Given its expected capabilities, AWIPS II will likely be of interest to the academic community for education and research.

The UPC received its first unrestricted copy of the AWIPS II source code in late July 2011. Program Center staff are evaluating the code and determining what steps will be necessary to create a package suitable for use by community members. Additional information, including previous announcements and FAQ on GEMPAK migration, is available at: <http://www.unidata.ucar.edu/software/gempak/nawipismigration/>

3.3 Software Training Workshops

Each year, the Unidata Program Center organizes training workshops, conducted by UPC software developers, on its software and data systems. The workshop topics include Unidata's display and analysis packages GEMPAK and the IDV, as well as data access and management tools, the Local Data Manager (LDM), the Network Common Data Form (netCDF), RAMADDA, and THREDDS software for cataloging, browsing, and accessing remote data and metadata.



Training workshops introduce participants to the wide range of Unidata software.

This year's training workshops, which were a tremendous success, were attended by 69 participants from 6 countries: United States, Canada, Mexico, Costa Rica, Spain, and Germany. The attendees represented a wide range of organizations, including universities, government agencies, research organizations, and the private sector.

4 Cyberinfrastructure Standards

4.1 Adoption of CF-NetCDF as an OGC Standard

In April 2011, the Open Geospatial Consortium (OGC) membership approved the Network Common Data Form (netCDF) Core Encoding Standard, and netCDF Binary Encoding Extension Standard - netCDF Classic and 64-bit Offset Format as official OGC standards.



Unidata and other OGC members introduced netCDF into the OGC as a candidate OGC standard to encourage broader international use and greater interoperability among clients and servers interchanging data in binary form. Among other benefits, this will make the large collections of environmental netCDF data more readily accessible and usable by non-experts. In addition to their ongoing development of netCDF itself, Unidata Program Center staff worked with the OGC to provide the formal specifications necessary for netCDF's adoption as an OGC standard.

4.2 OGC Technical Committee Meeting



OGC Technical Committee and GEOSS meetings in September 2011

The week of September 19, Unidata hosted the meetings of the OGC Technical Committee and Global Earth Observation System of Systems (GEOSS) meetings. The participation (~360) at these meetings exceeded the previous record by nearly 50%. Unidata's efforts continued with presentations on the enhanced data model and CF conventions extensions to the core netCDF data model standard. In addition our experimentation with the use of web brokering services (namely, GI-cat from the U of Florence ESSI Labs) infrastructure to establish data search capabilities for THREDDS server was highlighted in the Met/Ocean/Hydro water cycle summit.

5 Building Community

5.1 2011 Community Equipment Awards

The Unidata 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 60 universities. Since this program has a large, positive impact on the university departments, it continues to receive very strong support from the NSF and the community.



A Unidata equipment award helped establish this lab at University at Albany, State University of New York

For 2011 awards, special consideration was given to proposals that:

- Include installation of either the THREDDS Data Server or a RAMADDA server (or both) to share data relevant to furthering Unidata's mission with the community at-large

- Include installation of a prototype AWIPS II EDEX server, when AWIPS II is made available in the Fall 2011 time frame, to share data relevant to furthering Unidata's mission with the community at-large.

We received a total of nine responses to the 2011 RFP and funded eight of them, partially or fully. The high success rate for award proposals should encourage others who may have hesitated to apply in the past.

University	Project
New Mexico State University PI: David DuBois	Portal for Community Access to Meteorological, Satellite, and Model Archives
Pennsylvania State University PI: Charles Pavloski	IDD Ingest Relay Replacement in Support of the THREDDS/RAMADDA Server System
Rutgers University PI: John Kerfoot	Upgrade of Existing Computer Hardware to Facilitate Processing and Distribution of Large Oceanographic Environmental Datasets from the Rutgers University Coastal Ocean Observation Laboratory
San Jose State University PI: Alison Bridger and Marty Leach	Server Upgrade and Electronic Map Wall at San Jose State University
Texas A&M University PI: Gerald J. Creager	Upgrading LDM Server and Archive Systems to support Atmospheric Sciences at Texas A&M University and in the Broader Community
University of Colorado/CIRES PI: Catherine A. Smith	Improving Access to a Climate Data Repository using Unidata Tools
University of South Florida PI: Jennifer M. Collins	Upgrading Meteorological Analysis and Visualization Capability
University of Salento & CMCC, Italy PI: G. Aloisio, S. Siore, O. Marra	Establishment of a Multiplexed THREDDS Installation and a RAMADDA Collaboration Environment for Community Access to Climate Change Data

To see the wide range of previous recipient institutions and for more information on this year's awardees see: <http://www.unidata.ucar.edu/community/equipaward/>

5.2 2011 American Meteorological Society Meeting



Unidata's Michael James discusses the AWIPS II system with a community member at the AMS 2011 meeting

Several Unidata Program Center staff members attended the 91st annual meeting of the American Meteorological Society in Seattle, WA in January 2011. The conference theme — *Communicating Weather and Climate* — brought many opportunities for discussion of how Unidata technologies can facilitate the analysis and communication of observational and model weather and climate data.

The Tenth Annual AMS Student Conference and Career Fair, “Communicating Weather and Climate - The Role of a Young Scientist,” occurred over two days before the main conference sessions began. Unidata Users Committee Student Representative Stefan Cecelski was on hand to discuss Unidata with interested students at Unidata’s table at

the Career Fair, as were several Unidata Program Center staff members. Student interest was strong, with career fair attendees lining up to discuss Unidata’s offerings and opportunities.

Unidata’s booth in the main AMS Exhibition hall was also well attended. Program Center staff members were on hand to provide demonstrations of the Integrated Data Viewer and the current prototype of the AWIPS II National Centers perspective, and to meet with members of the Unidata community.



Unidata Users' Committee student representative Stefan Cecelski talks with a student at Unidata's table at the AMS Student Conference career fair

5.3 Results of the Community Survey

The community’s input is always a vital part of understanding community needs as well as defining and shaping the future of Unidata, and providing supporting metrics for the National Science Foundation, Unidata’s primary sponsor.

As noted in last year’s annual report, in late 2010, the Unidata Users Committee conducted a survey, posing 31 questions to the Unidata community to gather information about the users, understand their needs and assessment of the products and services from Unidata and the overall state of the program. The answers painted a picture of the evolving community and how it uses the data and tools Unidata provides, and how Unidata can better serve the academic community.

The committee was pleased that 240 members of the Unidata community from 36 countries replied to the survey. Some of the other statistical highlights include:

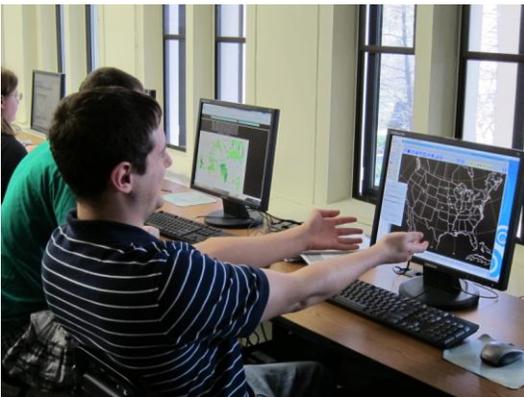
- Nearly half of the respondents identified themselves as researchers, indicating that adoption of Unidata products within the research community has increased.
- A large majority (nearly 75%) identified themselves as specializing in Meteorology or Atmospheric Science. Respondents who listed the fields of Oceanography, Earth System Science, Environmental Science, Climate Science, and Computer Science as specialties also made up significant sub-groups.
- Nearly half of the respondents report using Unidata tools and data more than five hours per week.
- About 97% of the users were either satisfied or highly satisfied with the Unidata program.

Program center staff have worked to address issues raised in the survey, including:

- Making it easier to use NetCDF libraries under the Windows operating system
- Enhancing ease-of-use of the Local Data Manager (LDM)
- Providing additional display features and control over use of system memory for the Integrated Data Viewer (IDV)
- Keeping GEMPAK users better informed about AWIPS II development

5.4 Featured Community Site: The University at Albany

The following article (a longer version was originally published in the News@Unidata blog) highlights one university's use of Unidata technology and equipment funding.



Undergraduate Matt Corbi prepares a convective outlook using NMAP2

*By Kevin R. Tyle
Department of Atmospheric and
Environmental Sciences,
University at Albany,
State University of New York*

In the spring of 2010, the Department of Atmospheric and Environmental Sciences (DAES) at the University at Albany, State University of New York received funds from Unidata's annual Community Equipment Awards program to renovate the department's electronic map room. As a result, during the summer of 2010 our department purchased eight Dell Optiplex 780 desktop computers with dual-quad core CPUs (thus eight CPUs are

available per unit) and eight GB of RAM. Seven of the systems sit in the DAES electronic maproom, while the eighth resides in the Principal Investigator's office, for use as a development machine as well as an emergency hot spare.

The new machines have been a boon to the maproom's users, as the computers they replaced (2006-vintage PCs) each had only a single CPU. In addition to the performance improvement attributable to the additional processing power, the fact that we are now able to use 64-bit CentOS 5 and Windows 7 operating systems allow users to allocate more than the previous limit of 1.5GB of RAM to Java-based programs, such as Unidata's Integrated Data Viewer.

Maproom Software

Although the maproom is used by faculty, staff, and students, junior and senior level undergraduates are the heaviest users of the new machines. The students put a variety of tools to excellent use in local and national forecast contests, synoptic lab presentations and discussions, and class projects. Historically, Unidata's GEMPAK/N-AWIPS software has been the most widely used meteorological display and analysis package in our department. Students are also exposed to Unidata's Integrated Data Viewer (IDV) during the spring semester when they take the P.I.'s computer applications class.



Instructional Support Specialist Ross Lazear leads a Friday research map discussion

The maproom also hosts two quasi-weekly research discussions, one led by Dr. Paul Roundy centering on tropical-extratropical interactions, and another hosted by Dr. Lance Bosart where recent interesting weather events are explored from a variety of temporal and spatial scales. Discussion participants use the maproom's Crestron audio-visual system to display graphics from a variety of sources on the new workstations, from external websites to locally-installed packages such as MATLAB and NCAR Graphics in addition to Unidata software.

RAMADDA in the Maproom

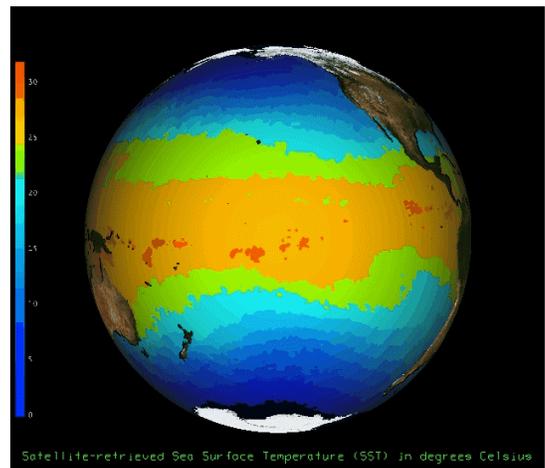
Another key goal of the DAES equipment proposal was to enable sharing of data locally and externally via Unidata's RAMADDA server. The department's RAMADDA server was established prior to the funding of this proposal, and users can upload content easily with the IDV's Publisher plugin as well as view content stored on RAMADDA. Currently, output from the DAES' regional Weather Research and Forecasting (WRF) Model run is updated four times a day and served via RAMADDA. Users are also encouraged to use RAMADDA to house their IDV bundles of interest.

5.5 Using the IDV to Study Marine Coral Stress

Researchers from Macquarie University in Sydney, Australia; the Wildlife Conservation Society in New York; the department of Geo-Information Science and Earth Observation (ITC) at the University of Twente, Enschede, The Netherlands; and the University of Warwick in Coventry, United Kingdom are using the IDV to help analyze environmental stresses on marine corals. The stress factors include high temperatures, ultra-violet radiation, weather systems, sedimentation, as well as stress-reducing factors such as temperature variability and tidal dynamics. Their paper Global Gradients of Coral Exposure to Environmental Stresses and Implications for Local Management, was published in the online journal PLoS One and has been featured in other scientific magazines including Nature.

The authors hope their study will help identify reef systems where biodiversity is high and stress is low, aiding in conservation efforts where they have the best chance to succeed.

Long-time Unidata community member Valentijn Venus of the ITC, which provided supercomputing facilities for the study, pointed out in an ITC news report about the study that decision-makers must often integrate oceanographic data (analysis and model output available in formats like netCDF) with ecological data (i.e. the GPS-based observations of coral health). The researchers chose to use the IDV because it allowed them to easily integrate multidimensional data into a seamless global picture showing coral exposure to environmental stresses.



6 Organizational Advances

6.1 Development of Unidata's 2011 Strategic Plan

In mid-2011, UPC Staff began work on creating a new Unidata strategic plan to guide activities for the development and implementation of our next five-year NSF grant proposal. While the plan is still in its formative stage, UPC staff and our governing committees have worked to elucidate a vision for how Unidata can better serve its core constituency of atmospheric science researchers and educators while reaching out to other geoscience communities. We encourage input from the UCAR community on the strategic directions and goals for the program going forward and how best Unidata can meet the evolving needs of educators and researchers in the atmospheric and related sciences. We anticipate that the development of the new strategic plan will be completed in early 2012 and the plan will be disseminated to the community for feedback.

6.2 Updated Unidata Web Site

Earlier this year, the UPC redesigned its web site to make it easier for users to find the information they are looking for and use. The visually more appealing, revamped site features new navigation features and reorganized menus.

Unidata is also replacing the monthly Unidata Community E-Letter with the **News@Unidata** weblog. Switching from the newsletter-on-a-webpage format to a blog will give the UPC the opportunity to communicate with its community more frequently — and make it easier for users to add your insights to the conversation via blog comments or social media.

As often happens with home-improvement projects, working on the big changes to the web site remains a work in progress and it has reminded us of other, smaller projects we want to tackle. But it is worth adding that the response to the redesigned web site from the community has been highly positive.

6.3 New Committee Members

The Unidata Program Center is pleased to welcome six new members to our governing committees. Committee members normally serve three-year terms; these terms are finishing up for four members of the Users committee and two members of the Policy committee. New members and those finishing their terms will overlap for one meeting, which will take place in mid-October, 2011.

The UPC staff looks forward to working with our new committee members, and to having all the current members of both committees at the Program Center in Boulder, Colorado for the October meeting.

The following provides a brief introduction to the scientists joining Unidata's committees. You can additional information about the governing committees, including contact information for committee members, on the [Governing Committees](#) page.

Bart Geerts, Users Committee

Dr. Bart Geerts is an associate professor of atmospheric sciences at the University of Wyoming. He teaches a wide range of courses including Introduction to Meteorology, Weather Analysis and Forecasting, Synoptic Meteorology, and Mesoscale Dynamics. His current research includes study of the dynamics and microphysics of orographic precipitation, the dynamics of radar fine-lines in the pre-convective continental boundary layer, dynamical processes in orographic cumuli, and boundary-layer circulations over relatively warm water.

Dave Dempsey, Policy Committee

Dr. David Dempsey is a professor of meteorology at San Francisco State University. He served on Unidata's Users Committee from 1996-2000, co-chairing the Planning Committee for the 1997 Unidata Triennial workshop. He was also involved in planning the 2000 Triennial workshop, the MetApps Task Force, and the IDV Steering Committee. His current research includes mesoscale numerical modeling of topographically-forced circulations and numerical model building.

Gerald Creager, Users Committee

Gerald Creager of Texas A&M University has been an active member of the Unidata community for more than ten years, and is a user of numerous Unidata software packages. He operates a widely available set of LDM servers providing IDD data to research and educational institutions, and has been instrumental in implementing a private IDD network for the NOAA-funded Southeastern Coastal Ocean Observing and Prediction (SCOOP) program. Mr. Creager was co-chair of the Open Geospatial Consortium's University Domain Working Group until the fall of 2011.

Jennifer Collins, Users Committee

Dr. Jennifer Collins is an Associate Professor of Geography in the Department of Geography, Environment, and Planning at the University of South Florida. Her research focuses on weather and climate. As a hurricane researcher, Dr. Collins is interested in the interaction between large scale climatic patterns such as the El Niño-Southern Oscillation (ENSO) and the Madden-Julian Oscillation and seasonal patterns of tropical cyclone activity in multiple oceanic basins.

Martin Baxter, Users Committee

Dr. Martin Baxter is an Assistant Professor of Meteorology in the Department of Geology and Meteorology at Central Michigan University. His research has examined the climatology of snow to liquid ratio and methods for forecasting this quantity, as well as the effects of upstream convection on mesoscale banded snowfall. He teaches Synoptic Meteorology and was awarded CMU's Excellence in Teaching Award for 2010.

William Gallus, Policy Committee

Dr. Bill Gallus is a Professor of Synoptic and Mesoscale Meteorology, Numerical Weather Prediction in the Department of Geological and Atmospheric Sciences at Iowa State University. He served as a member of Unidata's Users Committee from 2007-2010, and uses Unidata software and data in weekly lab exercises given to his students. His current research interests are primarily directed toward improved prediction of small-scale atmospheric phenomena, especially severe thunderstorms and their rainfall.

6.4 Space Shuttle Program Thanks Unidata

The Unidata Program Center has received a commendation from the National Weather Service's Spaceflight Meteorology Group, thanking the program for providing the Local Data Manger software and technical support for both the LDM and McIDAS packages. Over the course of the Space Shuttle program, the LDM was used to transport observational and experimental data from a variety of sources, including the NWS and the University of Wisconsin Space Science and Engineering Center.

The UPC received a certificate and a formal letter of recognition from Frank C. Brody, chief of the Spaceflight Meteorology Group. Describing Unidata's contributions, Brody thanks Unidata developers Tom Yoksas and Steve Emmerson by name:

We would like to specifically thank Tom Yoksas and Steve Emmerson for their assistance with McIDAS and our AWIPS LDM implementation. Please accept this specially designed certificate, marking the end of the Space Shuttle program, as a token of our appreciation for your efforts. The certificate contains a patch flown in space aboard the STS-134 mission of Space Shuttle Endeavour, launched on May 16 and landed on June 1, 2011.

The Unidata Program Center staff is honored to be recognized by the Space Shuttle Program for the quality and broader impact of its work.

6.5 Access Data Publication

One of the publications resulting from the Access Data project (formerly DLESE Data Services project) was the winner of a AAAS *Science* Prize for Online Resources in Education (SPORE). The essay "Making Earth Science Data Accessible and Usable in Education" is available in the online version of *Science* at:

<http://www.sciencemag.org/content/333/6051/1838.full.pdf>

6.6 EarthCube Participation

Staff from the Unidata Program Center have been actively participating in EarthCube as the project. EarthCube organizers put out a request for community input, seeking white papers on topics related to EarthCube. The UPC staff responded in the form of the following white papers dealing with the three main areas Technology and Cyberinfrastructure Solutions, EarthCube Designs, and Governance Models.

- [Unidata Governance: A Quarter Century of Experience](#)
- [Technology Solutions for Scientific Data Interoperability: Unidata's Perspective](#)
- [An EarthCube Design Process: Unidata's Perspective](#)
- [Data Interactive Publications](#)

In addition, three UPC staff members attended and contributed ideas at the recently held EarthCube Charrette near Washington Dulles.