

of modeling to teach petrology is dictated by the level of expectation we have for students and their facility with modeling approaches. For example, do we expect students to push buttons and navigate a program, understand the conceptual model and/or evaluate the results of a model. Whatever the desired level of sophistication, specific elements of design should be incorporated into a modeling exercise for effective teaching. These include, but are not limited to; use of the scientific method, use of prior knowledge, a clear statement of purpose and goals, attainable goals, a connection to the natural/actual system, a demonstration that complex heterogeneous natural systems are amenable to analyses by these techniques and, ideally, connections to other disciplines and the larger earth system. Databases offer another avenue with which to explore petrology. Large datasets are available that allow integration of multiple lines of evidence to attack a petrologic problem or understand a petrologic process. These are collected into a database that offers a tool for exploring, organizing and analyzing the data. For example, datasets may be geochemical, mineralogic, experimental and/or visual in nature, covering global, regional to local scales. These datasets provide students with access to large amount of related data through space and time. Goals of the database working group include educating earth scientists about information systems in general, about the importance of meta-data about ways of using databases and datasets as educational tools and about the availability of existing datasets and databases. The modeling and databases groups hope to create additional petrologic teaching tools using these aspects and invite the community to contribute to the effort.

ED51A-08 0945h

International Volcanological Field School in Kamchatka and Alaska: Experiencing Language, Culture, Environment, and Active Volcanoes

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The Kamchatka State University of Education, University of Alaska Fairbanks, and Hokkaido University are developing an international field school focused on explosive volcanism of the North Pacific. An experimental first session was held on Mtnovskiy and Gorely Volcanoes in Kamchatka during August 2003. Objectives of the school are to: (1) Acquaint students with the chemical and physical processes of explosive volcanism, through first-hand experience with some of the most spectacular volcanic features on Earth; (2) Expose students to different concepts and approaches to volcanology; (3) Expand students' ability to function in a harsh environment and to bridge barriers in language and culture; (4) Build long-lasting collaborations in research among students and in teaching and research among faculty in the North Pacific region. Both undergraduate and graduate students from Russia, the United States, and Japan participated. The school was based at a mountain hut situated between Gorely and Mtnovskiy Volcanoes and accessible by all-terrain truck. Day trips were conducted to summit craters of both volcanoes, flank lava flows, fumarole fields, ignimbrite exposures, and a geothermal area and power plant. During the evenings and on days of bad weather, the school faculty conducted lectures on various topics of volcanology in either Russian or English, with translation. Although subjects were taught at the undergraduate level, lectures led to further discussion with more advanced students. Graduate students participated by describing their research activities to the undergraduates. A final session at a geophysical field station permitted demonstration of instrumentation and presentations requiring sophisticated graphics in more comfortable surroundings. Plans are underway to make this school an annual offering for academic credit in the

Valley of Ten Thousand Smokes, Alaska and in Kamchatka. The course will be targeted at undergraduates with a strong interest in and aptitude for the physical sciences, not necessarily volcanology. It will also serve as an entry point for students wishing to make extended exchange visits to the Russian Far East or Alaska, and to graduate students in volcanology wishing to undertake thesis research in North Pacific volcanism. The school represents the first educational effort of the newly established Japan Kamchatka Alaska Subduction Project (JKASP), which seeks to bring scientists of our three nations together in the study of one shared geophysical province, the Kuril-Kamchatka-Aleutian Arcs.

ED51B MCC: Level 2 Friday 0830h

Education and Outreach Efforts of Major Research Facilities and Organizations III Posters (*joint with OS, P, T, C*)

Presiding: S E Franks, Scripps Institution of Oceanography; A N Federman, NASA Ames Research Center

ED51B-1183 0830h POSTER

NASA satellite missions CALIPSO and CloudSat collaborate with the GLOBE program to involve students internationally in data collection for scientists researching climate change

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NASA supports involvement of K-14 students and teachers in each of their missions. CALIPSO and CloudSat are two satellite-based research missions with unique education and outreach programs. These missions will be co-manifested for launch in 2004 and are included in the NASA "A-Train" satellite formation. The A-Train will consist of six missions flying in close proximity, providing combined detailed observations about the Earth's atmosphere that will allow scientists to make better predictions related to climate change. CALIPSO will use Lidar to detect size and distribution of aerosols to aid in improving our understanding of the role aerosols and clouds play in Earth's climate system. CloudSat will use radar and provide a global survey of cloud properties to aid with improving cloud models and the accuracy of weather forecasts. Each of the A-Train missions has a distinctive education and outreach program for students and teachers. Included in the CloudSat and CALIPSO outreach programs is a partnership with the GLOBE program aimed at involving students worldwide in mission observations and data collection. GLOBE is a network of over 12,000 K-14 schools, science centers, after school programs, and environmental clubs. from over 100 countries where students collect scientific data according to precise protocols and enter the data into a central database allowing both scientists and students to utilize the data. CloudSat and CALIPSO will partner with GLOBE schools worldwide to enlist student assistance with data collected by both satellites. Students will use the existing GLOBE protocols on aerosols and clouds to collect data as the satellites pass over their schools. CloudSat scientists will have students make visual observations related to cloud cover, cloud type and precipitation. This information will be compared to the CloudSat radar data to determine the accuracy of the satellite radar unit. CALIPSO will have students collect and report on aerosol measurements taken with a hand-held sun photometer. CALIPSO and CloudSat education and outreach programs support the national education standards related to climate change and the effects aerosols have on climate. Both missions will provide students with an opportunity to participate in research and data collection on a global level. The data collected by students internationally for CALIPSO and CloudSat will allow them to better understand the impacts made by humans on Earth's atmosphere and how these impacts are global in scope.

URL: <http://www.calipso.larc.nasa.gov/http://cloudsat.atmos.colostate.edu>

ED51B-1184 0830h POSTER

Projects on Education, Research and International Training for Students and Junior Scientists in Atmospheric Sciences

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Stimulated by rapid economic development and the need for better environmental prediction, the atmospheric science communities in East Asia countries have enjoyed considerable growth over the past 10 years. As a result, the East Asia countries have established many exciting and innovative research facilities and projects focusing on atmospheric sciences. Two outstanding examples are the Earth Simulation System facility in Japan and the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) Project in Taiwan. These facilities and projects hold great promise for significant advancement in atmospheric sciences, and present important opportunities for education, research, and international training for American scientists, engineers and educators. Under the support of the International Programs Division of the National Science Foundation, we have established an AWARE (American Workforce and Research and Education) program at the University Corporation for Atmospheric Research (UCAR). The purpose of this program is to establish an international linkage between the National Center for Atmospheric Research (NCAR), the U.S. university community and educational, research and operational institutions in East Asia. Through this program, we provide opportunities for U.S. students and junior scientists to participate in important collaborative research projects between the U.S. and East Asia countries. In this paper, we will describe the program and the various ongoing collaborative research projects. We will also discuss the education, research, and international training experiences of U.S. students in these collaborative research projects.

URL: <http://cosmic.ucar.edu>

ED51B-1185 0830h POSTER

Organization and Implementation of a University-Wide Collaboration for Advancing Teaching Technology and Science in Public Schools

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The University of Arizona's Collaboration for the Advancement of Teaching Technology and Science (CATTS) was formed 4 years ago for the purpose of teaming university graduate and undergraduate science students with local K-12 teachers to enhance science teaching at all grade levels. This NSF-funded GK-12 program has been remarkably successful at training university students to use exemplary science education materials and to enable them to work within the culture of K-12 classrooms. The program relies on the formation and maintenance of a respectful, robust, and mutually beneficial relationship between the university and Tucson area school districts, school principals, and schoolteachers. This paper explores the process we have used and are using to build and maintain a partnership between two very diverse cultures: the K-12 culture and the university's research-based culture. The CATTS program links University of Arizona outreach projects with schools, trains CATTS Fellows on current educational pedagogical thinking, and provides a means of evaluating the teaching effectiveness of CATTS Fellows. The presentation will describe the strategies and techniques for building and maintaining alliances by school districts, school administrators, and teachers. We will also describe recruiting and training practices and various corrective actions we have taken to improve the program over its lifetime. The CATTS program provides an effective outreach tool for educational programs in geophysics, marine biology and oceanography, climatology, hydrology, and space physics and astronomy, to name a few. As such it is an example of a core outreach program that can be used at research universities, national research facilities, or non-research oriented colleges. The program also provides an effective way to train future teaching professors and scientists to effectively participate in formal and informal education and public outreach programs.

URL: <http://www.geo.arizona.edu/catts/>

ED51B-1186 0830h POSTER

Supporting Systemic Science Reform - Collaboration to Advance Teaching Technology and Science (CATTS) and the National Optical Astronomy Observatory (NOAO)

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Through the NSF-funded Collaboration to Advance Teaching Technology and Science (CATTS), graduate and undergraduate students in the sciences partner with elementary, middle, and high school teachers to support efforts in science education. One such partnership, sponsored by the National Optical Astronomy Observatory (NOAO), works to enhance the teaching of astronomy and optics-related topics. Graduate and undergraduate Fellows in the CATTS/NOAO program support the efforts of teachers through the classroom implementation of GEMS (Great Explorations in Math and Science) curriculum guides such as Invisible Universe, Living With a Star, Real Reasons for the Seasons, Color Analyzers, and More Than Magnifiers. These guides are inquiry-based, hands-on activities that closely align with the National Science Education Standards. Details of the guides as well as the organization and benefits of the partnership will be described here. The NOAO/CATTS collaboration represents a high leverage program using quality instructional materials as part of a professional development effort for teachers while providing valuable student experiences in science education. As such, it represents an effective educational model that may be duplicated at other research facilities with EPO missions. The University of Arizona's Collaboration to Advance Teaching Technology and Science (CATTS) program is sponsored under grant 9979670 from the National Science Foundation. NOAO is operated by the Association of Universities for Research in Astronomy (AURA), Inc. under cooperative agreement with the National Science Foundation.

URL: <http://www.geo.arizona.edu/catts>

ED51B-1187 0830h POSTER

Education and Public Outreach at a Graduate College of Marine Science: A case study from the University of South Florida

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The College of Marine Science (CMS) at the University of South Florida, along with the marine science research complex that continues to grow in its vicinity, represents one of the largest marine research facilities in the Southeast. In addition to CMS, part of a state university, and it's associated Center for Ocean Technology, three federal agencies, two state agencies, a private college, and two private companies are concentrated around Tampa Bay. CMS is a member of several large organizations (JOI, CORE) and many researchers in this community are heavily involved in major national research initiatives (ODP, IODP, OOI, SEACOOS). CMS has a graduate degree program, but it also has a extensive foundation of education and public outreach (EPO) infrastructure, which includes educators, administrators, and researchers and serves an audience from K to gray. The strength of EPO at CMS has brought national recognition to the university and generated \$1 million in endowments. Two new awards from NSF's Centers for Ocean Science Education Excellence (COSEE) Program and the GK12 Program have enabled CMS to maximize the synergy from individual EPO efforts. The existence of this solid EPO base has become an asset to the research community as it seeks to fulfill new funding agency requirements for education components in research proposals. Ongoing projects, experienced personnel, and a network of teachers and schools provide multiple outlets for infusing the education system with the latest results produced by researchers, whether funding derives from individual awards or by collaboration of multiple PIs on a

large initiative. The lessons learned from building the EPO network at CMS will be discussed, as well as how this type of model is poised to meet the growing role of research institutions in education.

URL: <http://www.marine.usf.edu>

ED51B-1188 0830h POSTER

The U.S. Geological Survey's Earthquake Summary Posters: A GIS-based Education and Communication Product for Presenting Consolidated Post-Earthquake Information

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Earthquake Summary Posters (ESP's), a new product of the U.S. Geological Survey's Earthquake Program, are produced at the National Earthquake Information Center (NEIC) in Golden. The posters consist of rapidly-generated, GIS-based maps made following significant earthquakes worldwide (typically M>7.0, or events of significant media/public interest). ESP's consolidate, in an attractive map format, a large-scale epicentral map, several auxiliary regional overviews (showing tectonic and geographical setting, seismic history, seismic hazard, and earthquake effects), depth sections (as appropriate), a table of regional earthquakes, and a summary of the regional seismic history and tectonics. The immediate availability of the latter text summaries has been facilitated by the availability of Rapid, Accurate Tectonic Summaries (RATS) produced at NEIC and posted on the web following significant events. The rapid production of ESP's has been facilitated by generating, during the past two years, regional templates for tectonic areas around the world by organizing the necessary spatially-referenced data for the map base and the thematic layers that overlay the base. These GIS databases enable scripted Arc Macro Language (AML) production of routine elements of the maps (for example background seismicity, tectonic features, and probabilistic hazard maps). However, other elements of the maps are earthquake-specific and are produced manually to reflect new data, earthquake effects, and special characteristics. By the end of this year, approximately 85% of the Earth's seismic zones will be covered for generating future ESP's. During the past year, 13 posters were completed, comparable to the yearly average expected for significant earthquakes. Each year, all ESP's will be published on a CD in PDF format as an Open-File Report. In addition, each is linked to the special event earthquake pages on the USGS Earthquake Program web site (<http://earthquake.usgs.gov>). Although three formats are generated, the poster-size format is the most popular for display, outreach, and use as a working map for project scientists (JPEG format for web; PDF for download, editing, and printing) whereas the other (smaller) formats are suitable for briefing packages. We will soon make both GIS and PDF files of individual elements of the posters available online. ESP's provide an unprecedented opportunity for college earth-science faculty to take advantage of current events for timely lessons in global tectonics. They are also invaluable to communicate with the media and with government officials. ESP's will be used as a vehicle to present other products now under development under the auspices of NEIC and the ANSS, including rapid finite-fault models, global predictive ShakeMaps, "Did You Feel It?", and Rapid Assessments of Global Earthquakes (RAGE, Earle and others, this meeting).

URL: <http://earthquake.usgs.gov/>

ED51B-1189 0830h POSTER

The Denali EarthScope Education Partnership: Creating Opportunities for Learning About Solid Earth Processes in Alaska and Beyond.

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The Geophysical Institute of the University of Alaska Fairbanks, in partnership with Denali National Park and Preserve, has begun an education outreach program that will create learning opportunities in solid earth geophysics for a wide sector of the public. We

will capitalize upon a unique coincidence of heightened public interest in earthquakes (due to the M 7.9 Denali Fault event of Nov. 3rd, 2002), the startup of the EarthScope experiment, and the construction of the Denali Science & Learning Center, a premiere facility for science education located just 43 miles from the epicenter of the Denali Fault earthquake. Real-time data and current research results from EarthScope installations and science projects in Alaska will be used to engage students and teachers, national park visitors, and the general public in a discovery process that will enhance public understanding of tectonics, seismicity and volcanism along the boundary between the Pacific and North American plates. Activities will take place in five program areas, which are: 1) museum displays and exhibits, 2) outreach via print publications and electronic media, 3) curriculum development to enhance K-12 earth science education, 4) teacher training to develop earth science expertise among K-12 educators, and 5) interaction between scientists and the public. In order to engage the over 1 million annual visitors to Denali, as well as people throughout Alaska, project activities will correspond with the opening of the Denali Science and Learning Center in 2004. An electronic interactive kiosk is being constructed to provide public access to real-time data from seismic and geodetic monitoring networks in Alaska, as well as cutting edge visualizations of solid earth processes. A series of print publications and a website providing access to real-time seismic and geodetic data will be developed for park visitors and the general public, highlighting EarthScope science in Alaska. A suite of curriculum modules will be developed for middle school classrooms to enrich earth science curricula by taking students into the field, and by providing opportunities to interact with scientists using real EarthScope data and research results. Curriculum modules will take advantage of Denali's new "Nature Area Network", an IEEE 802.11b wireless network serving the backcountry areas of the Park where students can engage in hands on learning about geology and geophysics and share their experiences with students worldwide via the Internet. Curricula will also focus on the new field of digital story telling, in which students will develop their own understanding of solid earth processes by creating digital stories using readily available digital moviemaking technology. A training course will be developed to enhance K-12 educators' ability to teach earth science utilizing real data and research results. And a series of public lectures both at Denali and in communities across Alaska will engage Geophysical Institute researchers with the public and foster wider participation in the EarthScope Experiment. The anticipated benefits of this project are many. An increase in public awareness and understanding of solid earth processes will lead to better preparedness, and improved decision making regarding the mitigation of risk from seismic and volcanic hazards. Earth science education will be made more vital and engaging for both students and teachers. And Alaska's visitors and residents will gain a better understand and greater appreciation for the dynamic tectonic processes that have created the rugged landscape of the state and its national parklands.

ED51B-1190 0830h POSTER

Earth Science World ImageBank (ESWIB): A Comprehensive Collection of Geoscience Images Being Developed by the American Geological Institute

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Although there are geoscience images available in numerous locations around the World Wide Web, there is no universal comprehensive digital archive where teachers, students, scientists, and the general public can gather images related to the Earth Sciences. To fill this need, the American Geological Institute (AGI) is developing the largest image database available: the Earth Science World ImageBank (ESWIB). The goal of ESWIB is to provide a variety of users with free access to high-quality geoscience images and technical art gathered from photographers, government organizations, and scientists. Each image is cataloged by location, author, image rights, and a detailed description of what the image shows. Additionally, images are cataloged using keywords from AGI's precise Georef indexing methodology. Students, teachers, and the general public can search or browse and download these images for use in slide show presentations, lectures, papers, or for other educational and outreach uses. This resource can be used for any age level, in any kind of educational venue. Users can also contribute images of their own to the database through the ESWIB website. AGI is scanning these images at a very high resolution (16 x 20 inches) and depending on the author's rights, is making high-resolution copies (digital or print) available for non-commercial and commercial purposes. This ImageBank is different from other photo sites available in that the scope has more breadth and

depth than other image resources, and the images are cataloged with a very high grade of detail and precision, which makes finding needed images fast and easy. The image services offered by ESWIB are also unique, such as the low-cost commercial options and high quality image printouts. AGI plans on adding more features to ESWIB in the future, including connecting this resource to the up-coming online Glossary of Geology, a geospatial search option, using the images to make generic PowerPoint presentations that teachers can use and/or modify for their classes, lesson plans related to using the ImageBank, and a photo of the day' section that will highlight a particular photo which stands out. AGI began work on this project in August of 2002 with the initial scanning and editing of images. ESWIB currently has over 1,300 images cataloged and searchable through the database homepage. In addition to the cataloged images, there are approximately 6,700 images waiting to be edited and cataloged, and over 10,000 images identified for submission at this point. AGI is constantly soliciting images in an attempt to expand the database. Through press releases, e-mail announcements, and our member societies, AGI publicized the launch of ESWIB in June of 2003. Since the launch, ESWIB has received over 300,000 image views as well as publicity in Space Daily, Russian and German news sites, various links through science websites, and most recently in Science Magazine's NetWatch section (August 29th, 2003).

URL: <http://www.earthscienceworld.org/imagebank>

ED51B-1191 0830h POSTER

Scientific Ocean Drilling: A Legacy of ODP Education and Community Engagement by JOI/USSSP

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The U.S. Science Support Program (USSSP) was established in 1986 to support the participation of U.S. scientists in the international Ocean Drilling Program (ODP). Since inception, USSSP has been managed by Joint Oceanographic Institutions (JOI), through a cooperative agreement with NSF, and guided by the U.S. Science Advisory Committee (USSAC). One of USSSP's primary goals has been to enhance the scientific contribution of ocean drilling and to maintain its vitality through a broad range of education and outreach activities. USSSP's first educational program, the Schlanger Ocean Drilling Fellowship, was established to encourage doctoral candidates to conduct research aboard the ODP drill ship, JOIDES Resolution. Since 1987, 74 fellowships have been awarded and the program has been expanded to include shorebased ODP-related research and Masters degree candidates. USSSP's second major educational activity is the Distinguished Lecturer Series. To date, 70 scientists have spoken about their ODP research at 334 institutions, effectively reaching new and diverse educational communities. In addition, USSSP has developed and distributed two interactive educational CD-ROMs (ODP: Mountains to Monsoons and Gateways to Glaciation) and an educational poster (Blast from the Past). All three items are popular supplements in classrooms from middle school to college because they present accessible scientific content, demonstrate the scientific method, and illustrate the collaborative and international nature of scientific research. USSSP's outreach efforts have included publishing the JOI/USSAC Newsletter since 1988 and ODP's Greatest Hits (abstracts written by U.S. scientists). The latter is broadly used because it communicates exciting scientific results in lay terms. USSSP has sponsored other educational efforts including a workshop to seek recommendations for educational activities to be associated with future scientific ocean drilling. NSF is currently considering the response to their solicitation of proposals to manage a successor program to USSSP, which will support the involvement of U.S. scientists in the new Integrated Ocean Drilling Program. The educational and outreach component of the new USSSP will target students at all levels, building upon improving on the USSSP-ODP achievements.

URL: <http://www.joiscience.org/USSSP/>

ED51B-1192 0830h POSTER

Education and Outreach Plans for the U.S. Drillship in IODP

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The Integrated Ocean Drilling Program (IODP) began on October 1, 2003, following the end of operations of the 20-year Ocean Drilling Program (ODP). Education and outreach is a key component of IODP both nationally and internationally. The JOI Alliance (Joint Oceanographic Institutions, Inc., Texas A&M University, and Lamont Doherty Earth Observatory of Columbia University) will lead activities related to the U.S. drillship, coordinating these education and outreach efforts with those undertaken by the Central Management Organization, other IODP platform operators, and a U.S. Science Support Program successor. The Alliance will serve the national and assist the international scientific drilling communities by providing the results from the U.S. vessel to the public, government representatives, and scientists. The Alliance will expand upon media outreach strategies that were successful in ODP, such as issuing press releases at the conclusion of each leg and for major scientific breakthroughs; conducting tours, press conferences, and events during port calls; working with the press at major scientific meetings, and encouraging journalists to sail on expeditions. The Alliance will increase its education role by developing, coordinating, and disseminating educational materials and programs for teachers and students on the scientific themes and discoveries of IODP science. An important component of the outreach plan is using the vessel and associated laboratories and repositories as classrooms. IODP plans include multiple ship berths each year for teachers, based on the success of a pilot program conducted by ODP in 2001. This program, featuring a teacher onboard for a cruise, was accompanied by a distance-learning program and on-line curriculum models. Teachers can tour, both virtually and directly, laboratories and core repositories and participate in scheduled activities and courses. Using science conducted onboard the ship, the Alliance will develop online curriculum materials, as well as publications and fact sheets geared toward nonscientists. The Alliance will partner with existing scientific and education organizations, including programs at their universities, to widely disseminate IODP results and materials.

URL: <http://www.iodp.org>

ED51B-1193 0830h POSTER

Understanding Science and Technology Interactions Through Ocean Science Exploration: A Summer Course for Science Teachers

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In order to replenish the national supply of science and mathematics educators, the National Science Foundation has supported the formation of the Center for Applications of Information Technology in the Teaching and Learning of Science (ITS) at Texas A&M University. The center staff and affiliated faculty work to change in fundamental ways the culture and relationships among scientists, educational researchers, and teachers. ITS is a partnership among the colleges of education, science, geosciences, agriculture and life science at Texas A&M University. Participants (teachers and graduate students) investigate how science is done and how science is taught and learned; how that learning is assessed, and how scholarly networks among all engaged in this work can be encouraged. While the center can offer graduate degrees most students apply as non-degree seekers. ITS participants are schooled on classroom technology applications, experience working on project teams, and access very current research work being conducted by scientists. ITS offers a certificate program consisting of two summer sessions over two years that results in 12 hours of graduate credit that can be applied to a degree. Interdisciplinary project teams spend three intense weeks connecting current research to classroom practices. During the past summer with the beginning of the two-year sequence, a course was implemented that introduced secondary teachers to Ocean Drilling Program (ODP) contributions to major earth science themes, using core and logging data, engineering (technology) tools and processes. Information Technology classroom applications were enhanced through hands-on laboratory exercises, web resources and online databases. The course was structured around the following objectives. 1. Distinguish the purpose and goals of the Ocean Drilling Program from the Integrated Ocean Drilling Program and describe the comparable science themes

(ocean circulation, marine sedimentation, climate history, sea level change and geological time). This objective will be achieved by correctly answering 8 of 10 multiple choice items on course posttest on science themes of ODP/IODP. 2. Describe the technical tools and processes for determining sea level history by preparing and presenting a multimedia presentation on coring. 3. Describe the processes for describing a drill core and apply those processes to core samples from Leg 194 by developing a laboratory analysis report on core samples based on protocol for analyzing cores. 4. Explain the distinguishing features of scientific from industrial coring processes by developing a paper that contrasts scientific from industrial coring processes. 5. Describe the substructure of the ocean basin and the scientific tools (equipment and processes) used to explore this substructure by preparing and presenting a multimedia presentation on bore hole data interpretation. 6. Analyze and interpret data sets from a bore hole by developing a laboratory analysis report on bore-hole data. Student performance data for objectives indicate a 16% average positive change on the science themes addressed in instruction related to objective one occurred. Similarly, a 12% average positive change occurred on science education topics related to earth science among the students in this class. Ongoing contact between faculty members during the academic year is planned as these summer participants engage in implementing IT interventions and professional development experiences based on ocean science data experienced in the summer experience.

ED51B-1194 0830h POSTER

Exploring the Oceans With OOI and IODP: A New Partnership in Education and Outreach

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The Ocean Observatories Initiative (OOI), a new program supported by the National Science Foundation (NSF), will investigate ocean and Earth processes using deep-sea and coastal observatories, as well as a lithospheric plate-scale cabled observatory that spans most of the geological and oceanographic processes of our planet. October 2003 marked the beginning of the Integrated Ocean Drilling Program (IODP), the third phase of a scientific ocean drilling effort known for its international cooperation, multidisciplinary research, and technological innovation. A workshop exploring the scientific, technical, and educational linkages between OOI and IODP was held in July 2003. Four scientific thematic groups discussed and prioritized common goals of the two programs, and identified experiments and technologies needed to achieve these objectives. The Education and Outreach (E&O) group attended the science sessions and presented seed ideas on activities for all participants to discuss and evaluate. A multidisciplinary dialogue between E&O facilitators, research scientists, and technology specialists was initiated. OOI/IODP participants support the recommendation of the IODP Education Workshop (May 2003) that the IODP and US Science Support Program (USSSP)-successor program have clear commitments to education and outreach. Specific organizational recommendations for OOI/IODP are: (1) E&O should have equal status with science and engineering in the OOI management/planning structure, and enjoy adequate staffing at a US program office; (2) an E&O Advisory Committee of scientists, engineers, technology experts, and educators should be established to develop and implement a viable, vibrant E&O plan; (3) E&O staff and advisors should (a) provide assistance to researchers in fulfilling E&O proposal requirements from preparation to review stages, (b) promote submittal of proposals to government agencies specifically for OOI/IODP-related E&O activities, and (c) identify and foster partners, networks, and funding opportunities. Specific E&O strategies include: (1) present observatory science and ocean drilling content, and the sense of discovery and international cooperation unique to

OOI/IODP, to a broad audience; (2) develop and maintain an effective website with distinct resources for K-20 educators, students, and the public; (3) provide pre-service, in-service, and in-residence programs for K-12 teachers that are synergistic with national and local education standards; (4) focus K-12 education efforts on middle school students in grades 5-8; (5) continue and expand existing, successful Ocean Drilling Program activities for undergraduate and graduate students and educators; and (6) try to avoid redundancy with existing E&O efforts within the ocean sciences community by adopting successful models and exploring partnership opportunities with other NSF-funded ocean science education centers and initiatives.

ED51B-1195 0830h POSTER

Launching Discovery through a Digital Library Portal: SIOExplorer

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The launching of an oceanographic expedition has its own brand of excitement, with the sound of the main engines firing up, and the lifting of the gangway in a foreign port, as the team of scientists and crew sets out for a month at sea with only the resources they have aboard. Although this adventure is broadly appealing, very few have the privilege of actually joining an expedition. With the "SIOExplorer" family of projects we are now beginning to open this experience across cyberspace to a wide range of students and teachers. What began two years ago as an effort to stabilize the Scripps Institution of Oceanography (SIO) data archives from more than 700 cruises going back 50 years, has now become an operational component of the National Science Digital Library (NSDL; www.nsdl.org), complete with thousands of historic photographs, full text documents and 3D visualization experiences. Our initial emphasis has been on marine geology and geophysics, in particular multi-beam seafloor mapping, including 2 terabytes of digital objects. The IT architecture implemented at the San Diego Supercomputer Center (SDSC) streamlines the integration of additional projects in other disciplines with a suite of metadata management and collection building tools for "arbitrary digital objects." The "CruiseViewer" Java application is the primary portal to the digital library, providing a graphical user and display interface, the interface with the metadata database, and the interface with the SDSC "Storage Resource Broker" for long-term bulk distributed data storage management. It presents the user with a view of the available objects, overlaid on a global topographic map. Geospatial objects can be selected interactively, and searches can be constrained by keywords. Metadata can be browsed and objects can be viewed onscreen or downloaded for further analysis, with automatic proprietary-hold request management. These efforts will be put to the test with national teacher workshops in the next two summers. Teachers, in collaboration with SIO-graduate students, will prepare and field-test learning-experience modules that explore concepts from plate tectonics theory for classroom and web use. Students will design their own personal voyages of discovery through our digital archives, promoting inquiry-based learning tailored to each individual. Future education and outreach efforts will include 1) developing a global registry of seafloor research or education projects (academic, industry, government), allowing at least a URL and a contact for further information 2) adding new collections, including dredged rocks and cores, 3) interoperating with other international data collections, 4) interacting with education and outreach projects such as the California Center for Ocean Science Education Excellence (COSEE), 5) continued testing of a real-time stand-alone digital library on a laptop shipboard acquisition system, 6) enhanced use of real-time Real-time Observatories, Applications, and Data management Network (ROADNet) satellite links to SIO vessels, and 7) continued construction of a series of museum exhibits based on digital terrain models. Now that SIOExplorer has become operational, we look forward to collaborating with other institutions for data and technology exchange, as well as for education and outreach opportunities. Support is provided by NSF NSDL, ITR and OCE programs, as well as by UCSD funds.

URL: <http://SIOExplorer.ucsd.edu>

ED51B-1196 0830h POSTER

SIOExplorer: Creating Educational Modules From Oceanographic Data

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Can we make a research tool also work for student discovery experiences? Earth Science digital libraries primarily exist on two separate planes: interfaces for accessing first order data as collected by scientists (i.e., CruiseViewer, <http://nsdl.sdsc.edu>), and libraries of indexed educational resources developed for use by teachers in the classroom (i.e., DLESE, <http://www.dlese.org>). Typically, data moves from first order data collections to an educational resource by way of a scientist or teacher who must invest large amounts of time in devising an interesting and pedagogically useful learning module (website, computer program, printable hand-outs, etc.). The SIOExplorer team, having established an interactive first order data access interface, now looks to develop tools to ease the transition of that data into useful products for the classroom. Our goal is to focus on developing tools to create education modules for teaching with an initial focus on Plate Tectonics in the K-12 classroom. We plan to build an interface for educators that allow them to query digital libraries and create and assemble learning modules based on digital objects shared by scientists. Teachers will be taught to use the CruiseViewer application, a first order data repository, to help in creation of the learning modules. Ongoing development of education standards and established standards such as the National Science Education Standards will also be accessible and serve as guidelines for the learning modules. The resulting integration of the first order data with the learning module creates an investigative learning environment for the students.

URL: <http://nsdl.sdsc.edu>

ED51B-1197 0830h POSTER

Development of 3D interactive visual objects using the Scripps Institution of Oceanography's Visualization Center

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Within the last year scientists and educators at the Scripps Institution of Oceanography (SIO), the Birch Aquarium at Scripps and San Diego State University have collaborated with education specialists to develop 3D interactive graphic teaching modules for use in the classroom and in teacher workshops at the SIO Visualization center (<http://siovizcenter.ucsd.edu>). The unique aspect of the SIO Visualization center is that the center is designed around a 120 degree curved Panoramic floor-to-ceiling screen (8'6" by 28'4") that immerses viewers in a virtual environment. The center is powered by an SGI 3400 Onyx computer that is more powerful, by an order of magnitude in both speed and memory, than typical base systems currently used for education and outreach presentations. This technology allows us to display multiple 3D data layers (e.g., seismicity, high resolution topography, seismic reflectivity, draped interferometric synthetic aperture radar (InSAR) images, etc.) simultaneously, render them in 3D stereo, and take a virtual flight through the data as dictated on the spot by the user. This system can also render snapshots, images and movies that are too big for other systems, and then export smaller size end-products to more commonly used computer systems. Since early 2002, we have explored various ways to provide informal education and outreach focusing on current research presented directly by the researchers doing the work. The Center currently provides a centerpiece for instruction on southern California seismology

for K-12 students and teachers for various Scripps education endeavors. Future plans are in place to use the Visualization Center at Scripps for extended K-12 and college educational programs. In particular, we will be identifying K-12 curriculum needs, assisting with teacher education, developing assessments of our programs and products, producing web-accessible teaching modules and facilitating the development of appropriate teaching tools to be used directly by classroom teachers.

URL: <http://www.siovizcenter.ucsd.edu>

ED51B-1198 0830h POSTER

Ocean Exploration Through the National Oceanic and Atmospheric Administration: Collaborations for Excellence in Exploration and Education

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The National Oceanic and Atmospheric Administration's (NOAA's) Office of Ocean Exploration launched seven multidisciplinary expeditions this year to little-known or unknown ocean regions. Scientists and educators explored New England seamounts, the Blake Plateau, deepwater habitats in the Gulf of Mexico, and other areas as they sought to more completely know and understand our ocean. This presentation will focus on how NOAA is leading a new era of ocean exploration through these expeditions in direct response to the President's Panel on Ocean Exploration Report entitled Discovering Earth's Final Frontier: A U.S. Strategy for Ocean Exploration. Expedition highlights and future program directions will be presented. Additionally, 10% of program funds are targeted to an education and outreach effort to unfold Key Objective 4 of the President's Panel Report. This objective specifically calls for reaching out in new ways to stakeholders to improve the literacy of learners with respect to ocean issues. Collaborations among scientists and educators to develop educational resources tied to the expeditions will be presented along with information on partnerships with the National Science Foundation's Centers for Ocean Science Education Excellence (COSEEs). Future program directions to build program capacity based on input received from a national workshop and program evaluation will also be addressed.

URL: <http://oceanexplorer.noaa.gov>

ED51B-1199 0830h POSTER

Minorities Striving and Pursuing Higher Degrees of Success in Earth System Science Initiative

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The Minorities Striving and Pursuing Higher Degrees of Success (MS PHD'S) in Earth System Science Initiative was developed by and for underrepresented minorities, with the overall purpose of facilitating our increased participation in Earth system science. The initiative was established with the goals of providing professional development experiences and mentoring opportunities that facilitate the advancement of minorities committed to achieving outstanding Earth system science careers. The MS PHD'S in Earth System Science Initiative sponsors activities that provide minorities with increased exposure to the Earth system science community, via participation in scientific conferences, mentoring relationships, and virtual community activities. The 2003 MS PHD'S in Ocean Sciences Program, which was sponsored by the MS PHD'S in Earth System Science Initiative and the Joint Global Ocean Flux Study (JGOFS) Program, facilitated activities that supported meaningful engagement of 25 underrepresented minority students at the final JGOFS Open Science Meeting, entitled A Sea of Change: JGOFS Accomplishments and the Future of Ocean Biogeochemistry. Future MS PHD'S sponsored activities will facilitate the engagement of program participants at American Geophysical Union and other professional society meetings.

URL: <http://msphds.marine.usf.edu/>

ED51B-1200 0830h POSTER

New Advances in Deep Submergence Technology Using Remotely Operated Vehicles, High-Bandwidth Ship-to-Shore Satellite Technology, and Internet 2

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In August of 2003, the authors carried out a major oceanographic research cruise to the Black Sea and Central Mediterranean Sea aboard the R/V Knorr using undersea vehicles linked in real time to scientists, engineers, and students ashore. Two vehicle systems, including an ROV and a towed vehicle, worked in tandem using multiple high-definition video cameras and sonar systems to investigate and sample a number of geological and archaeological sites. Scientists and engineers controlled the vehicles on a continuous basis in a shipboard command/control center. From a menu of more than twenty video feeds and computer generated displays within the control center, twelve video signals from the vehicles below, including two high-definition camera feeds, and six audio channels were transmitted via a shipboard satellite-tracking antenna to a receiving site in the United States. From there the signals were sent to a processing center and then placed on Internet 2 and distributed to a number of participating universities across the country. Scientists and engineers at these universities were able to participate in real time in shore-based control centers similar to the one at sea. Two-way audio communications made it possible for these researchers to have full access to the data streams aboard ship and gave them the ability to discuss what they were seeing as well as request additional information and displays on demand. When new discoveries were made, experts ashore could be networked into the decision-making process. This advanced telecommunication system not only provided scientists and engineers ashore the ability to participate in the cruise in real time but also students, teachers, and the general public could participate via both Internet 2 and the conventional Internet. These participants were situated at home, in schools, or at other educational venues across the country and had the ability to ask the project scientists and engineers questions while they carried out their research.

ED51C MCC: Level 2 Friday 0830h

The Benefits and Challenges of Education and Public Outreach Efforts Associated With Scientific Research Programs III Posters (*joint with OS, P, SA, SH, SM, C*)

Presiding: F Ireton, Science Systems and Applications, Inc.; J Thieman, NASA Goddard Space Flight Center

ED51C-1201 0830h POSTER

Extreme Space: Engaging and Educating the Public by Showcasing the Extremes of our Solar System

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The period of 2003 to 2006 is an exciting time in solar system exploration, with a fleet of more than a dozen spacecraft exploring the extremes of our solar neighborhood. NASA's Solar System Exploration Education and Public Outreach Forum plans to mine the richness of this intense mission activity and related natural astronomical events to develop a cohesive story of exploration. This is a unique opportunity to raise awareness of our solar system and provide inspiration for student career choices. The concentration of events includes mission launches and endings, spacecraft flybys, encounters, and landings, and sample returns to Earth. The missions target an exciting variety of extreme destinations in the solar system including the Sun, comets, Mercury, Venus, Mars, Jupiter, Saturn, and Pluto. To weave the variety of activities together into a simple concept, the SSE E/PO community

has selected Extreme Space as the basis of our unifying theme. Also referenced in the SSE Roadmap, this thread emphasizes the harsh environments of the planets and bodies, and the challenges of designing and executing robotic missions to explore them. The theme encompasses planetary missions, research, and astrobology, and is logically extensible to the Sun, the Earth and comparisons to other planets, including extrasolar worlds. We plan audience-focused activities around this theme, aimed at the informal and K-12 formal education communities. We are providing one-stop access to SSE mission content and E/PO resources, and professional development opportunities for scientists, teachers and informal education professionals. Content and resource needs include a calendar of events, news alerts, a summary PowerPoint presentation, image and video collections, and thematic education package.

URL: <http://solarsystem.nasa.gov>

ED51C-1202 0830h POSTER

The Hundred Year Hunt for the Red Sprite

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This presentation reviews an NSF Informal Science Education project directed by the PO of an ongoing NSF Physical Meteorology/Aeronomy-sponsored research program on red sprites. For over 100 years, anecdotal reports and citations in the literature have persisted of strange luminous apparitions occurring high above thunderstorms. They were long discounted by the scientific community - until 1989, when by pure chance, a video revealed two giant pillars of light extending tens of kilometers above a thunderstorm. Since then, thousands of events, now called sprites, have been imaged, many by the PI. Mesospheric sprites, at 40 to 90 km altitude, are induced by lightning discharges having highly unusual characteristics. Science is now gradually unraveling the nature of the giant lightning discharges which spawn sprites. In the process we have found even more unusual electrical discharges above thunderstorms, suggesting that many new discoveries await to be made. We produced and are distributing a planetarium DVD/video program (42 minutes length) entitled, "The Hundred Year Hunt for the Red Sprite." It documents the application of the scientific method to unraveling this century old mystery surrounding strange lights in the night sky. We also contrasted this story of discovery to the pseudo-science prevalent today in topics such as UFOs. With distribution to numerous planetaria and science centers, we believe over 200,000 persons will eventually view this program (which has won three major video production awards). Our long term goal is to inspire planetarium visitors to undertake their own self-directed learning programs. A companion educational web site (www.Sky-Fire.TV) allows students and adults sufficiently motivated by the planetarium experience to further investigate sprites and related basic science topics. The highly interactive web site challenges visitors to test their knowledge of sprites and lightning by participating in an on-line 20 question quiz game, which provides instant feedback and scoring. Visitors, encouraged to actively search the sky for these fleeting phenomena, have already reported a number of highly unusual events of potential scientific value.

URL: <http://www.Sky-Fire.TV>

ED51C-1203 0830h POSTER

Partnering With Scientists To Increase the Visibility and Use of Published Global Climate Change Data

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Scientific journal articles are notoriously difficult for non-scientists or scientists outside a specialty to comprehend. Yet in societally relevant fields such as global climate change, there is an urgent need to make the published results of scientific research more accessible and useable to a broad audience. NOAA's World Data for Paleoclimatology attempts to meet this need using the Internet to distribute raw data and information products from scientific publications. The Data Center creates "What's New" pages highlighting data

from recent publications, along with descriptions and ancillary information such as photographs. The Data Center also authors a "Climate TimeLine", online slide sets and photo gallery, and "Paleo Perspectives" web pages that describe the broader significance of scientific research, and how the data are used to improve our understanding of global warming, drought, and climate change. With the goal to inform and engage, the Climate Time Line provides interactive activities, and information that can be integrated into the classroom. The approach benefits a diverse audience by demystifying climate science and making it more accessible, and benefits scientists by increasing the visibility and use of scientists' published data. The success of the approach can be seen in web site user statistics and comments, and numerous awards for providing valuable information via the Internet. To solve the challenge of simplifying complex scientific problems while maintaining the accuracy and integrity of the scientific information, the World Data Center works closely with scientists who contribute the data. Underlying the effort are the hundreds of scientists who have contributed their data to the World Data Center, and reviewed and edited the online extensions of their research.

URL: <http://www.ncdc.noaa.gov/paleo>

ED51C-1204 0830h POSTER

NASA's DAAC Alliance Annual and Electronic Publishing: Communicating Research Uses of Earth-Observing Data to a Broad Audience

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The NASA Distributed Active Archive Centers (DAACs) are the data management and user services branches of NASA's Earth Observing System Data and Information System (EOSDIS). The DAACs process, archive, document, and distribute data from NASA's past and current Earth-observing satellites and field measurement programs. The DAACs were established in the early 1990s, and each DAAC serves a specific science discipline. The DAAC Alliance Annual is a multidisciplinary publication designed to highlight applications and research uses of satellite data archived at the NASA DAACs. Feature articles included in the publication describe research projects that use NASA satellite data. To facilitate understanding by a broad audience, which includes scientists, policymakers, and the general public, the articles are written at a lay audience level and include detailed explanations of scientific processes. Articles from the DAAC Alliance Annual are also published electronically on NASA's Earth Observatory and DAAC Alliance Web sites. The 9th edition of the NASA DAAC Alliance Annual publication, titled "Distributed Active Archive Centers Alliance: Supporting Earth Observing Science 2003," highlights the use of NASA satellite data in a variety of research disciplines, including oceanography, meteorology, seismology, land processes, cryospheric processes, and human influences on native habitats. For the first time, the 2003 edition also includes a glossy, center section featuring color data images that enhance the readers' understanding of the 11 feature articles.

ED51C-1205 0830h POSTER

Aqua Satellite Mission Educational Outreach

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An important component of the Aqua mission, launched into space on May 4, 2002 with a suite of six instruments from the U.S., Japan, and Brazil, is the effort to educate the public about the mission and the science topics that it addresses. This educational outreach includes printed products, web casts, other web-based materials, animations, presentations, and a student contest. The printed products include brochures for the mission as a whole and for the instruments, NASA Fact Sheets on the mission, the water cycle, and weather forecasting, an Aqua Science Writers' Guide, an Aqua lithograph, posters, and trading cards. Animations include animations of the launch, the orbit, instrument deployments, instrument sensing, and several