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The TOPEX/Poseidon and Jason-1 ocean altimetry missions offer the educator in the middle school or informal education venue a unique opportunity for reinforcing ocean science studies. Two new educational posters from the United States NASA/Jet Propulsion Laboratory and France's Centre National d'Etudes Spatiales provide teachers and students a tool to examine topics such as the dynamics of ocean circulation, ocean research, and the oceans role in climate.

Voyage on the High Seas: A Jason-1 Oceanic Adventure is a poster/board game that offers learning opportunities through a non-textbook activity designed to stimulate interest in ocean science in a fun and instructive environment. The object of the game is to be the first to sail your research vessel from the Mediterranean Sea to Seattle, Washington while gaining Discovery Points. The starting point in the Mediterranean is where the mythological adventurers Jason and the Argonauts set out on their epic voyage to find the golden fleece. Discovery and Quiz Cards are used to challenge players to gain knowledge and points by correctly answering questions using clues from the board. Teachers can directly photocopy additional activities from the reverse side of the board game for use in a middle school Earth science curriculum. The game is also a stand-alone poster that is an engaging world map depicting the world's oceans and continents, major ocean currents, and other important geographic features.

A second poster has been developed as a joint JPL/CNES effort. Oceans Music: Climates Dance highlights the ocean/climate link and provides educational activities that can be used directly in the classroom. The eye-catching poster is appropriate for display in both the formal and informal education setting. In both venues it should stimulate conversation about the ocean and provide a point of entry into inquiry-based learning about the connections between ocean circulation and global climate. It also seeks to emphasize the role of the ocean in sustaining life on Earth. Activities on the back of the poster can be used as supplemental material in a middle school Earth science curriculum, and are suitable for individual instruction and for classroom or group exercises. This poster will be published in both English and French.

Educational research indicates that an inquiry-based method of student engagement is an appropriate and effective teaching tool. These posters offer a fun and instructive environment to promote student interest in Earth Science in general and particularly in oceanography.

ED52A-0012 1330h POSTER

**Project CUES: A New Middle-School Earth System Science Curriculum Being Developed by the American Geological Institute**

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Project CUES is a middle-school earth systems science curriculum project under development by the American Geological Institute (AGI) and funded by the National Science Foundation (ESI-0095938). CUES features a student-centered, inquiry pedagogy and approaches earth science from a systems perspective. CUES will use the expanded learning cycle approach of Trowbridge and Bybee (1996), known as the 5E model (engage-explore-explain-elaborate-evaluate). Unlike AGIs Investigating Earth Systems (IES) curriculum modules, CUES will include a single hard-bound textbook, and will take one school-year to complete. The textbook includes a prologue that addresses systems concepts and four main units: Geosphere, Hydrosphere, Atmosphere, and Biosphere. Each eight-week unit takes students through a progression from guided inquiry to open-ended, student-driven inquiry. During first 4 to 5 weeks of each unit, students explore important earth science phenomena and concepts through scripted investigations and narrative reading passages written by scientists as inquiry narratives. The narratives address the development of scientific ideas and relay the personal experiences of a scientist during their

scientific exploration. Aspects of the nature of science will be explicitly addressed in investigations and inquiry narratives. After the guided inquiry, students will develop a research proposal and conduct their own inquiry into local or regional scientific problems. Each unit culminates with a science conference at which students present their research. CUES will be the first NSF-funded, comprehensive earth systems textbook for middle school that is based on national standards. CUES will be pilot tested in 12 classrooms in January 2003, with a national field test of the program in 50 classrooms during the 2003-2004 school year.

URL: <http://www.agiweb.org/education/cues/>

ED52A-0013 1330h POSTER

**"This Dynamic Planet" Map: Feedback Solicited on 3rd Edition in Progress**

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Cartography by Will R. Stettner (USGS-Reston) and Antonio Villaseñor (University of Utrecht)

Earlier editions of this 1:30 million Mercator world map of volcanoes, earthquakes, impact craters, and plate tectonics were published in 1989 and 1994. About 100,000 copies have since found their way to classrooms and research labs. Today's vastly improved data sets, particularly land and seafloor topography, allow improvements in the third edition, to be published in 2003. All elements of the new double-sided edition will be digital, and we are also working towards an interactive version on the web. As before, the front of the map will include a perspective cross-section illustrating plate tectonic processes, and an interpretive inset map of both sharp and diffuse plate boundaries and hotspots. Additions to earlier editions include polar caps on the front (making it a complete world map, for the first time), and a variety of supplementary resources printed on the back. The map's back will feature a 1:150 million geologic map of the world, plus timelines and a sequence of paleogeographic maps, giving temporal context to the "snapshot" of today's dynamics shown on the main map. It will also display progressively higher resolution graphics of selected examples of convergent, transform, and divergent plate boundaries, hotspot volcanoes, and impact craters. These features will, we hope, increase understanding of the main map, both for classroom work and individual study.

To make the map as accurate and useful as possible, we solicit feedback from AGU meeting participants. Our poster will be a current draft of the 1x1.5 m map, plus a laptop version of the ArcView GIS version for zooming in on areas of particular interest. Please stop by and help us refine areas that you know better than we do. The collective knowledge of AGU participants offers the potential of further improvement of the new map, and we ask for your help in that effort.

ED52B MCC: Hall D Friday 1330h

**The Participation of AGU Scientists in Support of K-14 Education and Public Outreach II Posters (joint with B, OS, SA, PA)**

**Presiding: C E Walker, National Optical Astronomy Observatory; S Q Foster, University Corporation for Atmospheric Research**

ED52B-0014 1330h POSTER

**A Space Physicists Adventure in K-5 Space Science Education**

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A UCLA partnership with El Marino Language Elementary School in Culver City CA has provided the opportunity to work with primary grade teachers and students. Our activities have been based around NASA OSS's Sun-Earth Day and Space Day. This years project is centered around Lockheed-Martins Student Signatures in Space program and includes a 2-hour after-school Professional Development Workshop for K-5 teachers, solar viewing, and an in class fun with magnets activity. The presentation will include a discussion of what NASA K-3 activities have been used and the motivation of the author to form a University-Elementary School partnership.

ED52B-0015 1330h POSTER

**High "IMPACT" STEREO EPO: Exploiting Opportunities for High Visibility Activities On a Shoestring**

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Our dynamic Sun offers exciting opportunities to share research discoveries of NASAs Sun Earth Connection Missions for the pre-college education and public outreach communities. NASA's STEREO/IMPACT Mission E/PO seeks to offer national programs for broad audiences that highlight the Missions solar and geo-space activities. The partnership between the Mission scientist and the Mission E/PO is essential to fully reap the fruits of this rich education and public outreach effort. We will share two events, a high visibility, successful Eclipse 2001 participation and a new project an exciting prototype program converting the science results of solar energetic particle data to sound, and ultimately to create a composition inspired by these sounds and related solar images by a musician. Data from an earlier twin-spacecraft Mission, Helios1/2 (courtesy of D. Reames, GSF and the Helios mission investigators) are used as a testbed for creating the stereo sounds from the future STEREO data. We hope these efforts will lead to a recording by an ensemble as well. We will discuss lessons learned and future opportunities for scientist participation.

ED52B-0016 1330h POSTER

**Bringing Hands-on Activities and Real Scientists to Students: Bishop Museums X-treme Science Exhibit, Holoholo Science Program, and Planned Science Learning Center**

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Bishop Museum developed the X-treme Science: Exploring Oceans, Volcanoes, & Outer Space museum exhibit in conjunction with NASA as part of their goal to increase educational outreach. A key element of the exhibit was the inclusion of real scientists describing what they do, and fostering the interaction between scientists and students. Highlights of the exhibit were interviews with local (Hawaii-based) scientists involved in current ocean, volcano, and space research. These interviews were based on questions that students provided, and were available during the exhibit at interactive kiosks. Lesson plans were developed by local teachers and scientists, and provided online to enhance the exhibit. However, one limitation of the museum exhibit was that not all students in the state could visit, or spend enough time with it. To serve more remote schools, and to provide for additional enrichment for those who did attend, the education department at Bishop Museum developed a traveling program with the X-treme Science exhibit as the basis. The Holoholo (Hawaiian for fun outing) Science program brings a scientist into the classroom with a hands-on scientific

inquiry activity. The activity is usually a simplified version of a problem that the scientist actually deals with. The students explore the activity, reach conclusions, and discuss their results. They are then given the opportunity to question the scientist about the activity and about what the scientist does. This allows students to understand that science is not something mystical, but rather something attainable. A key element of Holoholo remains the active participation of real-life scientists in the experience. The scientists who have participated in the program have had overwhelmingly positive experiences. Bishop Museum is developing a science learning center, with the objective of meeting local and national science standards using inquiry based science. The unifying theme of all three of these projects is involving students with active scientists who are accessible to them. AGU scientists are vital to realizing this goal.

URL: <http://www.bishopmuseum.org/education/holoholo/>

#### ED52B-0017 1330h POSTER

##### Education and Outreach in NOAA's Ocean Exploration Program: An Example From a Gulf of Alaska *Alvin* Cruise

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The report of the President's Panel on Ocean Exploration, *Discovering Earth's Final Frontier: A U.S. Strategy for Ocean Exploration*, outlined a strategy for a national ocean exploration program that included a strong educational outreach component. The National Oceanic and Atmospheric Administration's (NOAA) new Office of Ocean Exploration (OE), now in its second year, is carrying out the recommendations of the President's Panel through exciting exploratory and educational initiatives. With the establishment of OE, NOAA now has a great opportunity to reach out in new ways to teachers, students, and the general public to share the excitement of daily discoveries while at sea and to demonstrate the science behind these exploration initiatives. In 2002, OE sponsored several major exploration initiatives involving AGU scientists in various regions of our world's oceans, such as the Arctic, the Galápagos, the Gulf of Mexico, and the Gulf of Alaska.

An excellent example of the broad spectrum of opportunities that can be developed through a research cruise was the Gulf of Alaska Seamount Exploration Expedition (GOASEX). This *Alvin* submersible cruise included geologists studying how the seamounts formed, biologists studying crab distribution and reproductive strategies, and oceanographers sampling sediments and deep-sea corals for paleo-oceanographic information. Outreach and education products from this cruise were updated frequently on the Ocean Explorer web site, and included detailed lesson plans, logs, images, video clips, maps, and essays from the field so that students and the general public could follow the expedition.

This cruise was also used as an educational platform for fisheries observer trainers from the North Pacific Fisheries Observer Training Center, a 5<sup>th</sup> grade teacher from Illinois, and several undergraduate and graduate students from various institutions. Cruise participants have already shared their experiences with K-12 students and educators, and with undergraduate and graduate students at their respective institutions. A production team from the National Geographic Channel also joined the expedition, and will use cruise footage to produce several segments for their program. A port call in Kodiak, Alaska, provided an opportunity for local students, teachers, fishing and conservation representatives, and elected officials to come aboard the *R/V Atlantis* and view the *Alvin* and the science made possible by this expedition.

Many of the outreach opportunities developed through the Gulf of Alaska cruise can be duplicated on other research cruises, and all major OE expeditions include many of these initiatives, as do some of the minor expeditions. Details can be found on the NOAA Ocean Explorer website at <http://oceanexplorer.noaa.gov>.

#### ED52B-0018 1330h POSTER

##### Gummi-Bears On Fire! Bringing Students and Scientists Together at the Alaska Summer Research Academy (ASRA)

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When a gummi-bear is introduced into hot potassium chlorate there is a powerful reaction. This is analogous to the response we have seen to the Alaska Summer Research Academy (ASRA). ASRA is a residential science research camp supported by the College of Science, Engineering and Mathematics at the University of Alaska Fairbanks. The hallmark of ASRA is the opportunity for small groups of 4 or fewer students, ages 10-17, to conduct scientific research and participate in engineering design projects with university faculty and researchers as mentors. Participating scientists, engineers, faculty, graduate students, and K-12 teachers from a variety of disciplines design individual research units and guide the students through designing and constructing a project, collecting data, and synthesizing results. The week-long camp culminates with the students from each project making a formal presentation to the camp and public. In its second year ASRA is already a huge success, quadrupling in size from 21 students in 2001 to 89 students in 2002. Due to a high percentage of returning students, we anticipate there will be a waiting list next year. This presentation contains perspectives from administrators, instructors, staff, and students. Based on our experience we feel there is a large potential demand for education and public outreach (EPO) in university settings. We believe the quality and depth of the ASRA experience directly contributes to the success of a worthwhile EPO program. ASRA will be portrayed as a useful model for EPO at other institutions.

URL: <http://www.uaf.edu/csem/asra/>

#### ED52B-0019 1330h POSTER

##### Using Remote Sensing Technology, Web Casts, and Participation in a Valuable Research Project to Jazz Teachers and Excite Students About Science

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Scientific education of primary and secondary school children has become a topic of concern in Ohio and throughout the United States. So with that in mind, how do you get students excited about learning science? One route is to inform and jazz teachers about current technology! The University of Toledo has hosted three one-week, NASA and OhioView sponsored professional development institutes entitled, *Observing Earth from Space*, for teachers from grades K-12 during July 2000, 2001, and 2002. Sixty-seven teachers from the Upper Midwest and Kansas with Earth Science, Social Studies, and Physics backgrounds attended. Each participant acquired new ideas, plenty of educational materials, and posters of satellite imagery. The teachers received basic training in remote sensing, global positioning systems, digital elevation models, and weather observing techniques and learned about useful remote sensing applications. This instruction was conducted through: 1) presentations given by research scientists, 2) integration of the learned content

into authentic, hands-on lesson plans, and 3) participation in a learning adventure, where their students collected real-time earth science data at their respective schools while university research scientists gathered corresponding satellite imagery. The students observations were submitted via a simple Web interface: [www.remotesensing.utoledo.edu](http://www.remotesensing.utoledo.edu). One of the very exciting platforms used to communicate with the teachers and students throughout the school year were live Web Casts sponsored by NASA Glenn Research Center. The students data have successfully assisted in the validation of cloud/snow remote sensing algorithms, and next year the students observations will include various surface temperature readings. The participation in a cutting-edge technology workshop and in an important global climate change research project, applicable in the classroom, has added another worthwhile dimension to the learning process and career awareness for both the teachers and their students.

#### ED52B-0020 1330h POSTER

##### A Comprehensive Approach to Partnering Scientists with Education and Outreach Activities at a National Laboratory

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With the establishment of an Office of Education and Outreach (EO) in 2000 and the adoption of a five-year EO strategic plan in 2001, the University Corporation for Atmospheric Research (UCAR) committed to augment the involvement of AGU scientists and their partners in education and public outreach activities that represent the full spectrum of research in the atmospheric and related sciences. In 2002, a comprehensive program is underway which invites scientists from UCAR, the National Center for Atmospheric Research (NCAR), and UCAR Office of Programs (UOP) into partnership with EO through volunteer orientation workshops, program specific training, skill-building in pedagogy, access to classroom resources, and program and instructor evaluation. Scientists contribute in one or several of the following roles: program partners who bridge research to education through collaborative grant proposals; science content advisors for publications, web sites, exhibits, and informal science events; science mentors for high school and undergraduate students; NCAR Mesa Laboratory tour guides; scientists in the schools; science education ambassadors to local and national community events; science speakers for EO programs, conferences, and meetings of local organization; and science wizards offering demonstrations at public events for children and families. This new EO initiative seeks to match the expertise and specific interests of scientists with appropriate activities, while also serving as a communications conduit through which ideas for new activities and resources can be seeded and eventually developed into viable, fully funded programs.

URL: [http://www.ucar.edu/educ\\_outreach/volunteer/](http://www.ucar.edu/educ_outreach/volunteer/)

#### ED52B-0021 1330h POSTER

##### Project ASTRO-Tucson: An Educational Outreach Program For All Seasons

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Project ASTRO-Tucson represents a flexible program that is broad in content coverage and has utility for a diverse educational audience. As such, Project ASTRO forms the core of the National Optical Astronomy Observatories successful regional outreach program. The program is aligned with the National Science Education Standards, appeals to different teaching and learning styles and can be adapted for space, staff, and money constraints at individual schools. ASTRO is broad in its astronomy content coverage and also addresses the scientific process, best practices and pedagogy, student misconceptions, and authentic assessment issues. In Tucson it has been used successfully with elementary, middle and high school students of

different ethnic backgrounds, as well as with handicap-challenged and under-served students. ASTRO-Tucson is one of 13 sites nationally that have collectively reached over 100,000 students in the last 6 years.

The programs core element is the partnering of professional and amateur astronomers with K-12 teachers and community educators who want to enrich their astronomy and science teaching. The partnerships are extended through a training workshop, hands-on activities, effective educational materials, follow-up workshops, continued staff support, and connections to community resources. In turn, the interest generated by Project ASTRO has fostered new programs such as Family ASTRO (just begun in Tucson), which invites families to evening or weekend family events doing fun astronomy activities together. We will describe some of the lessons learned from the Project ASTRO and Family ASTRO programs in Tucson and discuss efforts to jump-start and localize a Project ASTRO-type program in Chile at Cerro Tololo Inter-American Observatory.  
URL: <http://www.noao.edu/education/noaoeco.html>

#### ED52B-0022 1330h POSTER

##### Science Education Using a Computer Model-Virtual Puget Sound

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We created an interactive learning environment based on an oceanographic computer model of Puget Sound-Virtual Puget Sound (VPS)-as an alternative to traditional teaching methods. Students immersed in this navigable 3-D virtual environment observed tidal movements and salinity changes, and performed tracer and buoyancy experiments. Scientific concepts were embedded in a goal-based scenario to locate a new sewage outfall in Puget Sound.

Traditional science teaching methods focus on distilled representations of agreed-upon knowledge removed from real-world context and scientific debate. Our strategy leverages students' natural interest in their environment, provides meaningful context and engages students in scientific debate and knowledge creation.

Results show that VPS provides a powerful learning environment, but highlights the need for research on how to most effectively represent concepts and organize interactions to support scientific inquiry and understanding. Research is also needed to ensure that new technologies and visualizations do not foster misconceptions, including the impression that the model represents reality rather than being a useful tool. In this presentation we review results from prior work with VPS and outline new work for a modeling partnership recently formed with funding from the National Ocean Partnership Program (NOPP).

#### ED52B-0023 1330h POSTER

##### Dive and Explore: An Interactive Exhibit That Simulates Making an ROV Dive to a Submarine Volcano, Hatfield Marine Science Visitor Center, Newport, Oregon

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We have created a new interactive exhibit in which the user can sit down and simulate that they are making a dive to the seafloor with the remotely operated vehicle (ROV) named ROPOS. The exhibit immerses

the user in an interactive experience that is naturally fun but also educational. This new public display is located at the Hatfield Marine Science Visitor Center in Newport, Oregon. The exhibit is designed to look like the real ROPOS control console and includes three video monitors, a PC, a DVD player, an overhead speaker, graphic panels, buttons, lights, dials, and a seat in front of a joystick. The dives are based on real seafloor settings at Axial seamount, an active submarine volcano on the Juan de Fuca Ridge (NE Pacific) that is also the location of a seafloor observatory called NeMO. The user can choose between 1 of 3 different dives sites in the caldera of Axial Volcano. Once a dive is chosen, then the user watches ROPOS being deployed and then arrives into a 3-D computer-generated seafloor environment that is based on the real world but is easier to visualize and navigate. Once on the bottom, the user is placed within a 360 degree panorama and can look in all directions by manipulating the joystick. By clicking on markers embedded in the scene, the user can then either move to other panorama locations via movies that travel through the 3-D virtual environment, or they can play video clips from actual ROPOS dives specifically related to that scene. Audio accompanying the video clips informs the user where they are going or what they are looking at. After the user is finished exploring the dive site they end the dive by leaving the bottom and watching the ROV being recovered onto the ship at the surface. The user can then choose a different dive or make the same dive again. Within the three simulated dives there are a total of 6 arrival and departure movies, 7 seafloor panoramas, 12 travel movies, and 23 ROPOS video clips. The exhibit software was created with Macromedia Director using Apple Quicktime and Quicktime VR. The exhibit is based on the NeMO Explorer web site (<http://www.pmel.noaa.gov/vents/nemo/explorer.html>).

#### ED52B-0024 1330h POSTER

##### The Rising Tide Project: Establishing a Sustainable and Desirable Tradition of Productive Interaction Between Researchers and Teachers

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With the support of an NSF Geoscience Education award, the Rising Tide Project was piloted during the summer of 2002 at Coastal Carolina University. The programs goal is to raise the level of scientific awareness and confidence on a local level by fostering collaboration between researchers, educators, and undergraduates. High school science teachers from surrounding counties work 120 hours during the summer with a university researcher and an undergraduate science major on a locally relevant marine science research project. Using the methodology and data from their experience, the teams design discovery- and inquiry-based activities for the teachers classrooms that emphasize hypothesis testing, data manipulation, and interpretation. After being tested in the classroom and revised, the web-based activities are posted on the South Carolina Aquariums educational web site. A series of built-in incentives attract faculty, teachers, and students into the program, and corporate sponsorship of teacher/student teams provides long-term sustainability. Due to the local emphasis and flexible scheduling, over 10% of the high school science teachers from surrounding counties applied for the program. Faculty researchers are attracted to the program because it enhances their research and teaching activities without imposing an unreasonable workload. Although designed for marine science programs in South Carolina, the Rising Tide model is adaptable to other disciplines and locations.

#### ED52B-0025 1330h POSTER

##### The PISCES Project: Bringing Graduate Students into Elementary School Classrooms

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The PISCES Project (Partnerships Involving the Scientific Community in Elementary Schools) is an NSF G-K12 funded initiative that is in its fourth year of funding. In the Project graduate students from San Diego State University, California State University San Marcos, and University of California San Diego partner with San Diego area elementary school teachers to immerse students in hands-on standards-based elementary science curriculum. The project has grown from 24 teachers representing 7 school districts and 10 Science Corps Fellows (graduate students), to over 100 teachers from 14 districts and 22 Fellows. During the second project year, Fellows interacted for over 10,000 hours with K-12 students. This close interaction, coupled

with high quality, ongoing professional development for teachers and intensive outreach efforts has resulted in increased student enthusiasm for science from K-6 students, an appreciation of the importance of high quality science education from Fellows, and improved commitment by teachers to utilize hands-on science materials.  
URL: <http://www.sdsu.org/pisces>

#### ED52B-0026 1330h POSTER

##### Teachers and Researchers Collaborate to Bring a Polar Field Experience to the K-12 Classroom

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Through a NSF sponsored program, Teachers Experiencing Antarctica and the Arctic (TEA), K-12 classroom teachers are linked with polar researchers to create science investigations in the classroom which model the real process of science. In addition, the teachers build on their research experience to work in their communities establishing a growing Polar Learning Community using engaging and innovative ways which underscore the relevance of polar science and our society.  
URL: <http://www.tea.rice.edu>

#### ED52C MCC: Hall C-TH Friday 1330h

##### Using Global Data Sets in a Local Context (joint with OS, S, T, GC, PA)

Presiding: C Manduca, Carleton Science Education Resource Center; D Mogk, Montana State University

#### ED52C-01 1330h

##### Drawing Connections Between Local and Global Observations: An Essential Element of Geoscience Education

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One of the hallmarks of geoscience research is the process of moving between observations and interpretations on local and global scales to develop an integrated understanding of Earth processes. Understanding this interplay is an important aspect of student geoscience learning which leads to an understanding of the fundamental principles of science and geoscience and of the connections between local natural phenomena or human activity and global processes. Several techniques that engage students in inquiry and discovery (as recommended in the National Science Education Standards, NRC 1996, Shaping the Future of Undergraduate Earth Science Education, AGU, 1997) hold promise for helping students make these connections. These include the development of global data sets from local observations (e.g. GLOBE); studying small scale or local phenomenon in the context of global models (e.g. carbon storage in local vegetation and its role in the carbon cycle); or an analysis of local environmental issues in a global context (e.g. a comparison of local flooding to flooding in other countries and analysis in the context of weather, geology and development patterns).

Research on learning suggests that data-rich activities linking the local and global have excellent potential for enhancing student learning because 1) students have already developed observations and interpretations of their local environment which can serve as a starting point for constructing new knowledge and 2) this context may motivate learning and develop understanding that can be transferred to other situations. (How People Learn, NRC, 2001). Faculty and teachers at two recent workshops confirm that projects that involve local or global data can engage students in learning by providing real world context, creating student ownership of the learning process, and developing scientific skills applicable to the complex problems that characterize modern science and society. Workshop participants called for increased dissemination of examples of effective practice, evaluation of the impact of data-rich activities on learning, and further