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Onondaga Lake, in Syracuse, NY, is described by the EPA as one of the most polluted lakes in the US. High levels of heavy metal and semi-volatile organic contamination provide an excellent case study that serves as the cornerstone for an environmental geochemistry course at Colgate University. Our course is designed to teach students basic environmental analysis skills including experimental design, sample preparation, analytical instrumentation operation, data processing and statistical analysis, and preparation of a collaborative scientific paper. Participating students generally have some background in environmental geology, but rarely more than one semester of chemistry. The Onondaga Lake project is the focus of the course for approximately half the semester. At the outset of the project, students are presented with a driving question that is answered through a series of guided field and lab investigations, such as an assessment of the environmental consequences of a proposed marina along the lakefront. The students' first task is to delve into the lake's environmental history, including identification of contaminants, location of point and non-point pollution sources, and clean-up efforts. Students then participate in 2 field trips to the site. First, students learn the geography of the lake system, collect sediment and water samples, and observe mitigation efforts at the wastewater treatment plant. The second trip is 2-3 weeks later, after students have assessed further sampling needs. Identification and quantification of organic compounds are accomplished by GC-MS, and heavy metal contents are determined by ICP-MS. Students compile their results, perform statistical analyses, and collaboratively draw their conclusions regarding the impact of the proposed project. The final product is a single report written by the entire class, an exercise in organization, cooperation, and planning that is usually the most challenging, but ultimately the most rewarding, aspect of the project. Basic laboratory and data processing skills are introduced to the class as they become necessary, but not before they are applied to the project. We have found that students find these very real environmental questions so compelling that they are motivated to learn the necessary skills when, in a more isolated laboratory setting, they would often otherwise be intimidated by them. Instead, the Onondaga Lake case study provides students with a powerful motivating force to learn both environmental geochemistry and the underlying chemical principles.

ED31A-06 0830h POSTER

Training Undergraduate Physics Peer Tutors

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The University of Wisconsin's Physics Peer Mentor Tutor Program matches upper level undergraduate physics students in small study groups with students studying introductory algebra-based physics. We work with students who are potentially at-risk for having academic trouble with the course. They include students with a low exam score, learning disabilities, no high school physics, weak math backgrounds, and/or on academic probation. We also work with students from groups under represented in the sciences and who may be feeling isolated or marginal on campus such as minority, returning adult, and international students. The tutors provide a supportive learning environment, extra practice problems, and an overview of key concepts. In so doing, they help our students to build confidence and problem solving skills applicable to physics and other areas of their academic careers. The Physics Peer Mentor Tutor Program is modeled after a similar program for chemistry created by the University of Wisconsin's Chemistry Learning Center. Both programs are now run in collaboration. The tutors are chosen for their academic strength and excellent communication skills. Our tutors are majoring in physics, math, and secondary-level science education. The tutors receive ongoing training and supervision throughout the year. They attend weekly discipline-specific meetings to discuss strategies for teaching the content currently being discussed in the physics course. They also participate in a weekly teaching seminar with science tutors from chemistry and biochemistry to discuss teaching methods, mentoring, and general information relating to the students with whom we work. We will describe an overview of the Physics Peer Mentor Tutor Program with a focus on the teacher training program for our undergraduate tutors.

ED31A-07 0830h POSTER

The Radio JOVE Project: A New Multi-channel Spectrum Analyzer

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A new radio spectrograph is now operational at the University of Florida Radio Observatory (UFRO) via the education and public outreach project called the Radio JOVE project (<http://radiojove.gsfc.nasa.gov>). The UFRO telescope is a 16-element 10-40 MHz log spiral array which is sensitive to both right-hand and left-hand circular polarization. Another spectrograph is connected to a 17-30 MHz log-periodic antenna located at Windward Community College in Hawaii (<http://jupiter.wcc.hawaii.edu>). Freely available software from Radio-Sky Publishing (<http://www.radiosky.com>) allows students, teachers, and radio astronomy enthusiasts to view the spectral data in real time via the Internet. Ultimately team members will be able to log on to the telescope and control the antenna and spectrometer's total sweep range, polarization, and calibrations. The software and telescope controls are discussed, and recent data results are shown. These data are of high quality and can lead to research applications.

ED31A-08 0830h POSTER

Modern Views of Ancient Solar Observatories

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The NASA Sun-Earth Connection Education Forum (SECEF) annually promotes an event called Sun-Earth Day. The event emphasizes the study of the Sun and its effects on the Earth and the rest of the Solar System. Sun-Earth Day 2004 will emphasize the June 8th Transit of Venus as a theme. For 2005 the highlight will be the study of the Sun by ancient cultures and how that relates to contemporary solar knowledge. There are many examples of ancient solar observatories around the world, but some of the best are found in National Parks. SECEF has been working with Chaco Culture National Historical Park in New Mexico to do a webcast showing knowledge about the Sun by the Chacoan people that is evident in the park. The Sun Dagger and other pictographs as well as Chaco building alignments indicate the influence of the Sun in the lives of this people. The cooperative planning for this event by NASA and the National Park Service (NPS) will be discussed. Other events emphasizing ancient observatories in other locations are also planned for the future. The partnership between SECEF and NPS is not limited to ancient observatories, however. The influence of the Sun on our daily lives is an appropriate topic for many parks and the possibilities for solar exhibits, daytime astronomy sessions, scientist lectures, etc. will be discussed as well.

URL: <http://sunearth.gsfc.nasa.gov>

ED33A CC: 518 C Wednesday 1330h

Communicating the Science of Climate Change to Teachers, Students, and the General Public (joint with A, GC)

Presiding: P Folger, American Geophysical Union; S Buhr, Cooperative Institute for Research in Environmental Sciences (CIRES); M A Geller, Institute for Terrestrial and Planetary Atmospheres, Stony Brook University

ED33A-01 1330h

Climate and Global Change Education and Outreach for Students, Teachers, and the Public at the National Center for Atmospheric Research, Boulder, Colorado

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The National Center for Atmospheric Research in Boulder Colorado is a leading research institution in the area of global and climate change research worldwide. As a component of NCAR's mission in research, education, and service, NCAR supports numerous programs designed to bring this science to different audiences in order to promote better understanding of climate and global change research as well as its relevance in learning contexts. Our climate and global change education and outreach effort targets several audiences, including professional development for middle and high school educators, exhibits, tours, websites, and development of educational resources on climate and global change topics. The design of our program intentionally leverages resources in support of multiple audiences in different settings. Over 80,000 visitors come to the NCAR Mesa Laboratory each year, and now have the opportunity to visit our new Climate Discovery exhibit unveiled in July 2003. This exhibit, which includes integrated curriculum resources addressing topics highlighted in the exhibit, will soon be extended to include an interactive Climate Future gallery. Our two-week summer professional development workshops - the NCAR Climate and Global Change Workshop and the NCAR Modeling in the Geosciences Workshop - provide extensive background information on the state-of-the-art of climate and global change research and modeling provided by leading researchers, training on computer- and non-computer based activities, field trips, project development, training for dissemination, and opportunities to share with their colleagues. Our education and outreach websites are now being expanded to include dedicated content and interactives addressing climate and global change topics, including the NCAR Education and Outreach website (www.ncar.ucar.edu/eo) and the Windows to the Universe website (www.windows.ucar.edu).

ED33A-02 1345h

Climate and Global Change: Programs and Services Reaching Public and K-12 Audiences at a National Research Laboratory

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The study of climate and global change is an important on-going focal area for scientists at the National Center for Atmospheric Research (NCAR). Programs overseen by the University Corporation for Atmospheric Research Office of Education and Outreach

(UCAR-EO) help to translate NCAR's scientific programs, methodologies, and technologies, and their societal benefits to over 80,000 visitors to the NCAR Mesa Laboratory each year. This is accomplished through the implementation of exhibits, guided tours, an audiotour, programs for school groups, and a teachers' guide to exhibits which is currently in development. The Climate Discovery Exhibit unveiled in July 2003 offers visitors a visually engaging and informative overview of information, graphics, artifacts, and interactives describing the Earth system's dynamic processes that contribute to and mediate climate change, the history of our planet's changing climate, and perspectives on geographic locations and societies around the world that have potential to be impacted by a changing climate. Climate Futures, an addition to this exhibit to open in the summer of 2004, will help visitors to understand why scientists seek to model the global climate system and how information about past and current climate are used to validate models and build scenarios for Earth's future climate, while clarifying the effects of natural and human-induced contributions to these predictions. UCAR-EO further strives to enhance public understanding and to dispel misconceptions about climate change by bringing scientists' explanations to visitors who learn about atmospheric sciences while on staff-guided tours and/or while using an audiotour developed in 2003 with a grant from the National Science Foundation. With advanced reservations, a limited number of visitors may experience demonstrations of climate models in the NCAR Visualization Laboratory. An instructional module for approximately 5,000 visiting school children and a teachers guide for the Climate Discovery Exhibit is in the development and field testing phase with a goal to promote interest in and understanding of how climate change studies align with K-12 science standards. Over the next year, much of the content will become available to national audiences via the new NCAR EO web site (www.ncar.ucar.edu/eo), UCAR-EO's summer teachers workshops, and sessions at the National Science Teacher Association meetings.

ED33A-03 1400h

Climate Change and K-12 Professional Development Opportunities at UCAR/NCAR

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Recognizing the paucity of information in K-12 textbooks related to climate change, UCAR's Office of Education and Outreach has developed two summer workshops designed to enhance earth science teacher's knowledge of climate and global change. The two workshops, Climate and Global Change for Geoscience Educators and Modeling in the Geosciences, comprise a significant component of UCAR/NCAR's teacher professional development efforts. The overall goals of the workshops are to provide standards-relevant science content, instruction on easy to implement inquiry-based classroom activities, and a broad overview of the geosciences to educator-leaders who are teaching sciences at the middle and high school levels. In its third year, the Climate and Global Change for Geoscience Educator workshop (sponsored by NCAR) focuses on the scientific foundation of climate change with an Earth system science focus and highlighting societal impacts, mitigation opportunities, and policy perspectives. Summer of 2004 will be the second year the Modeling in the Geosciences (sponsored by NASA) has been offered. This workshop explores modeling as a tool for better understanding Earth as a system including in-depth investigation of how scientists use climate models to better understand change. Both workshops include presentations by leaders in scientific research, instruction in appropriate technologies, standards based activities, field trips, project work, and discussions about pedagogy, educational standards, and classroom implementation. Both workshops use distance-learning resources to extend the experience past the summer residency, thus providing ongoing support and community mentoring opportunities. Applications for the workshops have far outweighed available space suggesting a need for such workshops. The selection process takes into account the need for a diverse group of participants, balanced between middle and high school educators, with a commitment to sharing the information

and resources that they receive through the workshops with colleagues in their home school districts via additional workshops, seminars, and presentations. This presentation will share the results of ongoing evaluation efforts of both workshops and a follow-up discussion of effective classroom implementation strategies.

ED33A-04 1415h

Global Climate Change: using field studies to prepare the next generation of scientists

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Global Climate Change is a new and invigorating concept in the pre-college classroom. To some it portends the altering of the Earth's climate by introducing anthropogenic influences and for others the natural progression of the Earth's systems. Regardless, climate change involves a plethora of environmental interactions and comprehension is a challenge for both teachers and students. This paper addresses a field studies program that prepares students to complete research projects associated with climate models affecting montane environments. It emphasizes a partnership between researchers from universities, government agencies, and public schools and their support of pre-college students in inquiry learning and research activities.

Beginning in 1994 students from a Pennsylvania high school and schools in Scotland have engaged in biannual holistic studies of montane and glacial environments with the objective of completing investigations concerning the energy budgets of these environments. This paper will focus on 2000 and 2002, and the support and partnership of Dr. Jeff Hare and CIRES in designing, supporting, and providing professional interpretations, while assisting teachers and students toward the completion of recognized papers regarding climate studies. Introducing students to the employment and operation of complex field equipment will be discussed. URL: <http://www.wyoming2002.org>

ED33A-05 1430h

What's Happening in my Backyard? A New England Focus on Global Climate Change

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Global climate change remains a difficult concept for the general public to understand. Melting ice sheets and ozone holes have little to do with their everyday lives. Despite this, there is strong evidence of widespread concern of global warming and climate change due to human activities. In order to educate New Englanders concerning climate change, the Atmospheric Investigation, Regional Modeling, Analysis and Prediction (AIRMAP) project has chosen to focus on developing and disseminating data and information on change within New England. Our approach is based on the notion that individuals can connect and understand climate change in their own backyards, whether it is warmer winters, an increase in precipitation, a longer growing season, more ozone exceedance days, or earlier lilac blooms. This data is also made available in easy to view formats on the AIRMAP web page, along with real-time air quality data, so that the general public can investigate change in their backyards on their own. Our experience suggests that students, teachers, and the general public become more interested in the global climate change when they connect it to their local environment.

URL: <http://airmap.unh.edu>

ED33A-06 1445h

Is This Global Warming? Communicating the Intangibles of Climate Change

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Unlike weather, which is immediate, tangible, and relevant on a daily basis, climate change is long-term,

slow to evolve, and often difficult to relate to the public's daily concerns. By explaining global-change research to wide and diverse audiences through a variety of vehicles, including publications, exhibits, Web sites, and television B-roll, UCAR has gained experience and perspective on the challenges involved. This talk will explore some of the lessons learned and some of the key difficulties that face global-change communicators, including: -The lack of definitive findings on regional effects of global change - The long time frame in which global change plays out, versus the short attention span of media, the public, and policy makers -The use of weather events as news pegs (they pique interest, but they may not be good exemplars of global change and are difficult to relate directly to changes in greenhouse-gas emissions) -The perils of the traditional journalistic technique of point-counterpoint in discussing climate change -The presence of strong personal/political convictions among various interest groups and how these affect the message(s) conveyed

ED34A CC: 518 C Wednesday 1530h

Multinational Education and Outreach Programs in the Earth and Space Sciences

Presiding: H Gaonac'h, Universit du Qubec Montral; C Laj, Laboratoire des Sciences du Climat et de l'Environnement

ED34A-01 1530h

The Benefits and Challenges of Education and Public Outreach Efforts Associated With Scientific Research Programs

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Earth and space science research programs, institutions, and societies the world over are increasingly attentive to the importance and value of scientists' involvement in effective education and public outreach (EPO). At the Fall 2003 meeting of the American Geophysical Union (AGU), the authors of this paper convened a successful session where scientist-educator partnerships presented papers about their EPO programs and the benefits and challenges of having them closely associated with scientific research programs, institutions, and spaceflight projects. It was the largest education session out of the unprecedented 24 sessions that were approved. Our session's invitees and contributors represented multiple AGU space and Earth science disciplines, and included a mix of large, medium, and small EPO programs and projects. We surveyed all poster and oral presenters to ask them for the top three benefits and three challenges they faced in their work. This paper will summarize the results of this survey. We intend for our paper to be a valuable resource for the broader international community of those interested in optimizing the integration of exemplary EPO programs with scientific research programs, and in supporting effective EPO roles for research scientists.

ED34A-02 1545h

S'COOL: Providing Flexibility to Explore Science with NASA in 64 Countries

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