A SUMMARY OF THE 18TH AMS SYMPOSIUM ON EDUCATION

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The education symposium, held as part of the annual meeting of the American Meteorological Society (AMS), brings together people interested in education related to the atmospheric sciences at every level from kindergarten to 12th grade and provides a unique opportunity for them to connect with one another. While a planning committee chooses a few special topics each year, conference themes emerge organically from the combination of formal presentations and informal conversations. In 2009, three themes emerged: collaboration, including international collaboration; technology to broaden the reach of atmospheric science education; and strategies to teach more atmospheric science in a crowded K–12 curriculum. The conference was dominated by a pragmatic approach to these themes: Attendees did not debate the merit of different pedagogical approaches; instead, they focused on offering a suite of approaches to create more opportunities for students to learn atmospheric and related sciences.

THE 18TH AMS SYMPOSIUM ON EDUCATION

WHAT: Educators at all levels shared effective strategies for increasing the quality and quantity of education in the atmospheric and related sciences. Broad themes included a focus on collaboration, use of technology to enable learning, and strategies to get more atmospheric and related sciences into K–12 schools.
WHEN: 11–13 January 2009
WHERE: Phoenix, Arizona

SPECIAL SESSION: NOAA'S EDUCATION AND OUTREACH. The education symposium opened with a special session focused on the educational activities of the National Oceanic and Atmospheric Administration (NOAA). It was especially timely to consider NOAA's education efforts in light of the 2007 America Competes Act, which provided the first formal mandate for NOAA's support of

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education in the areas of weather, climate, and oceanography. The themes of NOAA's presentations paralleled those of the symposium as a whole: collaboration, more teaching of atmospheric science, and using technology.

One way NOAA fosters collaboration is with external grants, and three presentations described national and regional funding opportunities, including support for undergraduate and graduate students studying in NOAA-related disciplines (see the sidebar for a list of online resources).

NOAA presenters described strategies they are using to increase the amount that students learn about the atmosphere in K–12 classes. One strategy is to create a set of literacy principles that will influence state and local standards and help ensure a place for weather and climate in crowded K–12 curricula. NOAA also helps teachers learn or become more comfortable with atmospheric science concepts, which makes them more likely to include them in their classes. The Teacher at Sea program, for example, invites 20–30 teachers a year to participate in NOAA research, either at sea, in the air, or in the field.

Several presentations emphasized NOAA's increasing use of technology to reach broader audiences. One presenter described how the National Weather Service is doing fewer resource- and time-intensive classroom visits and instead investing in technology to provide broader outreach through interactive online activities, technology-driven media kiosks, and computer games. Another presenter described the NOAA Ocean Data Education (NODE) Project, which uses real-time NOAA data to enhance the understanding of basic science processes. A module on El Niño, presented as an example, introduces students to online data through five levels of interaction, beginning with entry (where students first learn about El Niño) and ending with invention, where they use the data to investigate their own, original ideas about El Niño.

ANNUAL SESSION 1: K–12 AND INFORMAL EDUCATION. Collaboration was taken to international levels when participants were invited to submit abstracts for the Eighth International Conference on School and Popular Meteorological and Oceanic Education, also known as Education: Water, Oceans, Climate (EWOC). EWOC 2009 provided an opportunity to discuss international meteorological and climate education initiatives that were under way around the world and across the full range of grade levels in formal to informal educational settings.

A number of the programs presented in the K–12 session leveraged technology. The Center for Multiscale Modeling of Atmospheric Processes (CMMAP) at Colorado State University has teamed with the University Corporation for Atmospheric Research (UCAR)'s Windows to the Universe Web site to develop online content, interactive online activities, and image galleries related to climate and climate modeling. Project BudBurst is a nationwide community science initiative designed to engage the public in observations of phenological (plant life cycle) events. By using Web-based forms to report the dates on which plants produce leaves, flower, and set seeds, kids and adults across the United States gain awareness of climate change and contribute data for scientific investigation.

The K–12 session included unique emphasis on the effectiveness of an "old fashioned" face-to-face classroom. The Oklahoma Climatological Survey, for example, has developed a 1-day "climate training" workshop for local and regional planners focused on the fundamentals of climate and weather, sources of climate information, climate change, and special topics such as drought and hazards. The University of Northern Iowa, with NOAA support, has offered a 1-week course on air quality for middle and high school teachers. In talking about their programs, both of these presenters emphasized that face-to-face interaction with a variety of instructors was key to the success of their programs.

JOINT SESSIONS WITH THE ANNUAL SYMPOSIUM ON FUTURE NATIONAL OPERATIONAL SATELLITE SYSTEMS (GOES-R AND NPOESS) AND THE CONFERENCE ON SATELLITE METEOROLOGY AND OCEANOGRAPHY. In 2009, for the first time, the education symposium, the annual symposium on future national operational satellite systems [Geostationary Operational Environmental Satellite-R Series (GOES-R) and National Polar-orbiting Operational Environmental Satellite System (NPOESS)], and the conference on satellite meteorology and oceanography combined efforts for two joint sessions on education and training relevant to satellite remote sensing.

Many of the presentations in the first joint session built on the proving-ground approach that underpins training for the new GOES-R. In this approach training and product development are linked; trainees use prototype products and provide feedback to improve the ultimate usability of those products even as the products themselves are being developed.

Since GOES-R has not yet launched, presenters explained that the prototype products are simulated by combining data from existing sensors. Two examples of this included simulating the data provided by the new Geostationary Lightning Mapper and using the Moderate Resolution Imaging Spectroradiometer (MODIS) data to simulate new data planned for the Advanced Weather Interactive Processing System (AWIPS). Not only does this troubleshoot the development of satellite products, but it ultimately allows people to deliver training in advance of the satellite launch, so that forecasters are ready to use new products as soon as they become available.

The second part of the joint session focused on satellite forecaster training. In keeping with the global coverage provided by satellites, the session had an international flavor. It began with an overview of satellite training activities for operational weather forecasters, which has been a cooperative effort involving NOAA, the Cooperative Program for Operational Meteorology, Education and Training (COMET), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), and the World Meteorological Organization (WMO), and has resulted in a network of training programs worldwide. The second presentation discussed the Web-based training for satellite imagery that EUMETSAT provides to forecasters in Europe, Africa, the Middle East, and countries in Central and South America. The third presentation described COMET's latest endeavor, the Environmental Satellite Resource Center, a Web site that focuses on satellite meteorology products. Finally, Google Earth showed up again in this year's symposium, this time as a training tool that forecasters can use to display a combination of measured and observed datasets associated with hurricane cases.

The session concluded with a number of presentations related to NPOESS, especially focusing on the training that forecasters will need to be able to use NASA's new NPOESS products to enhance local- and regional-scale weather predictions. Two presentations together described the new sensors on NPOES, and some examples of how the data from these new sensors can improve environmental detection and prediction. In particular, the Visible Infrared Imaging Radiometer Suite (VIIRS) will add a new low-light visible channel that will extend the effective area that can be observed at any one time.

ANNUAL SESSION 2: UNIVERSITY AND COLLEGE EDUCATION. The first university session highlighted use of the Web to reach a broad array of students, stakeholders, and the general public. One presentation, for example, emphasized the success of WxChallenge (http://wxchallenge.com), a competition that enhances weather forecasting skills of students across North America via an online contest.

The second session emphasized the importance of bringing a diverse perspective to the discipline, being inclusive, and improving communication skills with broad audiences. A new focus in 2009 was the attention to engaging people with disabilities in atmospheric science. Imke Durre of NOAA presented strategies she uses to effectively communicate between blind and sighted researchers. A second presentation described adaptive strategies and assistive technology for persons with limited mobility and speech. Both presenters emphasized that having supportive mentors and collaborators who understood their needs and abilities was more important than any adaptive technology. A presentation introducing the McNair program, which focuses on increasing the number of diverse students entering doctoral programs and improving their chance of success while there, rounded out the emphasis on diversity.

The final presentation of the university session highlighted interactive Web-based modules developed by COMET, on topics such as hydrology and fire weather, which are helping broadcasters move beyond weather to become "station scientists."

JOINT SESSION WITH INTERACTIVE INFORMATION AND PROCESSING SYSTEMS (IIPS) FOR METEOROLOGY, OCEANOGRAPHY, AND HYDROLOGY. This joint session with IIPS and education wove together the themes of collaboration and technology by highlighting projects that link meteorologists and educators to introduce students to collecting, sharing, integrating, and visualizing meteorological data. The first presentation, from the Community Collaborative Rain, Hail, and Snow Network (CoCoRaHS), described how volunteers can observe and report precipitation at their home or school, providing high-resolution precipitation data that can be used to improve forecasts and as a venue for learning science. Another presentation described further progress on the Linked Environments for Atmospheric Discovery (LEAD) gateway, which allows students and K–12 educators to set up, run, and analyze numerical weather models quickly, efficiently, and with learner-centered interfaces that move the computer programming "out of their way."

In another link to international collaboration, Patrick Parrish of COMET invited the audience to

WEB LINKS

Most of the resources described in the symposium are available on the Web. This list highlights some of these resources. In addition, all the talks and posters presented at the symposium are available online (http://ams.confex.com/ams/89annual/techprogram/programexpanded_520.htm).

From the special session on NOAA:
- Climate Literacy Network invites visitors to learn about and even participate in the process of developing climate literacy (http://cleanet.org/cln/index.html)
- NOAA provides an overview of the many opportunities for undergraduate and graduate students (www.oesd.noaa.gov/noaa_student_opps.html)
- NOAA's Data in the Classroom (NODE) (http://datainthecclassroom.org/)

Other Web sites of interest include the following:
- Project Budburst (www.windows.ucar.edu/citizen_science/budburst/)
- CoCoRaHs (www.cocorahs.org/)
- International training programs in satellite meteorology (www.comet.ucar.edu)
- The McNair program at Embry-Riddle Aeronautical University includes programs in atmospheric and related sciences (www.erau.edu/pr/mcnair/)

consider attending the "creating activities for learning meteorology" (CALMet) conferences. The international venue offers participants an opportunity to learn about teaching techniques and tools used in other countries.

This combined session provided an opportunity to consider how meteorologists, educators, and students can benefit through cooperative efforts. Improving the manner in which youth are educated may further inspire this young generation, leading to richer lives through their understanding of the environment in which we live. It is hoped that by working together to improve accuracies in assessment and forecasting, lives will be saved and greater harmony will result from these educational efforts around the globe.

CONCLUSIONS. The education symposium provides a chance for people interested in atmospheric science education to share effective strategies, update each other on their progress, and even have a frank discussion of lessons learned. While there is no formal process for the conference to define a theme, certain ideas emerge from the collection of presentations, providing a window into the current and ongoing issues involved in atmospheric science education.

Many attendees felt that the K–12 curriculum provides too few opportunities to teach atmospheric science concepts, especially since these concepts are important for understanding climate change. As in previous years, several presentations suggested strategies or designed curricula that can teach atmospheric sciences in other contexts. A new approach focused on gaining more prominence for atmospheric science by defining a set of standards that can flow into the design of curriculum.

As in previous years, technology was emphasized, especially technology that helps students deal with atmospheric data and models. The presentations did not debate whether to use technology, or even how to use technology most effectively; but instead presented a suite of different approaches tailored to different audiences.

Both nationally and internationally, conference presentations emphasized collaboration. That collaborative spirit was evident in the overall tone of the conference, built on the implicit goal of improving education and inspiring this young generation, so that they can lead richer lives through their understanding of the environment in which we all live.