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## Promoting atmospheric, earth, and space sciences in higher education

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# PROMOTING ATMOSPHERIC, EARTH, AND SPACE SCIENCES IN HIGHER EDUCATION

BY EUGENE S. TAKLE AND DONALD J. WUEBBLES

**H**eads and chairs of programs in atmospheric, oceanic, hydrologic, and related sciences assembled for their biennial meeting on 14–15 October 2004 in Boulder, Colorado.<sup>1</sup>

Sessions on resources that are available to universities through AMS and AGU and through university and UCAR initiatives provided the context for panel and participant dialogue on topics ranging from curricula and courses to cyberinfrastructure, with the session on strategies for program survival and advancement garnering the most discussion.

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<sup>1</sup> The meeting was sponsored by the University Corporation for Atmospheric Research (UCAR) and the American Meteorological Society (AMS). Following the tradition begun in 2002, heads and chairs from Earth and space science departments, organized under the auspices of the American Geophysical Union (AGU), met concurrently with a special emphasis on items of mutual interest.

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## AMS AND AGU ARE ASKED TO BETTER PROMOTE ATMOSPHERIC, EARTH, AND SPACE SCIENCES

**What:** Leaders of academic departments of the atmospheric, oceanic, hydrologic, Earth, space, and related sciences discussed how to survive and thrive in a competitive university environment

**When:** 14–15 October 2004

**Where:** National Center for Atmospheric Research, Boulder, Colorado

**OPPORTUNITIES FOR UNIVERSITIES.** The AGU’s education-related workshops and resource sharing provide programs for education in Earth and space science at all levels, including the continuing development of members as educators. Eugene Bierly of AGU discussed recruitment into the geosciences and opportunities for increasing diversity in the workforce. Likewise, AMS helps promote the general public’s understanding of science. Recently retired AMS Executive Director Ron McPherson described an AMS initiative to equip broadcast meteorologists to more effectively serve the new role as “station scientist” for their television stations. The effort includes providing educational resources covering water issues and environmental topics. Incoming AMS President Walt Lyons discussed society certification programs and private sector meteorology, which will be society priorities for 2005. The AMS Policy Program offers opportunities for future leaders in atmospheric science to interact with high-level policy officials and

international leaders. AMS also provides guidance on university curricula and at the time of the meeting sought input as it revised its statement on the bachelor's degree in atmospheric science. Discussion focused on ways for students to “demonstrate competencies” instead of taking additional coursework in areas such as statistics, computer science, and related sciences.

A session on resources for educators described new opportunities for teaching with online data, using methods available through the National Digital Science Library (NDSL) and the Digital Library for Earth Science Education (DLESE), including the new Visual Geophysical Exploration Environment (see information online at [www.dpc.ucar.edu/vgee](http://www.dpc.ucar.edu/vgee)), an educational support tool. UCAR, through its education and outreach program and the Cooperative Program for Operational Meteorology, Education and Training (COMET) program assists faculty with materials covering a wide range of learning levels. A university/UCAR team is addressing a long-standing need to improve the way in which universities teach the fabrication, calibration, and use of advanced instrumentation. The team proposes workshops, pilot courses, and the development of online materials by a team of observations specialists and faculty.

New opportunities for collaboration—between disciplines and between universities—are available through support from the National Science Foundation (NSF). NSF's new initiative on complex environmental systems focuses on water, recognizing that its scientific and societal issues span spatial, temporal, and disciplinary boundaries. Another NSF-based program, the Consortium for the Advancement of Hydrologic Sciences, Inc. (CUAHSI), seeks predictive understanding of the terrestrial hydrological cycle and its links with climate and biogeochemical cycles. This consortium of approximately 100 universities and affiliate organizations is trying to help the United States meet its water needs in the twenty-first century.

A new study (information online at <http://qp.nas.edu/decadalsurvey>), commissioned by the National Research Council, seeks a consensus on recommendations for Earth and environmental observations from space over the next 10 years. University participation in the study is encouraged.

**STRATEGIES PANEL.** The panel of Don Wuebles (University of Illinois at Urbana–Champaign), Eric Betterton (University of Arizona), Judy Curry (Georgia Institute of Technology), Heather MacDonald (College of William and Mary), and Jim Kirkpat-

rick (University of Illinois at Urbana–Champaign) initiated a lively discussion on “From surviving to thriving: Strategies for advancing university geosciences programs in times of change.” The session covered issues facing geosciences departments and the lessons that will teach us to be more effective in the future. With some departments having closed in recent years, and many others being threatened by university administrations that all too often see their geosciences departments as being too small or not giving sufficient “return on investment,” the geosciences need to be more effective in selling their importance in college and university education. Innovative thinking will be necessary, and some of the ideas include the following:

- Demonstrate and publicize your department (and the science) at every opportunity.
- Make the university and public aware of the importance of the geosciences.
- Know the data—have the analyses and statistics to support the case for your department.
- Develop a strategic plan.
- Do a good job with program reviews.
- Invest resources and talent in core courses.
- Build bridges and develop alliances with other campus departments—develop a support group.
- Collaborate with geosciences departments at other schools and with UCAR/National Center for Atmospheric Research (NCAR).
- Size matters—strive to reach the critical level for your institution.
- Thriving programs produce large or increasing numbers of students.
- Understand the administration's concerns and build upon them.
- Excellence trumps all else.

**CYBERINFRASTRUCTURE IN THE GEOSCIENCES.** It is not surprising that cyberinfrastructure has been the subject of a number of recent planning documents for the various geosciences from the NSF and other agencies. High-end computing, data storage requirements, data-mining capabilities, and visualization have become ever-increasing challenges given the massive datasets and massive computing requirements of geosciences studies. This panel, led by Kelvin Droegemeier (University of Oklahoma), included Peter Cornillon (University of Rhode Island), Carl Kesselman (University of Southern California), Mary Marilino (UCAR), and Steve Meacham (National Science Foundation), and tackled some of the major cyberinfrastructure issues facing

the geosciences community. Because of the need for both a balanced environment for cyberinfrastructure activities (e.g., high-end computing, visualization, storage, networking, collaboration, and data-mining capabilities are all important) and a well-informed science community, Droegemeier and others are developing the Forum for Geosciences Information Technology (FIGIT) to foster a national dialogue on these topics. The panel also discussed several recent major software developments. For example, Cornillon described a data system integrator that much better defines the complex system of datasets that are being used in the geosciences by bringing order to the normally disordered array of many complex system elements (e.g., data archiving, data analysis, data mining, visualization). Also, Kesselman described software for e-Science-distributed global collaborations through the Internet.

Marlino described a recently published report that analyzes the growing role of cyberinfrastructure in geoscience education (Geoscience Education and Cyberinfrastructure, 2004; available at [www.dlese.org/documents/reports/GeoEd-CI.html](http://www.dlese.org/documents/reports/GeoEd-CI.html)).

**RESOLUTIONS.** The group formulated the following three resolutions:

- 1) The AMS, through its Board on Higher Education, and in coordination with the AGU, should collect, develop, and maintain resources to help atmospheric and related science departments prepare and implement program reviews, for example, statistics on faculty, students, enrollment (undergraduate and graduate), and employment. The material should be available through the AMS Web site in coordination with the Science Education Resource Center (SERC; information online at <http://serc.carleton.edu>), as well as through AGU.
- 2) Before the next heads and chairs meeting, AMS and AGU will jointly collect information, such as planning documents and assessment reports, which will be of use to geosciences departments when representing themselves and their unique disciplinary roles to higher administration.
- 3) Because many universities cannot afford to subscribe to the official electronic versions of AGU journals because the institutional subscription rate is triple the rate for print versions, the heads and chairs of atmospheric and geoscience departments request that the AGU reduce its institutional subscription rates to affordable levels.

Our next meeting will be held in October 2006.