

### 3.4 ENHANCING DIVERSITY IN THE GEOSCIENCES THROUGH NATIONAL DISSEMINATION OF AMS ONLINE WEATHER STUDIES AND ONLINE OCEAN STUDIES COURSES AT MINORITY SERVING INSTITUTIONS

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## 1. INTRODUCTION

The American Meteorological Society's (AMS) introductory undergraduate *Online Weather Studies* and *Online Ocean Studies* courses have brought innovative geosciences education to more than 300 colleges and universities nationwide, including over 100 minority serving institutions (MSIs). The *Online* courses are developed by AMS Earth system science educators and licensed to colleges and universities for local offering. Both courses rely heavily on the use of current geosciences data, thus providing a highly motivational approach to learning.

The *Online* courses are designed for implementation in a variety of instructional settings by faculty with a wide range of geoscience teaching experience. Local-National Teaching Partnerships between the AMS and licensed colleges ensure collegial assistance in all aspects of course implementation.

In order to maintain a competitive scientific workforce, our nation needs to attract more members of minority groups to scientific careers, particularly in the geosciences (Drummond 2004; Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development 2000). To help resolve the lack of access to geoscience courses that hinders many minority students, the AMS makes available its *Online* courses to MSIs and facilitates course implementation through National Science Foundation (NSF)-supported Diversity/National Dissemination Projects. These projects provide opportunities to attend course implementation workshops and participate in a mentoring program that networks instructors and their students with professional meteorologists and oceanographers and disseminates career information.

The *Online* courses are excellent vehicles to introduce undergraduates to the Earth system sciences and encourage future study and careers.

## 2. COURSE BACKGROUND

The idea for *Online Weather Studies* emerged at the AMS Undergraduate Faculty Enhancement Program (UFEP) conducted at the National Oceanic and Atmospheric Administration (NOAA)/National Weather Service (NWS) Training Center in Kansas City, MO in the summers of 1994 and 1995 (Geer et al. 2001). UFEP was an enrichment workshop on meteorology attended by college faculty who taught weather and weather-related courses. Development of *Online Weather Studies* was spurred by recommendations from UFEP participants and the success of the AMS DataStreme Atmosphere precollege teacher enhancement course in introductory meteorology implemented in the spring of 1996. *Online Weather Studies* was pilot tested in spring semester 1999 by 14 UFEP participants and DataStreme leaders at their colleges, and nationally implemented the following fall. The course has now been implemented at over 300 institutions nationwide (Fig. 1).

Success of *Online Weather Studies* and the AMS/NOAA Cooperative Program for Earth System Education (CPESE) DataStreme Ocean course for precollege teachers, implemented in fall 2003, encouraged development of *Online Ocean Studies*. This course was pilot tested in spring 2005 by 11 colleges and was nationally implemented in fall 2005. *Online Ocean Studies* has been licensed by over 20 institutions nationwide (Fig. 1).

## 3. COURSE STRUCTURE

*Online Weather Studies* and *Online Ocean Studies* were developed by AMS and are licensed by colleges for local offering and credit. The hallmark of the *Online* courses is the incorporation of current environmental data and investigations delivered via the Internet. Course components include a customized textbook, investigations manual containing the first halves of twice-weekly learning investigations, and a course website offering the near real-time completion component of each investigation, posted on a weekly schedule during fall and spring semesters. The course websites are updated continually with atmospheric

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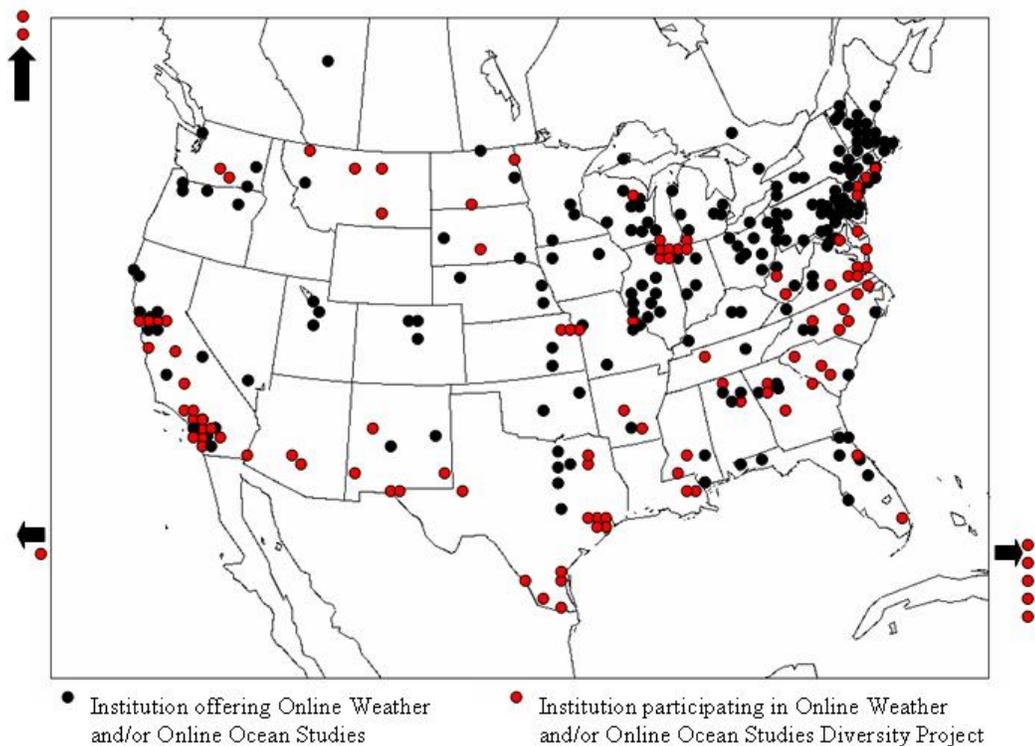


Fig. 1. Institutions offering *Online Weather Studies* and/or *Online Ocean Studies*. Institutions participating in a Diversity Project/National Dissemination Project are indicated by red dots.

summaries and oceanic news items, supplemental topic readings, and current Earth system science data. Course instructors also receive access to a secure faculty website containing answer keys and a faculty CD featuring various instructional materials, including textbook chapter review and test bank questions. These questions are formatted for easy transfer into a course management system.

The *Online* course packages provide the flexibility of offering the classes in traditional lecture/laboratory-based and partially to totally online instructional settings. The courses are designed to fit a 12-15 week semester, but can also be offered in a quarter system or during summer session using a combination of current and archived lessons and data. The turnkey design allows the courses to be offered by experienced meteorologists and oceanographers, as well as by those in other scientific fields, such as geography or chemistry.

Through Local-National Teaching Partnerships, the AMS offers collegial assistance and support to faculty implementing the *Online* courses. AMS staff stand ready to answer any questions concerning course administration and materials. Each new instructor is matched with a mentor who has taught the course in a similar instructional environment.

### 3.1 *Online Weather Studies*

*Online Weather Studies* is an introductory college-level meteorology course that was developed with support from NSF and in cooperation with NWS. The course introduces students to:

- the composition and the structure of the atmosphere
- methods of measuring and analyzing weather data
- energy flows to, from, and through the atmosphere
- atmospheric motions ranging from small to planetary scales
- the principles that govern weather and climate
- weather's impact on humans, particularly severe weather phenomena

The 15-chapter textbook was written by Joseph M. Moran, author of several leading introductory college-level meteorology and environmental sciences textbooks. AMS staff meteorologists prepare course investigations and disseminate materials to local institutions.

### 3.2 Online Ocean Studies

*Online Ocean Studies* is an introductory college-level oceanography course developed in cooperation with NOAA. The course examines the world ocean from an Earth system perspective and focuses on:

- the flow and transformations of water and energy into and out of the ocean
- the physical and chemical properties of seawater
- ocean circulation

- marine life and its adaptations
- interactions between the ocean and the other components of the Earth system (i.e. hydrosphere, atmosphere, geosphere, and biosphere)
- the human/societal impacts on and response to Earth system interactions

Oceanographers M. Grant Gross and Elizabeth Gross were major contributors to the writing of the 15-chapter, hardcover text. AMS Earth system science educators prepare and distribute course materials (Fig. 2).

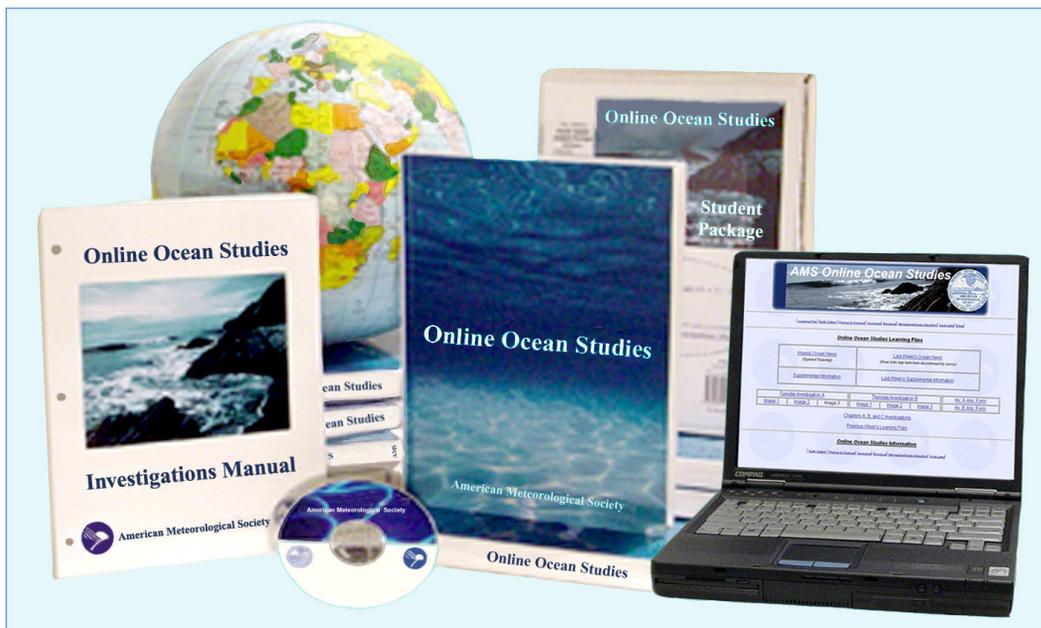


Fig. 2. *Online Ocean Studies* course materials include a printed textbook and investigations manual, an inflatable globe, course and faculty websites, and resource CD for faculty. A similar suite of materials is used in *Online Weather Studies*.

### 4. DIVERSITY/NATIONAL DISSEMINATION PROJECTS

Our nation faces a serious challenge in attracting members of racial and ethnic minority groups to scientific careers, especially those in the Earth system sciences (Geer et. al 2004). Only about 7% of the overall science and engineering workforce is composed of minorities, including African Americans, Hispanic Americans, American Indians, Alaskan Natives, Native Hawaiians, and Pacific Islanders (National Science Foundation 2000b), even though these groups represent about 27% of the U.S. population (U.S. Census Bureau 2000). In the geosciences, minorities earn only 4.6% of all bachelor's degrees, 3.3% of master's degrees, and 5% of Ph.D. degrees (National Science Foundation 2000a). It is imperative to boost minority participation in the sciences in order to maintain a robust and competitive scientific workforce

(Drummond 2004; Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development 2000).

A formidable obstacle in attracting students to the Earth system sciences has been lack of access, that is, no opportunity to enroll in an introductory geoscience course simply because none is offered at their college or university. To help alleviate this problem, the AMS makes available *Online Weather Studies* and *Online Ocean Studies*, which can be added to an institution's general education course offerings. AMS facilitates course implementation at MSIs through NSF-supported Diversity/National Dissemination Projects. Eligible institutions include Historically Black College and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Universities (TCUs), Alaska Native or Native Hawaiian (AN/NH) Serving Institutions, and institutions that can document a total minority enrollment of at least 30% of the student population.

Faculty participating in Diversity Projects are invited to attend expenses-paid, week-long workshops that cover course implementation procedures and key course topics. The workshops employ many guest speakers from NOAA and university geoscience departments and introduce faculty to operational activities. Instructors are also invited to a diversity workshop at the subsequent AMS Annual Meeting and present posters detailing their course implementation experiences. In order to provide further geoscience opportunities for interested students, faculty are put in touch with local NOAA offices and AMS provides student resources websites with career and internship information.

#### 4.1 *Online Weather Studies Diversity Project*

Since 2002, 108 MSIs, including 25 HBCUs, 32 HSIs, 8 TCUs, 2 AN/NH Serving Institutions, and 41 institutions with a 30% or greater minority student population have implemented *Online Weather Studies* through the Diversity/National Dissemination Project. Participants represent a broad range of scientific disciplines and only about one-third had previously taught a weather course. Faculty training takes place in May at the NOAA/NWS Training Center in Kansas City, MO and at the subsequent AMS Annual Meeting.



Fig. 3. John Jones, Deputy Director of the NOAA/NWS, speaks to an *Online Weather Studies* Diversity Project workshop group about NWS operations and opportunities for minority serving institutions.

At the week-long Kansas City workshop, NOAA/NWS meteorologists and AMS staff discuss fundamental weather topics, online learning pedagogy, critical thinking through technology, and how to get the most out of *Online Weather Studies* (Fig. 3). Participants learn about NWS operations by taking field trips to the NOAA/NWS Aviation Weather Center and the Topeka, KS forecast office. At the three-day AMS Annual Meeting workshop, faculty present a paper or poster on their course implementation, participate in a diversity session, and attend the Symposium on Education. *Online Weather Studies* is supported by the NSF Opportunities for Enhancing Diversity in the

Geosciences (OEDG) and Course, Curriculum, and Laboratory Improvement – National Dissemination (CCLI-ND) programs. Additional information is available at [www.ametsoc.org/amsedu/online/info/diversity.html](http://www.ametsoc.org/amsedu/online/info/diversity.html).

#### 4.2 *Online Ocean Studies Diversity Project*

The AMS was recently funded by the NSF CCLI-ND program to introduce *Online Ocean Studies* to 75 MSIs over a 3.5 year period ending in 2009. Faculty workshops will take place in Seattle at the University of Washington and NOAA facilities and at the subsequent AMS Annual Meeting. The Seattle workshop will include course implementation discussions, presentations by oceanographers on a variety of course topics, and field trips to the Pacific Marine Environmental Laboratory and the Northwest Fisheries Science Center. For project details, see [www.ametsoc.org/amsedu/online/oceaninfo/diversity.html](http://www.ametsoc.org/amsedu/online/oceaninfo/diversity.html).

### 5. CONCLUSIONS

AMS *Online* courses deliver highly motivational learning experiences that encourage additional student exploration of the geosciences, possibly leading to careers in science or science teaching. The turnkey course design and faculty enhancement workshops make possible course introduction at MSIs and other colleges nationwide.

By 2009, over 125 MSIs will have implemented *Online Weather Studies* and 75 MSIs will have introduced *Online Ocean Studies*. Thousands of students will have their first access to a geoscience course.

The AMS will continue to encourage even more institutions nationwide to offer its *Online* courses and will continually update the courses to fit the changing needs of colleges and their students.

### 6. ACKNOWLEDGEMENTS

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### 7. REFERENCES

- Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, 2000. "Land of Plenty: Diversity as America's Competitive Edge in Science, Engineering and Technology". [Available online at [http://www.nsf.gov/pubs/2000/cawmset0409/cawmset\\_0409.pdf](http://www.nsf.gov/pubs/2000/cawmset0409/cawmset_0409.pdf).]
- Drummond, C.N., 2004. "Increasing diversity in the Earth sciences", *Journal of Geoscience Education*, **52**, 2.

Geer, I.W., B.A. Blair, M.M. Ficek, R.S. Weinbeck, J.A. Brey, E.J. Hopkins, and J.M. Moran, 2001. "National dissemination of Online Weather Studies: a college-level distance-learning course on the basics of meteorology", *Preprints, Tenth Symposium on Education*, AMS, Albuquerque, NM, 134-136.

Geer, I.W., E.W. Mills, J.M. Moran, R.S. Weinbeck, W.A. Porter, J.L. Harris, and J.A. Brey, 2004. "Enhancing diversity in the geosciences through national dissemination of the AMS Online Weather Studies distance learning course", *Bull. Am. Meteor. Soc.*, **85**, 37-41.

National Science Foundation, 2000a: Report of the geosciences diversity workshop. National Science Foundation (NSF 01-53). [Available online at [http://www.geo.nsf.gov/geo/diversity/geo\\_diversity\\_workshop\\_final\\_report\\_august\\_00.html](http://www.geo.nsf.gov/geo/diversity/geo_diversity_workshop_final_report_august_00.html).]

\_\_\_\_\_, 2000b: Women, minorities, and persons with disabilities in science and engineering: 2000. National Science Foundation (NSF 00-327), 254 pp.

U.S. Census Bureau, 2000: Census 2000.