8A.2   AMS PROGRAMS TO ENHANCE EDUCATION IN THE OCEAN SCIENCES: THE MAURY PROJECT AND DATASTREME OCEAN

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1. INTRODUCTION

The American Meteorological Society (AMS) initiated its pre-college education program in 1990. Its first endeavor, Project ATMOSPHERE, was a pre-college teacher enhancement program using weather-related topics as a mechanism to promote science, mathematics and technology. At the core of this program was the formation of a national cadre of well-trained teachers, called AMS Education Resource Agents (AERAs). These teachers serve as peer trainers in their respective states, presenting AMS-developed modules on weather topics. Project ATMOSPHERE became the model for future initiatives of the AMS education program. In 1994, AMS embarked on a second teacher enhancement program, the Maury Project, in partnership with the United States Naval Academy and State University of New York (SUNY) at Brockport. Following the example of Project ATMOSPHERE, the Maury Project trains pre-college teachers on the physical foundations of oceanography (Smith *et al.*, 1997).

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In 1995, the AMS initiated its first distance-learning course, the DataStreme Project (now called DataStreme Atmosphere). This is a semester-long course on the basics of meteorology that partially delivers instruction to pre-college teachers via the internet. A key component of this course is a series of inquiry-based investigations that utilize near real-time environmental data made available via the course website. Two other such courses, DataStreme WES (Water in the Earth System) and DataStreme Ocean, were developed to provide instruction on the water cycle and ocean processes, respectively   All three of these courses are taught at numerous sites throughout the country via Local Implementation Teams (LITs). To date, almost 11,000 pre-college teachers have successfully completed at least one of the three DataStreme courses.

This paper describes the two AMS pre-college educational initiatives which focus on the ocean sciences: The Maury Project and DataStreme Ocean. Both initiatives provide inquiry-based experiences that enhance the understanding of the ocean and coastal environments.

2. THE MAURY PROJECT

The Maury Project is a program to enhance the backgrounds of pre-college teachers on

the physical foundations of selected oceanographic topics. The namesake of the program is Matthew Fontaine Maury (1806-1873), who was responsible for encouraging the Navy to pursue the study of the ocean as a scientific discipline.   Following in his footsteps, the Maury Project trains teachers to become peer-trainers equipping them with mechanisms to assist other teachers and their students to study the ocean and learn more about their world.

To prepare teachers for their peer-training duties, approximately 25 are selected to attend a two-week residence program held every summer at the U.S. Naval Academy in Annapolis, MD. Since 1994 over 300 teachers have completed one of these workshops. The program consists of a combination of lectures, laboratories, and hands-on activities to enhance teachers' knowledge of the physical foundations of oceanography. For example, teachers take measurements on the Chesapeake Bay using instruments onboard YP-686 (the Naval Academy's oceanographic research vessel), conduct a beach profile study, visit operational and research oceanographic facilities in the Washington D.C. area, attend lectures by prominent scientists, and share personal anecdotes plus helpful hints from their own teaching experiences. In addition, the two-week workshop provides an opportunity for teachers to learn about the U.S. Navy's role in oceanography from operational and scientific perspectives.

At the very core of the instruction of the Maury Project is a series of modules covering topics relevant to the ocean and coastal environment. These modules (titles listed Table 1) become the resource materials used by workshop participants in peer-training sessions conducted for their colleagues in their respective schools, school districts, or at national and regional science teacher conferences. This approach is a very effective mechanism to disseminate AMS instructional materials to thousands of teachers across the country. More importantly, these peer-training sessions provide an excellent opportunity for Maury participants to enhance their leadership skills as they gain self-confidence and the respect of their colleagues for their competence in presenting scientific material (Smith *et al*, 1997; 2002). While the primary purpose of the Maury Project is to enhance the scientific backgrounds of pre-college teachers the cultivation of leadership skills is a significant by-product of the program.

Table 1. Maury Project Modules

▪ *Wind Driven Ocean Circulations*
▪ *Density Driven Ocean Circulations*
▪ *Deep Water Ocean Waves*
▪ *Shallow Water Ocean Waves*
▪ *Ocean Tides*
▪ *Measuring Sea Level from Space*
▪ *Ocean Sound*
▪ *Coastal Upwelling*
▪ *El Nino – La Nina*
▪ *AMS Pressure Blocks*

3. DATASTREME OCEAN

To expand upon its ability to teach teachers about the ocean, AMS established a distance-learning course called DataStreme Ocean in 2003. This course is major initiative of the American Meteorological Society and the National Oceanic and Atmospheric Administration (NOAA) Cooperative Program for Earth System Education (AMS/NOAA CPESE). DataStreme Ocean is modeled after DataStreme Atmosphere and DataStreme WES, highly successful AMS teacher enhancement courses (Geer *et al*., 2002; Weinbeck *et al*., 2002). This semester-long course provides a descriptive knowledge

of oceanography for pre-college teacher enhancement that is partially delivered via the internet (Geer *et al*., 2004a). DataStreme Ocean investigates the ocean in the Earth system with special emphasis on the flow and transformations of matter and energy into and out of the ocean, the ocean's physical and chemical properties, ocean circulation, marine life and its adaptations, interactions between the ocean and the other components of the Earth system, and the human/societal impacts on and response to those interactions. Teachers who successfully complete DataStreme Ocean earn three hours of graduate credit from the State University of New York (SUNY) at Brockport and, in return, agree to serve as ocean resource teachers in their schools and school districts.

In 2002, a variety of instructional materials which were developed for DataStreme Ocean. These include a 15-chapter textbook, an investigations manual, and course website. Participating teachers explore twelve principal and three optional themes organized by chapter and corresponding to each week of the course. In addition, each week's theme is augmented with twice-weekly investigations. The first part of each investigation appears in the Investigations Manual and the second part is delivered via the course website. Online components of investigations are written to current and/or archived environmental data by AMS educator/scientists in their Washington DC office. The course website also features the *Weekly Ocean News*, *Supplemental Information*, and links to a variety of user-friendly oceanographic websites.

All AMS education programs, including DataStreme Ocean, utilize AERAs (Geer *et al*., 1999). Teachers who participated in prior Maury and DataStreme programs serve as members of Local Implementation Teams (LITs) and mentor course participants in the distance-learning course. In addition to peer

trainers, each LIT typically includes a scientist (e.g., a NOAA or Sea Grant oceanographer) or a university instructor with expertise in oceanography. LIT Leaders receive annual training at special summer programs at locations with oceanographic facilities and expertise (U.S. Naval Academy in 2000, University of Washington in Seattle in 2003, the University of Miami in 2004, and NOAA Headquarters in Silver Spring, MD in 2005). This training exposes teachers to current operational and research activities by university and NOAA scientists.

4. IMPACT OF THE TEACHER-ENHANCEMENT PROGRAMS

The Maury Project and DataStreme Ocean offer unique educational experiences in the ocean sciences for pre-college teachers. The Maury Project promotes understandings about fundamental physical characteristics of the sea as a tool to help enhance the study of science, mathematics, and technology as well as a wide range of activities that can be used across the curriculum. Responses from teachers who attended Maury summer workshops clearly demonstrate their satisfaction with the workshop and the materials developed for it (Smith and Geer, 2004). However, the impact does not end here. All participants must conduct peer-training sessions for teachers in their schools, school districts, states or even nationwide. To date, approximately 300 Maury participants have conducted 1200 workshops reaching an estimated 20,000 teachers nationwide. This has a dual impact in that a second tier of teachers receive instruction on ocean topics and Maury Project peer trainers are recognized for their expertise in oceanography and are viewed as leaders in their respective school systems. A number of these teachers are selected by AMS to participate as team leaders on Local Implementation Teams (LITs) for DataStreme

WES or DataStreme Ocean. Hence, the Maury Project not only enhances teachers' science background but also promotes professional development and leadership skills. Although the Maury Project is a teacher enhancement program, there are obvious benefits to the students of the teachers who attend the summer workshops and peer-training sessions. The actual number of students impacted by Maury Project teachers and/or learning materials is not known precisely However, a reasonable estimate of 100 students for each of the 20,000 teachers who have attended Maury Project peer-training sessions suggests the multiplicative effect of the "training the trainer" concept of this program.

DataStreme Ocean provides a different mechanism to enhance the study of ocean science. Unlike the Maury Project, which trains a limited number of teachers to become peer trainers of selected oceanographic topics, DataStreme Ocean delivers instruction to a larger number of teachers on a national scale; currently at 28 sites in 24 states. In the spring 2006 semester, 218 teachers successfully completed this course. (Some 1035 teachers have done so since the inception of the course in the fall of 2003.) An end-of-course survey of approximately 600 teachers, virtually all the participants in the first three semester-offerings, was conducted to determine the impact of the course. The following scores represent the percentage of respondents selecting the highest rating for each item listed: Course as whole, 97.0 %; science content, 99.3%; study materials, 95.2%; using internet delivery, 92.2%. These numbers document a high level of satisfaction with DataStreme Ocean.

While DataStreme Ocean is a teacher enhancement program, more than just the teachers enrolled benefit from the course. Survey results show that on average 3.8

colleagues are impacted during course by each teacher enrolled. Furthermore, the teachers reach 161.8 students on average during the semester enrolled in DataStreme Ocean. These numbers suggest that the DataStreme Ocean course reaches beyond the participants, providing ocean science instruction for their colleagues and students.

5. SUMMARY

The American Meteorological Society started its initiative in ocean science education in 1994. The Maury Project is a teacher enhancement program in which 25 precollege teachers annually attend a summer workshop. Participants then conduct peer-training sessions to deliver instruction on various topics in oceanography. DataStreme Ocean is a semester-long distance-learning course for teachers. Instruction is partly delivered via the Internet, including twice-weekly investigations relevant to ocean science. These programs serve a vital role in promoting the study of the ocean science to teachers and their students to enhance ocean literacy and awareness of the ocean environment.

For more information on all education programs of the American Meteorological Society, see: http://www.ametsoc.org/amsedu.

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