J1.8 THE MAURY PROJECT AND DATASTREME OCEAN: TEACHING TEACHERS ABOUT THE COASTAL ZONE

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1. INTRODUCTION

The educational initiative of the American Meteorological Society (AMS) began in 1990. Its initial program, Project ATMOSPHERE, was established to provide teacher enhancement opportunities on weather-related topics. An integral portion of this program was the formation of a national cadre of well-trained teachers, called AMS Education Resource Agents (AERAs), who serve as peer trainers in their respective states. Project ATMOSPHERE became the cornerstone of the AMS education program and serves as the model for its other endeavors. In 1994, AMS instituted its second teacher enhancement program, the Maury Project, in partnership with the United States Naval Academyand State University of New York (SUNY) at Brockport. The Maury Project provides teachers with instruction on the physical foundations of oceanography (Smith et al, 1997).

In 1995, AMS began the first in a series of distance-learning courses the DataStreme Project (now called DataStreme Atmosphere). This semester-long course provides teachers with instruction on the basics of meteorology that is partially delivered via the Internet, including investigations that utilize near real-time data. Two other courses followed the DataStreme model: DataStreme WES (Water in the Earth System) and DataStreme Ocean, which are taught at numerous sites throughout the country.

This paper describes two of the AMS educational initiatives which focus on the marine and coastal environment: the Maury Project and DataStreme Ocean. In particular, it will emphasize aspects of each that pertain to the coastal zone.

2. PROGRAM DESCRIPTIONS

2.1 *The Maury Project*

The Maury Project centers on a two-week residence program for teachers held every summer at the United States Naval Academy in Annapolis, Maryland. This workshop has been conducted for approximately 25 teachers annually since 1994. The program utilizes a combination of lecture, laboratory and hands-on activities to enhance teachers' knowledge of the physical foundations of oceanography. A major component of the instruction is a series of ten modules covering topics relevant to the marine and coastal environment. These modules are then used by the workshop participants to conduct training sessions for their colleagues in their respective schools, school districts or at national and regional science teacher conferences. This peer-training approach is an effective means for AMS to disseminate its 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 the respect of their colleagues for their competence in presenting scientific material (Smith et al, 1997; 2002). Since 1994, the approximately 275 Maury participants have conducted 1200 workshops reaching an estimated 20,000 teachers nationwide.

2.2 *DataStreme Ocean*

In the Fall of 2003, AMS initiated a distance-learning course for teachers called DataStreme Ocean. DataStreme Ocean is modeled after DataStreme Atmosphere and DataStreme WES, highly successful AMS teacher enhancement courses (Geer et al., 2002; Weinbeck et al., 2002). DataStreme Ocean is a semester-long course on the basic understandings of oceanography for precollege teacher enhancement that is partially delivered via the Internet (Geer et al., 2004). DataStreme Ocean is a major initiative of the American Meteorological Society (AMS) and the National Oceanic and Atmospheric Administration (NOAA) Cooperative Program for Earth System Education (AMS/NOAA CPESE). Teachers who successfully complete DataStreme Ocean earn three hours of graduate credit from the State University of New York (SUNY) at Brockport and agree to serve as ocean resource teachers in their schools and school districts. DataStreme Ocean investigates the ocean in the Earth system with special emphasis on the flow and transformations

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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.

Development of DataStreme Ocean instructional materials began in spring 2002 and culminated in a customized 15-chapter textbook (with M. Grant Gross and Elizabeth Gross as major contributors), study guide, and course homepage. Participating teachers explore twelve principal themes organized by chapter and corresponding to each week of the course. (Three optional themes are also presented in the text.) Central to each week's theme are twice-weekly benchmark investigations. The first part of each investigation appears in the study guide and the second part is delivered via the course homepage on Tuesdays and Thursdays. Online components of investigations are written to current and/or archived environmental data by AMS education staff in Washington, DC. The course homepage also features the *Weekly Ocean News*, *Supplemental Information*, and links to a variety of user-friendly oceanographic web sites.

As with all AMS education programs, teachers play a central role in implementing DataStreme Ocean (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 addition to peer trainers, each LIT typically includes a scientist (e.g., a NOAA or Sea Grant oceanographer) or college/university instructor with expertise in oceanography. In preparation for the course, LIT Leaders attended special summer training sessions at locations with oceanographic facilities and expertise (University of Washington in Seattle in 2003, and the University of Miami in 2004). These sessions exposed teachers to current operational and research activities by university and NOAA scientists. (For more information on DataStreme Ocean, please go to http://www.ametsoc.org/amsedu/DS-Ocean.)

3. APPLICATION TO THE COASTAL ZONE

One can define the *coastal zone* as the dynamic interface between the ocean and the other components of the Earth system, that is, the geosphere, atmosphere, and biosphere. Both the Maury Project and DataStreme Ocean deliver topics relevant to the coastal zone and coastal processes.

3.1 *Maury Project*

While instructional materials covered in the Maury Project workshop and modules deal with all aspects of the ocean, a significant amount of instruction focuses on the coastal zone. This is enabled by the site of the workshop itself. Teachers are brought to the United States Naval Academy, located on the Severn River at the mouth of the Chesapeake Bay. The Chesapeake Bay is the largest estuary in the nation and affords a unique laboratory for participating teachers to become familiar with the coastal environment.

During the first week of instruction the teachers are immersed in first-hand observations of the coastal environment. They are divided into two groups. Group A is taken on a three-hour transect from the mouth of the Severn to the deepest channel of the Chesapeake (approximately 80% of the width of the Bay), where the teachers make a series of observations (temperature, salinity, density, light transmission at depth, mud samples at the bottom, and some biologics). Group B travels to a local beach where they measure the slope and explore the area for both live and fossil organisms (the area is known for fossilized shark teeth). The following day, the two groups switch activities so that all participants experience both field studies. Aside from a session on how to use instruments, the teachers are not given instruction on the coastal zone and coastal processes (this lecture comes later). Instead, the pedagogical technique of discovery is employed which enables the teachers to learn about the coastal zone through direct observation prior to formal classroom instruction on coastal processes. This discovery-first approach is well received by the teachers. Classroom instruction covers beaches (formation, evolution and erosional processes), longshore currents, and riptides, demonstrating the interaction of ocean, atmosphere and land within the coastal zone.

A key component of the Maury Project is a collection of teacher guides developed by the AMS education program as instructional resources for the summer workshop participants. There are four such modules having direct application to the coastal zone: Shallow Water Waves, Ocean Tides, Coastal Upwelling and El Niño-La Niña. Teacher guides provide single topic modules, which include basic understandings and classroom appropriate activities to enhance the teaching of coastal concepts. Workshop participants then utilize the modules as the basis for peer-training sessions at local, state and national teacher conferences and elsewhere to train their colleagues about the marine and coastal environment.

3.2 *DataStreme Ocean*

While this course takes a comprehensive approach to studying the ocean, a significant portion of DataStreme Ocean is devoted to the coastal zone. The Earth system perspective, which emphasizes interactions between the various subsystems, is particularly effective in exploring and understanding coastal properties and processes. Virtually all twelve weeks of the course include some aspect of the coastal zone. Topics covered include tidal influences, near shore currents, environmental stressors (associated with the rapidly growing human population in the coastal zone), exploitation of coastal resources, natural hazards such as storm surges and tsunamis, adaptations of marine organisms to the coastal zone, and coastal zone management. In addition, several of the weekly investigations (e.g., Ocean in the Earth System, Sediment from Land to Sea, Coastal Processes, and Coastal Impact of Tropical Cyclones) provide teachers with classroom activities to enhance their knowledge and teaching capability about the coastal zone. Hence teachers taking this semester-long course receive an excellent overview of the oceanography of the coastal zone.

4. CONCLUSIONS

Since 1990, the American Meteorological Society has designed and disseminated a number of educational opportunities for teachers in the atmospheric, oceanographic and hydrologic sciences. This includes summer workshops and distance-learning courses for teachers as well as instructional materials appropriate for the classroom. Two of these programs incorporate significant components involving the coastal zone. The Maury Project trains approximately 24 teachers annually at the United States Naval Academy in Annapolis, Maryland. In this workshop teachers attend lectures, conduct field studies, and receive training and learning materials pertinent to coastal processes. DataStreme Ocean is a semester-long course partially delivered via the Internet and offered through LITS nationally. Course materials and investigations provide significant instruction on the coastal zone and coastal processes. Both programs are designed to enhance the knowledge of pre-college teachers about the marine environment, which includes not only the blue waters of the deep ocean but coastal and near shore regions as well. By participating in such programs, teachers are well schooled on major aspects of coastal properties and processes.

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