P1.1 A DECADE OF AMS DATASTREME COURSES - TEACHERS USING EARTH SYSTEM INFORMATION

Robert S. Weinbeck *
SUNY Brockport, Brockport, New York

Ira W. Geer
American Meteorological Society, Washington, DC

Joseph M. Moran
American Meteorological Society, Washington, DC

David R. Smith
U.S. Naval Academy, Annapolis, MD

Edward J. Hopkins
University of Wisconsin-Madison, Madison, WI

Elizabeth W. Mills
American Meteorological Society, Washington, DC

Bernard A. Blair
American Meteorological Society, Washington, DC

1. INTRODUCTION

The genesis of the American Meteorological Society's (AMS) Educational Program was in an initiative approved by the AMS Council in 1990 supporting educational needs in the atmospheric and oceanic sciences (Smith and Geer, 1991). The goal of the American Meteorological Society's (AMS) Educational Program is to improve science education in K-12 classrooms by providing teachers with the content background to effectively understand and utilize current environmental information delivered via Internet. This authentic environmental data provides excitement to classroom studies, improves learning, and allows implementation of the *National Science Education Standards*. We strive to accomplish this goal through the offering of three teacher enhancement courses using blended instruction methods. Each participating teacher then functions as an Earth system science education resource person for his/her colleagues following the course.

2. DATASTREME PROJECT

In 1995 the DataStreme Project, a national teacher enhancement course concerning the basics of weather and climate, was created by the AMS Education Program with funding by the National Science Foundation. The DataStreme course delivery process relied on a partnership of the AMS Education Program and local master teachers and scientists. The DataStreme course was offered via Local Implementation Teams (LITs), each typically a collaboration of a master precollege teacher as leader along with a professional meteorologist and a college science educator. The AMS Education Program staff custom-designed course learning materials including a carefully tailored textbook and study guide. A key aspect of the DataStreme course delivery process was its partial materials and data distribution via the Internet. The access to current weather data proved to be the highly motivational aspect for teachers and their students. The course became an effective introduction to atmospheric science for K-12 teachers across the nation.

The course textbook covers traditional topics in meteorology. In contrast to most weather courses, however, the text functions more as a reference. The key course component is the study guide which contains the first part of 24 investigations, two per week, for teachers to finish with questions written by AMS Education Program staff to near-realtime data and delivered via the course website. National weather summaries and supplemental information files are delivered each weekday via the course website along with custom designed meteorological data products that are updated as frequently as hourly. A chapter of the text sets the principal theme for each week's work scheduled over a twelve-week semester. Each LIT and its participating teachers meet at the beginning, middle and end of the semester and team mentors maintain weekly communication with each participant. Teachers who complete the course earn three hours of graduate credit through the State University of New York College at Brockport.

---

* *Corresponding author address:* Robert S. Weinbeck, American Meteorological Society, 1120 G St., N.W., Suite 800, Washington, DC 20005; e-mail: *weinbeck@ametsoc.org*.

3. THE DATASTREME MODEL

Evaluations of the success and effectiveness of the DataStreme course were conducted by a survey at the end of the course. After the initial offering, additional surveys were made of changes in pedagogical attitude and content acquisition between the beginning and the end of each term. LIT leaders and members also completed evaluations. After several semesters, an assessment of long-term course satisfaction was surveyed from participants who had taken the course at least one semester ago. The resulting high level of satisfaction for the course and its method of delivery led to the conceptualization of an empirical *DataStreme Model* for teacher enhancement.

The DataStreme weather course, now renamed **DataStreme Atmosphere**, has been offered each semester since 1996. That course has been joined by two additional DataStreme distance learning, teacher enhancement courses with environmental investigations founded on near-realtime telecommunicated data. This builds on the experience of excitement with authentic science in a motivating setting. The blend of individualized learning employing asynchronous course delivery of learning materials, coupled with personalized weekly mentoring, and complemented by several face-to-face course meetings has proven to be very popular and successful. Figure 1 shows one of the DataStreme Atmosphere LIT meetings. Figure 2 shows the semester and overall total numbers of precollege teachers who have completed the DataStreme Atmosphere course.

Figure 1. Teachers attending a DataStreme Atmosphere LIT meeting.

The success of DataStreme Atmosphere inspired the development of a second teacher enhancement course, **Water in the Earth System** (WES) with NSF support. DataStreme WES employs the vehicle of the global water cycle to explore the Earth system. First offered in Spring 2001, WES also has the DataStreme delivery model (i.e., Local Implementation Teams, text and study guide, Internet learning materials delivery, several in-person meetings and weekly individual mentoring). The DataStreme WES course website delivers a Weekly Water News file that is continually updated with water-related items from around the world, a supplemental water information file, the second half of twice-weekly learning investigations (delivered on Tuesday and Thursday versus DataStreme Atmosphere's Monday and Wednesday schedule), and many site links to water topics and environmental information regarding water (Geer et al., 2003). Figure 3 shows the semester and cumulative numbers of precollege teachers who have completed the DataStreme WES course.

Based on the growing success of the DataStreme Atmosphere and DataStreme WES courses, and with support from the National Oceanographic and Atmospheric Administration (NOAA), the AMS Education Program then proceeded to develop **DataStreme Ocean**, an oceanography teacher enhancement course. During the Fall 2003 semester, 22 LIT members piloted the course materials in a semester schedule arrangement (Geer et al., 2004b). DataStreme Ocean was nationally implemented in Spring 2004 as a "beta" test. Figure 4 shows teachers completing an activity under guidance of the LIT leader at one of the DataStreme Ocean course meetings. Figure 5 shows the semester and overall total numbers of precollege teachers who have completed the DataStreme Ocean course (Geer et al., 2004a).

4. AMS/NOAA CPESE

The AMS has had a long and productive partnership with the National Oceanic and Atmospheric Administration (NOAA) in its educational initiatives. NOAA's National Weather Service has provided assistance in the conduct of two-week summer resident teacher workshops, initially supported by the National Science Foundation, since 1991. NOAA agencies have also assisted in the offering of Maury Project summer workshops at the U.S. Naval Academy since 1994. Notably over 200 NOAA personnel

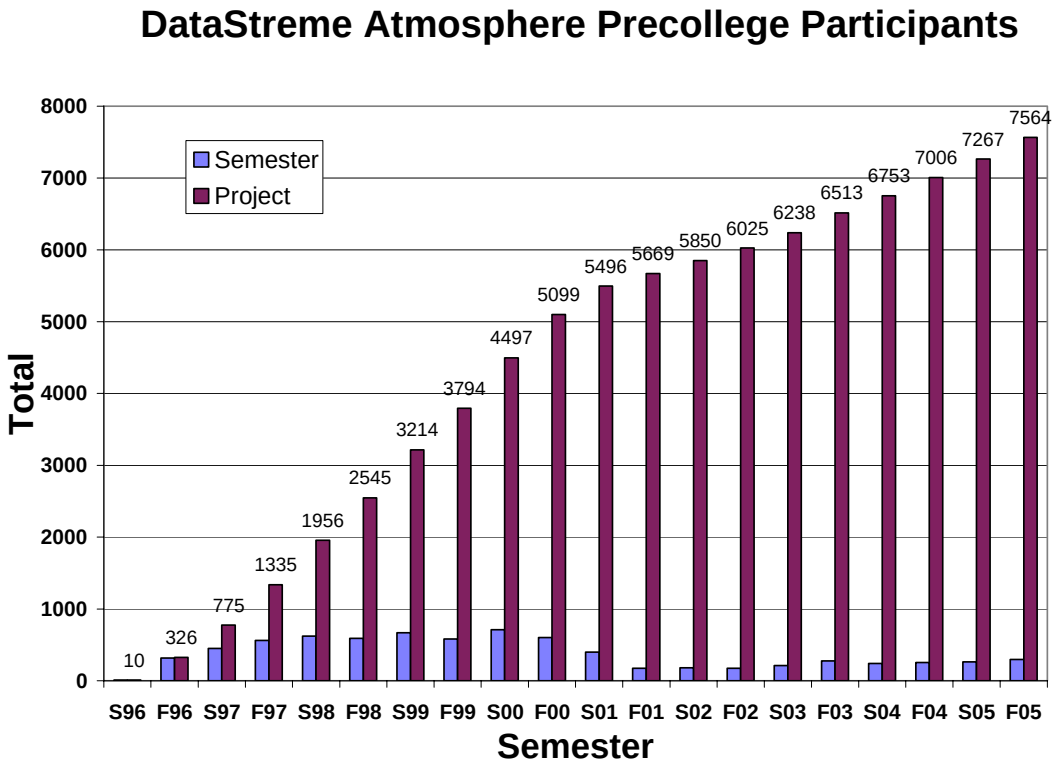

Figure 2. DataStreme Atmosphere precollege participant completions.

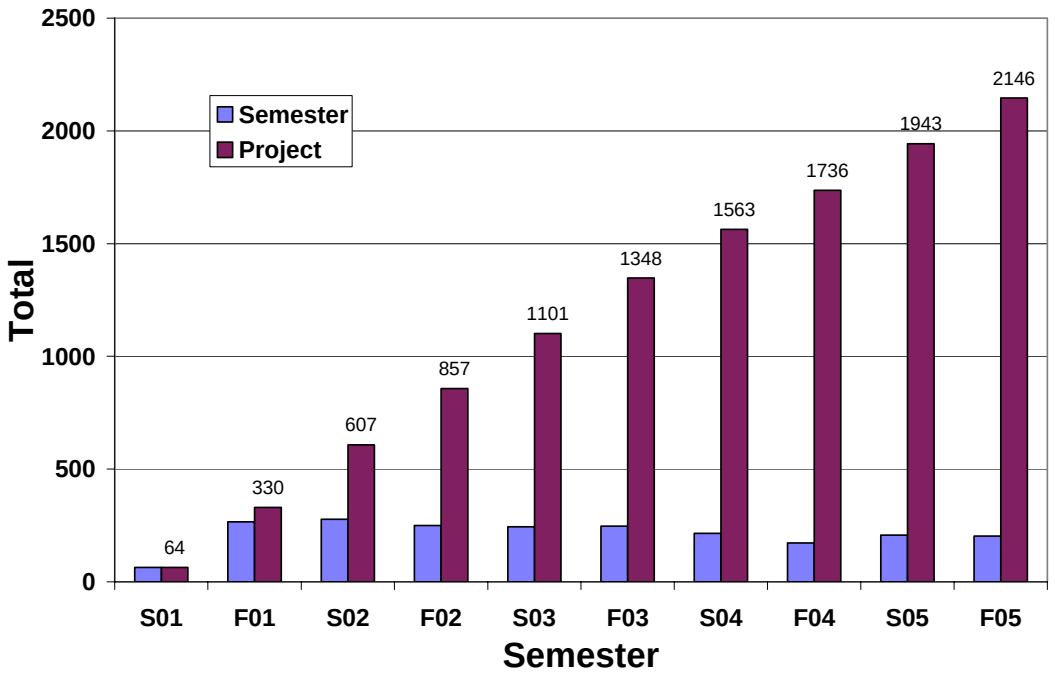

Figure 3. DataStreme WES precollege participant completions.

have served as volunteer participants on LITs in DataStreme Atmosphere, DataStreme WES and DataStreme Ocean courses.

Figure 4. Teachers work through DataStreme Ocean activities using a globe at a LIT meeting.

This in-kind and volunteer support led to the creation of the Cooperative Program for Earth System Education (CPESE) by AMS. NOAA has provided support to the AMS Education Program to (a) continue DataStreme Atmosphere beyond its NSF-funded phase, (b) develop and implement the DataStreme Ocean teacher enhancement distance-learning course, and (c) encourage greater future minority participation in science by training greater numbers of teachers who are members of groups underrepresented in the sciences and/or teach in schools with large minority student populations through the DataStreme courses and summer resident workshops (Geer et al., 2004a).

5. COURSE EVALUATIONS

5.1 *Participant Evaluations*

Course participants complete evaluations at the end of the term that include a series of questions rating the course overall, its instructional materials, the effectiveness of presentation and the course value to their background. Also, demographic information and subjective effects on their teaching practices and their students are requested. The general questions used a scale having three options, e.g. *good/fair/poor*. Table 1 shows the attitudinal response summaries for the DataStreme Atmosphere (ATM), DataStreme Water in the Earth System (WES), and DataStreme Ocean (OCE) courses since each course's inception. Percentages shown are the average over the course history of the most positive response in each category. As can be seen, the responses are highly positive and consistent among the three courses. The overall satisfaction with the course, its materials and the science content is exceptionally high. The use of LITs and Internet delivery in the blended learning format has also been very well received. Even within the semester in which the teachers had been taking the course, they reported that they interacted with about 4 other teachers regarding the course and had impacted 150 or more students.

Table 1. DataStreme course summary and evaluation data.

Course Summary	**ATM**	**WES**	**OCE**
Semesters offered	20	10	5
No. LITs*	40	28	25
No. states*	26	23	23
Total Completions†	7564	2146	821
Evaluation Averages			
Course as whole	95	97	97
Science content	98	99	99
Learning materials	93	96	96
Internet delivery	92	93	92
Mentoring process	88	87	91
Offering via LITs	88	90	92
Enhancement value	90	91	94
Avg. teacher impacts	3.9	4.8	3.6
Avg. student impacts	143.8	165.5	159.8

* Numbers from Fall 2005 offering.
† Estimated for end of Fall 2005.

5.2 *Beginning/Ending Surveys*

A survey instrument is also administered at the first course meeting to assess participants' initial pedagogical attitude in four classroom strategy areas using a 5-category scale from "minimal" to "exemplary". The areas were: the ability to use weather/water/ocean (as appropriate) information to meet student needs, to teach science, to manage learning with Internet-delivered data, and to assist colleagues. These same areas are surveyed again at the final course meeting. The general mastery of course content background was also assessed using eleven science- questions covering the general topics of the course's textbook chapters. Similar questions

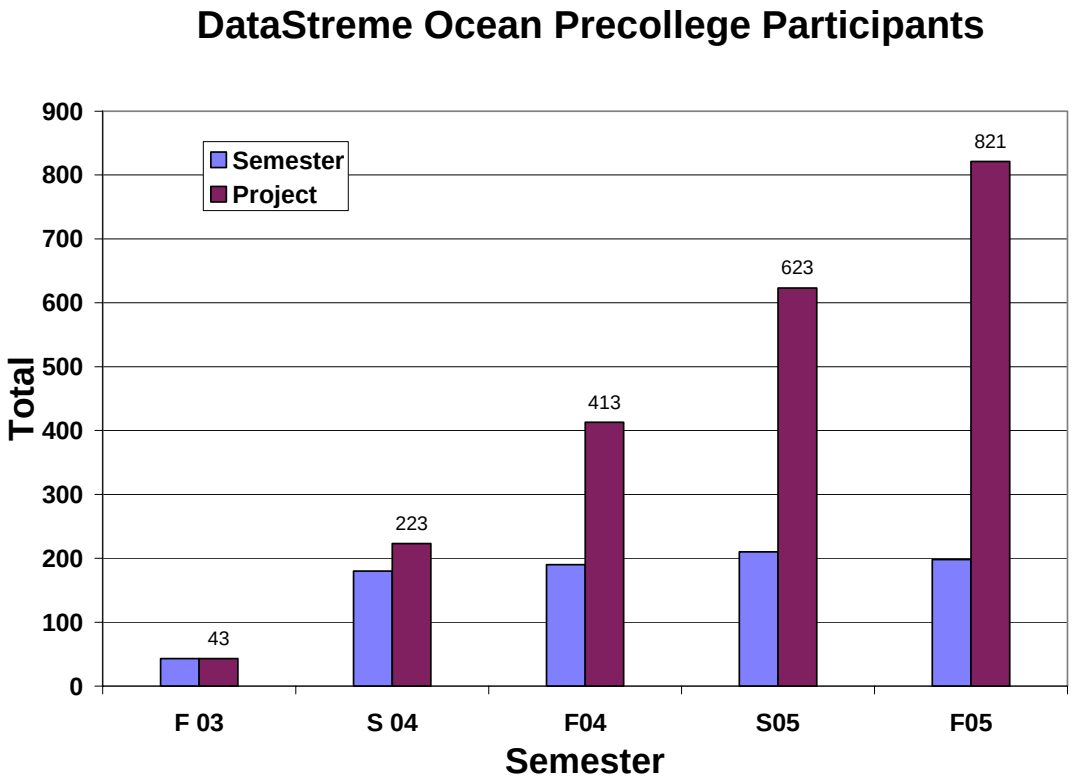

Figure 5. DataStreme Ocean precollege participant completions.

were again included on the survey conducted at the final meeting. Table 2 shows the averages of the changes in category of pedagogical attitude and the changes in percentage of content questions answered correctly between the Beginning and Ending Surveys over the history of the courses. Participants' self-assessed attitude to using the focus material of the course for teaching and peer interactions showed that they felt their abilities were increased by 1.5 levels, from initially "rudimentary" to finally "adequate"/"superior". General mastery of course topics, as shown by the number of correct responses to eleven science-content questions, had an average percentage increase from 14 to 18 percent, depending on the course. The more general water cycle material (WES) was apparently more familiar to course participants than the lesser-known oceanography (OCE) and weather (ATM) information. The initial correct percentages were approximately 55% while final correct percentages were over 70%. Both the attitude and content increases were statistically significant at the 95% level (Weinbeck et al., 2002).

Table 2. DataStreme course change data from Beginning and Ending Surveys.

	ATM	WES	OCE
Pedagogy			
1. wx/wtr/oce for interest	1.3	1.2	1.4
2. wx/wtr/oce for science	1.4	1.2	1.4
3. Internet use for science	1.6	1.5	1.7
4. assist colleagues	1.7	1.5	1.6
Average	**1.5**	**1.4**	**1.5**
Content			
Average	**18.4**	**13.6**	**16.7**

5.3 *Long-term Impacts*

Results from an earlier follow-up survey that was given to DataStreme alumni at least one-semester after their enrollment indicated that each teacher had approximately 20 interactions with colleagues and impacted 225 students. Employing these averages along with numbers of participants completing the courses each year (allowing for some attrition of effort with time), we estimate that hundreds of thousands of teachers and millions of students have benefited from the teachers completing the DataStreme courses.

6. CONCLUSIONS

In its fifteen years of operation, the AMS Education Program has developed an enviable national reputation. In the decade of offering teacher enhancement courses, its DataStreme Atmosphere, DataStreme WES and DataStreme Ocean courses have developed over ten thousand resource teachers and peer-trainers who in turn interact with hundreds of thousands of their colleagues. One further indicator of course satisfaction is the completion rate for participants. Over the course histories, the percentage of participants who completed the course after beginning were 96, 98 and 98% for the DataStreme Atmosphere, WES and Ocean courses, respectively. These values are remarkably high for any distance-learning course. Also, many participants have elected to take more than one of the courses if available in their areas.

Master precollege teachers trained in various aspects of the AMS Education Program have also been instrumental in the implementation of the National Science Education Standards at their state levels, through writing local and state frameworks and assessment materials. They have demonstrated leadership impacting the teaching of science, mathematics and technology in almost 40 states.

The ten thousand teachers trained in AMS Earth system science courses are using current environmental data to train their colleagues and students in exciting ways to bring immediacy and purpose to science teaching.

For more information on the DataStreme courses, please see,

Atmosphere:
http://www.ametsoc.org/amsedu/DataStremeMiddle.html

Water in the Earth System:
http://www.ametsoc.org/amsedu/WES/index.html

Ocean:
http://www.ametsoc.org/amsedu/DS-Ocean/Join.html

7. REFERENCES

Geer, I.W., J.M. Moran, D.R. Smith, R.S. Weinbeck, E.J. Hopkins, and B.A. Blair, 2003: Water in the Earth System (WES): A midterm evaluation of a distance learning course on the water cycle. *Preprint CD*, *12th Symp. on Education*, Long Beach, CA.

Geer, I.W., J.M. Moran, B.A. Blair, R.S. Weinbeck, D.R. Smith, and E.J. Hopkins, 2004a: DataStreme Ocean: A new distance-learning course for precollege teachers on the basics of oceanography. *Preprint CD*, *13th Symp. on Education*, Seattle, WA.

Geer, I.W., R.S. Weinbeck, J.M. Moran, E.J. Hopkins, E.W. Mills, and B.A. Blair, 2004b. DataStreme courses: Teacher enhancement utilizing current environmental data and the Internet, *Preprint CD, 13th Symp. on Education*., AMS, Seattle, WA, 4 pp.

Smith, D.R. and I.W. Geer, 1991: Establishment of the American Meteorological Society's Atmospheric Education Resource Agents (AERA) Program. *Bull. Am. Meteor. Soc*., **72**, 612-615.

Weinbeck, R.S., I.W. Geer, E.J. Hopkins, J.M. Moran, and B.A. Blair, 2002: DataStreme: A distance-learning teacher enhancement model that works. Preprints, *11th Symp. on Education*, Orlando, FL, 90-92.