13.6 MODERNIZING THE AMS K-12 TEACHER PROFESSIONAL DEVELOPMENT MODEL FOR CONTEMPORARY LEARNING NEEDS

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1. INTRODUCTION

After the AMS Education Program was established in 1990, Dr. Ira Geer quickly developed a prominent presence in K-12 teacher professional development. His work built on years of leading similar programs as a faculty member at the State University of New York's College at Brockport. Ira had an innovative vision for making weather information accessible to teachers and students, enhancing their understanding of weather concepts, and fostering collaborative relationships between teachers and experienced scientists.

2. DATASTREME

The AMS DataStreme initiative, which began in the mid-1990s and continues to this day, is a testament to the longevity and impact of Ira's vision for K-12 education. The following sections explore its evolution.

2.1 *Foundation*

The AMS Project Atmosphere program was established in 1992. It built on earlier training sessions at the NWS Training Center in Kansas City to create a group of master teachers who could train their colleagues and share knowledge with their students (Figure 1). The Maury Project (Project Ocean) followed in 1994, playing a major role in developing master teachers with expertise in physical oceanography. Both programs were instrumental in shaping leaders for the AMS DataStreme program, which Ira launched in the mid-1990s.



Figure 1. Outreach card for Project Atmosphere. [AMS]

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2.2. *DataStreme Atmosphere*

DataStreme Atmosphere, the first funded course, provided current weather data to teachers and inspired them to share the excitement of hands-on data usage and study with students and other educators. A key part of this vision was the newly emerging technology of internet accessibility, which allowed data to be relayed and curated at an accelerated pace. Ira had the foresight to leverage this technology in Geoscience education. Equally important to him was elevating teachers as respected professionals and empowering them to expand their impact on K-12 students and fellow educators through their participation in AMS programs.

DataStreme enabled hundreds of teachers to participate during fall and spring semesters while fostering local connections between educators and scientists. Dr. Geer's original DataStreme model featured 3-member Local Implementation Teams (LITs) composed of Project Atmosphere alumni, university scientists, and NOAA/NWS forecasters. These teams mentored 8-10 teachers each semester. Dr. Robert Weinbeck, a faculty member at SUNY Brockport, served as the course instructor of record, allowing participants to earn graduate credit. Drs. Geer and Weinbeck collaborated on hands-on course investigations and laid the foundation for a comprehensive course textbook, later authored by the late Dr. Joseph Moran of the University of Wisconsin-Green Bay. Dr. Edward Hopkins developed a Daily Weather Summary, which was shared with teachers to help them study weather patterns. The emerging use of the Internet further facilitated the sharing of NWS weather maps formatted for educational purposes, along with dissemination of NOAA resources (Figure 2).



Figure 2. A student of a DataStreme teacher examines a NOAA graphic. [Photo courtesy of LoriAnn Pawlik, used with teachers and family/student permission]

2.3. *DataStreme Expansion*

Over time, Dr. Geer, and later Dr. James Brey, expanded the program with NSF, NOAA, and NASA-supported courses, including DataStreme Water in the Earth System (2001-08), DataStreme Ocean (2006-present), and DataStreme Earth's Climate System (2009-present), complementing DataStreme Atmosphere and summer workshop-focused offerings (Figure 3). To date, more than 20,000 teachers have completed DataStreme courses, with thousands more participating in AMS summer courses. According to an AMS survey-based impact model, these educators have reached over 200,000 colleagues and millions of students.



Figure 3. Textbooks used in the DataStreme Atmosphere, Earth's Climate System, and Ocean courses.

2.4. *Transition to Pennsylvania Western University*

In 2017, with the retirement of Dr. Weinbeck, then Education Director Wendy Abshire facilitated the transition of AMS courses to Pennsylvania Western University (PennWest), formerly California University of Pennsylvania, with Professor Dr. Chad Kauffman leading the evolution. This institutional change brought further modernization to the DataStreme mentoring model and introduced the use of a learning management system (LMS). The suite of weather, ocean, and climate courses enabled an AMS community of practitioners who could take multiple courses, earn the PennWest/DataStreme post-baccalaureate certificate, and be recognized as Certified AMS Teachers (CAT).

2.4. *New DataStreme Model*

Dr. Geer's vision continues to thrive under a new model that retains the core elements of a highly successful graduate course: personal support for teachers; educators and scientists as course mentors; a university partnership for graduate credit; and a continued emphasis on current data-rich, hands-on learning. In 2023-24, AMS paused its DataStreme courses to implement a major programmatic upgrade led by Director Dr. Aaron Price. This pause year was driven by NOAA Education's priorities to create a modern, more inclusive pedagogical model and broaden course participation, focusing on reaching underserved communities. The revision to the AMS Education teacher PD model was informed by a needs-analysis survey that Dr. Price conducted in the fall of 2023. He initially interviewed a select group of K-12 teachers and then distilled interview information into 23 specific PD needs. The AMS team then disseminated a survey fully completed by 186 teachers. Results show that hands-on activities, concrete takeaways, and accurate science are the most important elements of PD to those surveyed. Less important to them were learning about the latest trends in teaching, having reflective moments, and hybrid learning (they strongly prefer in-person learning). Figure 4 shows a partial ranking of needs from the collected data.

	Overall		
	Average Rank	St. Dev.	Freq of #1 Ranks
Number of Responses	*186*		
Hands-On Activities: Engaging teachers with interactive activities, allow them to be a student.	7.06	5.54	24
Authentic Science Experience: Providing real-world science experiences and applications.	8.10	6.14	26
Interactive Classroom Materials: Using materials that promote active learning and engagement.	8.87	6.08	13
Up-to-Date Science Content: Keeping the curriculum current with the latest scientific findings.	9.25	6.05	15
Content Relevant to Student Lives: Making content relatable, practical, and significant to students.	9.56	6.01	9
Use and Concrete Takeaways for Students: Focusing on immediate usefulness for students.	9.59	6.18	8
Concrete Takeaways for Teachers: Focusing on immediate usefulness in teaching.	9.72	6.51	14
Project-Based Activities: Encouraging learning through hands-on projects.	10.32	6.09	8
Field Trips and Experiential Learning: Incorporating practical, real-world, unique experiences.	11.30	6.81	7
Intellectual Rigor and Growth: Educator personal growth regarding science.	11.89	5.78	4
Graduate Level Course Credit: Offering credit that counts towards advanced education.	12.49	7.01	15
Collaborate With Other Educators: Fostering collaboration and idea sharing among teachers.	12.65	6.05	5
New Technologies: Introducing and utilizing cutting-edge technologies in teaching.	12.97	6.35	3

Figure 4. Survey ranking of teacher PD program priorities.

This upgrade focused on the following: (1) creating a more accessible and inclusive course pedagogical model; (2) enhancing course activities with revisions of the course investigations manuals and Current Studies investigations; (3) restructuring the mentoring system into focused teams on course content, navigation, and pedagogy; and (4) utilizing modern educational tools such as Padlet and Slack for communication (Figure 5).

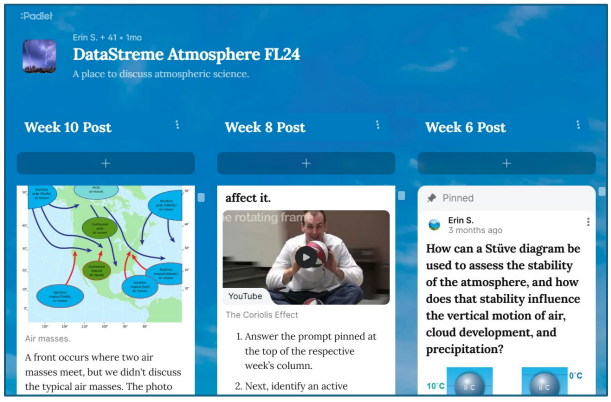


Figure 5. Screenshot of DataStreme Atmosphere Padlet.

Each course has a Padlet linked from the PennWest LMS and is used for postings and discussion by program

staff, teacher participants, and mentors concerning particular content items. AMS staff and mentors utilize Slack and specific channels for communication on a range of course items. Mentors continue to support AMS staff and the PennWest course instructor by interacting with teacher participants and providing timely and valuable feedback. The pedagogy group also evaluates the Lesson Plan submitted by teachers near the end of the semester.

The new model allows for additional NOAA partnerships. A group of NOAA personnel has volunteered to be content specialists for each course, ready to answer teacher participant questions that the DataStreme course content mentor group may pose to them.

There is also an increased emphasis on reaching underserved teachers and students, a priority that was central to Ira's vision. AMS modified its course outreach to advertise the course as being available to teachers at any U.S. location, not just those connected to a particular mentor. AMS also installed a scoring system that prioritizes diversity in all its forms (teaching experience, community location, type of school, etc.).

The DataStreme courses resumed in the fall 2024 semester, and AMS, in partnership with the CIRES Center for Education, Engagement, and Evaluation (CEEE) group, has been collecting data that will allow for assessment of the new model and future refinement.

3. CONCLUSIONS

The AMS DataStreme courses continue to embody Ira's vision for K-12 teacher professional development in Earth system science, which began half a century ago at SUNY Brockport. While the courses have naturally evolved through modernization, expansion, and transition, they remain grounded in the core values Ira established at the AMS Education Program's inception.

4. ACKNOWLEDGEMENTS

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