

Teaching School Teachers about Weather and Climate

Science teachers in public schools face a difficult challenge to educate tomorrow's leaders about climate and global change while meeting state standards in physics, environmental, and Earth sciences. Scott Denning, Director of Education and Diversity for CMMAP, and Brian Jones, Director of the Little Shop of Physics, have developed a 2-credit course on Weather and Climate for Teachers that combines advanced undergraduate content with pedagogical innovation and a library of classroom inquiry modules to give teachers the tools they need to succeed. The course is taught during the summer to avoid conflicting with teachers' busy academic-year schedules, and presents a semester's worth of material in five action-packed days.

Standards-based course content is organized by "following the energy" from the Sun through the atmosphere to the Earth's surface and back to space, driving wind, weather, and ocean currents along the way. It is divided into 10 half-day units, each of which is taught according to the "Five E's: Engage, Explore, Explain, Extend, and Evaluate." We begin with a "bang" by surprising teachers with a 5-minute classroom experience (*Engage*) that challenges their assumptions and piques their curiosity. This is followed by a longer inquiry activity (*Explore*) in which participants learn basic physical principles of climate by hands-on experimentation. Formal academic content is then presented through in lecture format with notes and visual aids (*Explain*), after which teachers spend an hour or so working in groups to solve problems in depth (*Extend*). Each unit culminates in a discussion of how the activities and content could fit into existing curricula and classrooms, and how the unit itself could be improved (*Evaluate*). This past year we have incorporated a sixth "E", *Exploration*, which introduces how some of these Atmospheric Science concepts were explored and discovered. Thomas Birner, CSU Atmospheric Science Professor, joined the course this year, playing the role of historical scientists Teisserenc de Bort and Edmond Halley.

The course has so far been offered to 170 K-12 teachers over five summers, and is available as a "kit" including all science content, media, and inquiry activities at <http://www.cmmmap.org>. Course participation has been expanded to emphasize underrepresented groups and underserved school districts in the region, and from large urban districts nationwide. Over the last 3 years we have reached out to teachers who are affiliated with CSU's Alliance Partnership and most recently with teachers from the Pine Ridge Reservation in South Dakota.

Teachers receive a stipend for their participation, as well as breakfast and lunch each day and about three large boxes of classroom supplies to allow them to easily use or adapt the inquiry activities to their own lessons. They submit a written lesson plan to receive University credit, which is important for their own professional development. We also want the next generation of leading climate modelers to be excellent teachers, so graduate students at the Center participate in every aspect of the course, and lead the Extend sections of each unit. They gain valuable classroom experience in a fun but very intense week of work.



*Thomas Birner, CSU Atmospheric Science Professor, and Adam Pearlstein, LSOP member played the role of Teisserenc de Bort and Richard Assman, during this "Exploration" piece, where they discussed the discovery of the stratosphere.*



*2011 Weather and Climate for Teachers Participants*