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A summary report on EWOC 2006: An international conference to promote weather, ocean, and climate education

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1. INTRODUCTION

This past summer (July 2006), the Seventh International Conference on School and Popular Meteorological and Oceanographic Education (ICSPMOE) was held in Boulder, Colorado. The purpose of this conference is to provide educators with a forum to share information about initiatives that promote the study of weather, ocean and climate. Educators and scientists described a myriad of programs, activities and outreach endeavors to promote the study of atmospheric, oceanic and related topics for both formal and informal education. This paper reviews the history of the previous six conferences, summarizes highlights of the EWOC 2006, and discusses plans for the next conference.

2. HISTORY OF THE CONFERENCE

The International Conferences on School and Popular Meteorological and Oceanographic Education, now known as EWOC (Education: Weather, Ocean, Climate) began in 1984, when the first such conference was held in an Oxford University college. The host organization was the Royal Meteorological Society (RMS) and the conference was co-sponsored by the American Meteorological Society (AMS) and the World Meteorological Organization (WMO). The meeting attracted 82 participants from 22 countries, and the proceedings of the conference were published by the RMS in 1985 in a volume called *Weather Education* (Walker, 1985). This publication contains a record of the papers presented at the conference, as well as information about the workshops and exhibitions that were important elements of the meeting. It also contains the text of the address by Professor G.O.P. Obasi, Secretary-General of the World Meteorological Organization, who opened the conference.

The second conference expanded its focus by including oceanography as a field of interest. It was held in July 1989 in Crystal City, just outside Washington DC. It was hosted by the AMS and co-sponsored by the RMS and the WMO. The conference attracted 180 participants from sixteen countries, of which almost 100 were teachers from the USA, supported by the AMS and a generous grant from the National Science Foundation (Snow et al., 1990).

The third ICSPMOE was held in Toronto, Canada, in July 1993 at the Ontario Science Centre. The host organization was the Canadian Meteorological and Oceanographic Society, and the co-sponsors were again the AMS, the RMS and the WMO. The conference attracted 140 participants from twenty countries (Newman and Smith, 1994).

The venue of the fourth conference, held in July 1996, was the University of Edinburgh, Scotland, and the host organization was again the RMS with the AMS and the WMO as co-sponsors. The conference attracted 124 participants from sixteen countries, many of whom took advantage of the two post-conference study days which focused

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upon the outstanding geology of Scotland's east coast (Moran et al., 1998).

The fifth ICSPMOE (the first conference called EWOC) was held in Australia in July 1999. The first two days of the conference took place in the University of Ballarat and the last two in a secondary school in Melbourne. On the third day of the conference, enroute from Ballarat to Melbourne, conference delegates enjoyed visits to the Marine Discovery Centre at Queenscliff and the Australian Bureau of Meteorology in Melbourne. The conference was hosted by the Australian Meteorological and Oceanographic Society, and the co-sponsors were again the RMS, the AMS and the WMO. In addition, several Australian institutions provided support, among them the Bureau of Meteorology. The conference attracted 105 participants from twelve countries. An innovation for this conference was a competition for Australian schools in which students undertook weather projects (Smith and Moran, 2000).

The sixth conference was held in the Universidad Europea de Madrid, Spain, in July 2003. It was hosted by the university's Physics Department and attracted 120 participants from nineteen countries. The co-sponsors were, yet again, the RMS, the AMS and the WMO, with additional sponsorship provided by a number of Spanish organizations, including the Instituto Nacional de Meteorologia. For the first time, the pre-print volume took the form of a CD, produced by the host organization. Again, there was a competition in which school children were invited to prepare weather broadcasts.

Clearly, the six previous conferences have provided educators with an excellent opportunity to exchange their ideas on how to promote the study of weather, oceans, and climate and to present their innovations for the classroom or popular educational venues.

3. ACTIVITIES OF EWOC 2006

3.1 *Conference Venue*

The local host for EWOC 2006 was the University Corporation for Atmospheric Research (UCAR) Office of Education and Outreach (www.ucar.edu) in Boulder, Colorado, on behalf of the American Meteorological Society. The Local Arrangements Committee included representatives from several UCAR programs, NOAA, and the University of Colorado.

UCAR is the management organization for the National Center for Atmospheric Research (NCAR), one of the world's premier research facilities for atmospheric and related sciences. NCAR supports the community of atmospheric and geoscience researchers with tools such as aircraft and radar, to observe the atmosphere, and technology and assistance necessary to interpret and use these observations, including supercomputer access, computer models, and user support. NCAR's research projects, many in collaboration with the world-wide community of university researchers, cover a vast array of topics including: *atmospheric chemistry*—such as the chemical structure of healthy and polluted air; *climate*—including temperature, rainfall, winds, and extreme events over decades or centuries, from prehistoric times to the present and into the future; *weather ingredients*—such as cloud physics, storm structure, and other keys to improved weather forecasting; *weather hazards to transportation*—including detection and warning systems for turbulence and icing in the air and on the ground; *interactions between the Sun and Earth*—including solar weather; *computer science innovation*—for understanding and visualizing the whole Earth system; and *the role of humanity* in both creating change and responding to weather and climate.

The UCAR Center Green campus was the site of the conference. This venue provided a perfect setting for scientists and educators to discuss their contributions promoting educational endeavors on weather, ocean and climate.

3.2 *Conference Program*

The seventh conference (designated EWOC 2006) attracted 135 delegates from twelve different countries. The program included the following themes:

- The role of learned societies in educational outreach
- Enhancing public awareness of meteorology and oceanography through the media
- Teacher training
- Business and education partnerships for meteorology and oceanography
- Student-centered educational programs
- Cyberinfrastructure and computer-based learning for meteorology and oceanography
- Science, society and schools
- Education and outreach for the coastal and marine environment
- Indigenous perspectives of weather, climate and oceans
- Promoting diversity and enhancing the involvement of under-represented groups In meteorology and oceanography
- Informal education for meteorology and oceanography

- International education programs and collaborations.

The conference opened with welcoming remarks by Dr. Richard Anthes (President of UCAR), Dr. Momadou Saho (Chief of Fellowships Division, Education and Training Department, WMO), Dr. J. Malcolm Walker (Education Resources Manager, Royal Meteorological Society and founding father of the Conference) and Dr. David R. Smith (Program Committee Chair for EWOC 2007). Next, the conference was addressed with an inspiring talk by Dr. Tim Killeen (Director of NCAR) on the role of a national laboratory in promoting science education.

The conference consisted of 63 oral and 36 poster presentations, and 27 hands-on workshop sessions. The oral presentations were divided into 13 sessions according to the themes listed above, distributed over four days. The 4th of July had a special schedule due to the holiday. That day began with a poster session. Next, a number of AMS Education Resource Agents conducted hands-on activities for the rest of the attendees similar to an AMS Weatherfest. These activities demonstrated a variety of weather lessons suitable for the classroom. Examples include:

"Gravity Rules?"
"Boiling Water, with Ice"
"Catching the Invisible Giant"

There were two other workshop sessions during the week. In one session on Monday afternoon, AMS Education Resource Agents conducted three Maury Modules ("Coastal Upwelling", "Wind Driven Ocean Circulations", and "Density Driven Ocean Circulations") and three Project ATMOSPHERE modules ("Highs and Lows", "AMS Pressure Blocks", and "Hazardous Weather"). These modules provide instruction on various ocean and atmospheric topics with activities appropriate for classroom use. The final workshop session was conducted by various university and NCAR scientists and/or educators. These included topics related to climate and global change, modeling the Earth system, uses of digital libraries, etc. These workshops provided the attendees with excellent hands-on activities to assist teachers in elementary, secondary and even college classrooms to enhance the understanding of weather, ocean and climate topics.

The complete program and several papers are available on the EWOC 2006 conference website: http://www.ametsoc.org/meet/fainst/ewoc2006.html

3.3 *Field Trips and Post-Conference Activity*

In addition to the presentations and workshops, there were also a number of tours of research laboratories and scientific facilities in the Boulder area. Wednesday afternoon tours included:

National Renewable Energy Laboratory (Golden, CO) – Participants were introduced to the lab's research on renewable energy and energy efficiency technologies and practices, advances related science and engineering, and how it transfers knowledge and innovations in photovoltaics, bioenergy and wind energy to address the nation's energy and environmental goals.

National Oceanic and Atmospheric Administration (Boulder, CO) - This tour provided access to the Space Environment Center which monitors and reports solar activity and space weather and the National Weather Service Forecast Systems Laboratory, followed by a demonstration of Science on a Sphere.

USGS National Ice Core Lab (Lakewood, CO) – The tour of this USGS facility described and demonstrated the storage, archiving, and study of ice cores recovered from the polar regions of the world. The lab provides scientists with the capability to examine and measure ice cores, and it preserves the ice cores long-term for current and future investigations.

Fiske Planetarium (Boulder, CO) - The planetarium at the University of Colorado presented a show exploring many issues pertaining to ancient astronomy of Latin American and Native American cultures. It described the connections these cultures made with the cosmos and how sophisticated observations of the skies were influential in the development of architecture, calendars, and important stellar alignments.

There were three optional field trips on Wednesday evening in the Boulder area:

The Story Rocks Tell – Hiking Table Mesa to the Flatirons - The 2.5 mile hiking trail from NCAR Mesa Lab to the Flatirons presented exceptional views of the eastern plains as well as opportunities to explore the geological history of the Rocky Mountains. The group traversed rock units spanning ages from 300-80 million years old.

In Search of Pleistocene-Relict Plant Communities and Associated Wildlife in the Boulder Mountain Park - A two-mile hike into a cool, moist canyon in the Boulder Mountain Park provided an opportunity to view plant communities found nowhere else in the southern Rockies. The field trip leader described how these forested canyon communities survived 10,000 years of climate change. He also

pointed out wildflowers and wildlife of special interest.

Colorado Mining History Field trip to Jamestown, Colorado - An early evening field trip to historic Jamestown, Colorado (elevation 6929 ft, 2132 m), allowed participants to explore the legacy of past mining for gold and fluorite and related current water quality issues in this foothill community of 200 residents which relies on a pristine mountain stream for its drinking water.

The grand finale was a post conference field trip, entitled Weather, Flash Floods, and Natural History on the East Slope of the Colorado Rocky Mountains. This full day field trip featured dramatic geology, mountain vistas, weather stories, and wildlife viewing. The route (from Boulder, to Fort Collins, up the Big Thompson River, to the Alluvial Fan at Horseshoe Park in Rocky Mountain National Park) explored the sites and circumstances of three devastating flash floods that have occurred on the eastern slope of the Colorado Rocky Mountains in during the month of July over the past three decades. Torrential rains by mid-afternoon while visiting the Alluvial Fan water falls required the termination of the field trip and a return to Boulder. Fortunately, no flash floods were reported in the area!

The tours and field trips enhanced the conference by providing participants with both a scientific and cultural flavor unique to the Boulder, CO area. They were indeed splendid events which enriched the experiences of all who attended.

4. PLANS FOR THE FUTURE

Prior to closing the conference, a few resolutions were passed as guidance for future meetings. These included:

#1 - Be it resolved that at future EWOC conferences all nations would develop and share climate education curricula in order to prepare our youth to meet future challenges facing our environment.

2 - Whereas teachers throughout the world need assistance in understanding and teaching topics in meteorology, oceanography and climate, and

Whereas the learned societies around the world have developed, tested and successfully delivered materials and instruction, including classroom-ready activities, on topics in meteorology, oceanography and climate to support teachers in their understanding of these disciplines, and

Whereas there is a lack of awareness in many school districts of the teaching resources provided by learned societies, therefore,

Be it resolved that the International Organizing Committee for School and Popular Meteorological and Oceanographic Education (also known as the EWOC Organizing Committee) extend invitations to school district officials and education department officials responsible for staff development to attend future EWOC conferences with a view toward making greater utilization of the resources in primary and secondary schools.

#3 - Whereas a goal of the International Conference on School and Popular Meteorological and Oceanographic Education is to promote understanding of our physical environment,

Be it resolved that we expand our focus to promote the study the Earth as a system, to include the Earth and space sciences in addition to meteorology and oceanography, in addition,

Be it resolved that our conferences in the future identify issues and challenges of global importance, in addition,

Be it resolved that our conference continue to provide a forum for the exchange of data, information, and instructional materials and to offer an opportunity for participants to form partnerships, collaborate on projects and share the achievements of their educational outreach efforts.

#4 - Whereas the International Conference for School and Popular Meteorological and Oceanographic Education strives to promote educational outreach for our respective disciplines on a global scale and that we wish to enhance the understanding of weather, oceans and climate by all throughout the world.

Be it resolved that the International Organizing Committee make a concerted effort to increase participation at future conferences of educators from underdeveloped countries worldwide and to reach out to underrepresented populations that are not currently attending our meetings

The International Organizing Committee elected to expand its focus for its next meeting. Given the direction of atmospheric, oceanic and related sciences to broaden its scope toward the entire Earth System, the consensus of the Committee was to broaden the scope of future conferences to include educational outreach in the Earth and space sciences. It is hoped that this approach would attract a broader audience, especially

teachers who are required to teach subjects covering the Earth and space sciences. The Committee also decided to hold its next conference in Prague, the Czech Republic, tentatively scheduled for July 2009. Attempts will be made to solicit participation from other geosciences education organizations to join in this effort to promote awareness in both formal and informal settings of how to enhance our understanding of our Earth system and space and how to best teach students of all ages about these topics.

5. SUMMARY

The International Conference on School and Popular Meteorological and Oceanographic Education (also known as EWOC 2006) was held on 3-7 July 2006 EWOC conference. The UCAR Office of Education and Outreach hosted the conference at the UCAR Center Green facility in Boulder, Colorado. Informal, K-12, and undergraduate teachers from around the world with interest in weather, oceans, and climate educational programs attended this event. There were a total of 135 participants from twelve countries in attendance. The conference consisted of 63 oral and 36 poster presentations, and 27 hands-on workshop sessions on a wide variety of topics relevant to weather, ocean and climate topics. In addition, there were several tours of laboratory facilities and fieldtrips to scenic locations in the Boulder area. This five-day event provided participants with a marvelous opportunity to share information about their respective educational outreach endeavors and how they promote awareness of weather, climate and oceans.

Before closing the meeting, the attendees passed four resolutions to provide direction for future activities and future conferences. In addition, the International Organizing Committee elected to hold the next conference in Prague, the Czech Republic, likely in July of 2009. It was further decided to broaden the scope of this meeting to include the Earth and space sciences.

Details on the conference may be accessed on http://www.ametsoc.org/meet/fainst/ewoc2006.html

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