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THE COMET PROGRAM: A DECADE OF PROFESSIONAL DEVELOPMENT FOR OUR CIVILIAN AND MILITARY WEATHER SERVICES

Timothy C. Spangler*
UCAR/COMET® Boulder
Boulder, Colorado

1. INTRODUCTION

In 1989, the University Corporation for Atmospheric Research (UCAR) and the National Weather Service (NWS) established the Cooperative Program for Operational Meteorology, Education and Training (COMET) to promote a better understanding of mesoscale meteorology and to maximize the benefits of new weather technologies. Initially, the program was funded primarily by the National Weather Service through a NOAA cooperative agreement. The Navy Meteorology and Oceanography Command and the Air Force Air Weather Service (later named the Air Force Weather Agency) were also major sponsors of COMET's early distance learning activities.

To fulfill its commission, the COMET Program addresses education and training needs for weather forecasters, hydrologists, and university educators by disseminating scientific knowledge and supporting related applied research activities. Keeping in mind that practicing forecasters and hydrologists have limited time available for professional development, the COMET Program produces and delivers training materials on broad topics that are divided into short, focused sections. These materials are designed to be easy to learn from and to serve as a ready body of reference materials for the working professional in the operational forecast community. In addition, the COMET Program provides funding for applied projects that link universities and local forecast offices in conducting collaborative research that improves the transfer of science to practice and serves the public good.

Much of the COMET Program's success comes from adherence to the following goals:

- Provide high quality learning opportunities and assistance in developing educational programs by applying state-of-the-art educational technologies
- Seek innovative ways to enhance the performance of weather forecasters and improve the public's use of weather products
- Expedite the transfer of scientific knowledge into forecast operations
- Provide mechanisms for operational forecasters, research scientists, and academic scholars to work together to advance the science
- Build strategic alliances with educational institutions, the federal government, professional organizations, and industry to facilitate the development and distribution of educational products and services

2. EARLY YEARS: 1990-1995

During the early years of the program (1990-1995), COMET focused on distributing distance learning via the Laser Disc. Subjects were selected for their impact on weather services, both civilian and military, that were being modernized. The emphasis was naturally on the impact of Doppler radar and the use of mesoscale models to understand and predict mesoscale processes. The list of laser disc modules is presented in Table 1.

During this period, the assumption was made that NWS forecasters and military forecasters would be treated the same. This approach proved not to be workable. While 50% of NWS forecasters used the modules, the number was much lower for military users. Part of the reason for this was a disparity in the background knowledge of the two groups. NWS forecasters tended to hold college degrees in

*Corresponding author address: Timothy Spangler, UCAR/COMET, P.O. Box 3000, Boulder, CO 80307 USA; email: spangler@comet.ucar.edu.

meteorology, while military forecasters often had only high school degrees and were trained in meteorology in technical schools. Consequently, the content level of the modules was often geared at too high a level for the average military forecaster. It also proved difficult to expect a Navy ship for example to maintain and operate a laser disk player in the tight quarters typical of a Navy shipboard weather office.

Table 1 COMET Modules on Laser Disc

- Marine Meteorology*
- Forecast Process*
- Workshop on Doppler Radar Interpretation
- Boundary Detection and Convection Initiation
- Heavy Precipitation and Flash Flooding
- Numerical Weather Prediction
- Extratropical Cyclones

* available in both laser disc and CD formats

The program also focused on training NWS trainers, primarily the Science Operations Officer (SOO), from each NWS office. During this period, every SOO was required to take the COMET Mesoscale Analysis and Prediction Course, an eight-week graduate level course in mesoscale processes. Residence courses were covering mesoscale meteorology, hydrology, and satellite meteorology were also available to SOOs and other focal points. These people were then supposed to train the staff in their home offices, using the distance learning modules as additional resources. However, staffing cuts at the NWS meant that local training has been difficult to accomplish.

3. 1996-1999

The COMET Program changed its approach to distance learning in 1996 in several ways. It began to recognize the differences in the civilian and military forecasters and engineered more flexibility into the distance learning materials that were produced. Modules were shorter, more operationally focused, and distributed on compact disc (CD), which allowed them to be run on more reliable machines than the laser disk players. This was especially effective for the Navy shipboard weather offices. It also allowed individuals to take modules home for study. The number of topics distributed on CD grew rapidly, as can be seen in Table 2. During this period, NESDIS became a sponsor of the program and funded a comprehensive series of distance

learning modules on GOES and POES satellite data.

Classes continued to be offered to the SOO on various topics in mesoscale meteorology, to satellite focal points on new applications of satellite meteorology and to service hydrologists and hydrology focal points on advances in hydrology, and hydrologic modeling.

Table 2 COMET Modules on CD

- COMAP Symposium on Numerical Weather Prediction: Presentation Archive Including Three NWP Web Modules
- ASMET - Satellite Meteorology in Africa, Volume 2
- ASMET - Satellite Meteorology in Africa, Volume 1
- An MCS Matrix (v. 1.0) Including Mesoscale Convective Systems: Squall Lines and Bow Echoes (v. 3.0)
- Review of GOES IR Imagery Including Winter and Icing Applications
- Satellite Meteorology: Using the GOES Sounder
- Satellite Meteorology: Case Studies Using GOES Imager Data
- Hydrology for the Meteorologist: Basic Hydrology for Headwater Forecasting
- Satellite Meteorology: Remote Sensing Using the New GOES Imager
- Anticipating Convective Storm Structure and Evolution
- Fire Weather
- A Convective Storm Matrix: Buoyancy/Shear Dependencies
- Forecast Process*
- Marine Meteorology*

* available in both laser disc and CD formats

4. 2000-2003

This period was marked most strikingly by the transition to the World Wide Web for distribution of education and training. Modules were now available for free to the entire meteorological community (including international users). In 2002, COMET's meteorological education website (MetEd) had estimated 300,000 extended user sessions by users from all the weather services, the private sector, universities, and the international community. The National Polar-orbiting Operational Environmental Satellite System

(NPOESS) project and the Meteorological Service of Canada also joined COMET to sponsor the development of new distance learning products and services.

Modules now are smaller, much more focused on operational issues, and easier to update. The program has produced a lengthy series of modules on mesoscale processes designed primarily for the military forecaster, although they are extensively used by other forecasters as well. We now have over 85 web-based modules, covering a broad range of meteorological topics (Table 3). Some of these modules have been translated in to Spanish, French, and Russian. A complete list of all modules produced by the COMET Program is available at

http://www.meted.ucar.edu/resource_modlist.php

Table 3 Topics of COMET Modules

- Aviation Weather
- Climate
- Coastal Weather
- Emergency Management
- Fire Weather
- Fog and Low Stratus
- Hurricanes/Tropical
- Hydrology/Flooding
- Marine Meteorology
- Mesoscale Meteorology
- NWP (Modeling)
- QPF (Precipitation)
- Satellite Meteorology
- Winter Weather

The program has also branched into training for users of weather forecasts with modules produced for emergency managers on the topics of community hurricane preparedness and hazardous weather. The program also developed its first K-12 module entitled *Hurricane Strike!*[™] aimed at middle school kids. In this module, the student helps a fictional family prepare for an impending hurricane landfall. This module is the recipient of the 2003 Louis J. Battan Author's Award.

Residence classes have continued to focus primarily on trainers and focal points. But the distinct difference between the residence classes and distance learning of earlier years has blurred significantly. The residence classes are now viewed as good sources of distance learning materials, and many residence class

presentations have been developed into webcasts for wide distribution (Table 4).

Table 4 Webcasts from Residence Class Presentations

- A Social Science Perspective on Flood Events
- Dispersion Basics
- ENSO and Beyond
- Freezing and Melting, Precipitation Type, and Numerical Weather Prediction
- Heavy Banded Snow
- Hurricanes Canadian Style: Extratropical Transition
- Isentropic Analysis
- Quantitative Precipitation Forecasting Overview
- Rain Gauges: Are They Really Ground Truth?
- Should Synopticians Worry About Climate?
- Slantwise Convection: An Operational Approach
- The MJO Life Cycle
- The Role of the MJO on Oceanic and Atmospheric Variability
- The Use and Misuse of Conditional Symmetric Instability

5. SUMMARY

Over a 13-year period, the COMET Program has worked closely with both the U.S. and Canadian civilian national weather services and two of the U.S. military weather services to advance the skills and knowledge of forecasters. Over 2 million hours of training and education have been delivered. The program has focused on enhancing the skills of working weather forecasters, but many users from the United States and around the world have used COMET distance learning materials to improve the education of college students and new military trainees, and to broaden the skills of private sector meteorologists. The program continues today to work closely with the National Weather Service, the Naval Meteorology and Oceanography Command, Air Force Weather Agency, National Environmental Satellite Data Information Service, National Polar-orbiting Operational Environmental Satellite Systems, and Meteorological Service of Canada to improve weather forecasting worldwide.

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