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1. INTRODUCTION

The Science center for Teaching, Outreach, and Research on Meteorology (The STORM Project) is a cooperative program between the National Oceanic and Atmospheric Administration and the University of Northern Iowa (UNI). STORM seeks to increase public access to and understanding of atmospheric Key to achieving this broader science. understanding are science educators, especially those in middle and high school classrooms. A continuing education opportunity developed by the STORM Project was offered at UNI in June and July 2003. Forty-six science educators participated in one of two intensive one-week courses on weather analysis and forecasting. STORM has previously offered intensive summer forecasting courses for undergraduate and graduate students (Czarnetzki 2002).

2. COURSE DESIGN

Studies in Weather Analysis and Forecasting for Science Educators was designed for physical science teachers who had at least an introductory university-level course in atmospheric science or who were currently teaching a weather course/unit. Completion of the AMS DataStreme course (Geer et al. 1997) was one way that applicants could demonstrate exposure to basic atmospheric principles. Participants were recruited at the AMS Twelfth Symposium on Education, various state science teacher conferences, and through postings on the Iowa Science Teachers Association website.

The focus of the course was on modern, computer-based forecasting of convective weather systems. A working assumption was that participants were familiar with basic atmospheric principles or could quickly review them using the course textbook. The centerpiece forecasting technology was FX-Net (NOAA 1999), which emulates the Advanced Weather Interactive Processing System (AWIPS). The STORM Project has FX-Net installed on 24 student workstations and an instructor workstation in a renovated computer classroom.

A total of 46 teachers participated in the 2 sections of the course. Forty-four participants were from Iowa, one was from Michigan, and one was from Oregon. After introductory sessions on Sunday evening, weekday sessions ran Monday through Friday from 8:30 a.m. until 9:00 p.m. with extended breaks for lunch and dinner. Most of the participants were housed on campus. All participants earned two graduate credits from UNI.

Some of the major topics reviewed in the course were weather map analysis; METAR decoding; satellite and radar interpretation; principles of numerical weather prediction; severe weather forecasting; and uncertainty and atmospheric predictability. Each day included hands-on forecasting. Teachers were paired with a colleague and assigned forecast responsibility for a particular National Weather Service County Warning Area (CWA). By 5:30 p.m., each group produced a forecast of probability of precipitation during the "tonight" period (i.e., 00 to 12 UTC) for their CWA.

Participants' forecasts were guided by a particular technique each day. The first technique the class explored was the Perfect Prog. In this exercise, the Eta, Aviation (AVN), and Nested Grid (NGM) Models' precipitation predictions were blended to produce forecasts of precipitation measuring more than a trace inch. The second evening's forecast was based only on the statistical regression guidance produced by the Eta, AVN, and NGM. By the third evening, the course had covered a number of conceptual models for the forcing/enhancement of atmospheric ascent (e.g., frontogenesis, jet streaks, instability). Teachers were asked to identify where precipitation was favored by at least one of these models and to subsequently combine the 'perfect prog' and statistical regression techniques they had used in their two previous forecasts. The last evening's forecast was designed to illustrate severe weather

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forecasting techniques. Each group had to forecast the location of the one point in the United States that would be closest to the most severe weather reports (using a 60 nautical mile search radius) for the overnight period. Forecasts needed to be based on sound physical reasoning.

Each morning, teachers verified their own forecasts by interpreting METAR reports and assigning error points. Groups were also asked to share their own qualitative assessment of the 'goodness' of their forecast and how they could have improved their performance.

Participants were also required to develop a forecasting activity appropriate to their particular home classroom. These activities were shared with other participants on the last day of the course and ranged from METAR interpretation to temperature forecasting contests.

3. RESULTS

Teachers who participated in the STORM forecasting course gained valuable experience with modern weather prediction. Few were initially aware of the conceptual and numerical models used to produce a forecast, the wealth and variety of data involved in the process, or the complexity of producing a concise forecast from information that is often conflicting. The forecasting assignments, which progressed from literal acceptance of numerical guidance to forecasts guided by conceptual models, were designed to give participants an increasing sense of ownership of a forecast. Teachers quickly expressed the conviction that they could produce better probability of precipitation forecasts by usina prior experiences, knowledge of the local area, and conceptual models.

Participants were impressed by the which weather degree to forecasting incorporates technology into problem solving. Teachers were asked to write evaluations of FX-Net, since STORM is seeking to assess its use as an educational tool. Participants consistently noted the user-friendly nature of this interface to meteorological data. Beneficial features often mentioned by the 46 participants included the ability to overlay products, to toggle fields on and off in the primary display window, and to swap images between the primary and storage windows. The graphical presentation of data was found to be impressive and understandable. FX-Net products were deemed suitable for middle and high school students, especially those who are visual learners. Many teachers noted that they could spend an entire day looking at all of the data available to forecasters.

All teachers agreed that FX-Net would be invaluable in their own classrooms. Lacking this option, STORM designed a Web resource page with links to Internet resources that are similar to FX-Net products.

Participants generally favored the oneweek timeframe of the course. While additional forecasting experience would be gained during a longer course, participants' availability would likely begin to diminish. The broad audience the course served has greater potential to impact a larger number of middle and high school students.

4. FUTURE PLANS

A revised version of Studies in Weather Analysis and Forecasting for Science Educators is planned for summer 2004. Additional emphasis will be given to hands-on forecasting activities suitable for middle and high school students. As before, STORM will provide graduate credit, course materials, and room and board for teachers selected to participate. Application materials and further information about the course can be found on the STORM Project homepage at: http://www.uni.edu/storm

5. REFERENCES

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