10.1 THE WINTER WEATHER WARNING DECISION MAKING WORKSHOPS

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1. INTRODUCTION

The Warning Decision Training Branch (WDTB) delivered four training workshops on winter weather Warning Decision Making (WDM) during a two year span from October 2001 to July 2003. The primary objective for this three and a half day workshop was to deliver instruction to National Weather Service (NWS) forecasters on various winter weather forecasting and warning concepts, techniques and strategies. The aim was to help forecasters improve their ability to successfully apply these techniques in the forecast process and ultimately, provide better service with more timely and effective winter weather watches, warnings, and advisories.

This paper provides a look at some of the unique instructional and operationally oriented techniques of the winter weather workshop. Being learner-centered and performance-based was the goal for this workshop. WDTB instructors strove to establish this important relationship: each topic or presentation needed to be verifiable in the laboratory (i.e., concepts and/or techniques must be applicable in the 3-day simulation). This relationship is a proven formula for ensuring success in training (Stolovitch and Keeps, 2003).

The workshop objectives were developed from the specific job task Knowledge, Skills, and Abilities (KSAs) that a team of Subject Matter Experts (SMEs) developed from the Winter Weather Professional Development Series (PDS) (http://www.wdtb.noaa.gov/workshop/WinterWx/indexpds.html)

2. WORKSHOP FORMAT

We structured the format of the workshop presentations to mesh with the primary objectives and forecast methodology utilized for the 3-day laboratory Weather Event Simulator (WES) winter storm simulation (see section 3). This meant that the daily instructional presentations (which were typically conducted in the morning) were highly related to the learning objectives for latter that same day in the laboratory simulation. Thus, on the first day, the focus of the presentations was on the watch phase, the second day on the warning phase, and the third day, nowcasting.

For the first day, following introductions and statements of workshop objectives, a representative from the NWS Office of Climate, Water, and Weather Services (OCWWS) briefed the class on winter weather products and services. This discussion was especially timely as an updated NWS directive on Weather Forecast Office (WFO) winter weather products specifications was just being publicized.

Next, we had presentations aimed at climatology (forecasting the rarity of storms), ensemble forecasting (recognizing means and spreads), synoptic scale forecasting of precipitation type, and numerical weather prediction in general. Since the models are the primary tools in preparing the watch product, we stressed recognizing model signals at this stage. The winter weather watch products were defined in the workshop to give a 12 to 48 hour advance notice of a hazardous winter weather event which has the potential to threaten life or property.

The focus of the second day was the warning phase. Warning thresholds were defined as a situation when hazardous winter weather is occurring, imminent, or has a high probability of occurrence during the 12 to 36 hour period. So, we concentrated on how to analyze model forecast soundings using various techniques such as the top-down approach (Baumgardt, 1999) for forecasting precipitation type (12 to 36 hours out) . Plus, we introduced the use of BUFKIT (Mahoney, 2000) to visualize hourly model sounding parameters such as dendritic snow growth zones, thermal profiles, omega, and quantitative precipitation forecasts (QPF).

BUFKIT profiles were generated from running the Workstation Eta (WS Eta) model. Multiple runs over each domain used in the simulation were available for both the second and third days of the workshop. WS Eta model fields were displayable on AWIPS D2D (see figure 1) or with the BUFKIT sounding analysis program (see figure 2). BUFKIT was used to display hourly forecast profiles for multiple sites.

We also had presentations on the second day of the workshop on diagnosing the effects of frontogenesis and associated mesoscale banding phenomena in winter storm events. This was a very popular presentation as the concepts contained a technique that would improve operational forecasting

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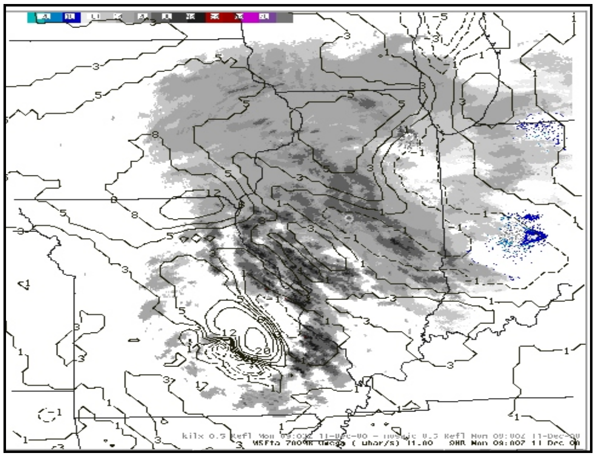

Figure 1. WES display of WS Eta 700 mb omega 9 hr forecast (contour interval every 2 μbar/sec) and 0.5 deg. radar reflectivity mosaic (shaded) valid 0900 UTC 11 December 2000.

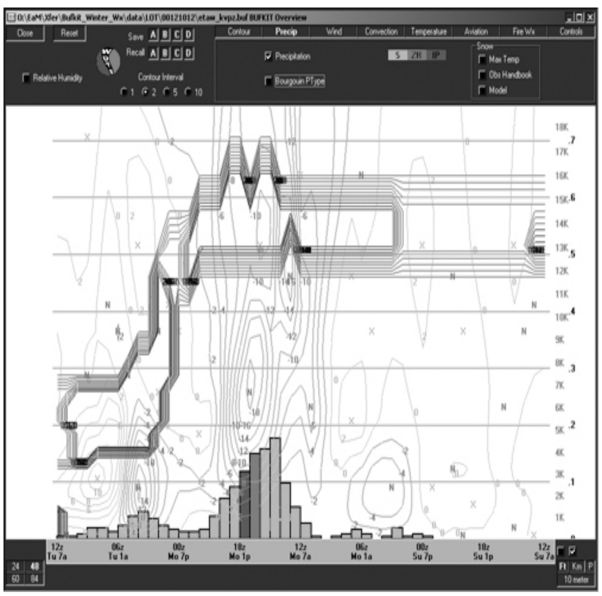

Figure 2. BUFKIT overview display from the WS Eta for Valparaiso (VPZ), IN for the simulation event. Hourly QPF with post-processed precipitation type shaded in bar graph format along x-axis (darker shades=mixed precip), negative omega (2μbar/s solid contoured), dendritic growth zone contoured in thick lines.

of heavy snow bands.

The third day (nowcast phase) we showed techniques for how to augment model forecasts with real-time integrated sensor data.

On Friday (last day of workshop) we wrapped up the exercise by showing the verification of the event, plus we discussed some lessons learned.

3. SIMULATION FORMAT

We first had to select a good winter storm case that would present a forecasting challenge and offer ample opportunities for training across multiple regions in the United States. We choose a case that occurred during 9-11 December 2000 which affected portions of the Central Plains, Upper Midwest and Great Lakes regions in the United States. Despite a great case, using a three-day case posed some problems for the workshop team.

When designing the case simulation, the key goal was to relate the simulation into as much as possible the material presented in the lectures each day. With an agenda filled with presentations on specific job-related skills, the three-day simulation concept was a natural extension of that goal. There were some key issues that needed to be overcome, however, to make the simulation work in the proposed manner. The rest of this section will focus on these issues and the results of overcoming them.

The idea of using multiple County Warning Areas (CWAs) for the simulation was unprecedented. In previous workshops, participants “worked” the simulations as one or at most, two CWAs throughout the *entire* case (for severe convective events, the workshop simulations usually last an hour or two). The winter weather workshop, on the other hand, utilized a totally new concept. Our simulation configuration was three forecasters working as a team at *nine different* workstations. The teams issued simulated products for

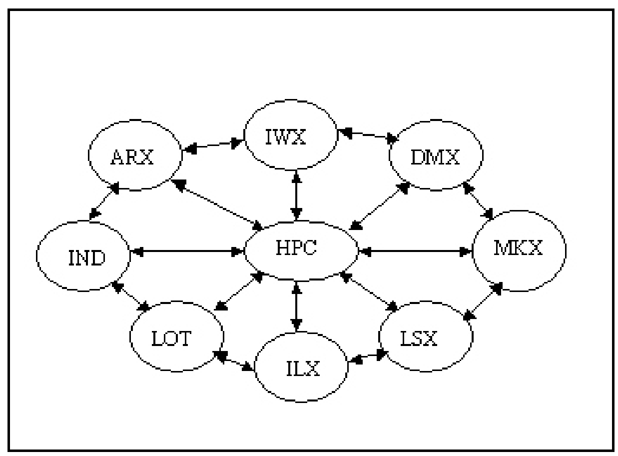

Figure 3. Depiction of collaboration flow of nested CWAs used in the winter weather simulation. The three-letter station identifiers are as follows: ILX (Lincoln , IL), LOT (Chicago, IL), IND (Indianapolis, IN), ARX (La Crosse, WI), IWX (North Webster, IN), DMX (Des Moines, IA), MKX (Milwaukee, WI), LSX (St. Louis, MO), HPC (Hydrometeorological Prediction Center).

eight different CWAs and the Hydrometeorological Prediction Center (HPC) (see figure 3), whose team was responsible for issuing national guidance products. Each team worked the same event over a *three day* period. The AWIPS D2D software is not necessarily designed to work in this manner, especially when CWA-specific data were utilized in the simulation. Thus, the devised solution led to some creative nesting of the data directories in D2D.

A second issue that came up conducting simulation was the local data generated for each CWA. At the time these workshops were first implemented, use of on-station models, such as the WS Eta, was still a new concept. It took some time to test the model parameterizations to get output that would provide added value to the operational models and be useful for applying the forecasting techniques discussed during the classroom presentations. Once the model parameterizations were set, then all of the model runs

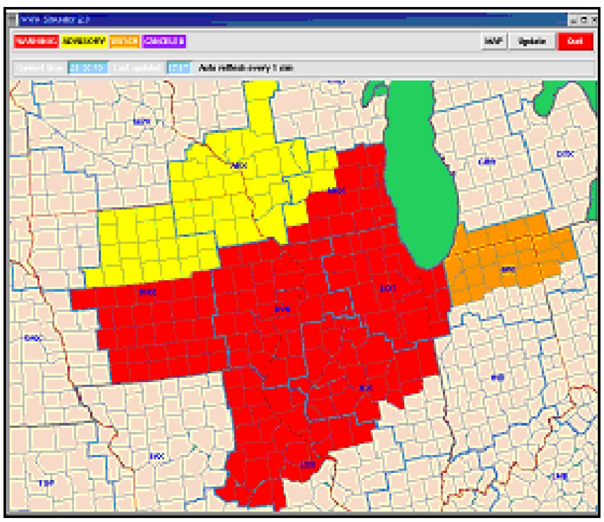

Figure 4. The WWA simulator tool used in the workshop to display watches, warnings, and advisories.

for each of the eight CWAs were created, which took longer than anticipated because of file size issues. Once the data were ready in their final form, the process to get the data viewable in AWIPS was a big challenge due to a lack of expertise.

A third significant issue dealt with the unavailability of a Watch/Warning/Advisory (WWA) tool for generating and displaying products in the simulation. Since collaboration among offices was a key concept of the workshops (and the simulations), a substitute program was created. This program, which is referred to as the WWA Simulator, allowed participants to issue products via WarnGen and track the products on a Graphical User Interface (GUI) to see how their products matched up with surrounding offices (see figure 4). This tool was invaluable during the workshop as a way of visualizing CWA collaboration and improving temporal and spatial consistency of watches and warnings.

By overcoming these three issues, the workshop experience was enhanced. The workshop participants were able to represent the different CWAs (and national center) with only a few minor technical issues. Having multiple CWAs allowed the participants to deal with a variety of forecast issues that could not have been represented using only a single CWA. The participants were able to use the Weather Event Simulator (WES) technology with AWIPS to utilize

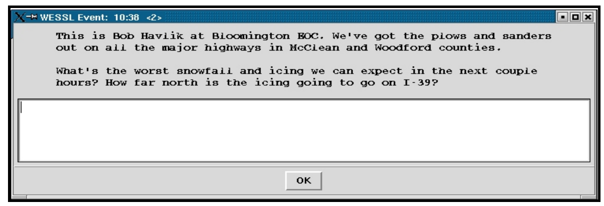

Figure 5. WESSL "pop-up" window used in the simulation.

new forecast techniques and data sources. One of the new features used in WES was the Weather Event Simulator Scripting Language (WESSL). This tool provided participants with simulated real-time queries, spotter reports and messages from emergency managers, and decision makers (See figure 5).

The daily "blast-up" calls headed by the HPC team occurred each day during the simulation where the class could discuss the event and come up with a common "big picture" of the upcoming event. The coordination and collaboration process simulated some aspects of operational HPC winter weather activities and led to more consistent products being issued by neighboring CWAs. If there were any product discrepancies, the participants utilized the WWA simulator to resolve product differences.

4. SUMMARY

The winter weather workshop utilized some innovative techniques to help students visualize and practice techniques for winter weather forecasting. Incorporating techniques such as use of BUFKIT for precipitation type forecasting into the simulation led to greater usability and understanding of key concepts presented at the workshop . The training objectives were met, which ultimately can lead to more effective winter weather products and services from the NWS.

5. REFERENCES

Baumgardt, Dan, 1999: Precipitation type forecasting, A VISITview teletraining presentation available online at http://www.cira.colostate.edu/ramm/visit/ptype.html.

Mahoney, E. A., and T. A. Niziol, 2000: BUFKIT: A software application toolkit for predicting lake effect snow. *Preprints, 13th Intl. Conf. On Interactive Info. and Processing Sys. (IIPS) for Meteorology, Oceanography, and Hydrology, Amer. Meteor. Soc.,* Long Beach, CA.

Stolovitch, Harold D, and Erica J. Keeps, 2003: Telling ain't training. *American Society for Training Development (ASTD),* Alexandria, VA, 193 pp.

The Warning Decision Training Branch (WDTB) Winter Weather Workshop, the complete list of presentations are available online at http://wdtb.noaa.gov/workshop/WinterWxIV/index.html.