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1. INTRODUCTION

Ensemble Prediction Systems (EPSs) are becoming more usable as a numerical weather prediction (NWP) forecasting tool, and are being produced by an increasing number of NWP centers around the world. Additionally, the National Weather Service (NWS) had a goal of expressing forecasts in probabilistic terms, a perfect application of EPSs. In response to the need for training on EPS, the University Corporation for Atmospheric Research (UCAR)/Cooperative Program for Meteorological Education and Training (COMET) developed NWP training during 2004 and the first half of 2005 to help forecasters intelligently use ensemble prediction systems (EPSs). This extended abstract will cover elements of this new training and the different modes of providing it.

2. TRAINING MODALITIES

2.1 *Web-based module*

A major training web-module on EPS was published in January 2005, called Ensemble Forecasting Explained. A screen capture of the web interface for the module is shown as Figure 1.

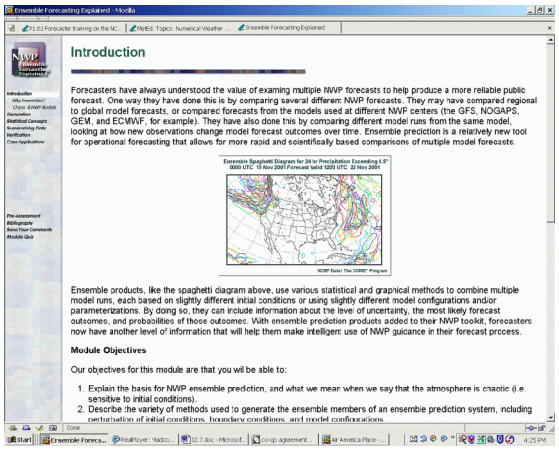

Figure 1. The interface for the Ensemble Forecasting Explained web module, published in January 2005.

This ensemble module is considered to be at an advanced level, and is divided into six sections, which can be accessed using the menu on the left-hand side of the web page. The initial three sections start with an introduction explaining the basis for ensemble prediction. Second, there is a discussion of how the forecasts in the EPS are generated. Then third, statistical concepts necessary to understand EPS products are covered.

The final three sections of the module include a section of how huge volumes of EPS data are summarized for use in the forecast process, a short section on EPS verification, and finally a section of web links to case applications from the NWP PDS case examples.

A unique feature of this module is pre- and post-module quizzes to assess the students' knowledge base and the effectiveness of the training in improving their knowledge of EPS and their use in the forecast process. The module can be taken in sections, and any sections deemed unnecessary by the trainer can be skipped without loss of usefulness. A printable version of the module is also available for use by trainers.

2.2 *Ensemble webcast*

A second mode of training, in the form of a webcast, was developed to complement the web-based Ensemble Forecasting Explained module. Dr. Bill Bua, with the support of COMET staff, authored this module as a somewhat more elementary supplement to the web module, and is intended for use by NWS, military, and private meteorologists. The Webcast itself is presented by Dr. Bua.

Figure 2 below shows a screen capture of the interface for the Webcast, called "Introduction to Ensemble Prediction". Sections include "Why Use Ensemble Forecasts?", "How Do We Make Ensemble Forecasts?", "Ensemble Products", "Ensemble Verification", "Use of Ensemble Products: Case Studies", and a summary section. Total time for the Webcast is 59 minutes.

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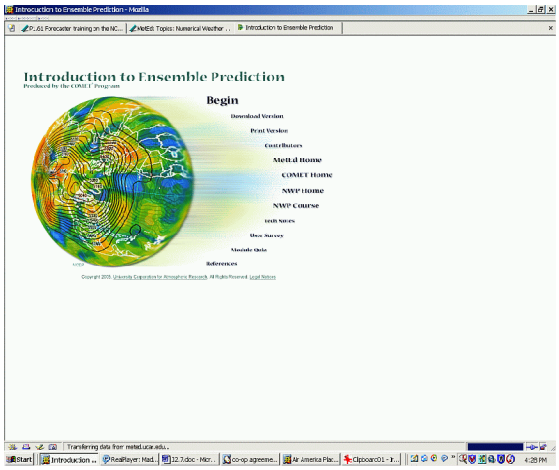

Figure 2. The interface for the Introduction to Ensemble Prediction webcast, published June 2005.

There is less emphasis in the Webcast on statistical methods and verification, and more emphasis on ensemble products and verification. More than one-half of the Webcast is devoted to the latter two topics. Download and print versions of the Webcast are also available. A module quiz can be taken to assess how well the Webcast information was assimilated by the student.

2.3 EPS matrix

While not yet published as of 5 July 2005, a web-based EPS matrix with links to general information on EPSs and the architecture of operational EPSs from different operational centers will be made available. The EPS matrix, similar to the NWP matrix, is a one-stop Web location for access to all things EPS. A draft of this matrix is shown below as Figure 3.

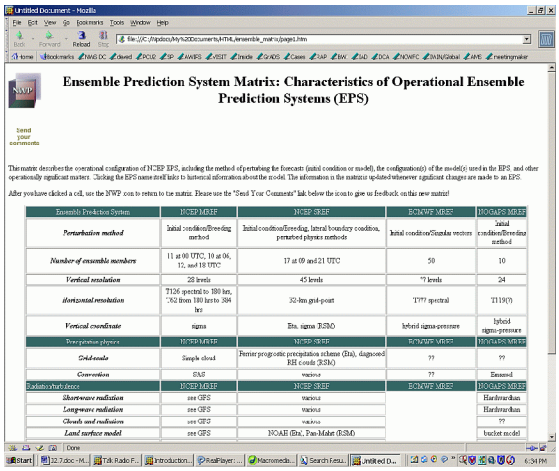

Figure 3. Draft of matrix interface providing one-stop web page for information on general EPS methodology and operational EPS information.

It is envisioned that the first column will be linked to the appropriate section of the web-based EPS training module. For example, the first item in the left-hand column, "perturbation method", would be linked to the "Generation" section of the Ensemble Forecasting Explained web module.

EPS-specific information will cover, at minimum, the National Centers for Environmental Prediction (NCEP) Medium-Range Ensemble Forecast (MREF) and Short-Range Ensemble Forecast (SREF) systems, the ECMWF medium-range ensemble, and the U.S. Navy NOGAPS medium range ensemble. It is likely that the Meteorological Service of Canada's EPS will be included as well.

2.4 *Case studies*

A series of case studies on EPS applications was started even before the Ensemble modules were created. These are included in the NWP PDS case applications section linked from the MetEd NWP training page. Several cases are complete, including winter weather cases for the Eastern U.S. and general cases involving the estimation of uncertainty in NWP model forecasts based on the predictability of the flow as assessed by the EPS forecast. Cases will be added as resources allow and situations arise.

3. PLANNED TRAINING FOR FISCAL YEAR (FY) 2006

In FY 2006, an additional mode of training will be developed and presented as field offices begin to obtain direct access to NCEP EPS data at the short- and medium-range through the Advanced Weather Information Processing System (AWIPS). Teletraining using VISITView software will be developed and delivered on both EPS systems as the data becomes universally available.

Additionally, case studies will continue to be developed on forecast problems of interest as situations arise.

4. CONCLUSIONS

The COMET Program has begin creating EPS training for field meteorologists at various levels of experience and training, in response to the increased usage of EPS in the forecast process and the need to produce probabilistic forecast products. Training comes in the form of web-based modules, webcasts, and web-based case studies.

In FY 2006, VISITView teletraining will be developed. Additional case studies will also be prepared and published as interesting EPS forecast applications occur.

5. ACKNOWLEDGEMENTS

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of the authors and do not necessarily reflect the views of NOAA or any of its sub-agencies.

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