Evaluating storm-scale model output for severe-weather forecasting: The 2007 NOAA HWT Spring Experiment

Michael C. Coniglio[1], John S. Kain[2], Steven J. Weiss[3], Ming Xue[4], Morris L. Weisman[5], Zavisa I. Janjic[6]

[1]University of Oklahoma/Cooperative Institute for Mesoscale Meteorological Studies, Norman OK, United States, Michael.Coniglio@noaa.gov
[2]National Severe Storms Laboratory, Norman OK, United States, Jack.Kain@noaa.gov
[3]Storm Prediction Center, Norman OK, United States, Steven.J.Weiss@noaa.gov
[4]Center for Analysis and Prediction of Storms/University of Oklahoma, Norman, OK, United States, mxue@ou.edu
[5]National Center for Atmospheric Research, Boulder, CO, United States, weisman@ucar.edu
[6]NOAA/NCEP/Environmental Modeling Center, Camp Springs MD, Zavisa.Janjic@noaa.gov

I. INTRODUCTION

The National Oceanic and Atmospheric Association (NOAA) Hazardous Weather Testbed (HWT) recently conducted the 2007 Spring Experiment at the new National Weather Center in Norman, Oklahoma over a seven-week period during the peak severe convective season, from late April through early June. As in recent Spring Experiments, the primary focus was an examination of near-cloud-resolving (dx = 2-4 km) configurations of the Weather Research and Forecasting (WRF) model in a simulated U.S. severe-weather-forecasting environment.

II. PRESENTATION OF RESEARCH

A new component to the Spring Experiment is the use of a 10-member ensemble of 4-km WRF model simulations provided by the Center for the Analysis and Prediction of Storms (CAPS). CAPS, the Environmental Modeling Center (EMC), and the National Center for Atmospheric Research (NCAR) provided additional WRF simulations. These simulations were evaluated based on their ability to 1) simulate the evolution of the pre-convective environment; 2) predict the location and timing of thunderstorm initiation and evolution; and 3) offer useful information on thunderstorm morphology with an emphasis on higher order classifications of discrete supercells and quasi-linear convective systems (QLCS). The main purpose is to determine the valued added by the use of storm-scale ensemble output compared to traditional deterministic model output. An example of a tool that was developed to display the ensemble information is shown in Fig. 1.

Evaluation procedures for the deterministic and ensemble forecasts include both subjective and objective verification strategies. Subjective approaches rely on the concept of consensus assessment by expert operational forecasters and research scientists. Panels of experts were anchored by forecasters from the Storm Prediction Center and scientists from NSSL and included a diverse group of researchers and forecasters from numerous meteorological centers and universities. The subjective evaluation was conducted in the context of an experimental operational forecasting environment. Objective methods will include traditional metrics such as equitable-threat and bias scores as well as object-oriented approaches for both deterministic and probabilistic model output as well as non-traditional techniques based on object-oriented measures. The goal of both approaches will be to provide specific information to model developers that can guide their efforts to improve various components of the WRF model and to examine the benefit of deterministic versus probabilistic output on the storm-scale.

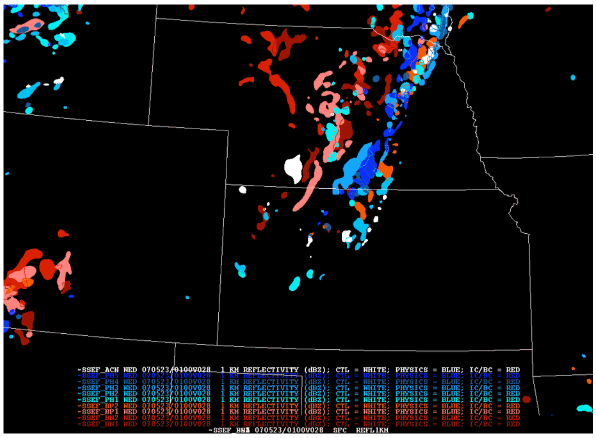

FIG. 1. A display of model-generated reflectivity ≥ 40 dBZ for each of the 10 storm-scale ensemble members valid 0100 UTC 23 May 2007. The white shading denotes the control member, the blue shading denotes member with physics-only perturbations and the red shading denotes members with both physics and initial condition perturbations.

III. RESULTS AND CONCLUSIONS

Preliminary results will be presented at the conference, focusing on assessments of the potential value of mesoscale and storm-scale ensembles and specific strengths and weaknesses of the different model configurations.