AN INNOVATIVE POST-PROCESSOR / OBJECTIVE ANALYSIS FOR THE PENN STATE RELOCATABLE NOWCAST / PREDICTION SYSTEM

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Short-term forecasts and nowcasts of meteorological information are becoming increasingly important for a variety of military, economic and public safety applications. A highly automated, rapidly relocatable nowcast and prediction system, whose cornerstone is the MM5, has been developed at Penn State (Stauffer et al. 2002). This relocatable nowcast / prediction system (RNPS) is designed to run locally (e.g., on the battlefield in the back of a HUMVEE), and it utilizes standard or satellite data communications. The RNPS is currently based on a triply nested mesoscale model (MM5), initialized by global model forecasts and utilizing four-dimensional data assimilation (FDDA) of asynoptic data sets. The system also features an innovative model post processor, also developed by Penn State, called the Unified Post-Processor System (UPPS). The RNPS and UPPS are optimized for fast execution on Linux PC/Sun platforms running C-shell scripts to automate the execution sequence.

The UPPS is based on widely accepted objective analysis and data assimilation approaches. It computes innovations or corrections based on the global model forecasts or MM5 RNPS gridded output, the past 2 hours of surface data and the past 6 hours of upper-air data. The weighting functions which blend the observations into the gridded model background fields are time dependent based on the difference in time between the observations and the background, and also flow dependent and anisotropic. In other words, the spatial influence region of the observations is not necessarily a simple circle as assumed by many objective analysis and data assimilation systems; the weighting will be elliptical in shape in stronger flows where there is more correlation in the background error along the flow rather than across the flow, and also aligned with the curvature of the flow. The innovations are computed based on the model background field that is closest in time to the mean time of the observations at the surface or above the surface, and then they are applied to the most recent model output. The UPPS is currently designed to use a combination of MM5 RNPS/global model data and observations to provide meteorological information to an altitude of ~30 km over a 500 km X 500 km area at 4-km horizontal resolution every 15 minutes. When the MM5 is not running, the UPPS still uses global model data interpolated to the MM5 grids and corrected by available observations, or when global model data are not available, the system will still utilize the local observations to produce the desired meteorological information.

Stauffer, D., N. Seaman, A. Schroeder, A. Deng, A. Gibbs and G. Hunter, 2002: Evaluation of a rapidly relocatable high-resolution numerical model and data assimilation system for meteorological nowcasting. Twelfth PSU/NCAR Mesoscale Model Users' Workshop, 24-25 June, Boulder, CO, 48-51.