

Improving GSI 3DVAR-Ensemble Hybrid Data Assimilation System for Mesoscale Application with the Rapid Refresh

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NOAA's Rapid Refresh system (RAP) is an hourly-updated regional data-assimilation and forecasting system that uses the Weather Research and Forecasting (WRF-ARW) model with 13-km horizontal grid spacing and the Gridpoint Statistical Interpolation (GSI) analysis package. The RAP version 1 has been running operationally at NCEP since May, 2012. Since then, many new advanced features have been developed and applied in a real-time experimental RAP version 2 (RAPv2) system. Among the RAPv2 enhancements, switching to a 3DVAR-Ensemble hybrid data assimilation procedure within GSI is the most important analysis upgrade. Application of the hybrid technique in the RAPv2 resulted in an immediate significant positive impact, as was reported at the 93rd AMS Annual Meeting, in January 2013.

The current RAPv2 GSI hybrid data analysis system is using coarser resolution GFS EnKF ensemble forecasts at 6 hour intervals to contribute half of the background error covariance. Most of the hybrid configurations are based on either default values or values from similar systems. The initial application of GSI hybrid within the RAPv2 has already significantly improved middle and upper level wind and water vapor forecasts, but we believe there is still some room for further improvement. We are examining a number of enhancements, including using EnKF ensemble forecasts at one or three hour intervals, tuning the ratio of static and ensemble BE, allowing BE ratio to vary vertically, and optimizing vertical and horizontal localizations for this mesoscale application. We also plan to test a RAP ensemble with GSI hybrid assimilation, which would be initialized from GFS EnKF ensemble members toward a goal of improving RAP forecasts of near surface fields and localized weather phenomena.

In the next couple of months, we will continue work on a series of experiments to improve the RAP GSI hybrid configurations as described above. This talk will share the lessons learned from these tests and report on the progress of the GSI hybrid application for the RAP system.