Retrospective Convective-Scale Data-Assimilation Experiments for Warn on Forecast

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NOAA's Warn-on-Forecast project is developing numerical weather prediction (NWP) techniques for very-short-range (0-1 h) prediction of severe weather: tornadoes, other strong winds, hail, and heavy rain. Such NWP systems require model grid spacing of 1 km or less, radar and satellite data assimilation (DA) at convective scales, ensemble forecasting, and frequent updates (~5 min) of analyses and forecasts.

To help us achieve the goal of improving high-resolution, rapidly-updated NWP for severe weather forecasting and warning, we are developing a testbed for DA and NWP techniques for retrospective periods with significant severe weather. This retrospective testbed will allow us to explore a parameter space including radar and satellite DA techniques [including ensemble Kalman filter (EnKF) and 3D Variational (3DVar) methods], multi-scale data assimilation, model resolution, etc. As a starting point, we are producing background ensemble analyses and forecasts like those proposed for future operational NOAA ensemble NWP systems: a 13-km North American Rapid Refresh Ensemble (NARRE) and a 3-km High Resolution Rapid Refresh Ensemble (HRRRE). Then, for the Warn-on-Forecast applications, we will nest smaller, higher-resolution grids into these ensembles. Our initial retrospective period includes destructive storms (e.g., the 24 May 2011 Oklahoma tornado outbreak and the 22 May 2011 Joplin, Missouri tornado) with significant forecast and warning challenges.

At the workshop, we will report on results to date for the retrospective experiments. In particular, we will discuss the sensitivity of the high-resolution ensemble forecasts to assimilated data (radar and/or satellite) and assimilation technique (e.g., EnKF or 3DVar), providing the opportunity to evaluate tradeoffs of computational requirements and forecast skill.