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Model Error Impacts on High Resolution Ensemble Forecasts of Low-Level Rotation in the 31 May 2013 El Reno, Oklahoma Supercell

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The goal of NOAA's Warn-on-Forecast project is to produce rapidly updating forecasts of thunderstorm hazards by assimilating Doppler radar data into an ensemble of high-resolution numerical simulations. Many initial case studies have shown promising results for predicting rotation in supercell thunderstorms for up to 60 minutes, producing maximum probabilities of low-level vertical vorticity along observed rotation tracks (e.g. Wheatley et al 2015; Yussouf et al. 2015). However, the majority of these studies employ coarser horizontal grid spacing than the 1-km spacing identified as a goal of an initial Warn-on-Forecast system.

This study examines the impact of reducing horizontal grid spacing, as well as increasing observation density, on a series of experiments produced by assimilating Multifunction Phased Array Radar (MPAR) data into an ensemble of numerical simulations using an asynchronous Local Ensemble Transform Kalman Filter (LETKF) technique. It is found that model biases within the microphysical parameterization result in erroneous updates to the ensemble analyses of hydrometeor mixing ratios when assimilating radar reflectivity. These errors vary with differing microphysical parameterizations and are exacerbated by finer horizontal grid spacing and observation density. The impact of the analysis errors on resulting forecasts of low-level cold pool and rotation tracks are small at coarser grid resolution but become large and can degrade the low-level rotation forecast at finer resolutions.