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Utilizing radar-derived rotation tracks for verifying model-simulated rotation in convection-permitting ensemble forecasts

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Explicit prediction of convective-scale phenomena is possible due to improvements in computational power and resources. In the framework of convection-permitting numerical weather prediction, convective processes are nominally resolved, and proxies like updraft helicity are simulated to identify sub-grid scale features and processes that are capable of producing severe weather. Predicting updraft helicity is of particular value as it identifies supercell thunderstorms, which often produce severe weather, in numerical models. Verifying such severe storm proxies is challenging because reported observations of severe weather are known to possess many nonmeteorological biases. As an alternative to storm reports, radar-derived rotation tracks are a source of more objective observations that are more analogous to model-simulated proxies for rotation. The practicality of verifying forecasts of such proxies with radar-derived rotation tracks was explored in this study.

Convection-permitting ensemble forecasts were retrospectively generated for four severe weather events that occurred in May 2013 in the central United States. Analysis focused on prediction of updraft helicity and maximum 0-3 km vertical vorticity. Probabilistic fields were generated from the model and observation data, and neighborhood-based verification approaches were employed to quantify forecast skill. Consistent throughout all cases, higher forecast skill was assessed when rotation track data were used instead of storm report data. Additionally, maximum 0-3 km vertical vorticity was found to be skillful in predicting areas of radar-observed rotation. The results of this study demonstrate the potential benefits of integrating model-predicted low-level vorticity and radar-derived rotation tracks into severe weather forecasting and verification practices.