European Conference on Severe Storms 2015
14–18 September 2015, Wiener Neustadt, Austria
ECSS2015-186

Spatial Verification Methods for Ensemble Forecasts of Low-Level Rotation in Supercells

Patrick Skinner (1), Louis Wicker (1), Dustan Wheatley (1,2), Kent Knopfmeier (1,2)
(1) NOAA/OAR/National Severe Storms Laboratory, (2) Cooperative Institute for Mesoscale Meteorological Studies, University of Oklahoma

An important component of NOAA's Warn-on-Forecast project is the production of probabilistic, short-term guidance of tornado potential using an ensemble of convection-resolving numerical prediction models. Recent ensemble forecasts of low-level rotation in supercells have typically been visualized by producing a probabilistic swath of low-level vertical vorticity exceeding a certain threshold, which is then compared to tornado damage paths. These studies have regularly produced maximum probabilities of low-level rotation coincident with observed tornado tracks, qualitatively indicating a skillful forecast. Despite these promising results, quantitative verification of ensemble low-level rotation forecasts by a prototype Warn-on-Forecast system requires more stringent observational proxies to low-level vertical vorticity as well as consideration of the four-dimensional ensemble forecast skill and spread.

This study applies two different spatial verification techniques to ensemble forecasts of low-level rotation produced for six tornadic events occurring in 2013 and 2014. Sixty-minute forecasts were produced at 15-minute intervals by assimilating Doppler radar data into a WRF-based ensemble with 3-km horizontal grid spacing using an ensemble Kalman filter (Wheatley et al. 2015). The resulting ensemble predictions of low-level vertical vorticity are verified against observed WSR-88D azimuthal wind shear interpolated to the model grid. As the spatial and temporal scales of mesocyclones are relatively small, object-based and field deformation spatial verification methods are employed to assess the forecast skill. Results are evaluated for their ability to provide a consistent measure of forecast skill as well as their ability to represent specific storm-scale characteristics, such as cyclic mesocyclogenesis or a bimodal distribution to the vertical vorticity forecast.