18–22 September 2017, Pula, Croatia
ECSS2017-146
© Author(s) 2017. CC Attribution 3.0 License.

Correcting Storm Displacement Errors in Ensembles Using Feature Calibration and Alignment (FCA)

Derek Stratman (1,3), Corey Potvin (2,3), and Louis Wicker (3)

(1) NRC Postdoctoral Research Associate, Norman, Oklahoma, United States (derek.stratman@noaa.gov), (2) Cooperative Institute for Mesoscale Meteorological Studies, University of Oklahoma, Norman, Oklahoma, United States, (3) NOAA/OAR National Severe Storms Laboratory, Norman, Oklahoma, United States

A goal of Warn-on-Forecast (WoF) is to develop forecasting systems that produce accurate analyses and forecasts of severe weather, such as supercells, for forecasters to utilize in operational warning settings. Recent WoF-related studies have indicated the need to alleviate storm displacement errors in both storm-scale analyses and short-term forecasts. One promising technique to reduce these errors is the feature calibration and alignment (FCA) method. The FCA mitigates displacement errors between observations and a model field while adhering to constraints to form a 2-D field of displacement vectors, which are used to adjust the prior model fields to more closely match the observations. Previous studies merging FCA with variational data assimilation systems have shown substantial improvement of analyses and forecasts, especially at earlier forecast times, by minimizing displacement errors. However, the WoF project mostly employs variants of the ensemble Kalman filter (EnKF) data assimilation technique to produce analyses. Early work has shown the potential benefits of correcting displacement errors for a single supercell within a CM1-LETKF (local ensemble transform Kalman filter) data assimilation system.

This study will merge the FCA with the CM1-LETKF system and vet the FCA as a potential alleviator of storm displacement errors using observation system simulation experiments (OSSEs). An idealized nature run of a supercell on a 250-m grid is used to generate pseudo-radar observations (i.e. reflectivity and radial velocity). 50 ensemble members are employed for the analyses and forecasts, which are performed on a 2-km grid. The FCA will use the composite reflectivity field to generate the 2-D field of displacement vectors and will be applied at the start of each LETKF analysis cycle. The FCA-LETKF system will be tested by displacing initial background fields in various directions and distances. In additional sensitivity tests, the vertical wind profile will be modified to produce faster storm motions without substantially changing the structure of the storm. These tests will reveal the impact of the FCA-LETKF system in cases of storm motion bias resulting from mesoscale analysis or model errors. The OSSEs will lay the foundation for future FCA-EnKF experiments with real data.