4–8 November 2019, Kraków, Poland
ECSS2019-99

The Nature and Variability of Ensemble Sensitivity Fields that Diagnose Severe Convection

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Ensemble sensitivity analysis (ESA) is a statistical technique that uses information from an ensemble of forecasts to reveal relationships between chosen forecast metrics and the larger atmospheric state at various forecast times. A number of studies have employed ESA from the perspectives of dynamical interpretation, observation targeting, and ensemble subsetting toward improved probabilistic prediction of high-impact events, mostly at synoptic scales. In this study, we produced sensitivity fields associated with severe convection over a 6-week period in May of 2016 in the United States to understand how sensitivity fields vary over many events, and whether forecast skill is associated with large sensitivity. We also attempted to understand whether the sensitivity of different severe aspects (e.g. rotation, high winds, simulated reflectivity) is the same or varies for the same event.

The magnitude and coverage of simulated reflectivity, updraft helicity, and surface wind speed were used as response functions, and the sensitivity of these functions to winds, temperatures, geopotential heights, and dew points at different atmospheric levels and at different forecast times were evaluated on a daily basis throughout the 6-week period. These sensitivities were calculated within the Texas Tech University real-time ensemble system, which possesses 42 members within and ensemble Kalman filter that run twice daily to 48-hr forecast time. Here we summarize the findings regarding the nature and the variability of the sensitivity fields over the 6-week period.