4–8 November 2019, Kraków, Poland
ECSS2019-43

Using Near-Ground Storm Relative Helicity in Tornado Forecasting

Brice Coffer (1), Matthew Parker (1), Richard Thompson (2), and Bryan Smith (2)

(1) North Carolina State University, Marine, Earth, and Atmospheric Sciences, United States (becoffer@ncsu.edu), (2) NOAA/NWS/NCEP/Storm Prediction Center, Norman, Oklahoma

Using a sample of 20,194 right-moving supercells from the United States spanning a 13-yr period, this study examines the possibility that tornado forecasts could be improved by utilizing the storm-relative helicity (SRH) in the lowest few hundred meters of the atmosphere (instead of much deeper layers). This hypothesis emerges from a growing body of literature linking the near-ground wind profile to the organization of the low-level mesocyclone and thus the probability of tornadogenesis. The study further addresses the ramifications of near–ground SRH to the skill of the Significant Tornado Parameter (STP), which is probably the most commonly used environmental proxy for tornadic thunderstorms.

Sounding-derived parameters for each supercell event are compared using forecast verification metrics, emphasizing a high probability of detection for tornadic supercells while minimizing false alarms. This climatology reveals that the kinematic components of environmental profiles are more skillful at discriminating significantly tornadic supercells from nontornadic supercells than the thermodynamic components. The effective-layer SRH has by far the greatest forecast skill among the components of the current STP. However, using progressively shallower layers for the SRH calculation leads to increasing forecast skill. Replacing the effective-layer SRH with the 0 - 500 m AGL SRH in the formulation of STP increases the number of correctly predicted events by 8% and decreases the number of missed events and false alarms by 18%. These results provide promising evidence that forecast parameters can still be improved through increased understanding of the environmental controls on the processes that govern tornado formation.