Demonstrating the Utility of Conditional Probabilities of Tornado Damage Rating in the Impact-Based Warning Era

BACKGROUND Conditional probabilities of tornado damage rating from near-storm environment data and radar-based storm-scale characteristics (2009-2013) were analyzed (Fig. 1). Figure 1. Spatial plot of tornado events (4770). EF4 EF3 (190) - EF2 (575) EF1 (1540) **INGREDIENTS-BASED APPROACH** Near-Storm Environment • Significant Tornado Parameter (STP; effective-layer calculation) can be used to gauge atmospheric tornado potential and assessed using a sounding or the SPC mesoanalysis (max value within 100 mi.). Convective Mode • Supercells disproportionately produce higher EF-scale damage rating tornadoes. Low-level Circulation • The highest peak inbound and outbound velocities (i.e. V_{rot}) at 0.5° elevation tilt—using velocity bins exhibiting cyclonic (anticyclonic) rotation within 5 mi and \leq 45° angle from the center of the circulation—from one of the volume scans during the tornado event were recorded. **Conditional Tornado Probabilities** • Using conditional probabilities can aid in the decisionmaking of tornado "threat tags" accompanying a tornado warning. Probabilities can help in assigning confidence towards a particular outcome (i.e., *base tier* tornado warning vs. considerable tornado warning) contingent upon a tornado occurring. The "condition" is met with the occurrence of a Tornadic Debris Signature (TDS) or confirmation of a tornado. **Character of Low-**Level Circulation **Understand mesoscale Consideration of** and near-storm **Convective Mode** environment Use raw and normalized probabilities of conditional tornado intensity **IMPACT-BASED WARNING (IBW) TASK** • Diagnose and anticipate the most probable category of tornado intensity Tornado Warning Damage Threat Tags Possible damage and generally a short-lived tornado No Tag ORNADO DAMAGE Credible observational evidence that a stronger variety tornado (EF2+) is imminent or ongoing. Tornado duration generally longer-THREAT. CONSIDERABLE lived. ORNADO DAMAGE | <u>DIRECT observational evidence that a stronger variety tornado (EF4</u>

EF5) is striking or about to strike a population footprint with 100%

<u>certainty.</u> Tornado duration generally long-lived. ***<u>FAR will be zero</u>.

THREAT.

CATASTROPHIC

Note that ~80% of the EF2 population \leq 60 kt, and ~40% of the EF3 population, fall below the 60 kt threshold for EF2+ tornadoes. We need to capture more of these events. Instead, we can normalize the dataset by equally weighting each EF-scale bin and filter the sample "outliers" outside the tips of the whiskers.

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