A Multiscale Analysis of the 15 May 2018 Northeast U.S. Significant Severe Weather Outbreak

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A significant severe weather outbreak occurred across portions of the Northeast U.S. on 15 May 2018. There were approximately 475 preliminary storm reports across the region with 37 of these being significant. Significant reports are defined as hail ≥ 5 cm (2 in), wind gusts ≥ 65 kts (75 mph), and tornadoes ranked ≥ EF2. Widespread straight-line wind damage, microbursts, macrobursts, and tornadoes occurred across portions of the Northeast as a result of an accelerating bowing line of convection. Multiple tornadoes spun up along this bowing segment with the strongest being ranked as EF2. Hail up to 7 cm (2.75 in) in diameter and 3 tornadoes were confirmed in association with a discrete, long-lived supercell that tracked from southeast NY into central CT. This event caused the greatest storm-related damage in CT since 1989, and estimated damage was equivalent to that of a Category 1 hurricane covering an area of 885 km^2 (550 mi^2) across 14 towns in CT. Five fatalities and multiple injuries occurred due to these storms.

This presentation investigates Convective Allowing Model (CAM) successes and failures for the event, multiscale environmental parameters, NWS Impact-Based Warning utility, and a brief storm-scale radar analysis. Some high-resolution CAMs such as the HRRR produced short-term forecasts that successfully resolved the timing, intensity, and storm characteristics associated with the convection, while other high-resolution models were less accurate, resulting in ensemble forecasts from the High Resolution Ensemble Forecast (HREF) that over-predicted convection too far north. Fast 500-hPa flow of 25–33 m s^{-1} (50–65 kt) existed across the region impacted by severe thunderstorms. The near storm environment included MLCAPE values of 1000–2000 J kg^{-1} collocated with effective shear of 45–60 kt and steep 700–500-hPa lapse rates observed at 7.7 ºC km^{-1} ahead of a tight 850-hPa θ_e gradient. Robust θ_e boundaries and steep mid-level lapse rates/elevated mixed layers (EML) have been shown to be associated with significant severe weather events like this one. Twenty-eight of 37 (75%) of the NWS warnings associated with the significant storm reports included enhanced wording beyond the base warning criteria in the text product. This suggests that warning forecasters have the skill to differentiate between “low-end” severe thunderstorms and those which pose an elevated threat to life and property.