The July 8, 2014 Significant Severe Weather Event in Central New York and Northeast Pennsylvania Part 1: The Convective Environment, Pre-event Forecasting Challenges and Tools

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ABSTRACT

A major severe weather event occurred across the upper Ohio Valley and northern mid-Atlantic region during the afternoon of July 8th, 2014. A total of 16 tornadoes were reported from Ohio through Pennsylvania and New York, along with numerous reports of large hail and damaging wind. This study focuses on the area covering central New York and northeast Pennsylvania, where a total of 7 tornadoes occurred. The large-scale environment is examined in terms of severe weather potential, some pre-event forecasting challenges are discussed, and the output from some forecast tools is shown.

A mid-tropospheric trough and associated surface cold front tracked east from the Great Lakes and Ohio Valley toward the mid-Atlantic region during the afternoon on the 8th. A north-south oriented surface trough developed downstream from the surface cold front over central New York and central Pennsylvania by early afternoon. Solar heating downstream from the cold front pushed surface temperatures into the middle 80s, with dew points into the middle 60s to lower 70s, resulting in mixed-layer convective available potential energy (MLCAPE) values from 1000-2000 J/kg by mid-afternoon. An anomalously strong southerly low-level jet developed ahead of the cold front, associated with very large anomalies of moisture flux at 850 hPa. Deep layer (0-6 km) shear values approached 50 kts over the northern mid-Atlantic region, with 0-1 km shear values around 30 kts. An elevated mixed layer was observed over the mid-Ohio Valley early on the 8th, sweeping northeast toward Pennsylvania and New York. Anticipation of these factors prompted the Storm Prediction Center (SPC) to issue an outlook for a slight risk of severe weather for the northern mid-Atlantic early on the 7th. The outlook was upgraded to a moderate risk early in the afternoon on the 8th.

Output from the 03 UTC July 8 and 15 UTC July 8 Short Range Ensemble Forecast is shown, indicating that the amount of instability associated with this event was uncertain prior to its occurrence. In addition, the most likely amount of instability appeared to increase as the forecast lead-time for the event decreased. Output from the SPC Storm-Scale Ensemble of Opportunity is shown from the 00 UTC run on the 8th and again from the 12 UTC run on the 8th. Consistent with an increasingly unstable forecast, the 12 UTC run of the ensemble indicated a much larger threat for a significant severe weather event than did the 00 UTC run. Finally, output from a locally-developed analog-finder program indicated that analogs for this event were not associated with a large number of severe weather reports when only modest values of MLCAPE were expected, however analogs contained many more severe reports including tornadoes when slightly larger MLCAPE values were expected. The output from these tools all indicated that the risk for a major severe weather event was initially uncertain, but appeared to increase as the event drew closer.