Using Specific Differential Phase to Predict Significant Severe Thunderstorm Wind Damage across the Northeastern United States

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The Storm Prediction Center (SPC) considers severe thunderstorms that produce measured or estimated wind gusts of at least 65 knots (74.8 mph), hail two inches in diameter or greater or an EF2 or greater tornado to be significant. Between 2012 and 2017, the Northeast (New England, New York, New Jersey and central and eastern Pennsylvania) saw 324 severe thunderstorm wind or hail reports that were either significant or produced injuries or fatalities. This is over double the number of tornadoes that were reported over the same time period (137). Many of these significant severe thunderstorm wind damage reports had a much larger societal impact as compared to the tornadic events as well. Considering the National Weather Service's implementation of Impact-Based Warnings, knowledge of a severe thunderstorm's damage potential is critical information for forecasters to have when issuing severe thunderstorm warnings.

Pinpointing which particular severe thunderstorms will produce significant wind damage can be a difficult challenge for the warning forecaster. Out of the 1402 severe wind reports received to National Weather Service Forecast Office at Albany between 2012 and 2017, only 47 (about 3%) were considered significant. However, these particular storms had a major impact on the lives of many people in the region and these storms received a large amount of media attention as well. Doppler radar radial velocity data may not always provide a clear picture on the scope of the storm, due to inherent problems regarding the radar beam's height and angle. Therefore, supplemental data is needed for warning forecasters to make accurate decisions.

This study has examined the use of Specific Differential Phase (K_{DP}) during the warning process. Vertical cross-sections taken within thunderstorms revealed elevated cores of high K_{DP} values were common within storms over the Northeastern US. When these elevated K_{DP} cores or columns collapsed to the surface, significant wind damage occurred in 31 of out of 46 cases examined across the Albany forecast area since 2012. Events examined included both linear events (such as squall lines and quasi-linear convective systems) and thunderstorms with supercell structures. The methodology for the warning meteorologist to use will be presented, as well as some examples from recent storms over the Northeastern United States. Although some additional null cases will need to be examined, the use of collapsing K_{DP} columns could be a very useful feature to assess during the warning process when anticipating the potential for significant severe thunderstorms.