

Knowledge of severe storm patterns may improve tornado warnings

July 1 2020, by Matthew Carroll



A mature supercell thunderstorm over Needmore, Texas. Credit: Raychel Sanner/Wikimedia Commons

A radar signature may help distinguish which severe storms are likely to produce dangerous tornadoes, potentially leading to more accurate

warnings, according to scientists.

"Identifying which storms are going to produce tornadoes and which are not has been a problem meteorologists have been trying to tackle for decades," said Scott Loeffler, a graduate student in the Department of Meteorology and Atmospheric Science at Penn State. "This new research may give forecasters another tool in their toolbox to do just that."

Scientists analyzed [radar](#) data from more than a hundred supercell thunderstorms, the most prolific producers of violent [tornadoes](#), and found a statistically significant difference in the structure of storms that produced a tornado and those that did not.

Weather radar constantly monitors storms across the country, and data similar to that used in the study are readily available to operational forecasters who issue warnings, the scientists note.

"These findings have potentially large implications for the accuracy and confidence of tornado warnings and public safety during [severe storms](#)," said Matthew Kumjian, associate professor of meteorology at Penn State and Loeffler's adviser. "We look forward to getting this information in the hands of operational meteorologists to assess the impact it has."

Tornado warning times have improved over the last several decades, thanks in part to numerical modeling research and intensive field campaigns, but [decision-makers](#) often must rely on readily available information like radar data when issuing storm warnings, the scientists said. Previous efforts using conventional radar have struggled to distinguish between tornadic and nontornadic supercells.

According to the researchers, in 2013, the U.S. upgraded its radar network to include polarimetric capabilities, which provide additional information about storms, including revealing the shape and size of

raindrops.

Using this information, the scientists compared areas with large, sparse raindrops and regions dense with smaller drops within supercell storms. The orientation of these two areas was significantly different in tornadic and nontornadic supercells, the researchers reported in the journal *Geophysical Research Letters*.

"We found for nontornadic supercells, the orientation of the separation between these two areas tended to be more parallel to the direction of the [storm](#)'s motion," Loeffler said. "And for tornadic supercells, the separation tended to be more perpendicular. So we saw this shift in the angles, and we saw this as a consistent trend."

Loeffler said the algorithm from the study can easily be adapted so operational forecasters could use the program in real time with the latest [radar data](#) available.

"Many factors go into issuing a tornado warning, but perhaps knowing the orientation in real time could help them make a decision to pull the trigger or to hold off," he said.

The scientists said while the signatures are promising, further numerical modeling studies are needed to understand better the relationship between the orientations and tornado formation.

Provided by Pennsylvania State University

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