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Article 2

Do Scores of Tornadoes Slamming Midwest Redefine "Tornado Alley"?

Death and disaster struck a handful of Midwest states over weekend.

By Brian Clark Howard and Ker Than, for National Geographic PUBLISHED NOVEMBER 20, 2013

And you thought Tornado Alley was all about Kansas.

Scores of tornadoes battered the Midwest over the weekend, killing at least six people in Illinois and injuring dozens more, flattening buildings, and knocking out power for thousands.

Tornado Watch: Means conditions are favorable for a tornado.
Tornado Warning: Means a tornado has been spotted.

Tornado watches were declared for swaths of Illinois, Indiana, Iowa, Michigan, Missouri, Ohio, and Wisconsin on Sunday. On Sunday evening, the National Weather Service said 77 tornadoes had been reported, mostly in Illinois, although the agency warned that some of those reports could represent multiple accounts of the same storm.

While the Great Plains states of Kansas, Nebraska, and the Dakotas, as well as parts of Texas, are collectively known as Tornado Alley for their frequent storms, the weekend was a reminder that Illinois, Indiana, Iowa, Michigan, Missouri, Ohio, and Wisconsin are also tornado-prone.
"It turns out that the [phrase Tornado Alley] isn't correct," says the Weather Channel's website. The site said that Florida actually gets more tornadoes per square mile than any other U.S. state.

Other states that also get as many or more tornadoes per square mile than the classic Tornado Alley states include Indiana, Illinois, Iowa, and Louisiana. "If we looked at states that get more than a handful of tornadoes just about every year, then the entire area east of the Rocky Mountains—excluding New England, New Jersey, and Delaware—could be called the 'tornado strike zone,'" the Weather Channel's site added.

Part of the reason why Tornado Alley has received so much attention is because it occupies a unique geographic position known as a dry line boundary where warm maritime tropical air (from the Gulf of Mexico); hot, dry air (from Arizona and New Mexico); and cool polar, dry air (from Canada) meet, explained Christopher Karstens, a research scientist with the National Oceanic and Atmospheric Administration's(NOAA).

"In the springtime, those air masses tend to work together to create environments that we saw," he told National Geographic earlier this year, referring to two tornado-heavy days. "Sometimes they collide in Oklahoma, sometimes in Texas, and sometimes in Kansas." Although tornadoes tend to occur most frequently in May and June, they can happen any month of the year, if atmospheric conditions are right.

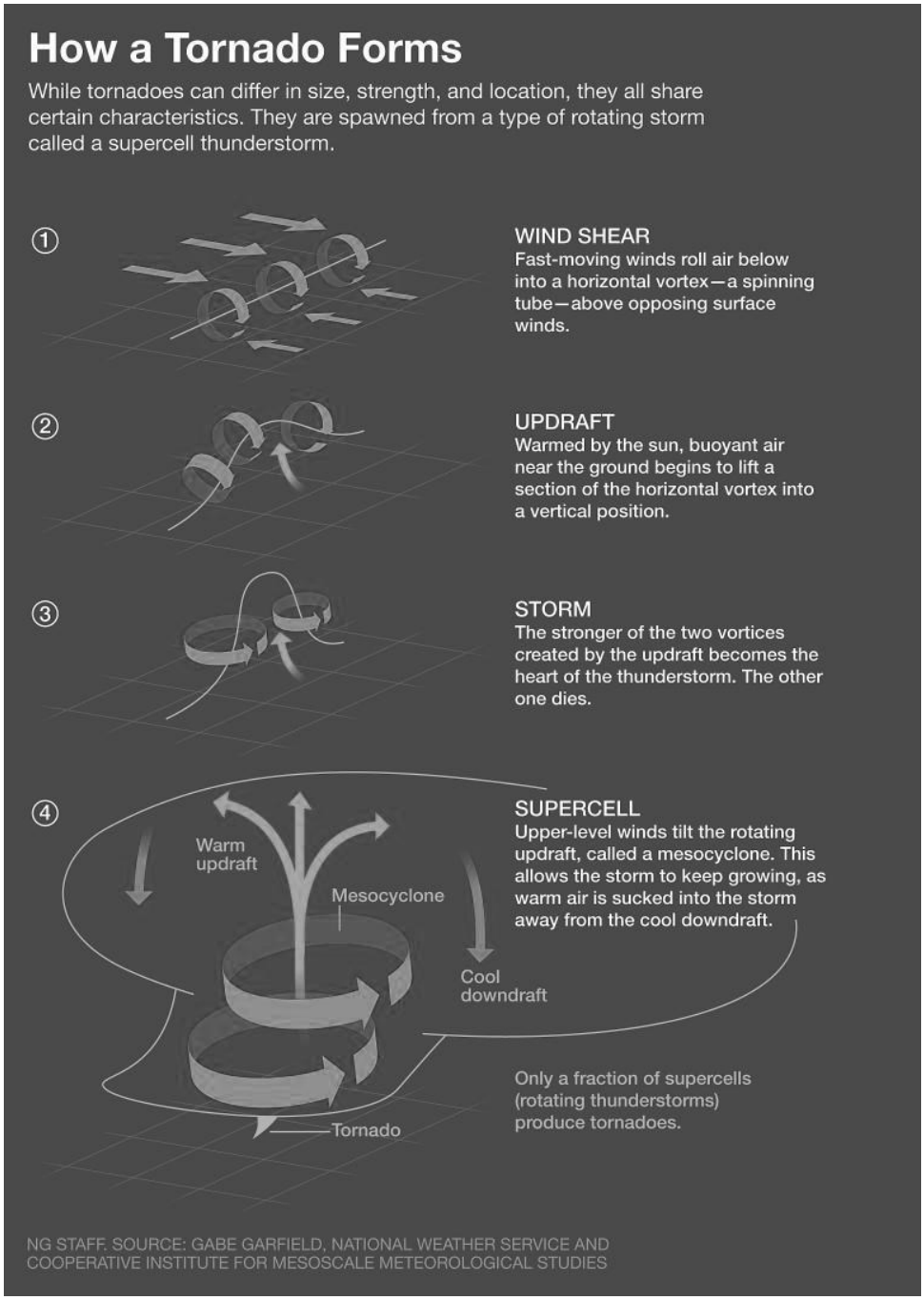
Another area with conditions similar to those of Tornado Alley is Bangladesh, said Chris Weiss, an atmospheric scientist at Texas Tech University in Lubbock. "They have a lot of violent tornadoes—some would argue even stronger [storms] and tornadoes—over there," Weiss said. "But a lot go unreported because they don't have nearly the observation network over there that we have over here."

How Tornadoes Form

While tornadoes can differ in size, strength, and location, they all share certain characteristics. They are spawned from a type of rotating storm called a supercell thunderstorm. And they are all driven by atmospheric instability and by a phenomenon known as wind shear.

Scientists understand some of the basic conditions necessary for tornadoes to form, but many fundamental questions about tornadoes still remain unanswered.

Tim Samaras, a tornado chaser who was killed by a twister on May 31, 2013, in El Reno, Oklahoma, said earlier in the year that we have a lot to learn about how tornadoes form. "We still don't know why some thunderstorms create tornadoes while others don't," he said. One way a tornado forms is when moist, warm air meets cool, dry air head on.



Tornado Forecasting

Tornadoes are much more difficult to forecast than hurricanes are. For example, the National Hurricane Center was able to predict the path of last year's *Hurricane Sandy* with startling accuracy a full five days before it made landfall.

In contrast, even though residents of Moore, Oklahoma, had advance warning that a potentially dangerous storm was moving in last May, they had only 16 minutes after the first warning on May 20 before the tornado touched down.

Part of the difficulty, Karstens said, is that tornadoes are much smaller than hurricanes.

"It's really a matter of scale," he explained. "With the hurricane being so large, we're able to populate our models with lots of points to resolve it and we can come up with much more accurate multiday forecasts."

In addition, while current computer models can predict when a supercell storm is likely to form, not all supercell storms give rise to tornadoes.

"That's one of the questions we're struggling with as scientists: Which storms will be the ones to go on producing tornadoes and which ones won't?" Karstens said. Karstens is involved in an NSSL project that aims to predict a tornado's path shortly after it forms, called *Warn-on-Forecast*.

He's optimistic that tornado forecasting will improve as computers and tornado modeling software become more powerful, and as more environmental data such as temperature and dew-point measurements are gathered close to tornado-spawning storms by instruments and tornado researchers. "We've got a long way to go," he said, "but I think we're making steady progress."

The intensity of tornadoes is measured on the Fujita Scale, which assigns a value based on wind speed and damage from F0 to F5.

The Fujita Scale (F Scale) of Tornado Intensity

F Scale	(km/hr)	(mph)	Damage
F0	64-116	40-72	Light - tree branches fall and chimneys may collapse
F1	117-180	73-112	Moderate - mobile homes, autos pushed aside
F2	181-253	113-157	Considerable - roofs torn off houses, large trees uprooted
F3	254-33	158-206	Severe - houses torn apart, trees uprooted, cars lifted
F4	333-419	207-260	Devastating - houses leveled, cars thrown
F5	420-512	261-318	Incredible - structures fly, cars become missiles
F6	>512	>318	Maximum tornado wind speed