Oklahoma Tornadoes Give Scientists The Slip

May 18 2010, By Devin Powell

The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one mile wide and 50 miles long. Credit: NOAA.gov

Predicting when and where a tornado will touch down is far from an exact science. And last week's twisters in the Midwest were no exception.

On the morning of May 10, dozens of vans and trucks loaded with weather-monitoring equipment fanned out near Stroud, Okla. The vehicles belonged to the VORTEX2 armada, the largest scientific storm chasing team in history. The readings on their high-tech instruments gave them good reason to believe they were surrounding a storm that was ripe for a tornado.

But luck wasn't on their side that day. The tornadoes they eventually spotted were miles away, outside of the area they had encircled -- too far away for many of the instruments to measure and moving too fast to catch.

"We cast the net and missed," said lead scientist Joshua Wurman of the Center for Severe Weather Research in Boulder, Colo., whose expeditions inspired the 1996 "Twister" film.

Three days and 150 miles later, the caravan reassembled beneath another severe thunderstorm near Cordell. This time, Wurman was less optimistic.

"I was talking to one of the other crews on the radio, saying I don't think this is going to make a tornado," Wurman said.

It did, five minutes later -- and the crews celebrated as the data poured in.

Forecasters Think Big

Scientists' understanding of severe storms has come a long way since Benjamin Franklin first noticed that weather patterns tended to move west to east over most of the United States.

Today, the National Weather Service uses computer models based on decades of research into how clouds, wind and weather behave. Fed by real time measurements of pressure and precipitation, the models approximately solve a series of equations that represent these physical processes, allowing NWS meteorologists to forecasts tornado risks.

Drawing on a network of more than 150 Doppler weather radars installed in the 1990s, the NWS issued warnings in advance of 67

percent of all tornadoes sighted in 2008, according to the National Oceanic and Air Administration. Last week, NWS advisories warned of a high tornado risk two days before a line of storms and tornadoes claimed the lives of five people in Oklahoma.

Forecasting tornado risk for weather systems hundreds of miles wide, though, is easier than predicting whether thunderstorm clouds in one spot will produce a tornado. The computer models' equations become increasingly difficult to solve as the scale shrinks, said research meteorologist Harold Brooks of NOAA's National Severe Storms Laboratory in Norman, Okla.

"The difference between one storm making a tornado and one not making a tornado is in the very fine details," said Brooks. "When we get down to the scale of a single tornado, we have to start paying attention to virtually everything, and there are lots of ways for errors to affect the outcome."

That hasn't stopped the storm chasers from trying.

Up Close

For half a century, scientists have pursued thunderstorms. Today, they carry a range of instruments -- including remote-control planes -- designed to measure precipitation, wind speed, temperature and pressure, as well as mobile Doppler radars that can see in far greater detail than the nationwide network.

"It's like looking at your hand," said Curtis Alexander of NOAA's Earth System Research Laboratory in Boulder, Colo. "As you move your hand away from your face farther and farther you can't see your fingerprints, the fine details are lost."

By comparing 60 tornadoes studied at close range, Alexander has begun to answer some basic questions about tornadoes. The data show that Midwestern twisters tend to be bigger than once thought (about 600-800 feet across) and that damage reports tend to underestimate the wind speeds of a typical tornado (about 135 mph).

Scientists also know what kinds of thunderstorms are most likely to give rise to tornadoes. Whirling columns of air come in a variety of shapes and sizes formed in different ways -- from small dust devils born in the heat of a clear day to water spouts that stretch from sea to cloud. Spring tornadoes in Oklahoma and across tornado alley are typically produced by large rotating thunderstorms called supercells.

A supercell does not always produce a tornado, though, and no one knows why. Based on Doppler radar images of supercells, 73 percent of all NWS tornado warnings turn out to be false positives, predicting tornadoes that never actually appear.

Karen Kosiba of Purdue University in West Lafayette, Ind. has found a potential clue to solving this mystery in data from last year's most successful tornado chase. On June 5, 2009 in Wyoming, a supercell thunderstorm produced a strong downdraft of wind about 15-20 minutes before unleashing a tornado.

"We have some theories that this rippling downdraft is important," said Kosiba. "But we don't really know what properties of downdraft are favorable."

Kosiba and other scientists think that the downdraft may be connected to precipitation patterns in the storm. The next generation of radars currently coming online could detect such patterns, potentially providing a new way to warn a specific location of an impending tornado.

The VORTEX2 armada will continue chasing storms until June 15 and then sit down with this year's data to see if it reveals any new insights into the tiny details that give birth to tornadoes.

More information: VORTEX2 - www.vortex2.org/home/

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