Alabama tornado team scours paths of killer storms

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The Mobile Meteorological Measurement Vehicle - a worn-looking '90s-model Dodge Intrepid with classic rock on the radio, a tower of weather gauges attached to its roof and a laptop computer bolted to its dash - crested a rolling hill on its way to tiny Hackleburg, Ala.

"There it is," said Kevin Knupp, a University of Alabama-Huntsville atmospheric sciences professor, tapping the window.

To the left, a swath of pine and oak leaned northeast, like a curve of toppled dominoes, while to the right, far off, trees lurched the other way - all pushed over by the counterclockwise swirl of a huge tornado.

In the passenger seat, graduate student Todd Murphy took notes on the GPS-enabled laptop. They had found what they were looking for: the path of one of the killer storms that battered northern Alabama on April 27.

Just six weeks earlier, the South had been hit by one of the most severe tornado outbreaks in U.S. history. In Alabama alone, an estimated 69 twisters killed about 240 people. Tuscaloosa and Birmingham were hit hard. Hackleburg, population 1,430, was leveled - plowed over by a mile-wide tornado that originated near the Mississippi-Alabama state line and didn't peter out until it reached Tennessee, traveling a 132-mile path. Eighteen people in Hackleburg died.

Knupp is in the field to assess the storm damage before it is all cleared away and to talk to witnesses while their memories are still crisp.

Over the next year or so, backed by funding from the National Science Foundation, he and his team will study what they've observed from the fallen trees and wreckage - as well as radar records, satellite images, survivor interviews and even YouTube videos posted by people who captured the freak weather and its aftermath. Less "Storm Chasers" than "CSI: Meteorology," the team hopes its data-gathering will deepen understanding of how the storms developed, improve tornado forecasts and save lives.

Knupp's team also believes that the unprecedented windfall of data spun off a single day of devastation could put several weather theories to the test.

Murphy wants to see how ripples in the air called ducted gravity waves help spawn tornadoes. Elise and Chris Schultz, a husband-and-wife grad student team, plan to test how well an experimental radar system can track the path of a tornado's "debris ball" - all the dust and trees and bits of houses the twister gathers up - something that is not possible with most radar used today.

If things pan out, the data may even give Knupp and postdoctoral researcher Tim Coleman a chance to test a controversial idea they've mulled over for years: that features on the ground like trees, hills and valleys influence the way tornadoes behave.

Knupp - trim and mild-mannered - grew up in twister country on his family's Iowa farm, where they grew corn and soybeans and raised hogs. He wrote his first scholarly paper about tornadoes in 1976 while he was an undergraduate at Iowa State University.

As a teen, he once convinced his father to stop the car on the way home from band practice so he could watch a funnel cloud approach. The family was soon engulfed in 60 mph winds, and Knupp thinks they were run over by a weak tornado. No one was hurt.

He briefly attempted to drive out and "surf" the April 27 storms too, but the extreme weather convinced him to turn his car around.

"I got close, and it looked pretty wicked," he said.

On April 27, instability in the atmosphere - warm, humid air near the ground and cooler, drier air aloft - accompanied strong wind shear. The combination is favorable for creating super-cell thunderstorms. Super cells can generate tornadoes.

In a typical significant tornado outbreak, the energy helicity index, which incorporates instability and wind shear, might register 3 or 4. In some parts of Alabama in the hours preceding the April 27 outbreak, it hit 11 - "about as large as you'd ever seen," Knupp said.

From his home in Huntsville, Knupp directed students to set up the university's mobile radar system, which can detect rain, hail and debris in clouds. The students hustled the truck-mounted device to an open location nearby and stayed with it until 8:30 p.m., riding out the storm. For about three hours during the late afternoon, MAX, as it's called, was the only radar in the region that wasn't knocked out by the weather.

Tracking the incoming images on his computer, Knupp saw storm after storm after storm. By lunchtime, two distinct weather systems had already spawned more than 30 tornadoes in the state, reportedly killing five and knocking out power to more than a quarter-million households and businesses.

Then, in the afternoon, came the mega-tornadoes, including the twister that plowed through Hackleburg. The National Weather Service would eventually determine there had been 19 tornadoes in Alabama rating EF3 or higher on the Enhanced Fujita Scale, which goes from EF0 (a small twister, like the one Knupp saw after band practice) to EF5 (a devastating one, like Hackleburg's). Sirens blared all day.

"A good data set," Knupp mused.

Not that it was going to be easy to collect. Driving toward Hackleburg, he and Murphy quickly saw that much of the debris had already been hauled away, and what was left was hidden behind hills or impossible to reach via the area's few roads. Branches swung menacingly close to the blades of the Dodge's roof-mounted anemometer, a little propeller that measures wind speed.

"Surveying in rough country like this is difficult," Knupp said as he pulled the car into a gravel driveway. White-plumed roosters wandered loose around lumber, clothes and insulation that had once been part of someone's home. Some trees here, he noted, were still standing; the tornado at this point had probably not been at full EF5 strength.

In town, houses were ripped off their foundations and trees were stripped of bark.

"This has got to be the EF5," Knupp said.

He'd know with more certainty soon. That morning, photographers he had hired were shooting aerial pictures of tornado paths. Knupp would later compare these with the Weather Service surveys, his own ground surveys and NASA satellite images that showed half of Alabama slashed with parallel tracks, as if the state had been clawed by a giant cat.

Just what governed the growth and direction of tornadoes that day? To get at that, Murphy was spending hours in his office staring at radar images of the storms, seeking out the little curls and hooks in the clouds that signal a tornado is developing.

He had already found one storm, an EF5 that rolled through Smithville, Miss., that appeared to have been created when a gravity wave collided with a thunderstorm. He expects to find more examples - bolstering the theory that meteorologists could improve tornado warnings by looking out for places where these lower-atmosphere ripples butt up against storms.

Knupp and Coleman were thinking through the topography problem - and what it means for the genesis of tornadoes.

Over their years watching storms in Alabama, they'd both visited many sites where storms traveling downhill seemed to spawn or intensify tornadoes. In the north Huntsville neighborhood of Anderson Hills, for example, brick houses on a subtle downslope were destroyed by a severe tornado in 1995 and later rebuilt - only to be mowed down again by the same twister that hit Hackleburg.

In the Birmingham, Ala., area, violent tornadoes have followed nearly identical paths at least four times, weakening as they moved northeast of the city where the land gently rises toward the Appalachian foothills.

Knupp and Coleman suspect that rotating storms and tornadoes stretch and get thinner, and thus spin more violently when they pass over downhill slopes, much as a figure skater twirls faster when she brings her arms in close to her body. But so far, some of their meteorological brethren haven't bought the connection.

Knupp thinks the April 27 event might produce more evidence than any other outbreak. This isn't just about scientific bragging rights. Knowing that a twister moving downhill is likely to intensify - and one moving uphill probably won't - could indicate where tornadoes likely will hit and where they will grow, the researchers added.

"If we can figure out what's going on here, we can help the National Weather Service lower their false alarm ratio," Coleman said.

The number of warnings issued by the National Weather Service has ballooned since the advent of modern Doppler radar in 1988. Fire off too many warnings that lead to nothing, and people are apt to start ignoring them. Researchers are examining whether warnings were ignored on April 27.

But ultimately, Knupp's work may show that the storms simply weren't survivable. Modern tracking technologies, spot-on warning systems and strict public adherence to safety and evacuation guidelines are great. The power of EF5 tornadoes may be greater.

As he walked through Hackleburg, Knupp peeked somberly into what remained of several house foundations and wondered aloud whether residents hiding in this corner or that could have made it.

"I've heard that people who took refuge in basements - some didn't survive," he said. "It's just a terrible thought."

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