

Background: Eric Nguyen/Corbis; From top: Courtesy of Joshua Wurman; Mike Maple/Zuma Press/Corbis; AP Images

More tornadoes hit the United States than any other country—upward of 1,000 a year. Even so, last year was a particularly bad one. More than 1,700 twisters tore across 48 states, killing 551 people—the highest tornado-related casualty count in 100 years. The most destructive tornado struck Joplin, Mo., in May, killing 160 people and causing more than \$2 billion in property damage. This year also got off to a bad start when a rash of tornadoes occurred in January, February, and March.

To help make sense of those events, *Current Science* spoke with Joshua Wurman, one of the country's leading authorities on tornadoes. Wurman is a researcher at the Center for Severe Weather Research in Boulder, Colo.

Current Science: Why were there so many tornadoes last year?

Joshua Wurman: Years with so many tornadoes do occur from time to time, just like years with big blizzards or bad hurricanes. It's just a natural fluctuation.

What was especially bad about 2011 was that several tornadoes directly hit large towns and small cities. That is rare.

Most tornadoes cross through open country, and even the worst ones usually just kill a few people. But, occasionally, a strong tornado can kill dozens of people, as in Joplin in 2011 or Oklahoma City in 1999.

CS: How are tornadoes rated?

Wurman: Tornadoes are rated according to the *Enhanced Fujita (EF) scale*. It ranks tornadoes by the damage they cause, not their actual winds. So a very powerful tornado crossing over open country may still receive a low rating, unless it crosses a town. The EF scale runs from EF0 for minor damage to EF5 for very severe damage. The Joplin tornado was an EF5.

CS: Did the January/February/March tornadoes surprise you?

Wurman: Many people were surprised. They assumed that



Tornado damage in Joplin, Mo.

By Stephen Fraser

TWIST OF FATE

A top tornado researcher talks about a very bad year.

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tornadoes are a springtime phenomenon. However, it isn't unusual for tornadoes to strike in the winter. Every year there are winter tornadoes in January and February, mainly in the southeastern U.S. Some winter tornado outbreaks can be particularly deadly since the population density in the Southeast is higher than it is in the traditional Tornado Alley of Kansas and the surrounding states.

CS: You and your team of meteorologists travel some 24,000 kilometers (roughly 15,000 miles) each year tracking tornadoes. How risky is that?

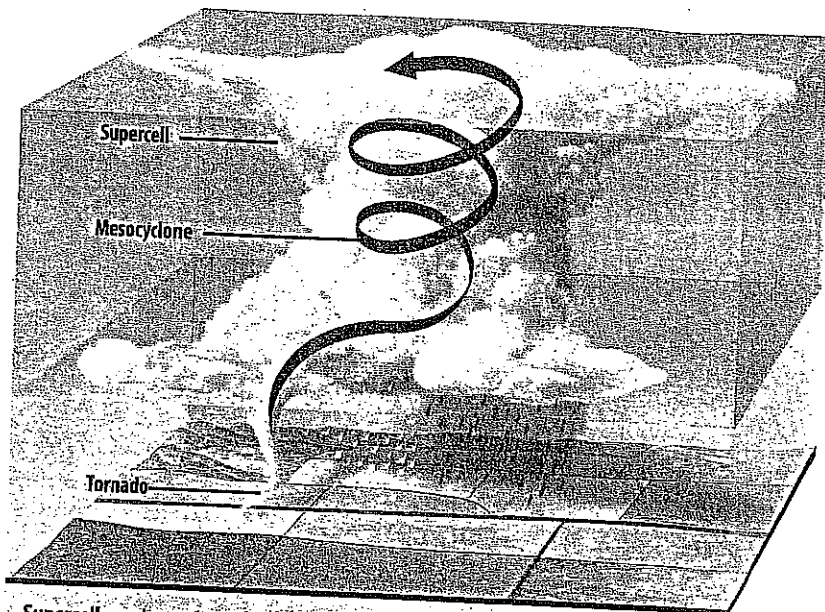
Wurman: We're studying a very dangerous and difficult-to-predict phenomenon. But we are very careful. My team has observed more than 170 different tornadoes, some of which were EF5s and included the strongest winds ever observed—484 kilometers (301 miles) per hour. We've never had an injury.

CS: What was your most outstanding experience watching tornadoes?

Wurman: Probably my most memorable tornado was the first strong one that I was able to observe with my *Doppler on Wheels (DOW)* radar. DOW is a specially outfitted truck with scientific equipment and radar. The tornado happened in 1995 in Dimmit, Texas. It was a visually striking tornado. But the most awesome thing was what I could see with my DOW radar computers. For the first time ever, I, and other scientists, could see inside the tornado and map its winds and debris. It was a revolutionary moment for me.

CS: What is a *supercell* thunderstorm?

Wurman: A supercell is a special kind of thunderstorm that rotates and can last for hours, producing severe hail, wind, and sometimes tornadoes.



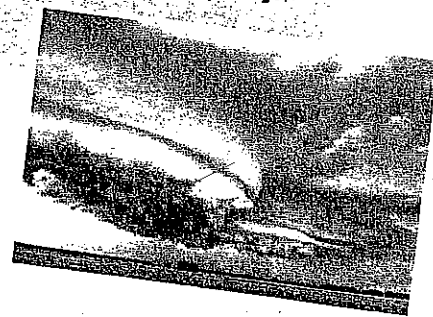
Supercells are huge thunderstorms that can last for hours and reach as high as 19 kilometers (12 miles) into the sky. They are characterized by a *mesocyclone*—a rising, rotating column of air that is anywhere from 2 to 10 kilometers (1.2 to 6.2 miles) wide. In some supercells, the mesocyclone spawns a violently spinning column of air that stretches to the ground. A tornado is born.

Graphic: Gary Hincks; Inset: Mike Hollingshead/Science Faction/Corbis

Supercell thunderstorms produce the strongest tornadoes. Supercells form when a particular series of conditions exist: First, the energy that powers a supercell comes from warm, moist air near Earth's surface. In the U.S., most of that air comes from the Gulf of Mexico. The moisture condenses into droplets, forming clouds and releasing huge amounts of heat energy. Second, the rotation that characterizes the supercell is caused by differences in wind speed and direction—slower winds coming from the southeast near the ground and faster winds coming from the west at mid levels in the atmosphere.

CS: What are the most important questions about tornadoes?

Wurman: The most important question is how to distinguish between the 25 percent of supercells that make tornadoes and the 75 percent of supercells that do not. Another question is how to predict the 5 percent of supercells that are about to make really violent, potentially killer tornadoes.



CS: What is your best answer to that question?

Wurman: The current thinking among scientists is that subtle changes in the *downdrafts* [sinking currents of air] in the supercells affect *tornadoogenesis* [the process of tornado formation]. Those subtle changes, which involve changes in temperature, the amount of rain or hail, and the intensity of the downdrafts, [most] likely determine whether a tornado forms and whether it grows into a violent, potentially killer tornado.

CS: How will that information help Americans?

Wurman: It could help us predict tornadoes better and issue tornado warnings that are more accurate and have more lead time. Then people will have more time to seek better shelter. **CS**

"Twist of Faith"
Article Assignment

Name: _____

Period: _____

I. On a separate piece of clean, white paper answer the following questions. Please do not rip paper out of your notebook.

1. After reading the article, complete the concept map. 15 pts.
2. Using the concept map, write a summary of the article. 25 pts.
3. Choose one important idea or fact that you learned from the article. Write the idea or fact and clearly **explain** why it is important. 15pts.
4. Give the article a new title and explain why your title fits the article. 5pts.

II. Answer the following questions. Five pts. each

1. What was the most destructive tornado in 2011 and how much property damage did it cause?
2. What does tornadogenesis mean?
3. What is DOW and why is it helpful for meteorologist, Joshua Worman?

ALL ANSWERS ARE TO BE ON A SEPARATE PIECE OF PAPER.

Concept Map

