

Hunt for the Supertwister

PROGRAM OVERVIEW

NOVA profiles the deadliest of tornadoes—supertwisters—and investigates prediction methods.



The program:

- recounts the May 3, 2003, supertwister that decimated Bridge Creek and Moore, Oklahoma, destroying 8,000 homes, killing 40 people, and causing \$1 billion of damage.
- relates some of the factors believed necessary for a tornado to form.
- describes one scientist's proposal to increase the number of Doppler radars in high-incident tornado regions.
- reviews the 1999 Oklahoma City and the 2002 La Plata, Maryland, tornado events.
- follows researchers Josh Wurman and Howie Bluestein as they study active tornadoes with radar-equipped trucks.
- accompanies a stormchasing tour company that sights and chases an F4 supertwister with winds of more than 200 miles per hour.
- looks at computer simulations that help researchers model tornado behavior.
- highlights the discovery of a new layer of complexity—the formation of mini-tornadoes at ground level—that may be the key to better tornado prediction.

Taping Rights: Can be used up to one year after the program is taped off the air.

BEFORE WATCHING

- 1 Ask students how tornadoes, hurricanes, and high winds differ. What kind of severe weather have students experienced? What actions do individuals take in preparing for these events? What actions do governments take? Why is it important to understand how severe weather happens?
- 2 Review with students the Fujita wind damage scale, known as the F-scale. Developed by meteorologist T. Theodore Fujita in 1971, the F-scale is a widely used tornado rating method even though it has never been scientifically tested. Emphasize to students that the rating, which is made after the tornadic event, is subjective depending on who is doing the rating. Find information about the scale at www.spc.noaa.gov/faq/tornado/f-scale.html
- 3 Organize students into two groups. As they watch, have one group take notes on the factors involved in the formation of tornadoes and the other group take notes on the tools and methods used to predict tornadoes.

AFTER WATCHING

- 1 Create a list on the blackboard of the factors involved in tornado formation and the tools and methods used to predict them. How do tornadoes form? Why are they so hard to predict?
- 2 Ask students to think of ways in which humans control their environment (e.g., air conditioning, heating, landscaping, swimming pools). What are some parts of the environment that humans cannot control (e.g., weather, avalanches, earthquakes, volcanic eruptions)? What are some ways people try to cope with natural disasters?

CLASSROOM ACTIVITY

Objective

To identify the best time of year and place to position spotters to see possible tornado outbreaks.

Materials for each team member

- copy of the “Spotting Tornadoes” student handout
- copy of the “Where the Tornadoes Are” student handout
- access to print and Internet resources

Procedure

- 1 Tornadoes can produce winds of more than 300 miles per hour, destroy homes, and kill people. Because tornadoes are extremely difficult to predict, the National Weather Service relies on spotters to be its eyes and ears in the field. Tell students that in this activity, they will be helping to identify the best time of year and place to position spotters to see possible tornado outbreaks.
- 2 Ask students in what areas of the United States they think tornadoes occur most often. Do they think tornadoes are more likely to occur at certain times of the year? If so, when? Why? Is there anywhere that tornadoes cannot form?
- 3 Organize students into teams and distribute the student handouts. Have them follow the instructions on their handouts and encourage them to present their information using a poster, a mockup of a newspaper, a multimedia presentation, or a play.
- 4 To conclude the lesson, discuss what students learned and clear up any remaining questions about tornado occurrence, spotting, and safety.
- 5 As an extension, have students choose one of the following research and reporting tasks:
 - a) Draw two illustrations that describe tornado myths. Include why the myths are untrue.
 - b) Prepare a table describing the Fujita tornado damage scale. Include examples so that classmates could use the scale to rate a tornado.
 - c) Research and report on where your state ranks in tornado events. Find state rankings at www.spc.noaa.gov/archive/tornadoes/st-trank.html

STANDARDS CONNECTIONS

The “Spotting Tornadoes” activity aligns with the following National Science Education Standards.

GRADES 5–8

Content Standard F:

Science in Personal and Social Perspectives

Natural hazards

- Internal and external processes of the Earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm and kill humans.
- Natural hazards can present personal and societal challenges because misidentifying the change or incorrectly estimating the rate and scale of change may result in either too little attention and significant human costs or too much cost for unneeded preventive measures.

Grades 9–12

Content Standard F:

Science in Personal and Social Perspectives

Natural and human-induced hazards

- Natural and human-induced hazards present the need for humans to assess potential danger and risk. Many changes in the environment designed by humans bring benefits to society, as well as cause risks. Students should understand the costs and trade-offs of various hazards—ranging from those with minor risk to a few people to major catastrophes with major risk to many people.

*Video is not required
for this activity.*

Classroom Activity Author
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ACTIVITY ANSWER

Tornadoes usually occur during a thunderstorm, although some tornadoes are formed by hurricanes. Meteorologists look for atmospheric conditions that will provide the four ingredients that contribute to tornado formation: moisture, instability, lift, and wind shear. These conditions can be present in giant thunderstorms called supercells, which are characterized by intense rotation within the storm. Supertwisters are the most powerful of all tornadoes.

Tornadoes form when warm, moist air that is pushed upward by a mass of cold air forms a thunderstorm. An updraft within the storm cloud can create a mesocyclone, a large mass of rotating air. When this mass comes in contact with the ground it becomes a tornado.

Most U.S. tornadoes occur in Tornado Alley, a relatively flat Midwestern area that includes Texas, Oklahoma, Kansas, Nebraska, Iowa, Illinois, Indiana, Missouri, Arkansas, and western Colorado. Warm, moist air from the Gulf of Mexico converges with cold, dry air from Canada and the Rocky Mountains, creating favorable conditions for the type of thunderstorms that might spawn tornadoes. In Florida and the Southeast region, tornadoes often result from hurricanes.

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Scientists use technology like Doppler radar to plot thunderstorms that could provide tornadoes and to predict where they are headed. Satellites take pictures of cloud formations for study. But volunteer spotters, who are trained by meteorologists, are the final critical link in the information chain. They provide details about whether tornadoes are actually being produced and can pinpoint their precise location.

Some spotters follow tornadoes in a vehicle; others observe the tornado from a fixed location. Safety tips for mobile spotters include

- always having a passenger who sights the tornado;
- being on the lookout for other storm spectators;
- making sure your vehicle is well maintained and has a full tank of gas;
- staying aware of lightning, which all thunderstorms produce;
- avoiding the most intense parts of the storm;
- being aware of what else is going on around you besides the storm; and
- having an escape route planned at all times.

Fixed spotters should also have a safety plan in place (as should anyone in a fixed location who encounters a tornado). Everyone in a high-risk area should know how to find shelter, such as a basement or underground safe room, in case a tornado approaches unexpectedly. If no place is available, the best

recourse is:

- laying down on the lowest floor of the building;
- shielding your head and body areas from debris;
- avoiding windows, doors, and outside walls; and
- putting as many walls between you and the outside as possible.

The best time and most likely place for a spotter to see a tornado is between April through June in central Oklahoma. Spotters are less needed in the regions that have a low risk of tornadoes; i.e., west of the Rockies and east of the Appalachian Mountains from Virginia northward.

The peak season for tornadoes begins in late winter in southern sections of the United States and shifts northward through mid-summer. However, tornadoes can occur at any time of the year where conditions are favorable; violent tornadoes have even been reported in mountainous regions. While tornadoes have been reported in all 50 states, weather conditions are not favorable in Alaska and Hawaii for the type of storms that generate tornadoes. According to the National Oceanic and Atmospheric Administration only one tornado was reported for Alaska and only 28 for Hawaii in the years 1950–1996, while Texas reported 5,860 during the same period. Based on those numbers, it would not be necessary to locate a spotter in those low-incident locations.

LINKS AND BOOKS

Links

NOVA Web Site—Hunt for the Supertwister

www.pbs.org/nova/tornado/

In this companion Web site to the NOVA program, discover why tornadoes are more frequent in the United States, read one story about how forecasting has changed, learn about how building practices affect tornado safety, and rate tornado damage using the Fujita scale.

May 4, 2003 Severe Weather Outbreak
mcc.sws.uiuc.edu/html/historical/may0403svrwx.htm

Details the tornado outbreak of May 4, 2003.

May 8, 2003 Severe Storms in the Midlands

www.hprcc.unl.edu/nebraska/may8-2003storm-report.html

Provides a comprehensive storm report on the May 8, 2003 tornado event.

May 15, 2003: Record Number of Tornadoes in the Texas and Oklahoma Panhandles

www.srh.noaa.gov/ama/Research/may_15_2003/030515.html

Details the tornado outbreak of May 15, 2003.

The Online Tornado FAQ

www.spc.noaa.gov/faq/tornado/

Contains a comprehensive guide to tornado facts including forecasting, climatology, spotting and chasing, and the Fujita tornado intensity scale.

Questions and Answers About Tornadoes

www.nssl.noaa.gov/edu/tornado

Provides tornado information for kids, parents, and teachers, including tips on safety and tornado detection.

Tornado Project Online

www.tornadoproject.com/

Provides tornado data along with personal experiences, tornado oddities, and tornado myths.

Tornadoes

www.noaa.gov/tornadoes.html

Includes lists of the deadliest outbreaks, significant tornadoes of the 20th century, and long-term averages by state.

Tornadoes: Nature's Most Violent Storms

www.crh.noaa.gov/lmk/tornado/index.html

Features information on what tornadoes are and how they form as well as photos of tornado damage and tips on staying safe during a tornado.

Weather Watch: Tornadoes

teacher.scholastic.com/activities/wwatch/tornado/index.htm

Provides background information on tornadoes, hands-on weather activities, and weather experts' answers to student questions about tornado prediction and stormchasing.

Books

Allaby, Michael.

Tornadoes.

New York: Facts On File, 1997.

Explains the science behind tornadoes and describes the consequences of significant tornadoes from the past.

Bluestein, Howard B.

Tornado Alley: Monster Storms of the Great Plains.

New York: Oxford University Press, 1999.

Presents a historical account of tornado research and an in-depth look at cause and effect.

Bradford, Marlene.

Scanning the Skies: A History of Tornado Forecasting.

Norman, Oklahoma: University of Oklahoma Press, 2001.

Outlines the history of today's tornado warning system and explains how technological advancements have greatly reduced tornado fatalities.

Grazulis, Thomas P.

The Tornado: Nature's Ultimate Windstorm.

Norman, Oklahoma: University of Oklahoma Press, 2001.

Explains the science behind tornadoes and includes personal accounts, photos of tornadoes and their aftermath, and information about tornadoes occurring outside the United States.

Verkaik, Jerrine and Arjen Verkaik.

Under the Whirlwind: Everything You Need to Know About Tornadoes but Didn't Know Who to Ask.

Elmwood, Ontario: Whirlwind Books, 2001.

Explains tornado formation and measurements utilizing photos, charts, and diagrams. Specifies tornado safety and preventative building tips, and offers advice on dealing with insurance companies and post-tornado trauma.

Spotting Tornadoes

Tornadoes can be violent, destructive, and difficult to predict, making them one of the most feared forms of extreme weather. An official from the National Weather Service needs your help to find the most likely place that significant (rated F2 or higher) tornadoes will form this year. Use all the resources you have been given and answer the questions below.

Procedure

- 1 Use print and Internet resources to research answers to the first two questions below.
- 2 Create a report that summarizes what you have learned. Decide how you want to present your report, whether as a poster, a mockup of a newspaper, a multimedia presentation, or a play. Be clear and concise when you are explaining the weather concepts involved in tornado formation. Create tables, graphs, and/or illustrations to convey information in your report.
- 3 Use the maps on your “Where the Tornadoes Are” handout to answer Question #3.

Questions

Write your answers on a separate sheet of paper.

- 1 The Warning and Coordination Meteorologist for your area first wants to make sure that you know enough about tornadoes to qualify to work as a spotter. Include the answers to these questions in your report:
 - What conditions do meteorologists look for when trying to identify the possibility of a tornado forming?
 - How do tornadoes form?
 - What methods do scientists use to track tornadoes?
 - In what areas of the United States do tornadoes occur with the greatest frequency?
- 2 Your safety is the meteorologist’s main concern. To make sure you will be safe while you are out chasing tornadoes, answer the following questions:
 - What precautions should you take if you are a mobile spotter tracking a storm with your car?
 - What safety measures should you take if you are providing spotting information from a fixed position, like your home or school?
- 3 The meteorologist wants recommendations for when and where to place her spotters this year. Use the maps she has given you from the National Severe Storms Laboratory on your “Where the Tornadoes Are” handout to answer her questions:
 - What time of year and in what areas would a spotter be most likely to see a tornado?
 - What U.S. regions would you recommend against placing spotters?
 - What, if any, pattern do you notice regarding the peak months for tornadoes throughout the United States?
 - Hawaii and Alaska are not on the data charts you have been given. But the meteorologist wants to know whether to position spotters in either of these states. Based on what you have learned about how tornadoes form, would you recommend placing spotters in either of those states? Defend your reasoning.



