Discovering Alabama

Teacher's Guide

Tornado

Suggested Curriculum Areas
- Earth Science
- Social Studies
- Civics/Government

Suggested Grade Levels
- 6–12
- portions are also suitable for adult groups

Key Concepts
- Humanity
- Empathy
- Selflessness

Key Skills
- Map Reading
- Research
- Communication

Synopsis

April 27, 2011 was a record-setting day for severe weather in Alabama. On that date, a total of sixty-two tornados slashed across the state, wreaking destruction in every region. This video recounts the terrible events of that day—including the EF4 tornado that ripped through Tuscaloosa very close to Discovering Alabama's offices—and celebrates the subsequent outpouring of great love and humanity as Alabama communities quickly rallied to help victims of the storms and tackle the difficult challenge of recovery. The video also highlights the weather-related causes of the April 27th tornados and includes discussion about tornado preparedness/safety and the realities of dealing with the aftermath of such events.

Portions of this Teacher Guide are suitable for use with adult groups as well as student groups. In either case, we should be mindful that many people were affected by the 2011 tornados. You will want to be carefully sensitive to those in your group who might have experienced personal loss and/or extreme distress from the tragic storms.

THE UNIVERSITY OF ALABAMA

ALABAMA MUSEUM of Natural History

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Before Viewing

1. Worldwide there are many different kinds of severe weather phenomena. Have students work in small groups to a) list as many kinds of severe weather as they can name/describe, b) identify the regions of the world where each kind most commonly occurs, and c) note the kinds of severe storms that occur in Alabama. Have the groups take turns reporting their lists as you record and compile on the blackboard, flip-easel, or other means. (It is helpful to have global maps available for this activity.)

2. Invite the class to share what they know about global variations in geographical and climate conditions affecting different regional weather patterns and storm occurrences. Discuss why Alabama has a history of more tornados than most other parts of the nation. Ask students if they remember where they were as tornados struck Alabama on April 27, 2011. Introduce the video by explaining that it revisits the record tornado outbreak on that date (and be sure to check if anyone in your group feels this might be too painful to revisit).

While Viewing

Ask students to note the specific weather conditions that fueled the unusual tornado outbreak of April 27th. Have students watch for the different ways that the tornados impacted Alabama.

Video Mystery Question: What is the meaning of the word "tornado"? (Answer: This is a trick question. No discussion of the word's meaning/derivation is presented in the video. Have the class research to determine the answer to this mystery question. The answer is also contained in the back page of this Guide.)

After Viewing

1. Allow some time for open discussion of the video. Invite anyone affected by the 2011 tornados to share his/her personal story/experience.

2. Return students to small groups and have each group develop a list of the various kinds of tornado impacts that affected Alabama (the back panel of this Guide, "Understanding and Preparing for Tornados," provides related information for teachers and discussion leaders). Discuss the groups' lists and review the particular weather conditions that contribute to the occurrence of tornados.

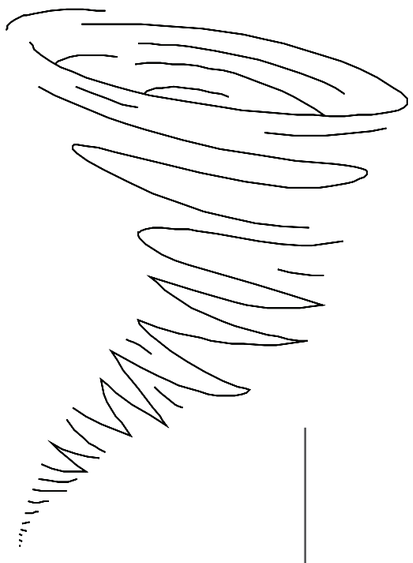
Extensions

1. Have students research the history of tornado activity in Alabama and the history of damage/impacts from these storms.

2. View the *Discovering Alabama* program "Dauphin Island." Compare the history of tornados in Alabama with the history of hurricanes affecting Alabama. Contrast the contributing weather conditions associated with the two different kinds of storms.

Philosophical Reflections

The destruction wrought by tornados and other kinds of natural phenomena are often referred to as "acts of God," in contrast to various destructive consequences that are caused by human activity. This distinction is applied especially in matters where there are questions of possible legal liability, lawsuits, etc. In recent years, however, scientists have been proclaiming a strong causal relationship between human activities (especially the burgeoning growth of human populations and the subsequent increased burning of fossil fuels) and the disruptive consequences of global warming, including the greater frequency and intensity of storms. Does this scientific evidence suggest that such record tornado events, as those of April 27, 2011, might be related to human activity and therefore subject to possible claims of legal liability? Or should the terrible storms of April 27th remain classified as "acts of God," albeit perhaps due to God having an especially irritable day?



Nature in Art

Nature is at once a source of great beauty and great destruction, and sometimes the pleasant and the terrifying are interwoven to create a rendering of rare exhibit: the amber aura upon a coastline in the days preceding a hurricane; the red tint in the otherwise gray sky of an approaching snow storm; the eerie green glow sometimes seen in the gathering presence of an impending tornado. Invite students to take a photograph or bring a picture to class that captures such a dual effect in nature.

Community Connections

1. Invite local weather authorities, civil authorities, or other such experts to visit the class and discuss local storm concerns, warning systems, building codes, emergency management, and other considerations relevant to proper preparedness and safety in the event of tornado activity.

2. Conduct a survey of community preparedness for a tornado event. This can be a simple telephone survey or a brief questionnaire distributed by mail (local authorities can help you devise appropriate questions and determine a suitable sample of survey contacts). Develop a community awareness packet summarizing your survey findings and encouraging proper tornado preparedness.

Additional References

National Oceanic and Atmospheric Administration's *National Weather Service*
website: http://weather.gov/

National Aeronautics and Space Administration (NASA)
website: http://nasa.gov/

U.S. Geological Survey of Alabama
website: http://usgs.gov/

Geological Survey of Alabama
website: http://gsa.state.al.us/

Alabama Emergency Management Agency
website: http://ema.alabama.gov/

Center for Severe Weather Research
website: http://cswr.org/

Alabama Meteorological Society
website: http://ametsoc.org/

Parting Thoughts

Discovering Alabama's *"Tornado" is not a video I enjoyed producing. Like our 2010 program, "Oil Spill," such terrible topics are not the sort of thing I would ever wish to cover. In each case, however, we were asked by state officials to cover these record events through the unique perspective of* Discovering Alabama. *I hope we accomplished this to the satisfaction of viewers across our state.*

Of course, the severity of the 2011 tornados is prompting new awareness and many new initiatives regarding tornado preparedness and safety. And this is certainly needed in a state so prone to tornado activity. Frankly, I've always felt confounded by the prevalent practice of ***not*** *including storm shelters in Alabama homes and other major dwellings, especially schools. Likewise, I've always been baffled at the tendency of some Alabamians not to pay attention during threatening weather conditions. But we can hope that the emerging new awareness will serve to remedy these concerns.*

Meanwhile, I would like to share an additional concern. Despite the propensity of tornados for bringing deadly destruction, these storms are also, shall we say, impressive phenomena of nature. So allow me to suggest that, while we should take all necessary precautions for safety during tornado weather, maybe we should also take care not to unnecessarily frighten our children. I would rather a child be cautiously impressed by nature's fury than be traumatized every time storm clouds appear. Proper precaution and preparedness are definitely in order, but children also benefit from a healthy curiosity for the many wonders of nature—yes, even for storms. In fact, storms sometimes have beneficial consequences, for example, bringing, even creating, landscape openings that enable the establishment of new natural communities and increased natural diversity.

Oh yeah, I almost forgot, weather phenomena are ever changing, season to season, week to week, and sometimes even day to day. Nature's forces are always on call and available for the curiosity of young minds. With a little encouragement, most youngsters can acquire an active interest in such outdoor natural phenomena. And in my opinion, just about any active outdoor interest serves children better than today's all too common tendencies to become wholly fixated on indoor games and gadgetry.

Happy outings,
Dr. Doug

Discovering Alabama

Activity/Information Sheet

Tornado

Understanding and Preparing for Tornados

A basic science lesson teaches that weather is a function of temperature, moisture, and wind patterns that differ around the world, depending upon regional latitude, physiography, and other factors. Thus there are many kinds of storms including wind storms, squalls, gales, ice storms, snow storms, blizzards, ocean storms, firestorms, dust storms, hail storms, hurricanes, typhoons, and tornados. Differing regions of the world tend to have more or less of certain kinds of storms, and of course, Alabama is in a region with frequent tornado activity.

A tornado is "a violently rotating column of air, in contact with the ground, either pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud." For a vortex to be classified as a tornado, it must be in contact with both the ground and the cloud base. Tornados come in many shapes and sizes, but they are typically in the form of a visible condensation funnel, whose narrow end touches the earth and is often encircled by a cloud of debris and dust. Most tornados have wind speeds of less than 110 miles per hour, are about 250 feet across, and travel a few miles before dissipating. The most extreme tornados can attain wind speeds of more than 300 miles per hour, stretch more than two miles across, and stay on the ground for dozens of miles.

There are several scales for rating the strength of tornados. The Fujita scale rates a tornado by damage caused and has been replaced in some countries by the updated Enhanced Fujita Scale. An F0 or EF0 tornado, the weakest category, damages trees, but not substantial structures. An F5 or EF5 tornado, the strongest category, rips buildings off their foundations and can deform large skyscrapers. The similar TORRO scale ranges from a T0 for extremely weak tornados to T11 for the most powerful known tornados. Doppler-radar data, photogrammetry, and ground-swirl patterns (cycloidal marks) may also be analyzed to determine intensity and assign a rating. Depending on the strength of a tornado, its winds can cause damage in several ways. Human lives and property are foremost concerns, but tornados can also devastate forestlands, streams and lakes, and other natural habitats.

Tornado Development

Tornados often develop from a class of thunderstorms known as supercells. Supercells contain mesocyclones, an area of organized rotation a few miles up in the atmosphere, usually 1–6 miles across. Most intense tornados (EF3 to EF5 on the Enhanced Fujita Scale) develop from supercells. In addition to tornados, very heavy rain, frequent lightning, strong wind gusts, and hail are common in such storms.

Most tornados from supercells follow a recognizable life cycle that begins when increasing rainfall drags with it an area of quickly descending air, known as the rear flank downdraft (RFD). This downdraft accelerates as it approaches the ground and drags the supercell's rotating mesocyclone towards the ground with it. As the mesocyclone lowers below the cloud base, it begins to take in cool, moist air from the downdraft region of the storm. This convergence of cool air, with the warm air in the updraft, causes a rotating wall cloud to form.

The RFD also focuses the mesocyclone's base, causing it to siphon air from a smaller and smaller area on the ground. As the updraft intensifies, it creates an area of low pressure at the surface. This pulls the focused mesocyclone down, in the form of a visible condensation funnel. As the funnel descends, the RFD also reaches the ground, creating a gust front that can cause severe damage a good distance from the tornado. Usually, the funnel cloud begins causing damage on the ground (becoming a tornado) within a few minutes of the RFD reaching the ground. Initially, the tornado has a good source of warm, moist inflow to power it, so it grows until it reaches the "mature stage." This can last anywhere from a few minutes to more than an hour, and during that time, a tornado often causes the most damage and, in rare cases, can be more than one mile across.

Occasionally, a single storm will produce more than one tornado, either simultaneously or in succession. Multiple tornados produced by the same storm cell are referred to as a "tornado family." Several tornados are sometimes spawned from the same large-scale storm system. If there is no break in activity, this is considered a tornado outbreak (although the term "tornado outbreak" has various definitions). A period of several successive days with tornado outbreaks in the same general area (spawned by multiple weather systems) is a tornado-outbreak sequence, occasionally called an extended tornado outbreak.

Tornado Frequency

The United States has the most tornados of any country, nearly four times more than estimated in all of Europe, excluding waterspouts. This is mostly due to the unique geography of the continent. North America is a large continent that extends from the tropics north into arctic areas, and has no major east-west mountain range to block air flow between these two areas. In the middle latitudes, where most tornados of the world occur, the Rocky Mountains block moisture and buckle the atmospheric flow, forcing drier air at mid-levels of the troposphere due to downsloped winds, and causing the formation of a low-pressure area downwind to the east of the mountains. Increased westerly flow off the Rockies forces the formation of a dry line when the flow aloft is strong, while the Gulf of Mexico fuels abundant low-level moisture in the southerly flow to its east. This unique topography allows for frequent collisions of warm and cold air, the conditions that breed strong, long-lived storms throughout the year. A large portion of these tornados form in an area of the central United States known as Tornado Alley. This area extends from Texas northeast to Canada, with Oklahoma lying along the western side of this corridor and Alabama lying along the Southeast side.

Tornados are most common in spring and least common in winter, but tornados can occur any time of year if favorable conditions occur. Spring and fall experience peaks of activity as those are the seasons when stronger winds, wind shear, and atmospheric instability are present. Tornado occurrence is highly dependent on the time of day because of solar heating. Worldwide, most tornados occur in the late afternoon, between 3 p.m. and 7 p.m. local time, with a peak near 5 p.m. However, destructive tornados can occur at any time of day. The Gainesville Tornado of 1936, one of the deadliest tornados in history, occurred at 8:30 a.m. local time.

Tornado Safety

Although tornados can strike in an instant, there are precautions and preventative measures that people can take to increase the chances of surviving a tornado. Weather radios provide an alarm when a severe-weather advisory is issued for the local area. Authorities, such as NOAA's Storm Prediction Center (http://spc.noaa.gov), advise having a pre-determined plan should a tornado warning be issued. When a warning is issued, going to a basement or an interior first-floor room of a sturdy building greatly increases the chances of survival. In tornado-prone areas, many buildings have storm cellars on the property. These underground refuges have saved thousands of lives.

Unless the tornado is far away and highly visible, meteorologists advise that drivers park their vehicles far to the side of the road (so as not to block emergency traffic) and find a sturdy shelter. If no sturdy shelter is nearby, lying low in a ditch is the next best option. Some authorities say that highway overpasses are one of the worst places to take shelter during tornados, as the constricted space can be subject to increased wind speed and funneling of debris through the overpass.

In Alabama, helpful information about tornado preparedness can be obtained by contacting such sources as the Alabama Emergency Management Agency, your local planning commission, or your regional planning council. A number of national storm information sources are listed in the "Additional References and Resources" section of this Guide.

Excerpted from http://en.wikipedia.org/wiki/Tornado