

Thunderstorms, Tornadoes, Lightning...

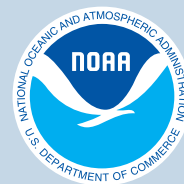
...Nature's Most Violent Storms



A PREPAREDNESS GUIDE

Including Tornado Safety Information for Schools

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service





Tornadoes

Although tornadoes occur in many parts of the world, they are found most frequently in the United States. In an average year, 1,200 tornadoes cause 60-65 fatalities and 1,500 injuries nationwide. You can find more information on tornadoes at www.spc.noaa.gov.

Tornado Facts

- A tornado is a violently rotating column of air extending from a cumuliform cloud, such as a thunderstorm, to the ground.
- Tornadoes may appear nearly transparent until dust and debris are picked up or a cloud forms within the funnel. The average tornado moves from southwest to northeast, but **tornadoes can move in any direction** and can suddenly change their direction of motion.
- The average forward speed of a tornado is 30 mph but may vary from nearly stationary to 70 mph.
- The strongest tornadoes have rotating winds of more than 200 mph.
- Tornadoes can accompany tropical storms and hurricanes as they move onto land.
- Waterspouts are tornadoes that form over warm water. Water spouts can move onshore and cause damage to coastal areas.

Be Ready Year Round

- Tornadoes can occur at any time of day, any day of the year.
- Have a plan of action before severe weather threatens. You need to respond quickly when a warning is issued or a tornado is spotted.
- When conditions are warm, humid, and windy, or skies are threatening, monitor for severe weather watches and warnings by listening to NOAA Weather Radio, logging onto weather.gov or tuning into your favorite television or radio weather information source.

The Enhanced Fujita Scale

The National Weather Service (NWS) uses the EF-Scale to assign a tornado a 'rating' based on estimated wind speeds and related damage.

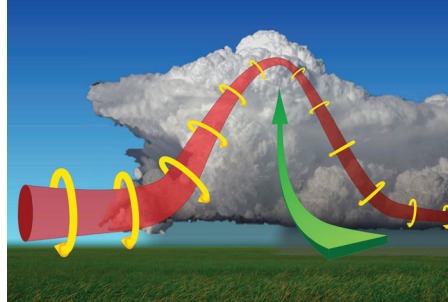
EF- SCALE	
EF RATING	3 Second Wind Gust (mph)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

How Tornadoes Form

Before thunderstorms develop, winds change direction and increase in speed with altitude. This creates an invisible, horizontal spinning effect in the lower atmosphere.



Rising air within the thunderstorm updraft tilts the rotating air from horizontal to vertical.



An area of rotation, 2-6 miles wide, now extends through much of the storm. Most tornadoes form within this area of strong rotation.



Chuck Doswell III

Weak Tornadoes

- 88% of all tornadoes
- Less than 5% of tornado deaths
- Lifetime 1 – 10+ minutes
- Winds less than 110 mph
- Produces EF0 or EF1 damage



Wikimedia/Justin Hobson

Strong Tornadoes

- 11% of all tornadoes
- Nearly 30% of all tornado deaths
- May last 20 minutes or longer
- Winds 111-165 mph
- Produces EF2 or EF3 damage



Wikimedia/Joshua Jans

Violent Tornadoes

- Less than 1% of all tornadoes
- 70% of all tornado deaths
- Can exceed 1 hour
- Winds greater than 166 mph
- Produces EF4 or EF5 damage

More detailed information on the EF-Scale can found at:
www.spc.noaa.gov/efscale

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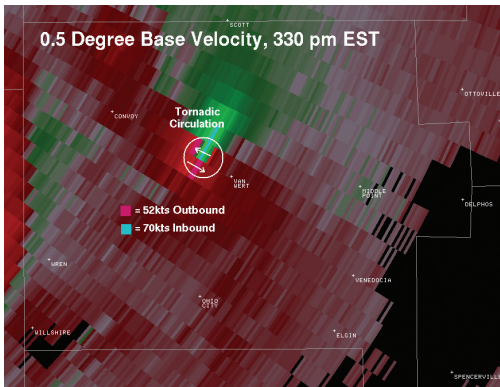


Figure 1

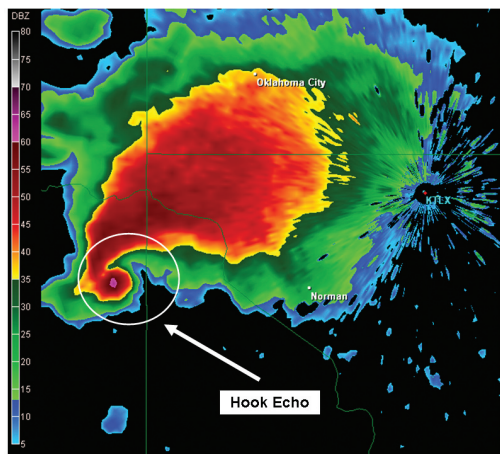


Figure 2



Figure 3

NOAA/Brian Bill

Weather Radar Watches the Sky

The NWS has a Doppler radar network strategically located across the country that can detect air movement toward or away from the radar. Early detection of increasing rotation aloft within a thunderstorm can allow life-saving warnings to be issued before the tornado forms. In Figure 1 Weather Service Doppler radar detected strong rotation within the storm where red colors (winds moving away from the radar) and green (winds blowing toward the radar) are close together. Figure 2 reveals the “hook echo” that appeared in the radar’s reflectivity data. Figure 3 shows a violent tornado in northern Oklahoma at the same time the radar image was taken.

Tornado Fiction and Fact

FICTION: Lakes, rivers, and mountains protect areas from tornadoes.

FACT: No geographic location is safe from tornadoes. A tornado near Yellowstone National Park left a path of destruction up and down a 10,000 foot mountain.

FICTION: A tornado causes buildings to “explode” as the tornado passes overhead.

FACT: Violent winds and debris slamming into buildings cause the most structural damage.

FICTION: Open windows before a tornado approaches to equalize pressure and minimize damage.

FACT: Virtually all buildings leak. Leave the windows closed. Take shelter immediately. An underground shelter, basement or safe room are the safest places. If none of those options are available, go to a windowless interior room or hallway.

FICTION: Highway overpasses provide safe shelter from tornadoes.

FACT: The area under a highway overpass is very dangerous in a tornado. If you are in a vehicle, you should immediately seek shelter in a sturdy building. As a last resort, you can either: stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible, OR if you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands. Your choice should be driven by your specific circumstances.

FICTION: It is safe to take shelter in the bathroom, hallway, or closet of a mobile home.

FACT: Mobile homes are not safe during tornadoes! Abandon your mobile home to seek shelter in a sturdy building immediately. If you live in a mobile home, ensure you have a plan in place that identifies the closest sturdy buildings.

Answers to frequently asked questions about tornadoes can be found at:
www.spc.noaa.gov/faq/tornado/index.html

Tornado Safety Rules

- The safest place to be is an underground shelter, basement, or safe room.
- If no underground shelter or safe room is available, a small, windowless interior room or hallway on the lowest level of a sturdy building is the safest alternative.
- Mobile homes are not safe during tornadoes. Abandon mobile homes and go to the nearest sturdy building or shelter immediately.
- If you are caught outdoors, seek shelter in a basement, shelter or sturdy building. If you cannot quickly walk to a shelter:
 - Immediately get into a vehicle, buckle your seat belt and try to drive to the closest sturdy shelter.
 - If flying debris occurs while you are driving, pull over and park. Now you have the following options as a last resort:
 - *Stay in your vehicle with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.*
 - *If you can safely get noticeably lower than the level of the roadway, exit your car, and lie in that area, covering your head with your hands.*
- Your choice should be driven by your specific circumstances



Brian Peters

Occasionally tornadoes develop so rapidly that advance warning is not possible. Remain alert for signs of an approaching tornado such as a dark, often greenish sky, large hail, or a loud roar similar to a freight train.

Flash Flood Safety Rules

- Avoid driving, walking, or swimming in flood waters.
- Stay away from high water, storm drains, ditches, ravines, or culverts. Even moving water only six inches deep can knock you off your feet. Move to higher ground.
- Do not let children play near storm drains.
- If you come upon a flooded roadway never drive through it.

**TURN AROUND
DON'T DROWN!!!**

For more information on
flood safety, please visit:
www.floodsafety.noaa.gov



USGS/Don Becker



NOAA/PA 201051