



# Tornado Safety

David W. Smith, Extension Safety Program  
Texas Cooperative Extension  
Texas A&M University System

# Tornado Facts

- On average, about 1000 tornadoes are documented each year in the US.
- Texas has the most tornadoes annually - 124
- Oklahoma has the highest concentration of tornadoes – 7.5 per 10,000 square miles

*Source: National Climatic Data Center.*



Merriwa, NSW 5th November 1995. Photo by Mike Hadfield

# Tornado Facts

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- The largest tornado ever recorded was in the Texas Panhandle near Gruver on June 9, 1971. The tornado expanded over 2 miles wide, with an average width of 2500 yards.
- The strongest tornado ever recorded produced wind speeds of 318 mph in May 1999, near Bridge Creek, Oklahoma.
- The “Tri-state” tornado of March 18, 1925 is the deadliest tornado on record, killing 695 people in Missouri, Illinois, and Indiana.

# Tornado Facts

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- The largest tornado outbreak occurred when 147 tornadoes touched down in 13 US states on April 3-4, 1974.
- The record for most tornadoes in any month was set in May 2003, with 516.
- On average, tornadoes kill about 60 people per year (most from flying and falling debris).



# Where do tornadoes develop?

- ANYWHERE!
- Most tornadoes in the US develop just west of the Mississippi River Valley in an area called “Tornado Alley”.
- Most tornadoes form in late afternoon-early evening.
- Tornadoes are responsible for about 60 deaths per year in the US.



# How do tornadoes develop?

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- Warm humid air collides with a cold front.
- As warm air rises within the storm clouds, cooler air rushes in from the sides.
- A whirling wind is created that draws surrounding air toward its center.
- An area of strong rotation develops, 2 to 6 miles wide. A dark, low cloud base or “cloud wall” appears.
- As rotation becomes even stronger, a funnel develops.

# Tornado Forecasting

Doppler Radar

Source: NOAA



# Doppler Radar Analysis

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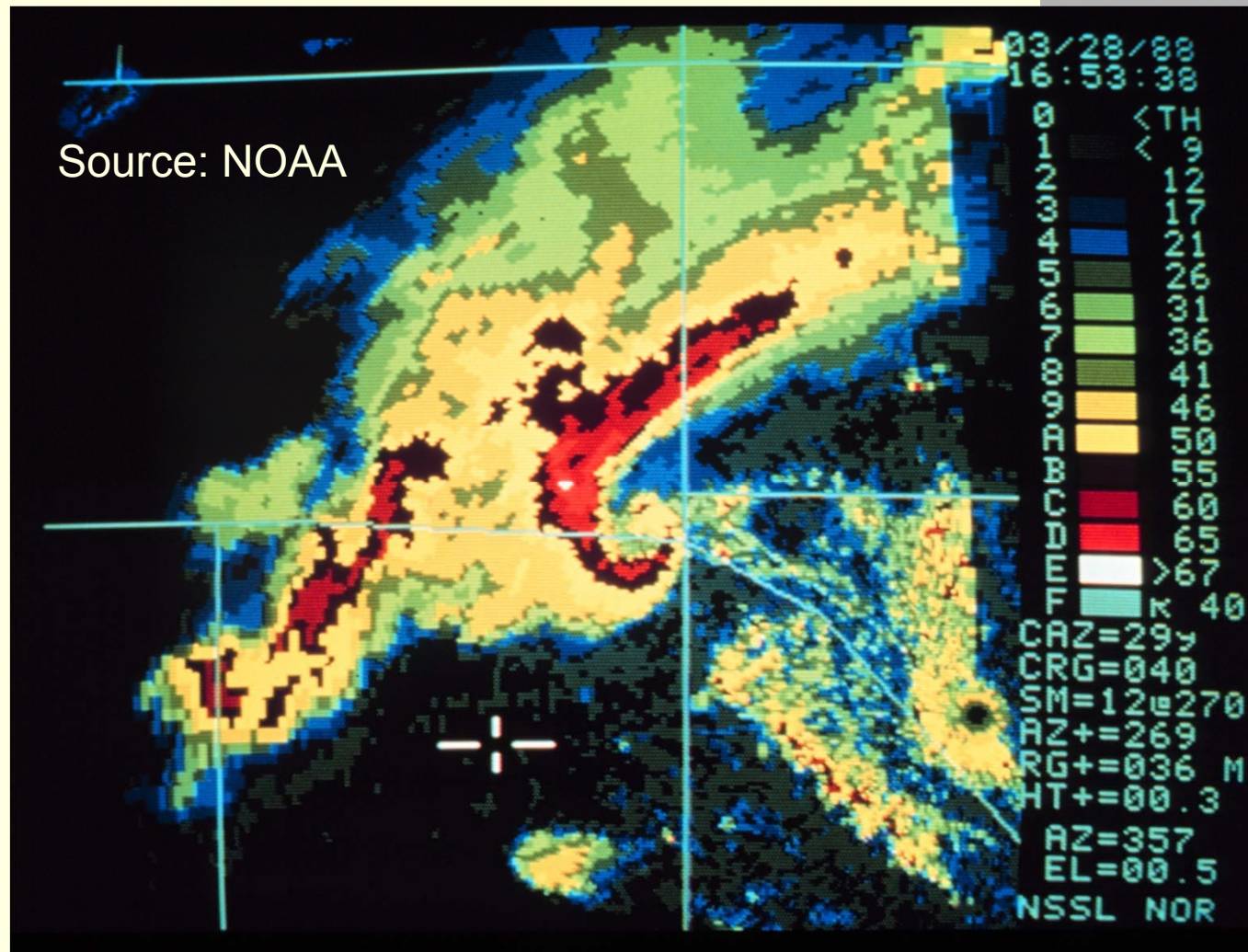
Source: NOAA





# Defined “Hook” Pattern Indicates that a Tornado is Likely

Source: NOAA



# National Weather Service Alerts

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- **Tornado Watch**: means that weather conditions exist where tornadoes are possible.
- **Tornado Warning**: means that a tornado has been spotted, or that Doppler radar indicates a thunderstorm rotation which can spawn a tornado.

# Tornado Forecasting

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- A tornado's size, strength, direction, and duration cannot be predicted.
- Size and strength of a tornado is not determined until after damage has occurred.
- Tornado direction cannot be predicted.
- The Fujita-Person scale provides a means of categorizing tornadoes. (It is not necessarily an accurate indicator of damage.)

# Fujita – Person Tornado Scale

Category	Wind Speed (mph)	Potential Damage
F-0	40-72	Chimney damage, tree branches broken
F-1	73-112	Mobile homes pushed off foundation or overturned
F-2	113-157	Considerable damage, mobile homes demolished, trees uprooted
F-3	158-205	Roofs and walls torn down, trains overturned, cars thrown
F-4	207-260	Well-constructed walls leveled
F-5	261-318	Homes lifted off foundations, carried considerable distance, autos thrown as far as 100 meters



# Wind Power

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Source: FEMA

**Palm tree pierced by plywood missile, Hurricane Andrew**

# Tornado Direction and Duration

- Most tornadoes travel from the southwest to northeast – BUT NOT ALL
- Some tornadoes have changed direction amid path and even backtracked
- They can last several seconds to more than an hour



Merriwa, NSW 5th November 1995. Photo by Mike Hadfield

# They are Unpredictable!

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# What are the warning signs?

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- Strong, persistent rotation in the cloud base





# Low-Hanging Wall Cloud

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# What are the warning signs?

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- Whirling dust and debris on the ground under a cloud base—tornadoes sometimes have no funnels.



# This is no Dust Storm!

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Source: NOAA



# What are the warning signs?

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- Hail or heavy rain followed by dead calm or a fast, intense wind shift. Many tornadoes are wrapped in heavy precipitation and cannot be seen.





# Keep an Eye on the Sky

- Hail storms may occur on the outer perimeter of storm cloud formations with no rain or damaging wind.



# Hail Stone Size Can Indicate Storm Intensity

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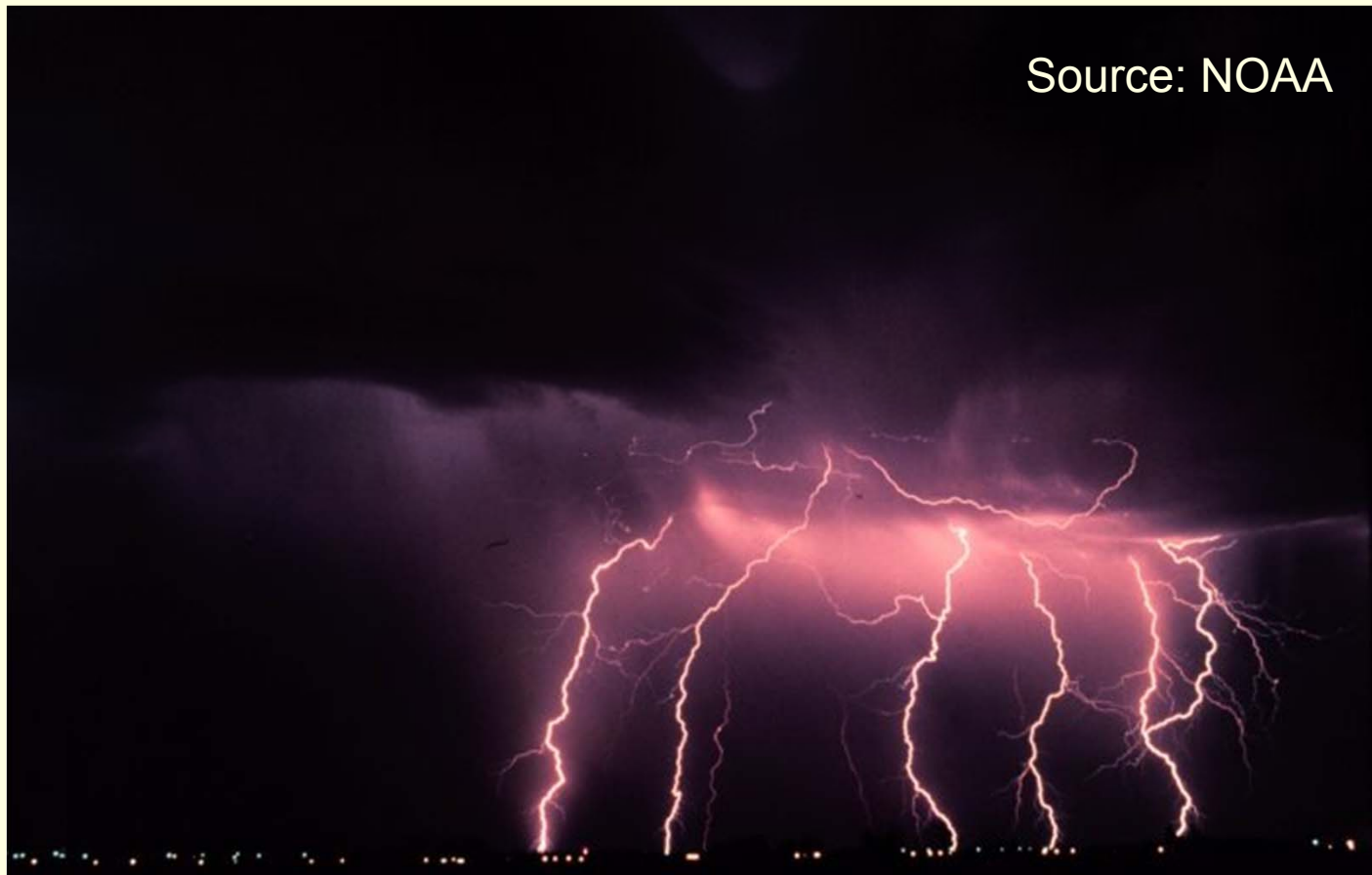
- This 4-inch diameter hailstone fell northeast of Breckenridge, Texas.



# What are the warning signs?

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- Loud, continuous roar or rumble, much like the sound of an approaching freight train.



# What are the warning signs?

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- At night, small, bright, blue-green to white flashes at ground level near a thunderstorm.





# What are the warning signs?

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- At night, persistent lowering from the cloud base, illuminated or silhouetted by lighting.





# Where should I seek shelter?

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- The absolute safest place to be during a tornado is underground in a specifically designed tornado shelter or “safe room” located in a basement.
- Otherwise, stay away from windows and move to an interior room such as a closet or bathroom.

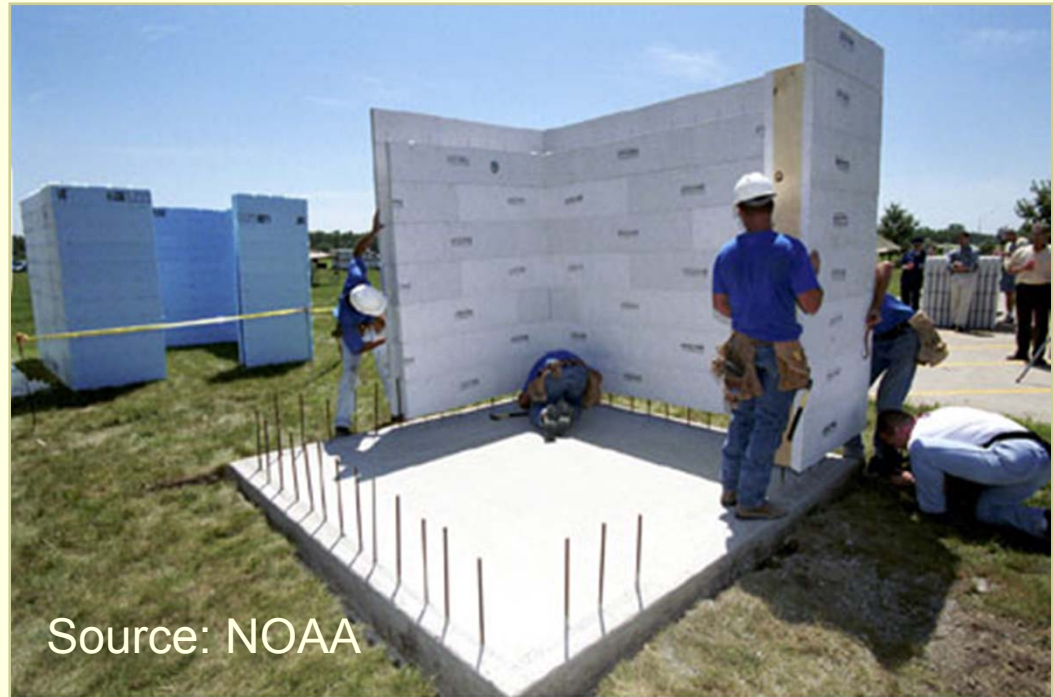
# Below-Ground Storm Shelter

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# “Safe” Room

- Provide protection against winds of up to 250 miles per hour and against flying objects traveling as fast as 100 miles per hour.
- Built inside but separate from the main house. The walls and ceilings are extra thick and strong so that the safe room remains standing and intact even if the rest of the house is destroyed by high winds and flying objects.



# Interior Room

- An interior room, such as a closet or bathroom, generally contains more structural protection than other parts of a house or building.



Source: NOAA



# Office Buildings

- Go directly to an enclosed, windowless area in the center of the building.
  - Under a stairwell
  - Interior hallway
- Crouch as low to the floor as possible, face down
- Cover your head with your hands or with some sort of thick padding (blankets)

Tandy Ctr South



Photographs by: Jesse Rangel, USACE





# Mobile Homes

- GET OUT!
- You are probably safer outside, even if you have to seek shelter out in the open
- If there is a sturdy building nearby, seek shelter there



# In a Car

- If the tornado is far away and visible, look for the direction it is traveling. If possible, drive at a right angle to its movement.
- Otherwise, get out of the traffic lanes and park the car.
- Get out and seek shelter in a sturdy building.
- If in open country, get away from the car and lay face down in a low-lying area.
- Avoid seeking shelter under bridges



# Open Outdoors

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- Look for shelter in a sturdy building
- Otherwise, lay face-down in a low-lying area with your arms protecting the back of your head
- Get away from any trees, cars or other objects that may be blown onto you

# After the Tornado ...

- Listen to instructions from emergency crews.
- Keep your family together and calm.
- Render first aid to the injured. Do not move injured people unless they are in immediate danger.
- Stay out of damaged buildings.
- Stay away from power lines.
- Don't use matches or lighters.
- If you smell fumes, leave the area at once.



Source: NOAA



# Tornado Myths

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1. *An underpass is a safe place to be.*
2. *You should open all windows to equalize pressure.*
3. *Mobile homes attract tornadoes.*
4. *I can outrun a tornado.*
5. *Hail always comes before a tornado.*



## *Myth 1: An underpass is a safe place to be.*

- Wind speeds accelerate under bridges.
- Deadly flying debris can be blasted into the spaces between the bridge and grade.
- People may be blown out from under the bridge.
- The bridge may collapse, peel apart or create large flying objects.



## *Myth 2: You should open all windows to equalize pressure.*

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- Opening the windows is a waste of precious time, and very dangerous.
- You may be injured by flying glass.
- If the tornado hits your home, it will blast the windows open for you.

## *Myth 3: Mobile homes attract tornadoes.*

- Tornadoes do not seek out and destroy mobile homes, though it may seem that way.
- Due to construction, mobile homes are more likely to experience damage.
- Most tornado deaths occur in mobile homes.
- Even with small tornadoes, mobile homes are blown off their foundations, even when tied down.



Photo courtesy NWS St. Louis

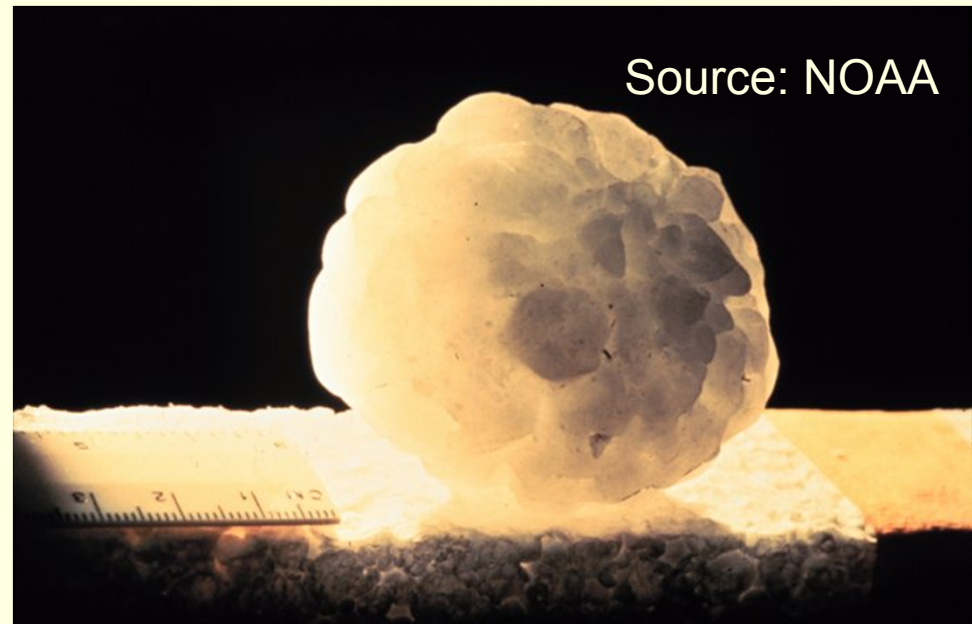
## *Myth 4: I can outrun a tornado.*

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- Most tornadoes occur in cars and mobile homes.
- There is no way to know the speed of an approaching tornado.
- Tornadoes have unpredictable paths and speeds.
- Your get-away speed may be affected by traffic, road obstructions, and weather.
- Get out of the car!

## *Myth 5: Hail always comes before a tornado.*

- Rain, wind, lighting, and hail vary from storm to storm, from one hour to the next.
- Large hail does indicate the presence of an unusually dangerous storm.
- Hail may happen before a tornado, however it is not a reliable predictor of a tornado threat.





# When it Comes to Tornadoes ... Expect the Unexpected!

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