
EXTREME WEATHER SAFETY

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<https://ise.ku.edu>



Overview

- ☐ Severe Thunderstorm Safety
- ☐ Flash Flood, Lightning, and Hail
- ☐ Tornado Safety
- ☐ Extreme Heat/Heat Wave
- ☐ Earthquake Safety



Thunderstorms, Lightning, and/or Hail

“Thunderstorm is a weather phenomenon characterized by the presence of lightning and thunder, and is often accompanied by heavy rain, strong winds, and sometimes hail”

Causes

- A rapid upward movement of warm, moist air, leading to condensation and cloud formation
- Often driven by an unstable atmosphere, resulting in the development of a tall cumulonimbus cloud

Key Ingredients

- Moisture – to form clouds and rain
- Unstable Air- relatively warm air that can rise rapidly
- Lift – fronts, sea breezes, and mountains are capable of **lifting** air to help form thunderstorms

Thunderstorms are dangerous storms that include lightning.



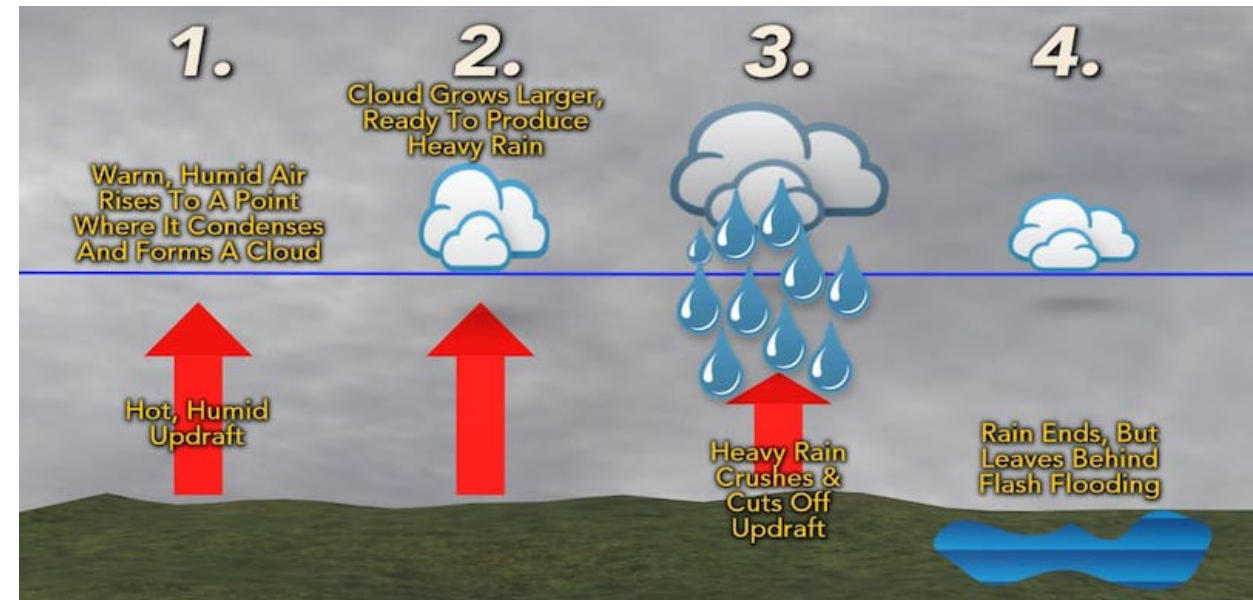
Include powerful winds



Create lightning and hail

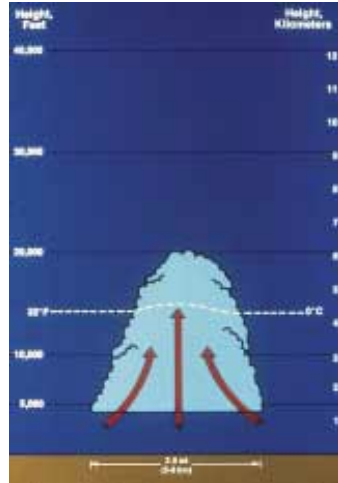


Cause flash flooding and tornadoes



Life Cycle of a Thunderstorm

Developing Stage



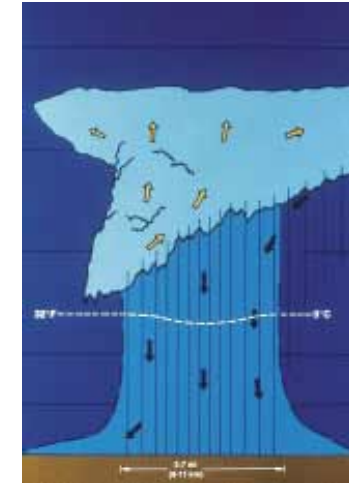
- ✓ Towering cumulus cloud indicates rising air.
- ✓ Usually little if any rain during this stage.
- ✓ Lasts about 10 minutes.
- ✓ Occasional lightning during this stage

Mature Stage



- ✓ Most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes.
- ✓ Storm occasionally has a black or dark green appearance.
- ✓ Lasts an average of 10 to 20 minutes but may last much longer in some storms.

Dissipating Stage



- ✓ Rainfall decreases in intensity.
- ✓ Some thunderstorms produce a burst of strong winds during this stage.
- ✓ Lightning remains a danger during this stage.

www.weather.gov/media/grr/brochures/nwsthunderstorms&lightning

Effects

- ❑ Thunderstorms affect relatively small areas when compared to winter storms and hurricanes
- ❑ A typical thunderstorm is 15 miles in diameter and lasts an average of 30 mins
- ❑ Nearly 1800 thunderstorms occur at any time around the world-
 - ✓ which is 16 million a year
- ❑ All thunderstorms are dangerous because they produce lightning
 - ✓ Lightning kills more people each year than hurricanes
- ❑ They are often accompanied by heavy rain, which could lead to flooding
- ❑ In the USA, an estimated 100,000 thunderstorms occur each year, but 10% are considered severe
- ❑ The National Weather Service considered a thunderstorm severe if:
 - ✓ 3/4 -inch diameter hail,
 - ✓ wind \geq 58 mph or Tornado

thunderstorms
and lightning...
the underrated killers!



www.weather.gov



Lightning

- ❑ Occurs with **ALL** thunderstorms
- ❑ An average of **93 deaths** and **300 injuries** yearly
- ❑ Causes several **hundred million dollars** in damage to **property** and **forest** annually

Flash floods/Floods

- ❑ The number **one** thunderstorm killer
Nearly 140 fatalities each year
- ❑ Most flash flood deaths occur at night and when people are trapped in automobiles

Flash floods are short-lived, while floods are prolonged



<https://www.weather.gov/media/grr/brochures/nwsthunderstorms&lightning>

Hail

Hail is a form of solid precipitation that consists of balls or irregular lumps of ice, often called a hailstorm

Causes about **1\$ billion** in damage to **property** and **crops** yearly

Costliest United States hailstorm: **Denver, Colorado, July 11, 1990**. Cost about **\$625 million**



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When are thunderstorms most likely?

Thunderstorms are more likely to happen in the spring and summer months:
often in the afternoons and evenings, **but can occur at all hours and year-round**

In the USA

- ❑ Along the Gulf coast and across the southeastern and western states, and often during the afternoon.
- ❑ They occur more frequently in the afternoon and night in the Plains states



People who are at **RISK**

From Lightning:

- ☐ People who are outdoors, especially under or near tall trees,
- ☐ In or on water,
- ☐ In or near hilltops

From Flooding:

- ☐ People in automobiles
- ☐ People in mobile homes



Environmental **clues**

When the skies **darken**, or a thunderstorm is **forecast**, look out for:

- ✓ Flashes of lightning
- ✓ Increasing wind
- ✓ Sounds of thunder
- ✓ Static on your radio



HOW TO STAY SAFE WHEN A THUNDERSTORM THREATENS

Basic measures during a thunderstorm warning

- ❖ Go indoors when thunder roars
move into a building or a car
- ❖ Pay attention to alerts and warnings
- ❖ Unplug appliances
- ❖ Do not use landline phones

www.lightningsafety.noaa.gov



What **YOU** can Do!

Now that you know thunderstorms are **COMMON** in **Spring** and **Summer**

Before the Storm.....

- ✓ Know the county, city, and state that you live in. Severe weather warnings are issued on a county or city basis.
- ✓ Check the weather forecast if you are going to be staying for an extended period outdoors
- ✓ Watch out for signs of approaching storms
- ✓ If a storm is approaching, keep tabs with NOAA news or any of any weather station
- ✓ Postpone all outdoor activities
- ✓ Check on those who have trouble taking shelter
- ✓ Sign up for your community's weather warning system. Join local social media groups
- ✓ Identify sturdy buildings close to where you live, work, study, and play in case you are caught outside
- ✓ Cut down or trim trees that could pose a potential danger.
- ✓ Consider buying surge protectors like lightning rods or conductors to protect home appliances.



What **YOU** can Do!

During the Storm.....

- ✓ Go to shelter immediately: A sturdy building or a car. Avoid small sheds, isolated trees, or convertible automobiles
- ✓ During lightning, if no sturdy shelter, get into hard-top automobiles and keep windows up.
- ✓ Get out of boats and away from water
- ✓ Avoid telephone lines and metal pipes; they are good conductors. Unplug all appliances that are not relevant to weather news.
- ✓ Do not take a bath or shower.
- ✓ Turn off air conditioning system- Power surges from lightning can overload the compressor
- ✓ During flooding, get to higher ground, abandon cars, and climb to higher ground. Do not attempt to drive to safety



If Caught Outdoors and No Shelter Is Nearby...

- ❑ Find a low spot away from trees, fences, and poles....
And ensure your spot is not subject to flooding.
- ❑ If caught in the woods, take shelter under the shorter/smaller trees.
- ❑ If you feel some tingling on your skin or your hair standing on end, squat low to the ground on the balls of your feet. Place your hands on your knees with your head between them. Make yourself the smallest target possible, and minimize your contact with the ground.
- ❑ If you are swimming or boating, get to land and find shelter immediately!

www.lightsafety.noaa.gov



AFTER the Storm

- ☐ Pay attention to the weather forecast and authorities to know when it is safe to go outside
- ☐ Watch out for **fallen power lines** and **trees**.
Report them immediately
- ☐ If you do not have a pressing need to go **OUT!** Stay indoors for as long as you can.



Take an Active Role in Your Safety

Go to [Ready.gov/thunderstorms-lightning](https://www.ready.gov/thunderstorms-lightning). Download the **FEMA app** to get more information about preparing for **thunderstorms, lightning, or hail**.

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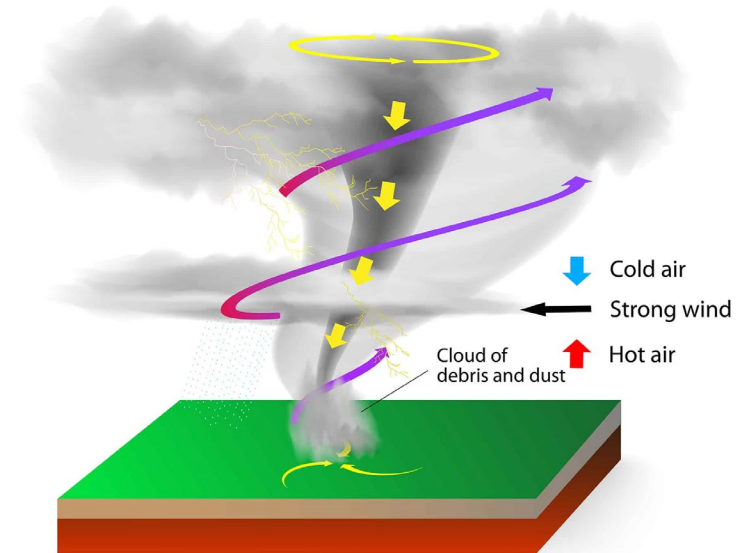
Tornadoes

What is a tornado?

Tornadoes are powerful, destructive, violently rotating columns of air that extend from a severe thunderstorm (supercell) to the ground

Supercells?

- ❑ Supercells are formed when air becomes **unstable**, and wind speed and direction differ at different altitudes. This condition is known as wind shear.
- ❑ Basically, the **wind at ground level** blows in one direction... while the wind higher up in the atmosphere has a **different speed and direction**... this causes a horizontal tube of air to form or a funnel cloud....



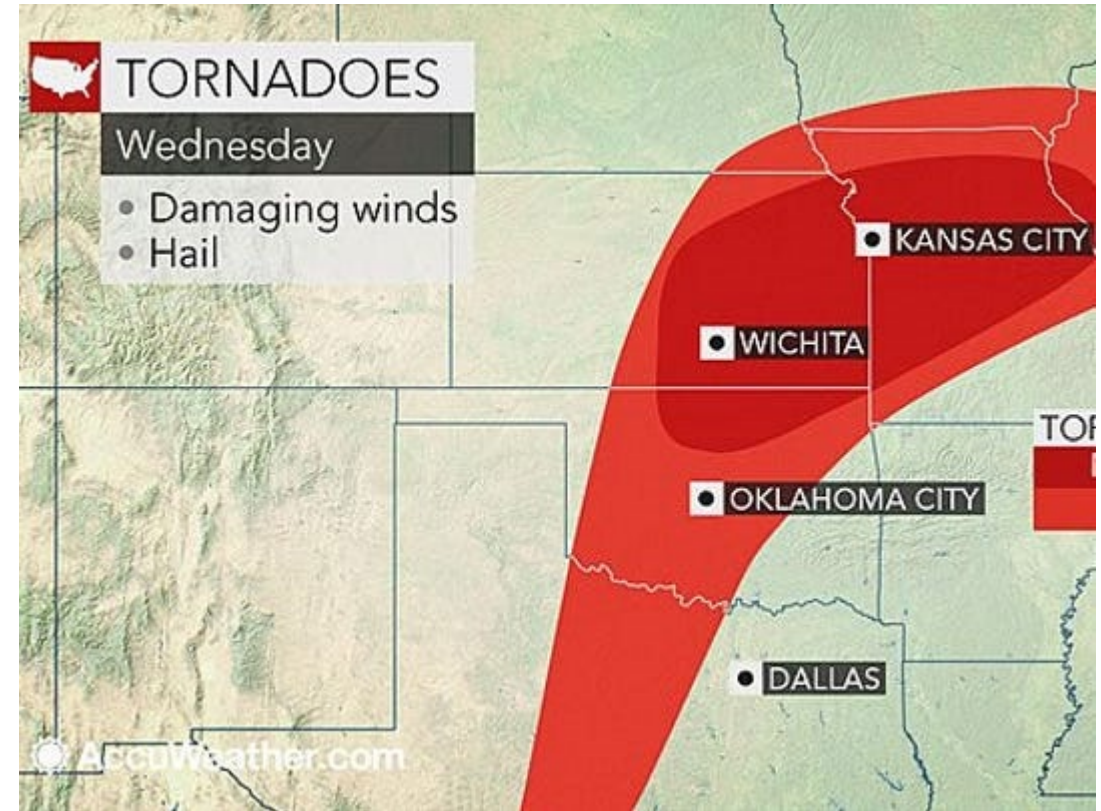
Tornadoes

Key ingredients?

- ❑ **Instabilities:** in warm, moist air near the ground, with cooler air aloft and wind shear
- ❑ **Change:** in wind speed and or direction with height.

What to know!

- ❑ They are considered nature's most violent storms
- ❑ Winds from a tornado can exceed 200 mph
- ❑ Results in an average of 80 deaths and 1,500 injuries yearly
- ❑ Most tornado fatalities occur to people in mobile homes and automobiles
- ❑ They knock down buildings, uproot trees, move vehicles.....
- ❑ And it can happen anywhere at any time.
- ❑ In the USA, tornado alley: Oklahoma, Kansas, Texas, Nebraska, and South Dakota



WHAT TO DO?

Before.....

- ☐ Find a safe room built to withstand high winds, or a small room with no windows on the lowest level of a sturdy building.
- ☐ Mobile or trailer homes are not safe...seek an alternative shelter.
- ☐ Have a support team of people you may assist or be assisted.
- ☐ Stay connected! Sign up for emergency alerts, local weather news, backup batteries, or ways to charge your phones, and have a battery-powered radio in case of a power outage.
- ☐ Gather emergency supplies: Food, water, and medicines. Stores and pharmacies may be closed
- ☐ Learn emergency skills like first aid and CPR



www.redcross.org/content/dam/redcross/get-help/pdfs/tornado/EN_Tornado-Safety-Checklist

WHAT TO DO?

During.....

Seek shelter immediately....

- ❑ If away from home, find a basement, an interior corridor, a tunnel, an underground parking lot, or a subway
- ❑ **STAY** away from windows, the upper floors of buildings, parked vehicles, and auditoriums
- ❑ If out in the open! Lie flat in a ditch or low area and protect your head, **STAY** away from poles and overhead lines.
- ❑ If driving! Drive at a **right angle** to the tornado's path. If you can't escape, **GET** out of the vehicle and seek a low-lying area.
- ❑ If at home! **GO** to the basement and take cover under a heavy table or workbench. Some people have **UNDERGROUND BUNKERS**
- ❑ Know the difference between a **tornado watch** (the conditions are favourable for a tornado) and a **tornado warning** (it has been spotted in your area).






<https://www.nsc.org/community-safety/safety-topics/emergency-preparedness/hurricane-preparedness>

Extreme Heat

Extreme heat often results in the highest annual number of deaths
Among all weather-related disasters

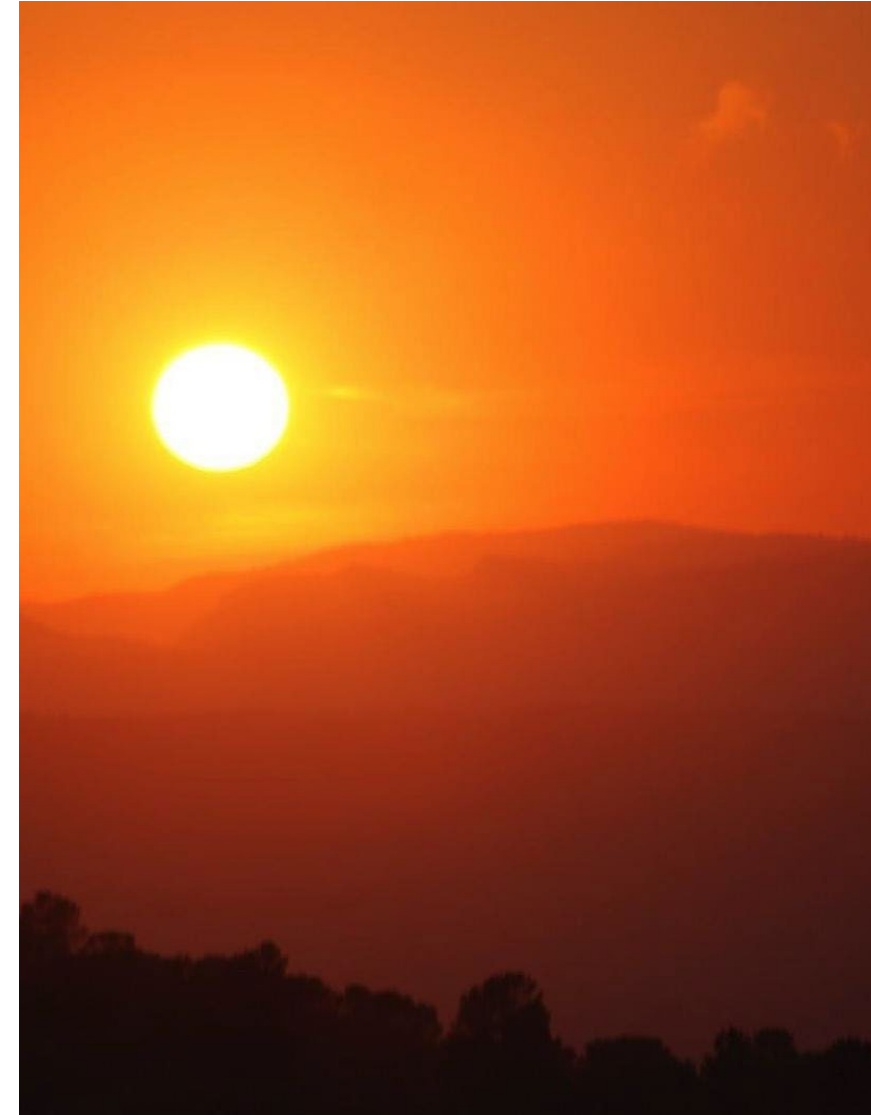
- ❑ In the USA, an average of 1300 deaths are related to extreme heat yearly.
- ❑ In 2021, heat-related deaths surged to about 1600, which was a 59% increase when compared to 2018. And a further increase to about 1862 deaths in 2023.

Heat Impacts: Vulnerable Populations

 PREGNANT	 NEWBORNS	 CHILDREN	 ELDERLY	 CHRONIC ILLNESS
Extreme heat events have been associated with adverse birth outcomes such as low birth weight, preterm birth, infant mortality, and congenital cataracts.	Newborns are extra sensitive to heat because their ability to regulate body temperature is limited.	Young children and infants are particularly vulnerable to heat, as their bodies are less able to adapt to heat than adults. Those under four are especially vulnerable.	Older adults, especially those who have preexisting diseases, take certain medications, live alone or have limited mobility are at higher risk for heat illness.	People with chronic medical conditions are more likely to have a serious health problem during a heat wave.

Source:
The Impacts of Climate Change on Human Health in the United States, A Scientific Assessment (U.S. Global Changes Research Program)

weather.gov 



Extreme Heat

EXTREME HEAT WATCH

An Extreme Heat Watch is issued when **dangerous heat is possible**.

Reschedule outdoor activities in the coming days. Make sure that children, the elderly, and pets have a place to cool off during the heat.

Be Prepared.

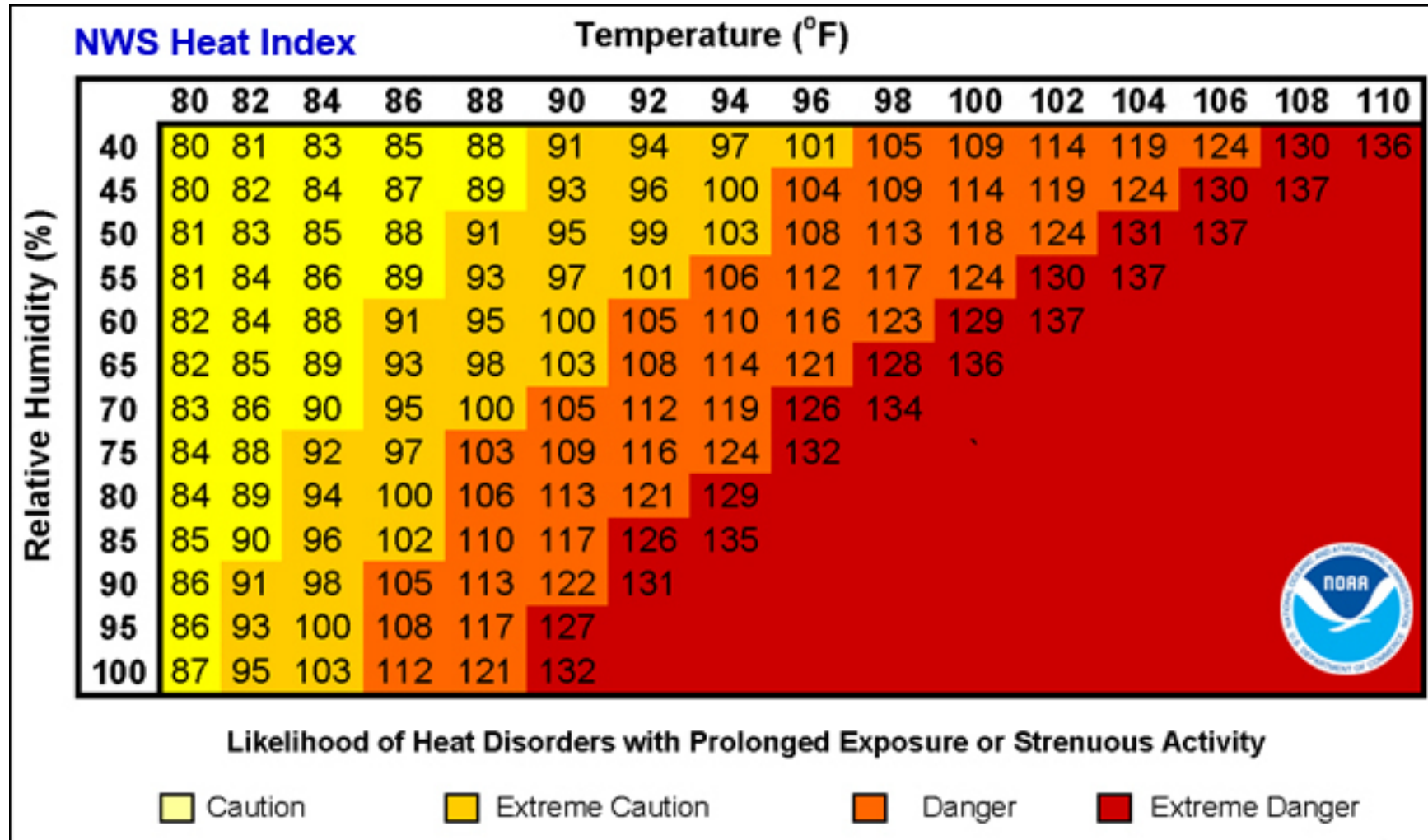
EXTREME HEAT WARNING

An Extreme Heat Warning is issued when **dangerous heat is happening or about to happen**.

Avoid heavy activity & direct sunlight. Stay hydrated, find a cool indoor place, and check on children, elderly & pets.

Take Action!

www.weather.gov/safety/heat



<https://www.weather.gov/images/safety/heatindexchart>

During a heat wave

- ☐ **NEVER** leave a child, adult, or animal alone inside a vehicle on a warm day.
- ☐ Find places with air conditioning, like libraries, shopping malls, and community centers.
- ☐ If you are outside, find shade. Wear a hat wide enough to protect your face, sunglasses, and sunscreen.
- ☐ Wear loose, lightweight, light-colored clothing.
- ☐ Drink plenty of fluids to stay hydrated
- ☐ Avoid using electric fans.
- ☐ Avoid high-energy activities.



Common signs of heat-related illness

✓ Heat cramps:

Signs: Muscle pains or spasms in the stomach, arms, or legs

Action: Go to a cooler location, remove excess clothing, and take a sip of a drink with salt and sugar. If it persists, seek medical help.

✓ Heat exhaustion:

Signs: Heavy sweating, muscle cramps, paleness, tiredness, weakness, dizziness, headaches, nausea or vomiting, fainting.

Action: Go to an air-conditioned place, remove clothing, and take a bath. Get medical help if symptoms get worse or last more than an hour.

✓ Heat Stroke:

Signs: Extremely high body temperature; red, hot, and dry skin with no sweat; rapid, strong pulse; dizziness, confusion; and unconsciousness.

Action: Call 911 or get the person to a hospital immediately

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Earthquake?

- ❑ An earthquake is a sudden, rapid shaking of the ground caused by the shifting of rocks deep underneath the Earth's surface.
- ❑ Earthquakes can cause fire, tsunamis, landslides, or avalanches. And they are very difficult to predict
- ❑ They can happen anywhere; however, in the USA, areas of higher risk are Alaska, California, Hawaii, Oregon, Puerto Rico, Washington, and the entire Mississippi Valley.
- ❑ In a recent event (5th of May 2025), a 4.1 magnitude earthquake hit in Southern Tennessee, which caused a secondary shake in most of the Southern States.



What to do?

Before an earthquake.....

❑ Understand Your Risk:

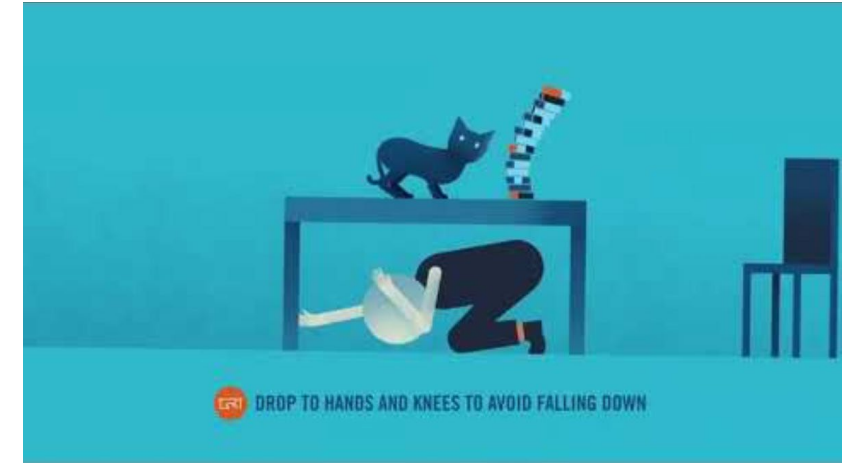
- ✓ Although it can happen anywhere, find out if you live in an area prone to earthquakes.

❑ Protect Your Home:

- ✓ Fix structural issues and make improvements,
- ✓ Consider getting an earthquake insurance policy.

❑ Make an Emergency Plan:

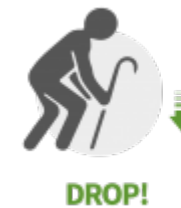
- ✓ Practice how to protect yourself during earthquakes with your family and coworkers.
- ✓ Make an emergency communication plan
- ✓ Make emergency supply kits that include food, water for several days, a fire extinguisher, and a whistle



Stay Safe During

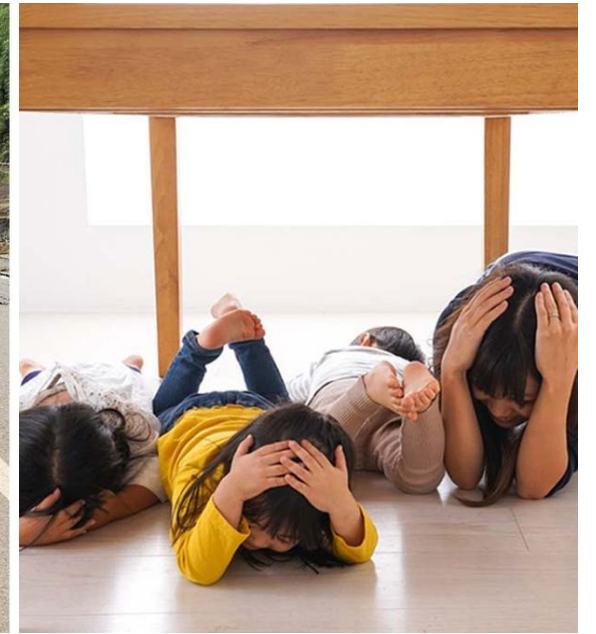
If an earthquake happens, protect yourself right away:

- ☐ If you are inside, stay and do not run outside, and avoid doorways.
- ☐ If you are in bed, turn face down and cover your head and neck with a pillow.
- ☐ If you are in a car, pull over and stop. Set your parking brake.
- ☐ If you're outside, stay there. Move to an open area away from buildings, trees, streetlights, and power lines. Drop and cover until the shaking stops to protect yourself from flying debris
- ☐ Practice **DROP**, **COVER**, and **HOLD**



Stay Safe After

- ❑ Expect aftershocks to follow the main shock of an earthquake. Be ready to Drop, Cover, and Hold.
- ❑ If in a damaged building, evacuate immediately
- ❑ If you are trapped, send a text, SOS, or bang on a pipe or wall. Cover your mouth with your shirt for protection. Instead of shouting, use a whistle.
- ❑ Check yourself to see if you are hurt and help others if you have training...**Learn to be helpful until help arrives.**
- ❑ If you are sick or injured and need medical attention, contact your healthcare provider **IMMEDIATELY.**



References

<https://www.usgs.gov/tools/latest-earthquakes>

<https://www.ready.gov/earthquakes#after>

<https://www.fema.gov/emergency-managers/risk-management/building-science/publications?>

<https://www.nehrp.gov/>

<https://www.fema.gov/emergency-managers/risk-management/earthquake>

<https://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies/earthquake.html>

https://www.nsc.org/community-safety/safety-topics/emergency-preparedness/tornado-preparedness?gad_source=1&gad_campaignid=1740577122&gclid=Cj0KCQjwoZbBBhDCARIsAOqMEZXhYKDpWyu-VBMUyBw_pQNUsMEFnLkZ01YdB3TwwpCo2j3GOCOh7e8aAnBoEALw_wcB

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Thank you!