

Description

- A thunderstorm is a rain shower during which you hear thunder.
- A thunderstorm is classified as “severe” when it contains one or more of the following
 - large hail (2 cm or more in diameter)
 - winds gusts 90 km/h or greater
 - heavy rain (50 mm or more per hour).





Requirements

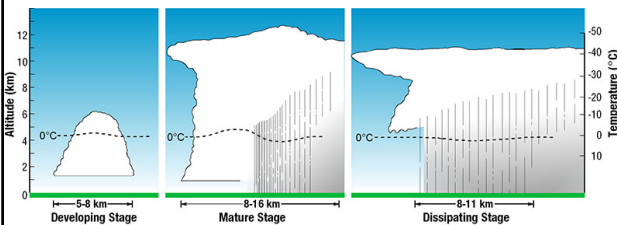
- Three basic ingredients are required for a thunderstorm to form.
 - moisture
 - humidity
 - rising unstable air
 - air that keeps rising when given a nudge
 - a lifting mechanism to provide the “nudge”
 - typically, a cold front

Process

- The sun heats the surface of the earth, which warms the air above it.
- If this warm surface air is forced to rise, it will continue to rise as long as it weighs less and stays warmer than the air around it.
- As the air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (convection).

- The water vapor it contains begins to cool, releases the heat, condenses and forms a cloud.
- When the water vapor condenses, it releases heat warming the air causing it to rise further.
- This process repeats until there is not enough heat energy left to warm the air.
- The cloud eventually grows upward into areas where the temperature is below freezing.

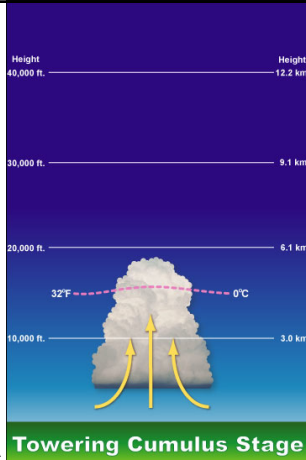
- Thunderstorms have three stages in their life cycle.
 - Cumulus (Developing) stage
 - Mature stage
 - Dissipating stage



Credit: National Severe Storms Laboratory/NOAA

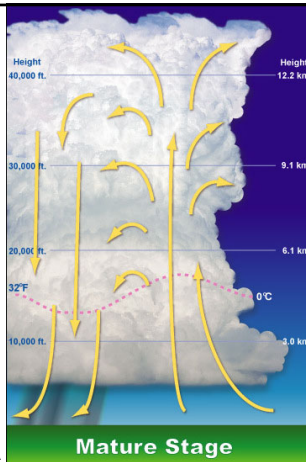
Cumulus (Developing) stage

- A **cumulus cloud is pushed upward** by a rising column of air (updraft).
 - The cumulus cloud soon looks like a tower.
- The updraft continues to get stronger.
- There is little to no rain during this stage but occasional lightning.

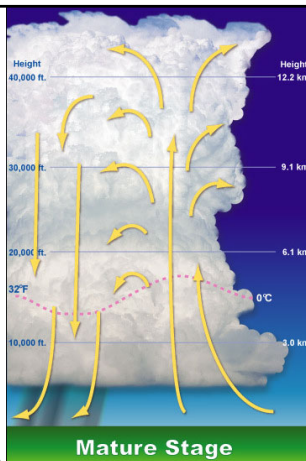


Mature stage

- The **updraft continues to feed the storm**.
- Condensing water near the top of the storm forms ice particles that grow.
 - Eventually the ice particles are too heavy and start to fall.
 - If they melt before hitting the ground it is rain, if not, it is hail.

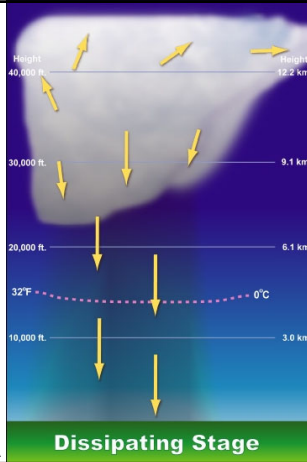


- **Precipitation begins to fall out of the storm, creating a downdraft** (a column of air pushing downward).
- The downdraft and rain-cooled air spreads out along the ground and forms a line of gusty winds.
- This stage is the most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes.



Dissipating stage

- The **updraft is overcome by the downdraft**.
- The cooler wind cuts off the warm moist air that was feeding the thunderstorm.
- Rainfall decreases in intensity, but lightning remains a danger.



Thunderstorm Safety

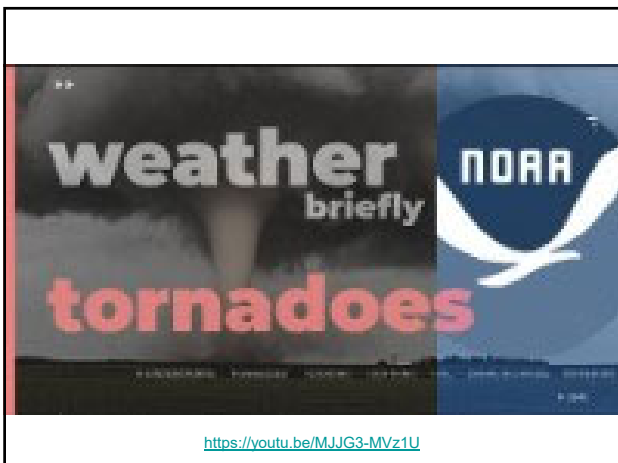
- **At Your House**
 - Go to a secure location away from windows.
 - Take your pets with you if time allows.
- **At Your Workplace or School**
 - Stay away from windows.
 - Do not go to large open rooms such as cafeterias, gymnasiums or auditoriums.

- **Outside**
 - Go inside a sturdy building immediately.
 - Sheds and storage facilities are not safe.
 - Taking shelter under a tree can be deadly.
 - The tree may fall on you.
 - Standing under a tree also put you at a greater risk of getting struck by lightning.
- **In a Vehicle**
 - Being in a vehicle is safer than being outside; however, drive to closest secure shelter if there is sufficient time.



Description

- A tornado is a narrow, violently rotating column of air that extends from a thunderstorm to the ground.
- Winds spiraling into a tornado can vary from 60 km/h to as high as 500 km/h.
- Tornadoes are the most violent storms on Earth.

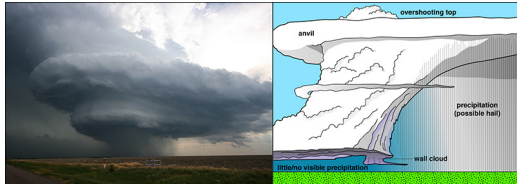


How do tornadoes form?

- The truth is that we don't fully understand.
- The most destructive tornadoes occur from supercells, which are rotating thunderstorms with a well-defined radar circulation called a mesocyclone.

What is a supercell?

- A supercell is an often-dangerous thunderstorm with a very organized internal structure including a rotating updraft that allows it to keep going for up to several hours.



Intensity of Tornadoes

- The Enhanced Fujita Scale is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure.
- Wind speeds are estimated from damage to structures based on the degree of damage to 28 damage indicators.

Tornado Safety

- At Your House
 - Go to your basement, safe room, or an interior room away from windows.
 - Don't forget pets if time allows.
- At Your Workplace or School
 - Proceed to your tornado shelter location quickly and calmly.
 - Stay away from windows and do not go to large open rooms such as cafeterias, gymnasiums, or auditoriums.

- Outside
 - Seek shelter inside a sturdy building immediately if a tornado is approaching.
 - Sheds and storage facilities are not safe.
 - Neither is a mobile home or tent.
 - If you have time, get to a safe building.
- In a vehicle
 - Being in a vehicle during a tornado is not safe. The best course of action is to drive to the closest shelter.
 - If you are unable to make it to a safe shelter, either get down in your car and cover your head, or abandon your car and seek shelter in a low lying area such as a ditch or ravine.



Description

- A hurricane is a type of storm called a tropical cyclone, which forms over tropical or subtropical waters.
- A tropical cyclone is a rotating low-pressure weather system that has organized thunderstorms but no fronts (a boundary separating two air masses of different densities).



Classification

- Tropical disturbance, tropical wave
 - Unorganized mass of thunderstorms, very little, if any, organized wind circulation.
- Tropical depression
 - Has evidence of closed wind circulation around a center with sustained winds from 20-34 knots (23-39 mph).
- Tropical storm
 - Maximum sustained winds are from 35-64 knots (40-74 mph)
- Hurricane
 - Maximum sustained winds exceed 64 knots (74 mph).

Hurricane Katrina Day by Day – National Geographic



<https://youtu.be/HbJaMWw4-2Q>

Blizzard



Blizzard Beauty
Credit: marcel lemieux (CC BY-NC 2.0)

Blizzard

- Usually formed when the jet stream dips far to the south, allowing cold air from the north to clash with warm air from the south.
- It's a blizzard if...
 - heavy falling or blowing snow
 - winds 40 km/h or more
 - visibility reduced to less than 400 m
 - for at least 4 hours.

Blizzard Safety

- Stay indoors and wait until it ends
- If you must go outside, dress properly to stay warm. Tie one end of a long rope to your door and hold onto the other end to avoid getting lost in the blinding snow.
- If you must travel during a winter storm, do so during the day and let someone know your route and arrival time.

- If your car gets stuck in a blizzard or snowstorm, stay in your car.
 - Allow fresh air in your car by opening the window slightly on the sheltered side – away from the wind.
 - You can run the car engine about 10 minutes every half-hour if the exhaust system is not blocked with snow.
 - Check the exhaust pipe periodically to make sure it is not blocked. Remember: you can't smell potentially fatal carbon monoxide fumes.

- To keep your hands and feet warm, exercise them periodically.
- In general, it is a good idea to keep moving to avoid falling asleep.
- If you do try to shovel the snow from around your car, avoid overexerting yourself.
 - Overexertion in the bitter cold can cause death as a result of hypothermia from sweating or a heart attack.
