

Severe Weather

Thunderstorms

Thunderstorms are created the same way all other precipitation forms. Warm humid air is forced up into the atmosphere. *The more rapid the rise, the more severe the storm will be.*

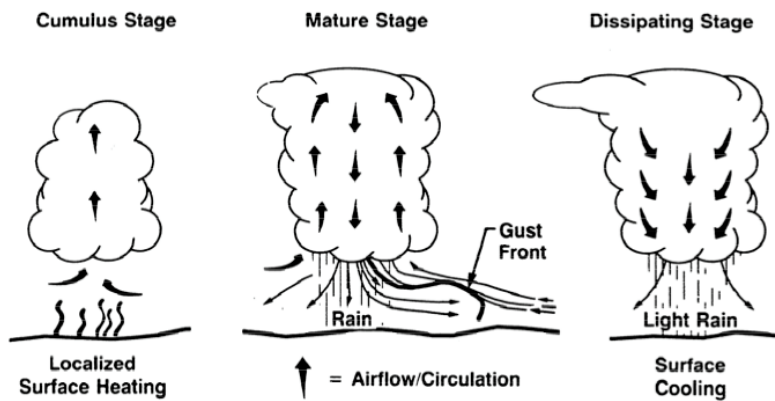


Figure 2. Airmass thunderstorm life cycle.

Air Mass Thunderstorms

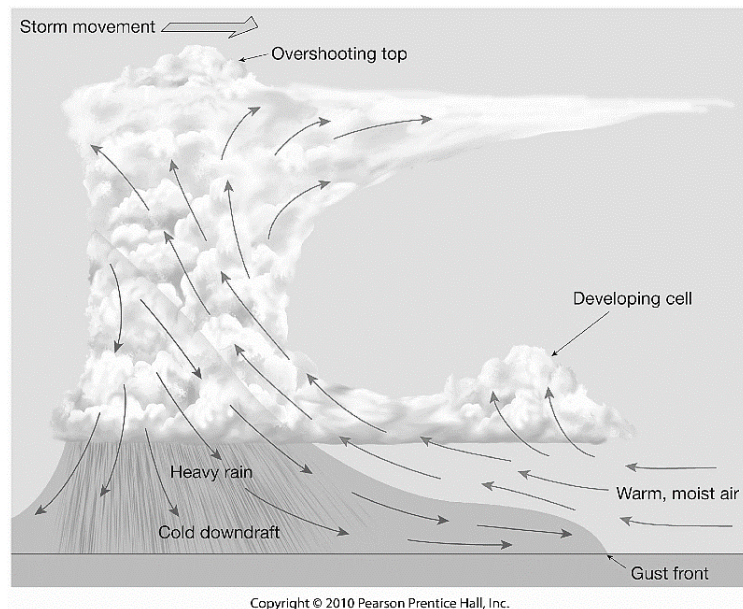
Air mass thunderstorms are short lived and are associated with rising warm air caused by local surface heating (similar to a sea breeze). As water vapor **condenses** into liquid it **releases energy** into the atmosphere intensifying the updraft.

These storms die quickly as the downdraft created by the precipitation kills the updraft that creates the storm.

Severe Thunderstorms

In the case of severe thunderstorms, the rapid rising of the air along fronts creates an updraft. A strong downdraft is created by the pressure of the falling precipitation.

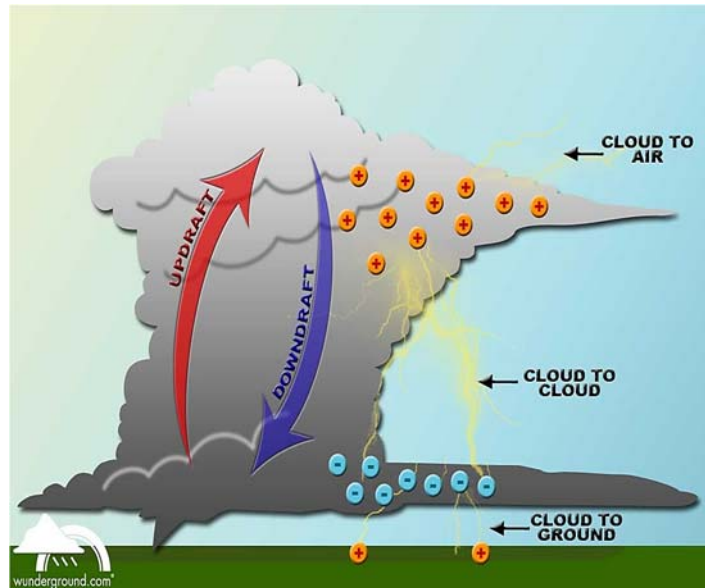
Because the air is being forced up by a moving front, the downdraft does not kill the updraft as the storm moves along with the front.



Lightning

The updraft and downdraft moving past each other create a static electric charge to build up. The discharge is lightning. Lightning will normally occur from cloud to cloud, but does strike the ground often. Lightning carries thousands of volts of with it and superheats the air as it passes through the atmosphere up to 50,000 degrees Fahrenheit. This causes the bright flash we see, but as the air is heated it also expands rapidly and creates a shockwave through the air that we hear as thunder.

Lightning is believed to be caused by wind shear. As updrafts and downdrafts flow past each other at high speeds it creates a static charge that builds up until it is discharged.



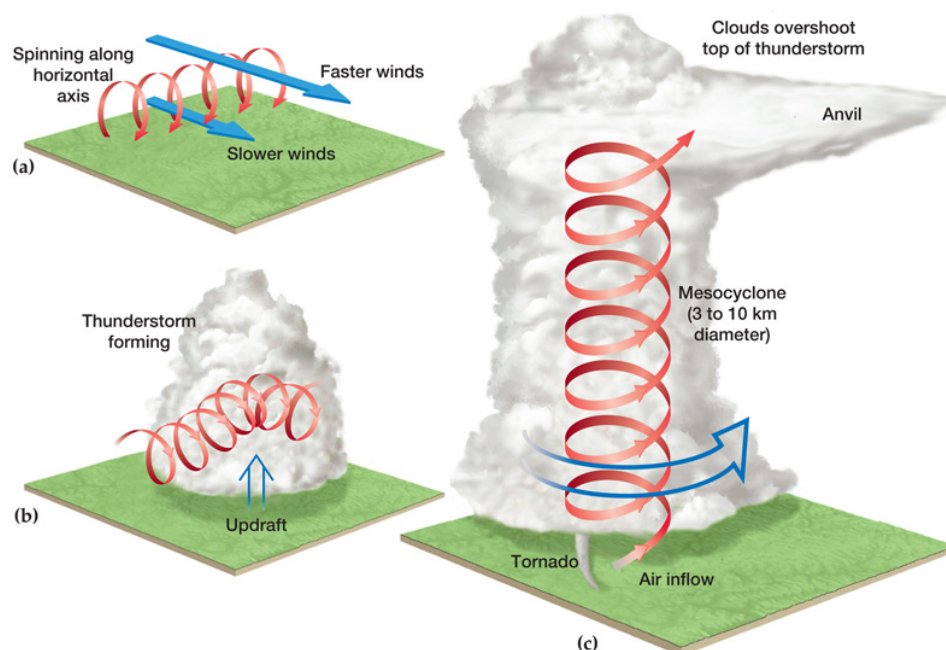
Thunderstorm Safety

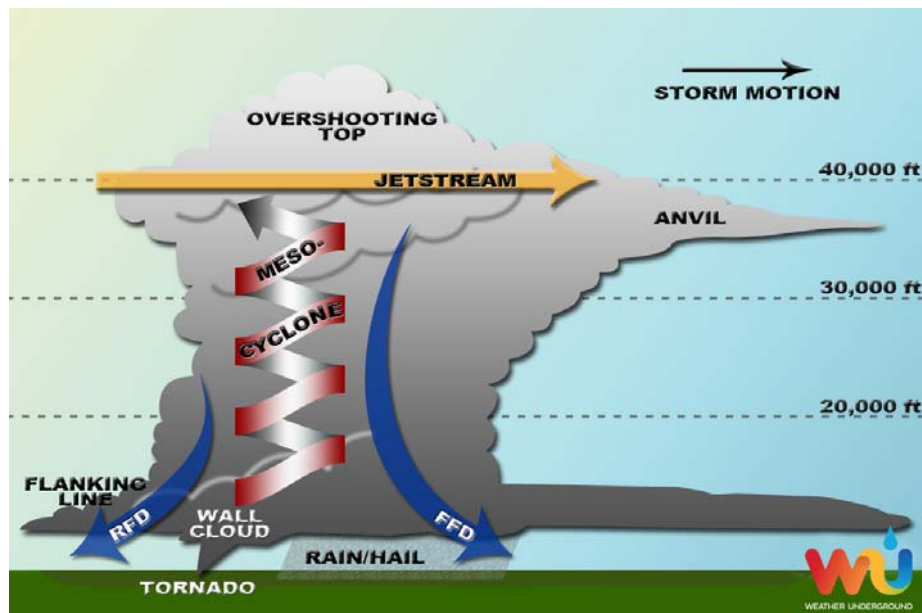
If caught in a thunderstorm outside, avoid being in open area where you are the tallest object or standing next to solitary trees. Get to the lowest point you can, even laying down in a ditch.

Tornadoes

Tornadoes are formed in supercell thunderstorms, which are often the result of mid-latitude cyclones. This is when a warm and moist air mass collides (mT) a cold and dry air mass (cP).

Wind traveling at difference speeds or different directions at different altitudes create a tumbling tunnel of air between them (a). Updrafts from forming storms can lift these tumbling tunnels of air (b). This can give the storm rotation (c) and creates what is classified as a supercell.





Tornadoes are common in the midwest and southwest of the United States during the spring and late spring.

Tornadoes have extremely high wind speeds but only last for a very short period of time, usually around 15 minutes but up to 1 hour. Tornadoes normally move NE with the storm.

Tornadoes are rated on the Fujita Scale or Enhanced Fujita Scale:

SCALE	WIND SPEED	POSSIBLE DAMAGE	Enhanced, Operational Fujita Scale
F0	40-72 mph	Light damage: Branches broken off trees; minor roof damage	EFO 65-85 mph
F1	73-112 mph	Moderate damage: Trees snapped; mobile home pushed off foundations; roofs damaged	EF1 86-110 mph
F2	113-157 mph	Considerable damage: Mobile homes demolished; trees uprooted; strong built homes unroofed	EF2 111-135 mph
F3	158-206 mph	Severe damage: Trains overturned; cars lifted off the ground; strong built homes have outside walls blown away	EF3 136-165 mph
F4	207-260 mph	Devastating damage: Houses leveled leaving piles of debris; cars thrown 300 yards or more in the air	EF4 166-200 mph
F5	261-318 mph	Incredible damage: Strongly built homes completely blown away; automobile-sized missiles generated	EF5 over 200 mph

Tornado Safety

Tornadoes can be very dangerous. The safest place to be during a tornado is in your basement in the southwest corner of the building. Tornadoes will normally move from south west to north east.

Hurricanes

Hurricanes are giant spinning collections of thunderstorms that have merged together. They are the most powerful and destructive storms on Earth.

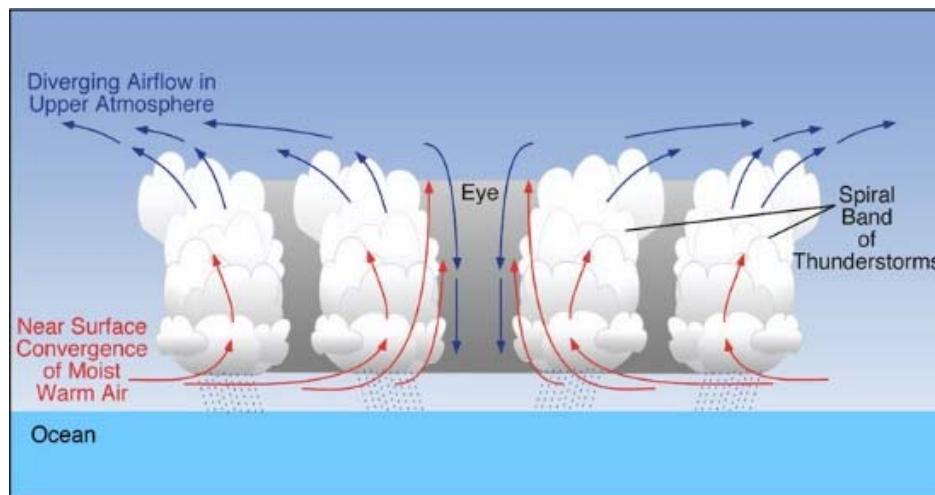
Hurricanes develop through several stages. Hurricanes live for as long as 3 weeks. They begin as a cluster of thunderstorms near the equator called a tropical disturbance. Once this disturbance begins to rotate as a result of the Coriolis Effect and the surface winds are fast enough it becomes a tropical depression. If the depression continues to grow it will form a tropical storm and eventually a hurricane. *To classify a tropical storm as a hurricane it must reach a sustained wind speed of 75 mph. In the northern hemisphere, hurricanes rotate counterclockwise.*

To live, hurricanes need 2 main things as fuel:

1. Heat
2. Humidity

Hurricanes and Positive Feedback

Positive feedback describes a cycle where a process continues to strengthen itself under the right conditions. Warm and Humid air over the ocean create the local Low Pressure that forms the first thunderstorm. In hurricanes, as the wind moves rapidly towards the eye it speeds up evaporation of the ocean, adding more humidity. When the humid air rises it condenses into clouds and rain. Condensation is a warming process which intensifies the low pressure. This in turn speeds up the wind as the pressure gradient steepens. Faster winds evaporates more water creating a positive feedback loop of infinite growth.



Hurricane season in the northern hemisphere runs from June 1st to November 31st. Warm water is the fuel for the storm and the ocean is warming or warm during this time.

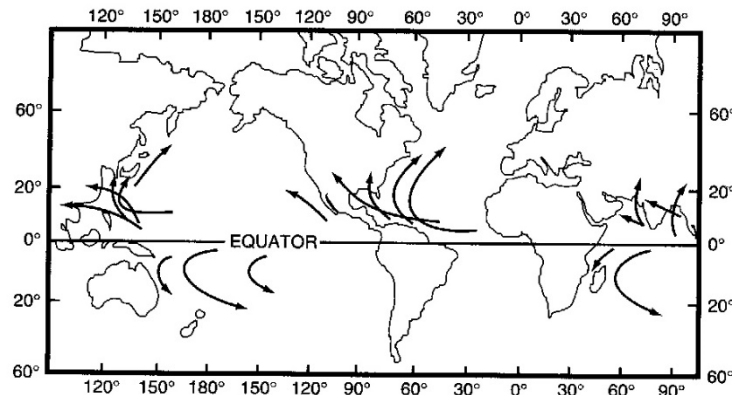
Saffir Simpson Scale

Hurricanes are rated based on windspeed:

Scale Number (Category)	Sustained Winds (MPH)	Damage	Storm Surge
1	74-95	Minimal: Unanchored mobile homes, vegetation and signs.	4-5 feet
2	96-110	Moderate: All mobile homes, roofs, small crafts, flooding.	6-8 feet
3	111-130	Extensive: Small buildings, low-lying roads cut off.	9-12 feet
4	131-155	Extreme: Roofs destroyed, trees down, roads cut off, mobile homes destroyed. Beach homes flooded.	13-18 feet
5	More than 155	Catastrophic: Most buildings destroyed. Vegetation destroyed. Major roads cut off. Homes flooded.	Greater than 18 feet

Hurricane Path

Hurricanes will follow the prevailing winds and ocean currents. They form at low latitudes but not directly on the equator. They will move west towards the east coast of a continent. In the Atlantic they will eventually turn north and then north east.

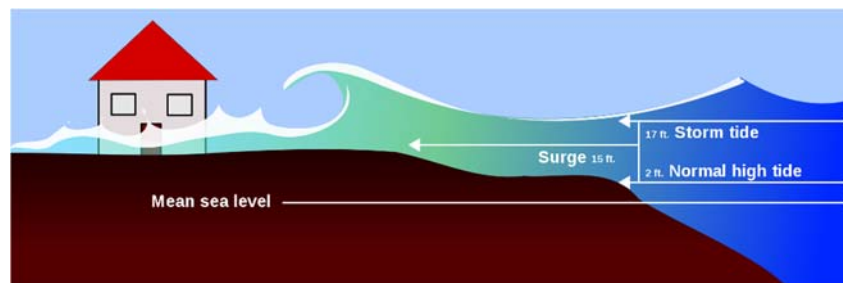


Hurricanes die when they lose their fuel source, warm ocean water. Either the storm makes landfall, or turns into colder ocean water.

Hurricanes will have a diameter of 400 miles and have 3 primary dangers:

1. Inland flooding from heavy rain
2. Strong winds
3. Storm Surge

Storm Surge is the most dangerous. The most life and property destruction is the result of storm surge.



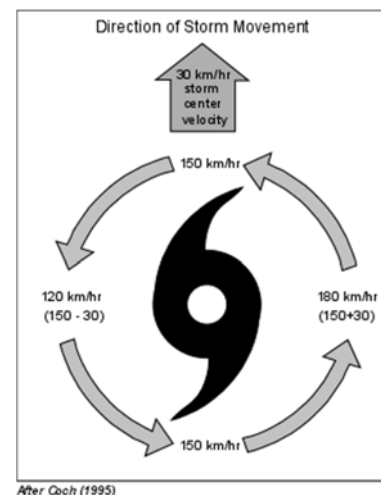
Eye Wall

The eye wall is a thick band of clouds moving with the fastest wind speeds around a calm center. The most dangerous wind speeds in the northern hemisphere will typically be found on the east or north east side of the eye. This is because the speed of the storm must be added to the wind speed. (see diagram) The stronger the wind the greater the storm surge will be.

Hurricane Safety

Hurricanes are the most powerful and destructive storms on earth. The best course of action is to evacuate days before the storm arrives. Hurricanes are long lived and can be forecast days in advance.

If evacuation is not an option, make sure to have 3 weeks of water and food safely stored. After a major hurricane infrastructure may be seriously damaged or completely broken down. There will be no water, no food and no power for days or even weeks.



Blizzards

Blizzards are simply severe storms occurring in the winter. A storm must meet 3 requirements to be considered a blizzard:

1. 56 kilometer per hour winds
2. Visibility less than 400 meters due to snow
3. Lasting for more than 3 hours

It is important to remember that it DOES NOT need to be snowing for there to be blizzard conditions. If snow is on the ground and is picked up by strong winds and blown around, it will still meet the visibility requirement.

The dangers from a blizzard include: Low temperatures, wind damage and reduced visibility.

Preparation for blizzards include: Stocking up on food and water and having alternative fuel sources for heat in case of power outages.