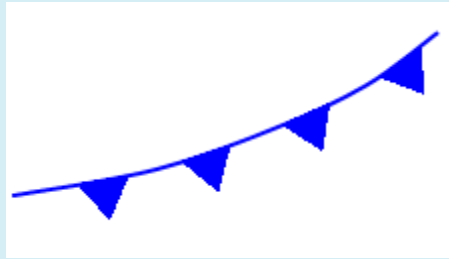


# Bell Ringer

1. What is an air mass?

2. What does this symbol mean?



3. What does this symbol mean?



# Finish Weather Maps Summary

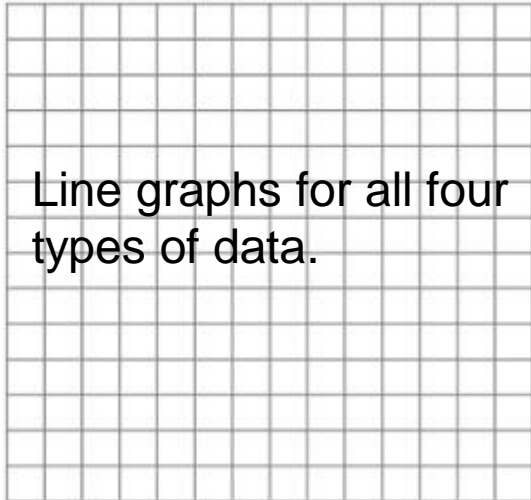
- **Google:**

Salt Lake City historical weather

Weather history for Salt Lake City, UT | Weather Underground

<https://www.wunderground.com/history/...etc> blah blah

Labels for the four types of data



Line graphs for all four types of data.

**What kind of correlations should we be seeing?**

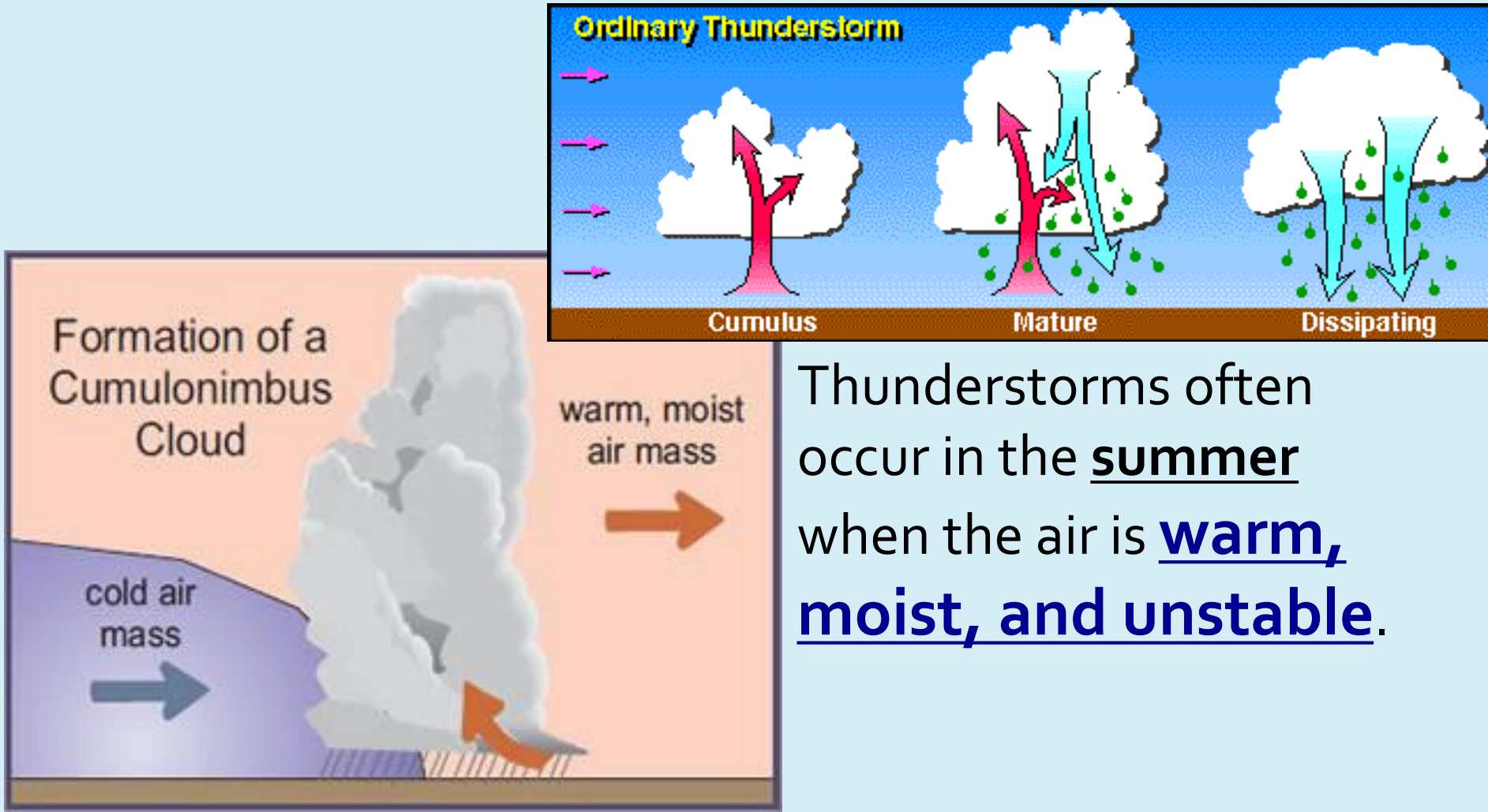
Labels for the dates

# Severe Weather



# Thunderstorms

- **Characterized by:** Dark cumulonimbus clouds that produce heavy rain, sounds of thunder, flashes of lightning, strong winds, and sometimes hail.



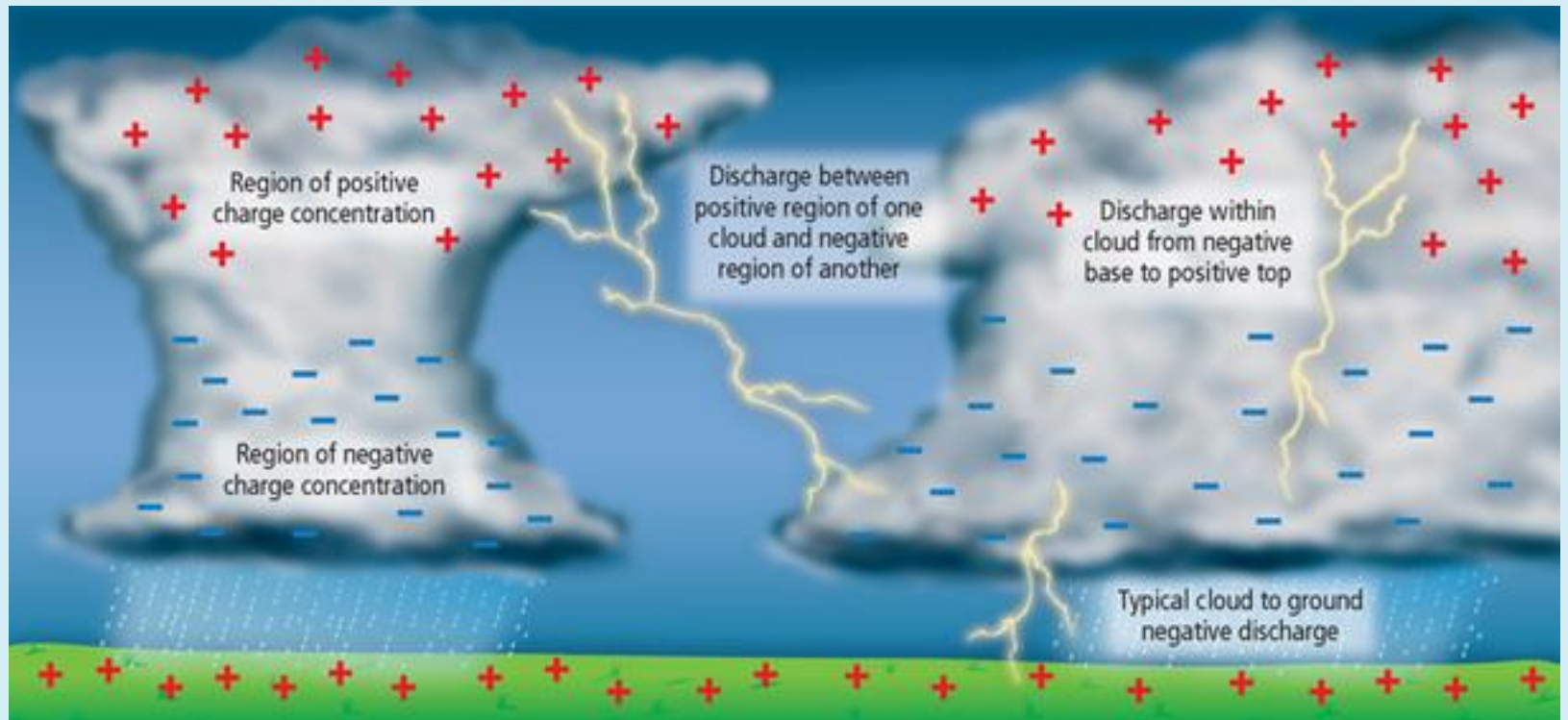
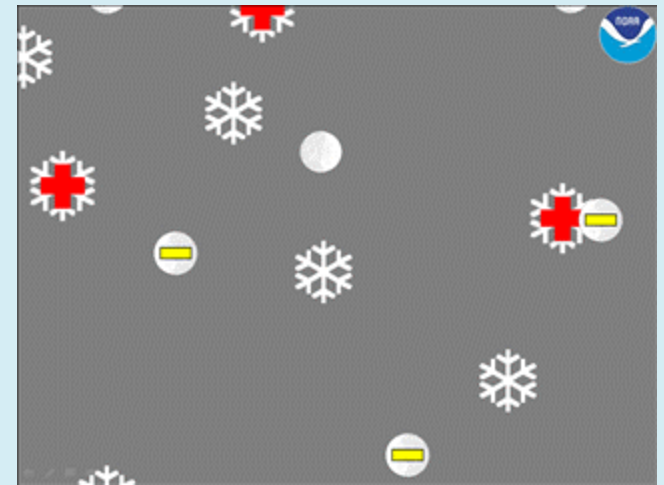
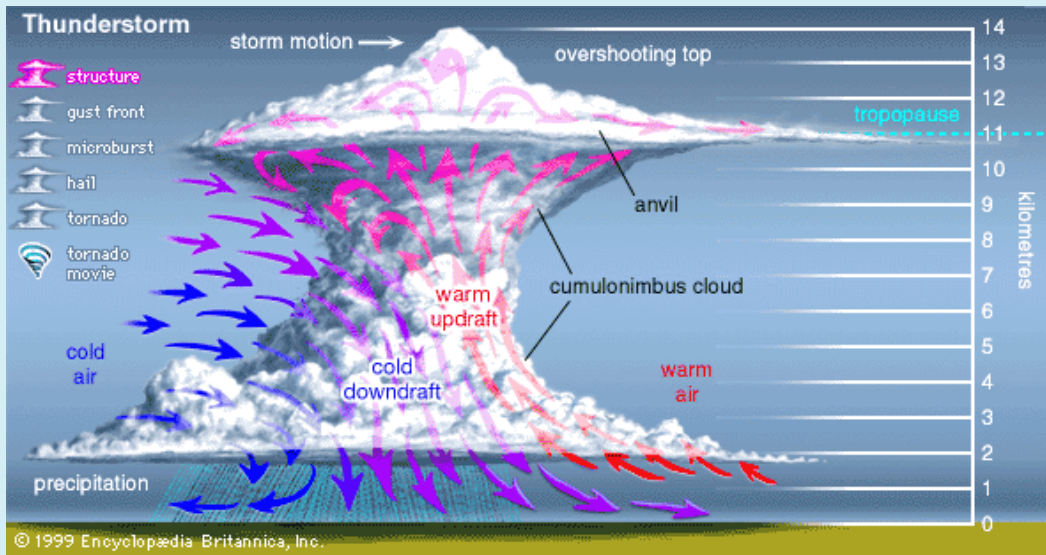
Thunderstorms often occur in the summer when the air is warm, moist, and unstable.

# Lightning

## Supercell Thunderstorm

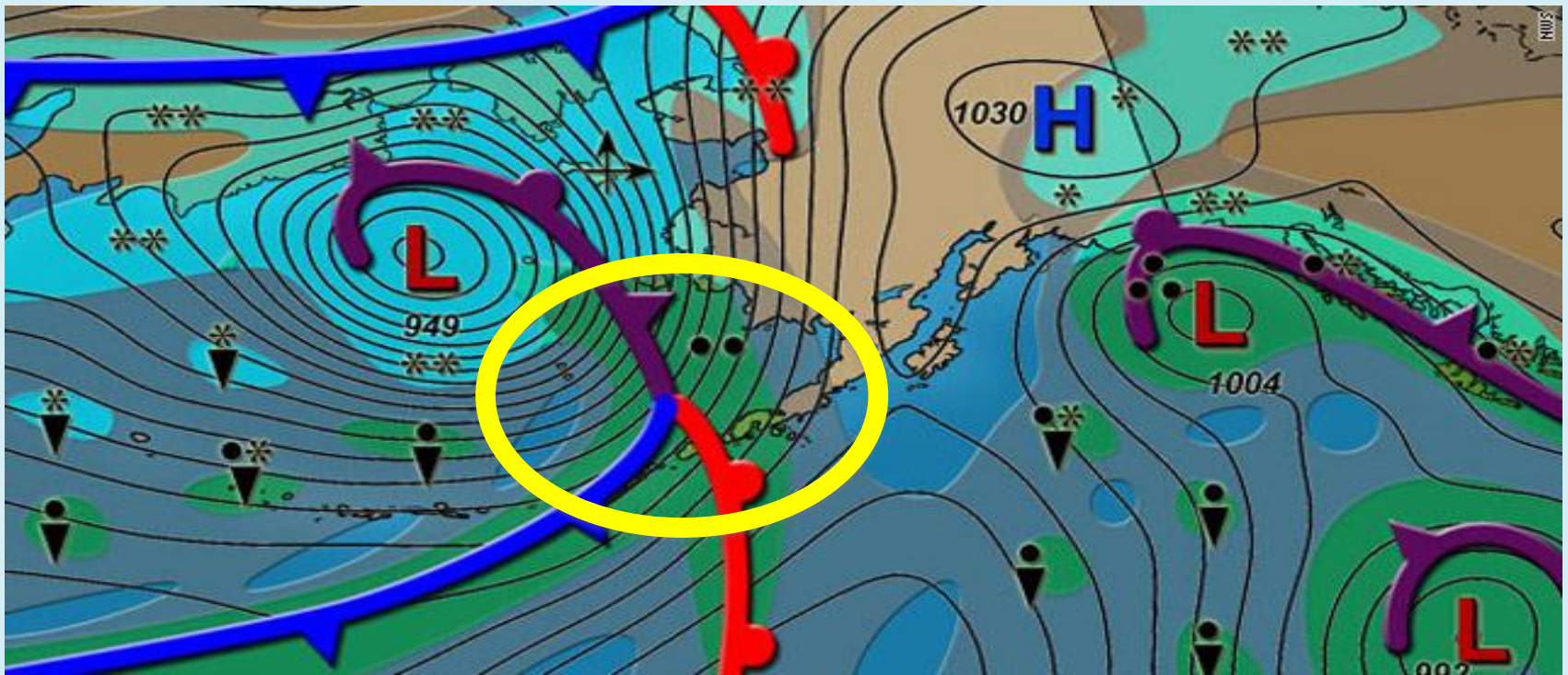






# Where do thunderstorms form?

- Thunderstorms **form along fronts** because air is **forced to rise** and **ahead of fronts**. **Supercells** are large single-cell thunderstorms with extremely **strong updrafts**.
- <https://www.youtube.com/watch?v=gwJk1IJdHXA>



# Roy Sullivan

- The odds of being struck by lightning is about 1:10,000
- Sometimes you can increase the odds, if you work outdoors on mountains for example.
- Roy Sullivan currently holds record for most times struck by lightning.

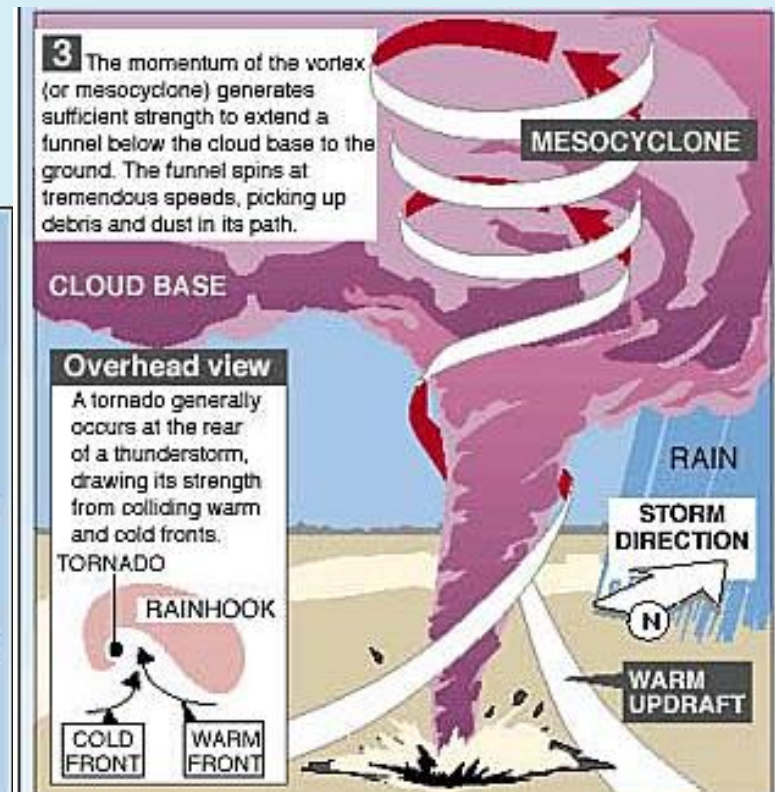
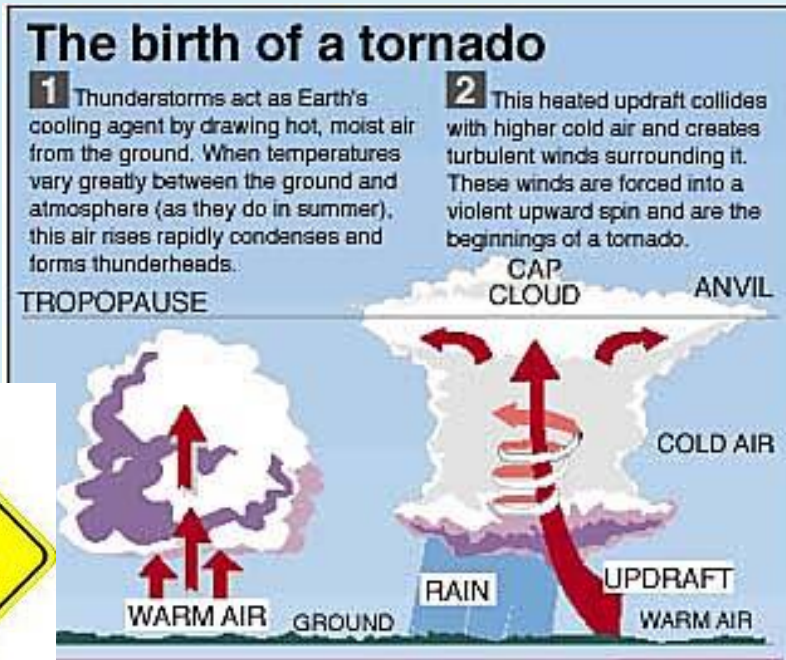




- The first documented lightning strike of Sullivan occurred in April 1942. He was hiding from a thunderstorm in a [fire lookout tower](#). The tower was newly built and had no [lightning rod](#) at the time; it was hit seven or eight times. Inside the tower, "fire was jumping all over the place". Sullivan ran out and just a few feet away received what he considered to be his worst lightning strike. It burned a half-inch strip all along his right leg, hit his toe, and left a hole in his shoe. <sup>[9][4]</sup>
- He was hit again in July 1969. Unusually, he was hit while in his truck, driving on a mountain road. The lightning first hit nearby trees and was deflected into the open window of the truck. The strike knocked Sullivan unconscious and burned off his eyebrows and eyelashes, and set his hair on fire. The uncontrolled truck kept moving until it stopped near a cliff edge. <sup>[7][4]</sup>
- In 1970, Sullivan was struck while in his front yard. The lightning hit a nearby power transformer and from there jumped to his left shoulder, searing it. <sup>[7][4]</sup>
- In 1972, Sullivan was working inside a ranger station in Shenandoah National Park when another strike occurred. It set his hair on fire; he tried to smother the flames with his jacket. He then rushed to the restroom, but couldn't fit under the water tap and so used a wet towel instead. <sup>[4]</sup> Although he never was a fearful man, after the fourth strike he began to believe that some force was trying to destroy him and he acquired a fear of death. For months, whenever he was caught in a storm while driving his truck, he would pull over and lie down on the front seat until the storm passed. He also began to believe that he would somehow attract lightning even if he stood in a crowd of people, and carried a can of water with him in case his hair was set on fire. <sup>[2][10]</sup>
- On August 7, 1973, while he was out on patrol in the park, Sullivan saw a storm cloud forming and drove away quickly. But the cloud, he said later, seemed to be following him. When he finally thought he had outrun it, he decided it was safe to leave his truck. Soon after, he was struck by a lightning bolt. Sullivan stated that he actually saw the bolt that hit him. The lightning moved down his left arm and left leg and knocked off his shoe. It then crossed over to his right leg just below the knee. Still conscious, Sullivan crawled to his truck and poured the can of water, which he always kept there, over his head, which was on fire. <sup>[2][10]</sup>
- The next strike, on June 5, 1976, injured his ankle. It was reported that he saw a cloud, thought that it was following him, tried to run away, but was struck anyway. <sup>[7]</sup>
- On Saturday morning, June 25, 1977, Sullivan was struck while fishing in a freshwater pool. The lightning hit the top of his head, set his hair on fire, traveled down, and burnt his chest and stomach. Sullivan turned to his car when something unexpected occurred — a bear approached the pond and tried to steal trout from his fishing line. Sullivan had the strength and courage to strike the bear with a tree branch. He claimed that this was the twenty-second time he hit a bear with a stick in his lifetime

# Tornadoes

- A tornado is a violently rotating column of air that forms from a mesocyclone, when it touches the ground it becomes a tornado. Air pressure on the center of a tornado is very low and air is sucked into the funnel cloud.



# How do tornados form?

- Four ingredients:

1. Cold dry air from north

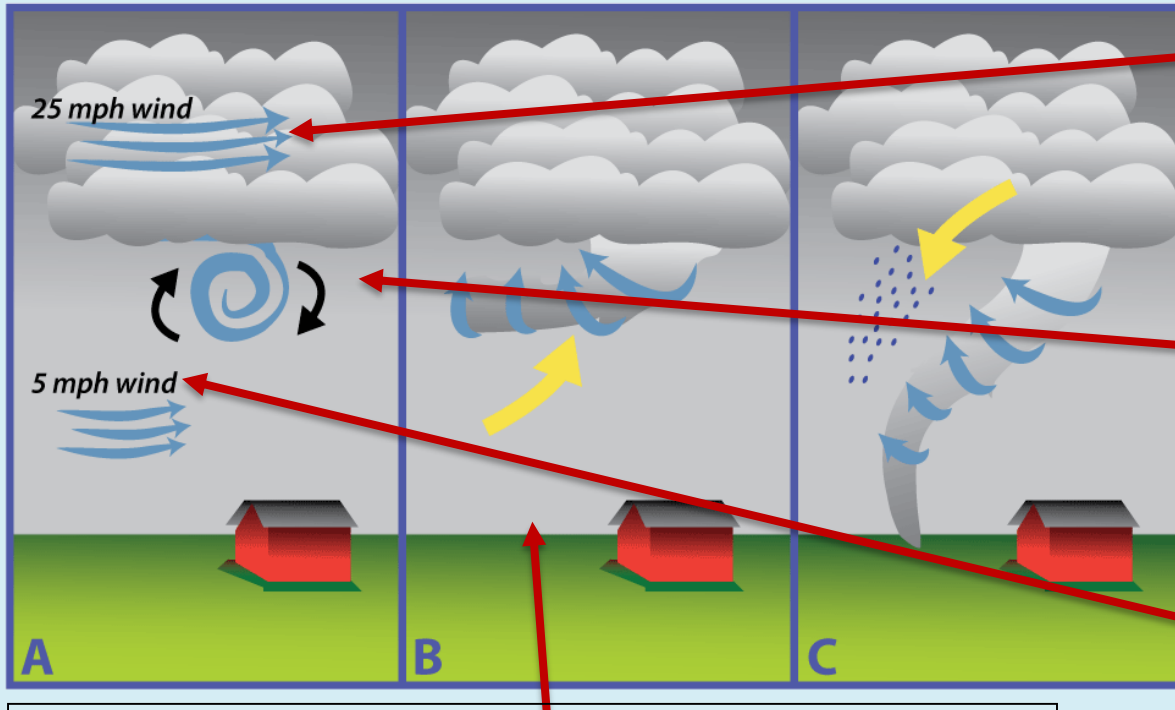
2. Warm moist air from Gulf

3. Warm dry air from SW

4. Jet Stream ← Very fast, very high winds!



# Tornado Development

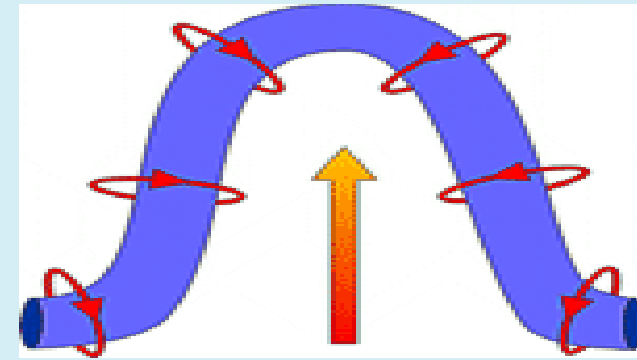
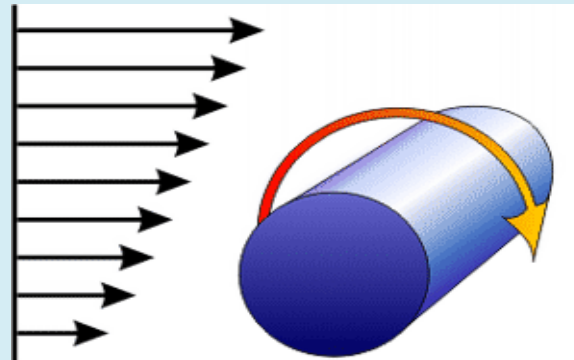


1. Cold air from the North meeting warm air from the south causes instability and storms.

2. Different speeds of air from the jet stream cause wind shear and air to start spinning in a circle.

3. Slower, warm, dry air creates a barrier for large warm pockets of air to form below.

4. Warm, moist pockets of air rise and push the spinning air up.



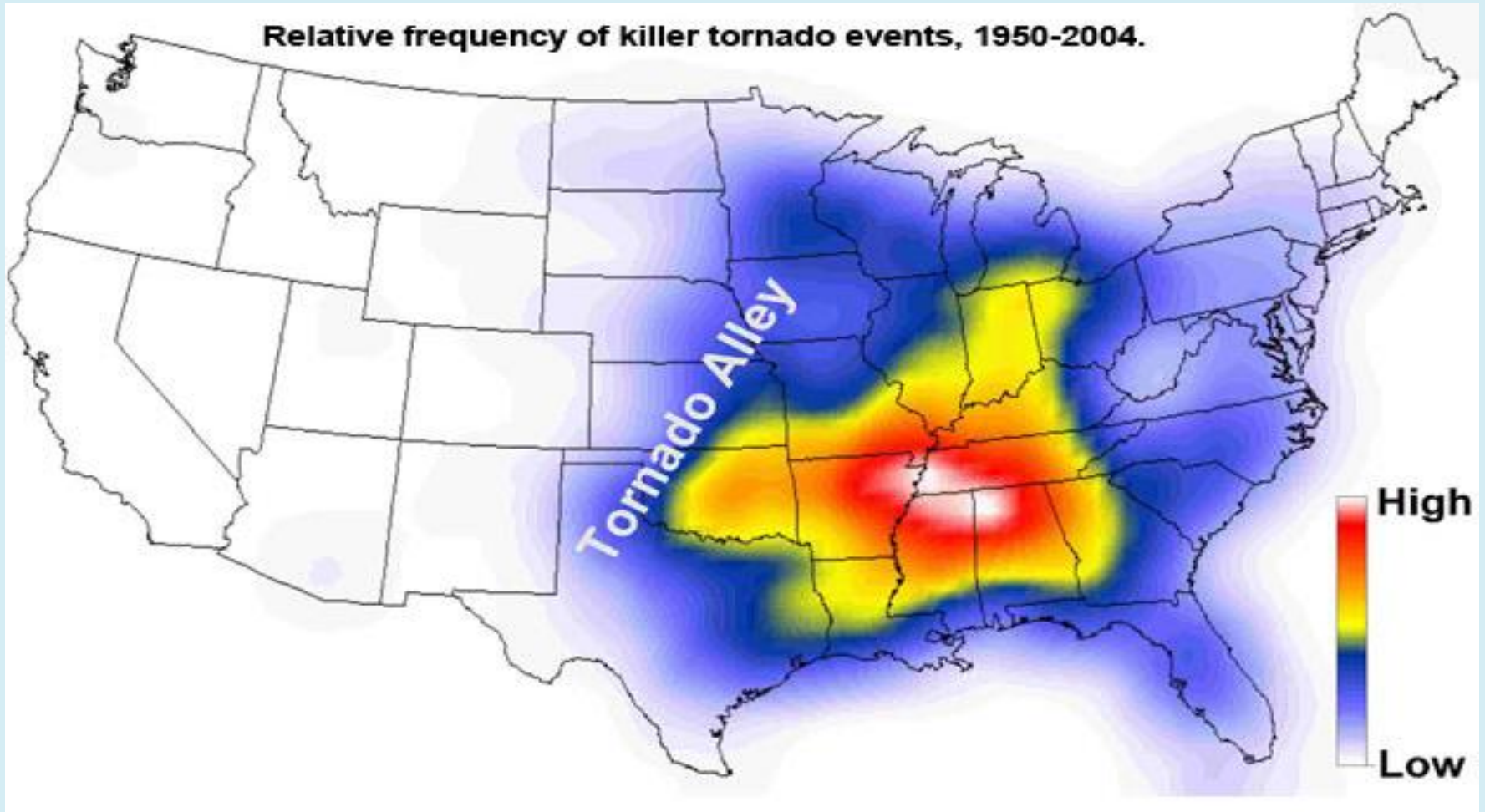


# Tornado!



# Where is “tornado alley”?

- A tornado can form in any state during any time of year, but they are most common in “tornado alley” during the **spring and summer months**.



**Watch**—means conditions are favorable for tornado to develop

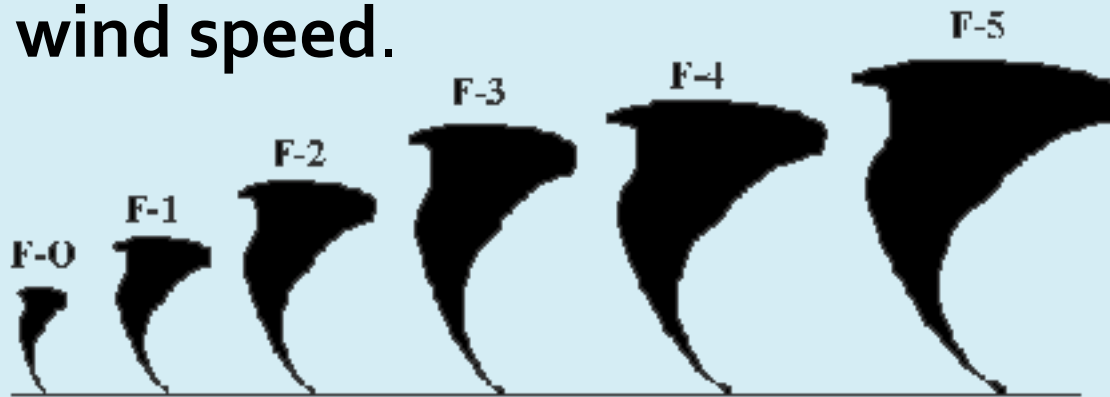
**Warning**—means that tornado has been spotted



NWS photo by Mike Branick



A tornado is measured using the [Fujita scale](#), it is based on **wind speed**.



Fujita Scale		Enhanced Fujita Scale* * In use since 2007	
F-0	40–72 mph winds	EF-0	65–85 mph winds
F-1	73–112 mph	EF-1	86–110 mph
F-2	113–157 mph	EF-2	111–135 mph
F-3	158–206 mph	EF-3	136–165 mph
F-4	207–260 mph	EF-4	166–200 mph
F-5	261–318 mph	EF-5	>200 mph





## EF-0. Light damage

Wind 65 to 85 mph. Causes some damage to siding and shingles



## **EF-1. Moderate damage**

Wind 86 to 110 mph. Considerable roof damage. Winds can uproot trees and overturn single-wide mobile homes. Flagpoles bend.







## **EF-2. Considerable damage**

Wind 111 to 135 mph. Most single-wide mobile homes destroyed. Permanent homes can shift off foundation. Flagpoles collapse. Softwood trees debarked.



## **EF-3. Severe damage**

Wind 136 to 165 mph. Hardwood trees debarked. All but small portions of houses destroyed.





## **EF-4. Devastating damage**

Wind 166 to 200 mph. Complete destruction of well-built residences and large sections of school buildings

## EF-5. Incredible damage.

Wind +200 mph. Significant structural deformation of mid- and high rise buildings.

Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 yards



May 25<sup>th</sup>, 2008

Catastrophic damage was reported in Parkersburg as much of the town was destroyed, with reports of flattened houses and debarked trees. Six people were killed in Parkersburg and at least two fatalities were reported where a housing development was destroyed. At least 70 people were injured



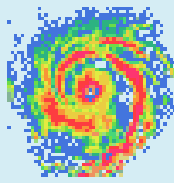
At 9:45 p.m. on May 4, 2007, Greensburg was hit by an EF5 tornado. The tornado was estimated to be 1.7 miles (2.7 km) in width and traveled for nearly 22 miles (35 km). Ninety-five percent of the city was confirmed to be destroyed, with the other five percent being severely damaged. The National Weather Service estimated winds of the tornado to reach 205 mph (330 km/h). This was the first tornado to ever be rated EF5 since the update of the Fujita scale.



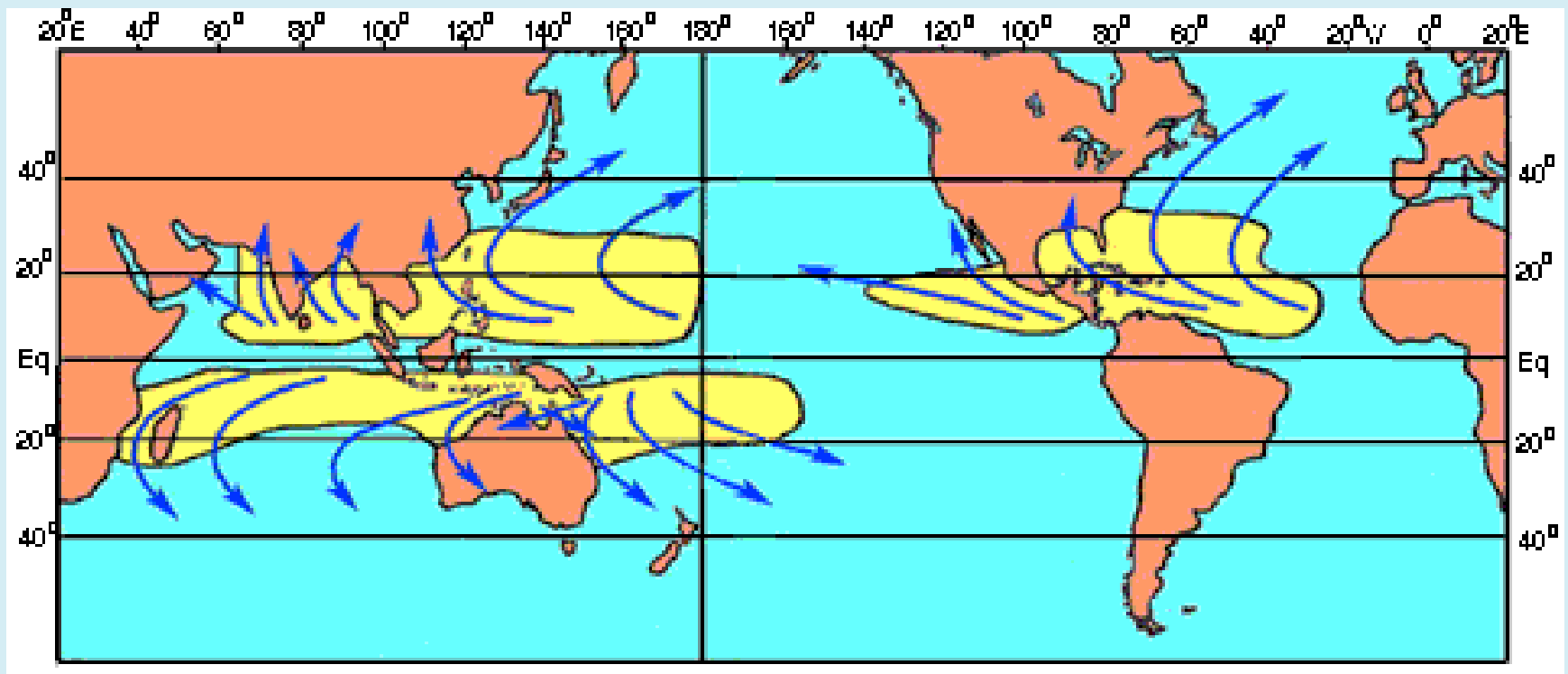


- <https://www.youtube.com/watch?v=eQcBcSVKb6U>
- <https://www.youtube.com/watch?v=WEH4Tj-eQao>
- <https://www.youtube.com/watch?v=8oDnMx8ER3Y>  
(56s)
- <https://www.youtube.com/watch?v=t2gTeXwdtPw>

# HURRICANES



- Low pressure systems that form over warm, tropical waters near the equator
- Most form between 5 and 20 degrees north latitude — they almost never form in the South Atlantic



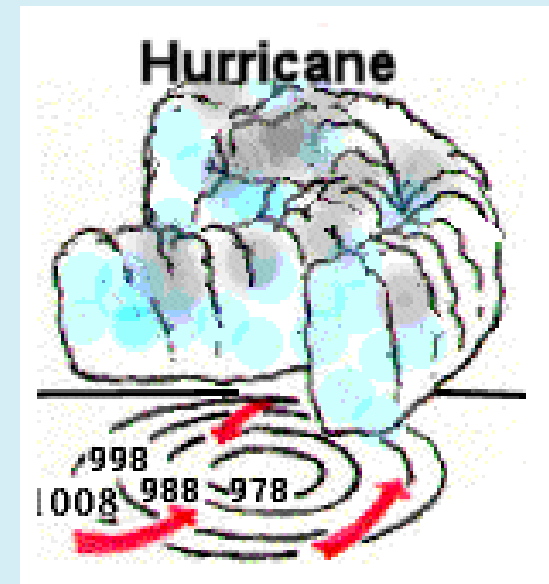
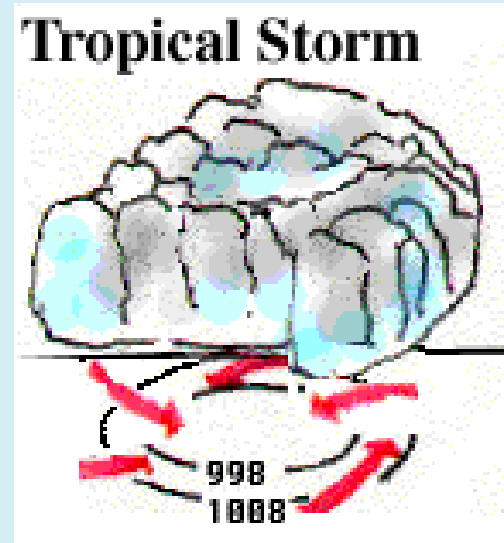
**Different names are given to hurricanes depending on where they form**

- 1. Atlantic—we call them hurricanes**
- 2. Pacific—they are called typhoons**
- 3. Indian Ocean—they are called cyclones**



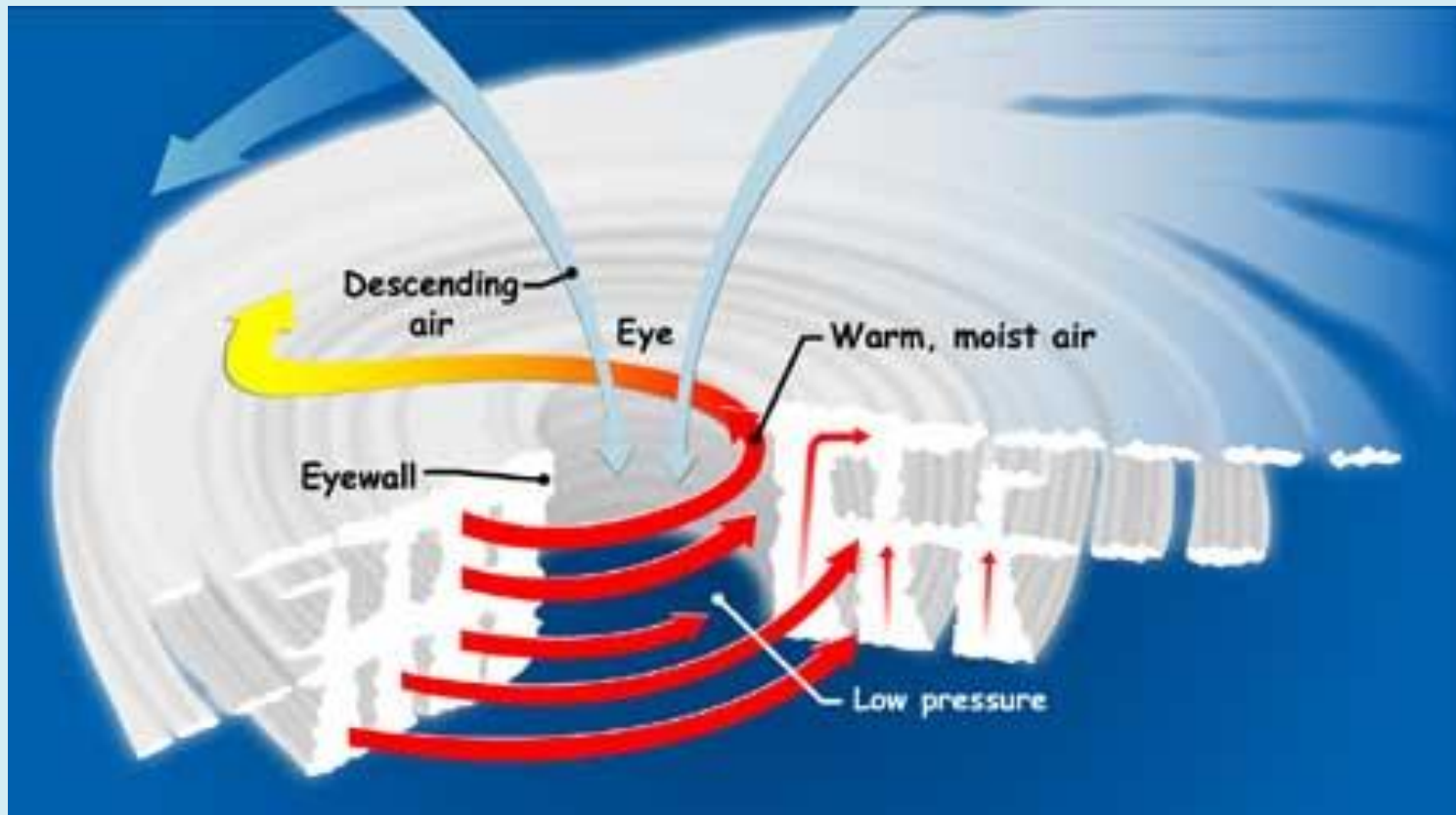
# Hurricanes

- A hurricane starts out as a **tropical storm**. It begins to gain strength from warm ocean water, which **evaporates** and then **condenses** to make storm clouds.
- This creates a low pressure zone and air starts moving in towards it.
- The more heat, the more rising air, and the lower the pressure.
- When the pressure is low enough, different things begin to happen and we call it a hurricane



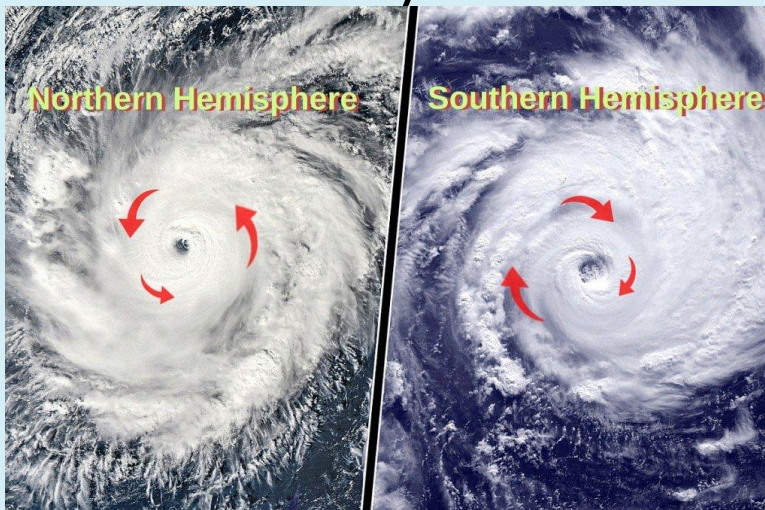
### 3 Ingredients for a hurricane:

1. LOTS of REALLY warm water
2. LOW wind speeds at high altitudes
3. Coriolis force

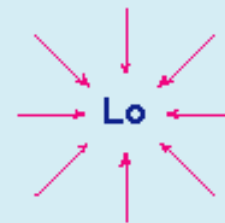


# Hurricane formation

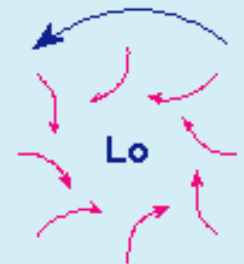
- Hurricanes never really happen around 20-90 degrees latitude. Why? (What ingredient are we missing?)
- No warm water!
- Hurricanes never happen around 0-5 degrees latitude. Why? (What ingredient are we missing?)
- Coriolis force! When air gets pulled into low-pressure zones, the Coriolis effect causes a rotational motion and is the source of the cyclone.



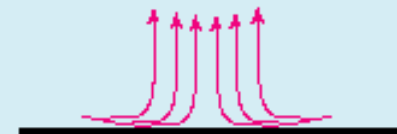
Top View:



Counterclockwise Wind Flow



Side View:



With Coriolis Effects



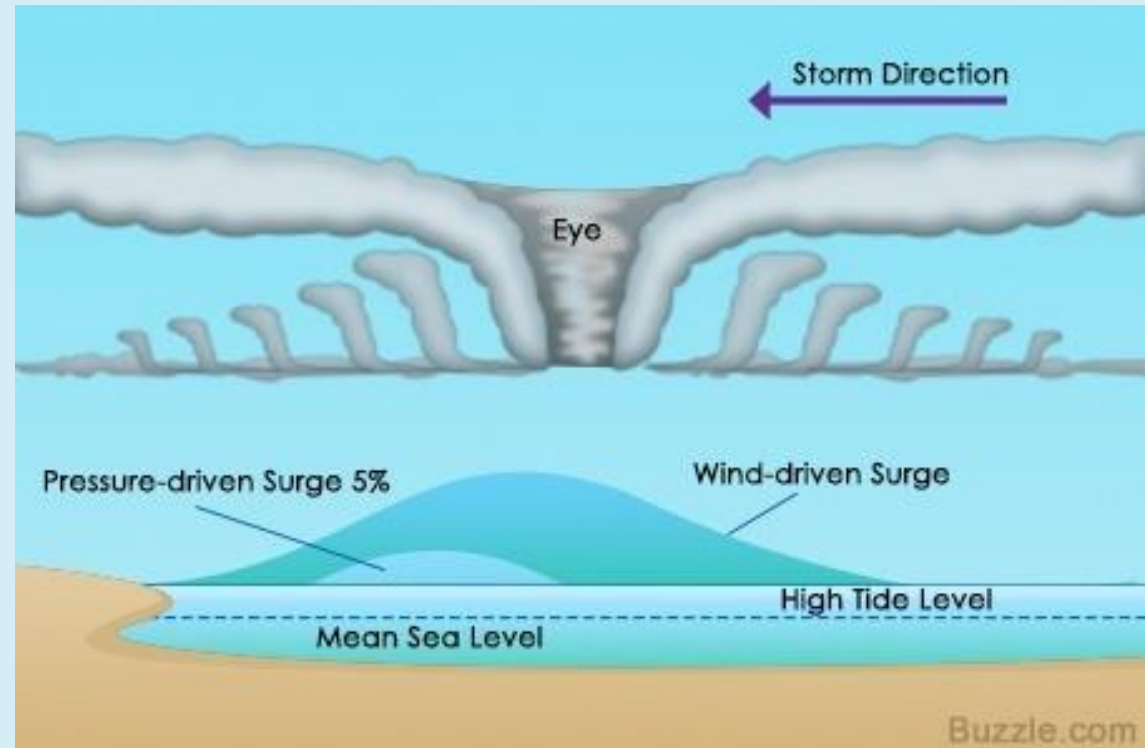
# Storm surge

- Storm surges are higher than normal sea-levels caused by two things:

1. Low pressure zone (water actually rises up a little)

2. Winds from the storm.

- Usually the most destructive part of a hurricane besides high winds



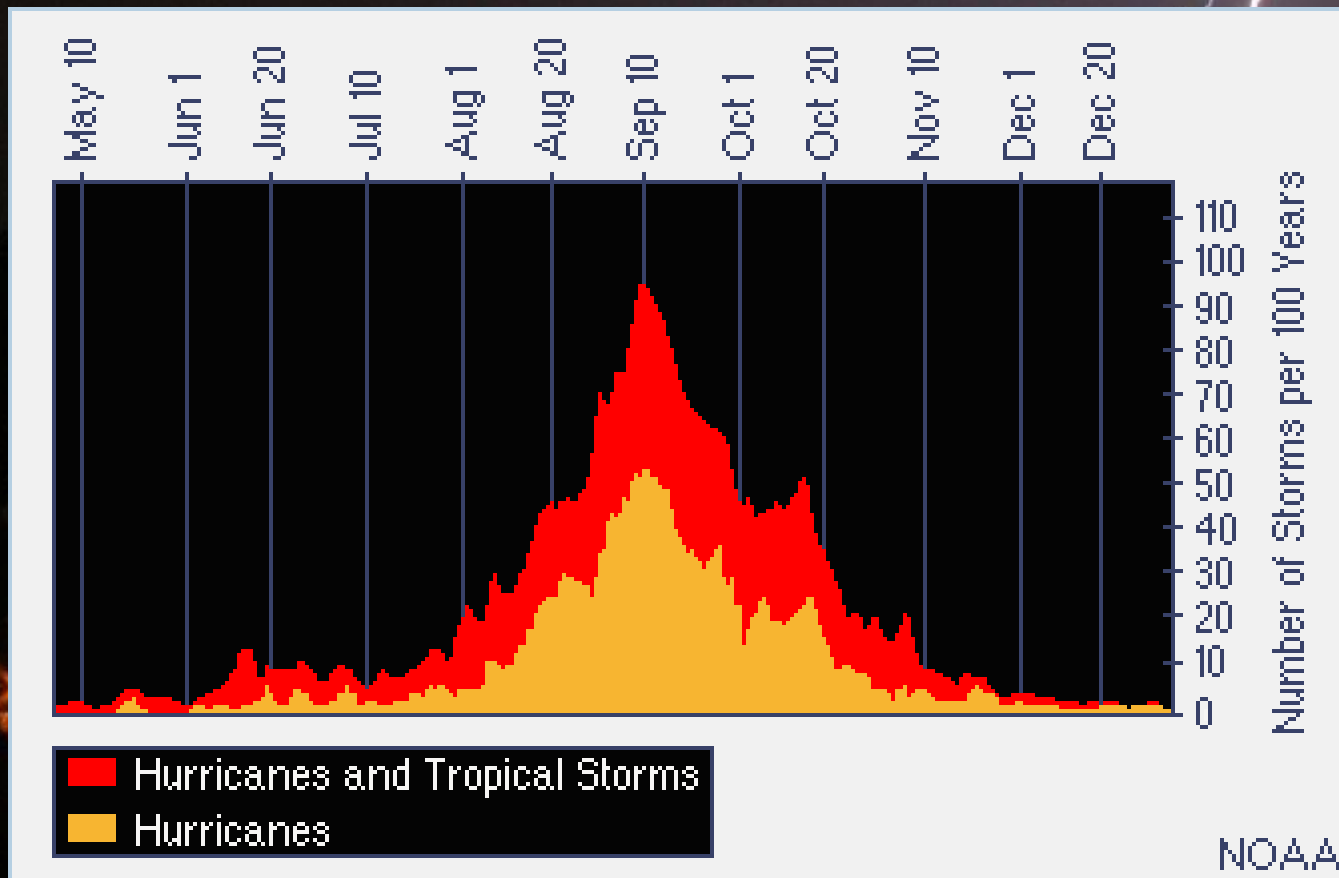
# THE END OF A HURRICANE

When a hurricane travels over land or cold water, its energy source (warm water) is gone and the storm weakens, quickly dying.



# HURRICANE SEASON

- Occurs from June through November
- Most hurricanes form during the late summer months because the ocean is still retaining heat from the warmer earlier months



# MEASURING DESTRUCTION

- We use the Saffir-Simpson scale to rank hurricane intensities

## Saffir-Simpson Scale

CATEGORY	WIND SPEED	STORM SURGE	DAMAGE
1	74-95 mph	4-5 feet	Minimal
2	96-110 mph	6-8 feet	Moderate
3	111-130 mph	9-12 feet	Extensive
4	131-155 mph	13-18	Extreme
5	Greater than 155	Greater than 18	Catastrophic

\*\*\*Notice how when the wind speeds increase, storm surge increases as well?



- [https://g.redditmedia.com/mXz1EFYDNS3bT7ig1MmDuyCCgIRy8LD8LbQq\\_CnnKj4.gif?w=1024&fm=mp4&mp4-fragmented=false&s=54b07b0240b46b0950aebffed95b3b41](https://g.redditmedia.com/mXz1EFYDNS3bT7ig1MmDuyCCgIRy8LD8LbQq_CnnKj4.gif?w=1024&fm=mp4&mp4-fragmented=false&s=54b07b0240b46b0950aebffed95b3b41)
- [https://www.youtube.com/watch?v=z1ONNM\\_73-8](https://www.youtube.com/watch?v=z1ONNM_73-8)

# Tornadoes - NOVA

- <https://www.youtube.com/watch?v=ZEDdOgOrsjc>