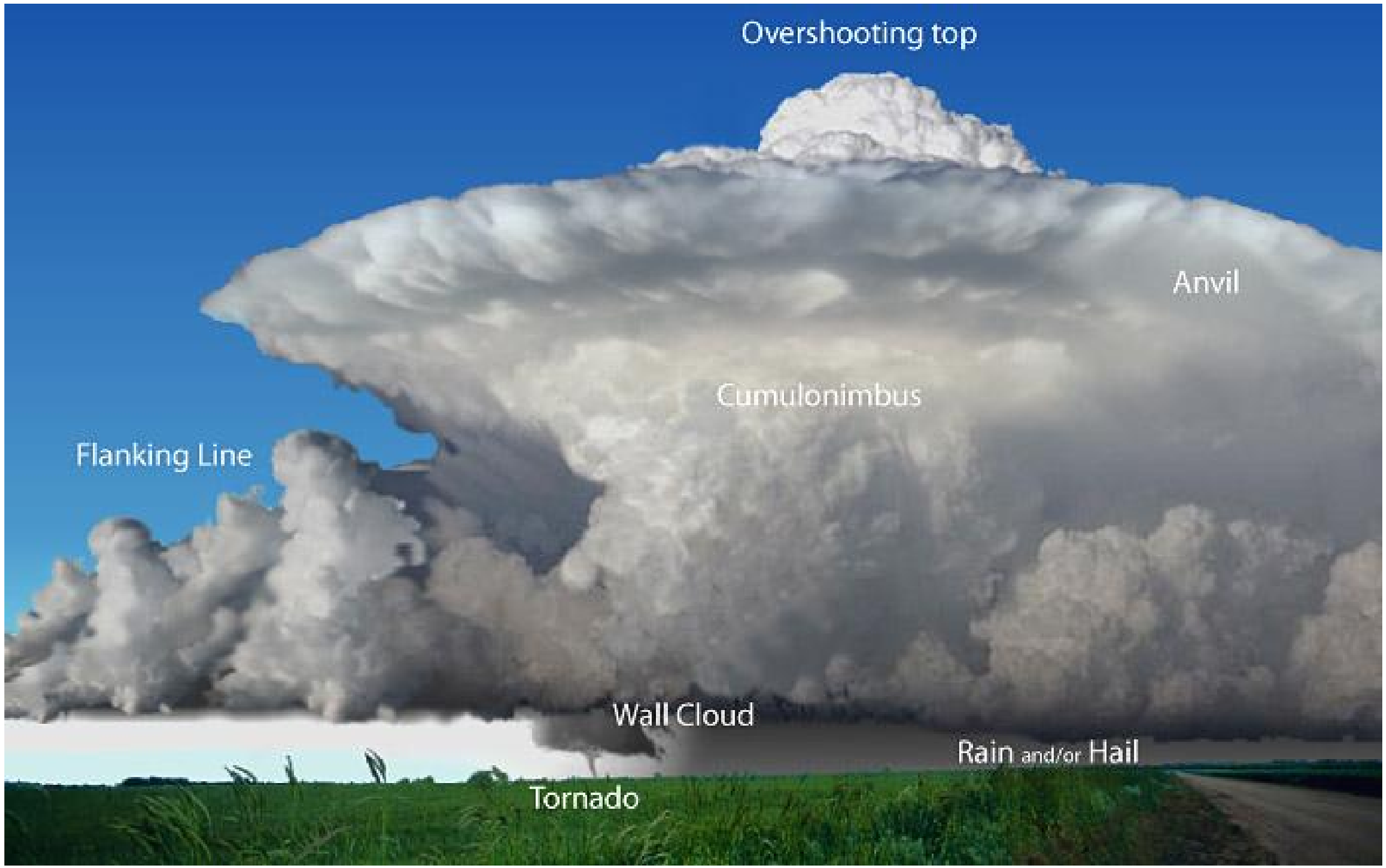
Thunderstorms and Tornadoes

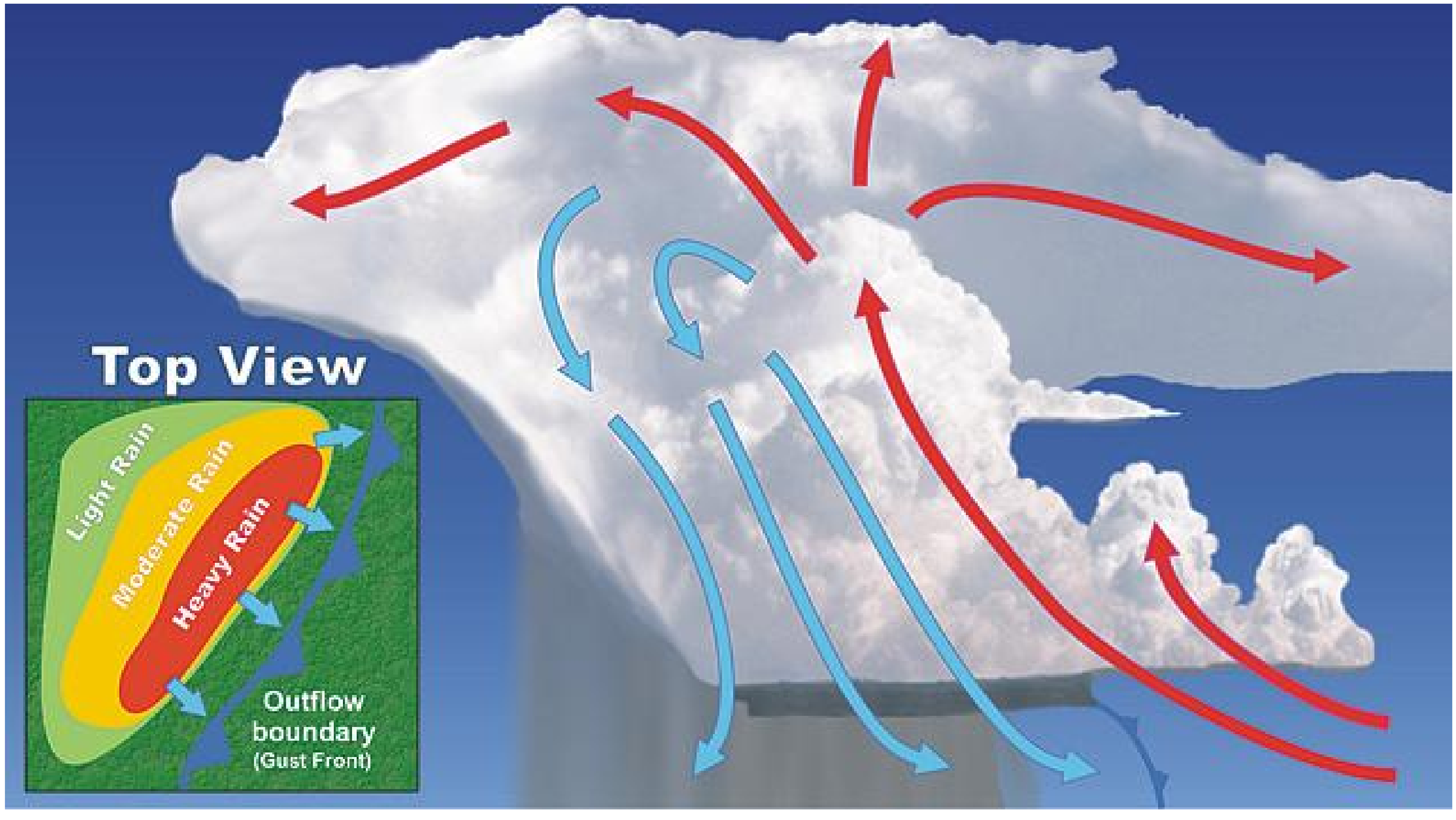
Thunderstorms- a violent weather event accompanied by lightning, thunder, strong winds and rain



There are ~ 4,000 thunderstorms per day worldwide

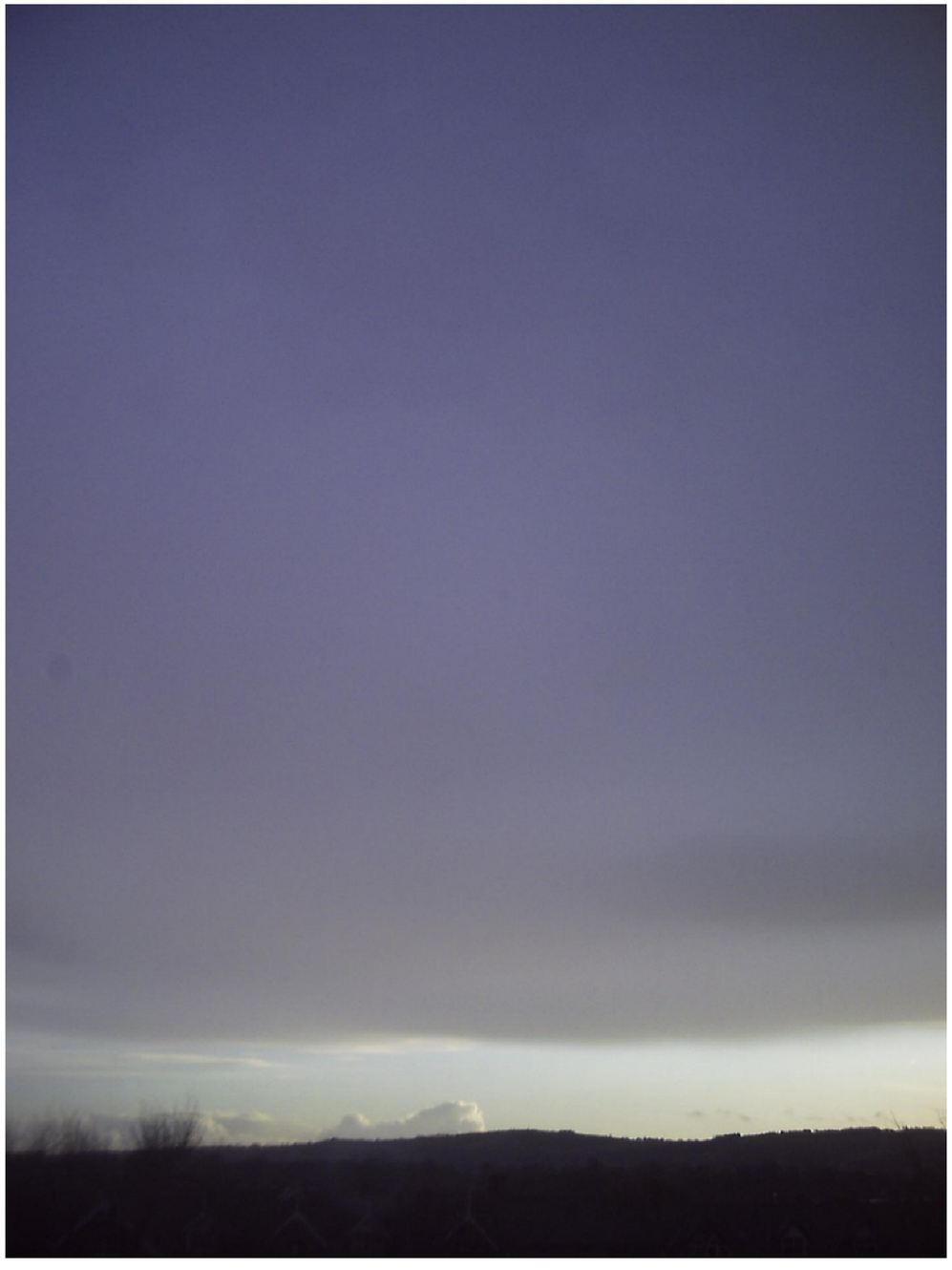
Thunderstorms form when warm, humid air rises into colder air in an unstable environment

– Usually occur in late afternoon or early evening



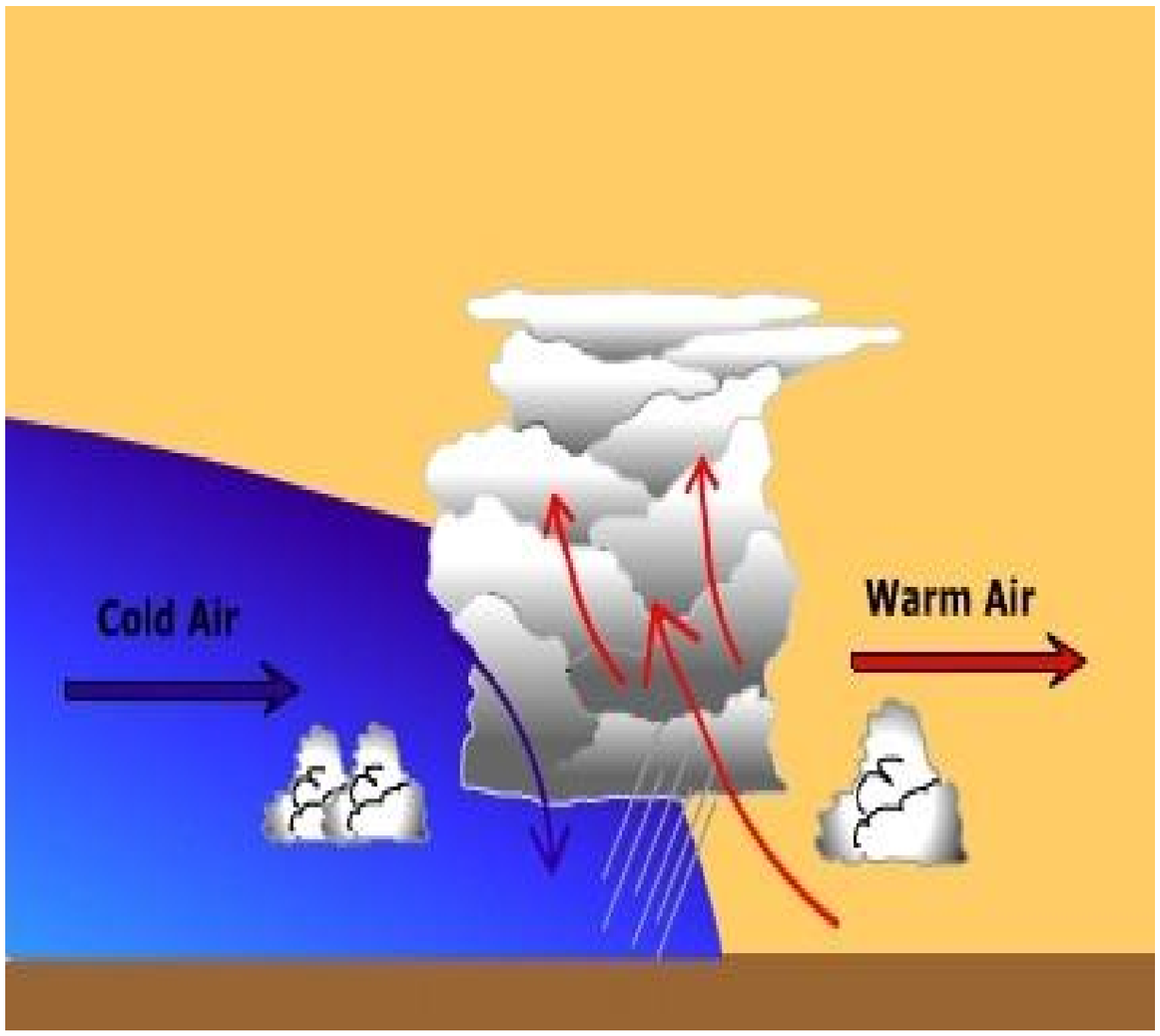
There are two kinds of thunderstorms:

cold front and warm air



Cold Front Thunderstorm

- Warm air is pushed up and over cold air
- Strong and last for several hours.
- Mostly in spring and fall.
- Can also have tornadoes and hail.

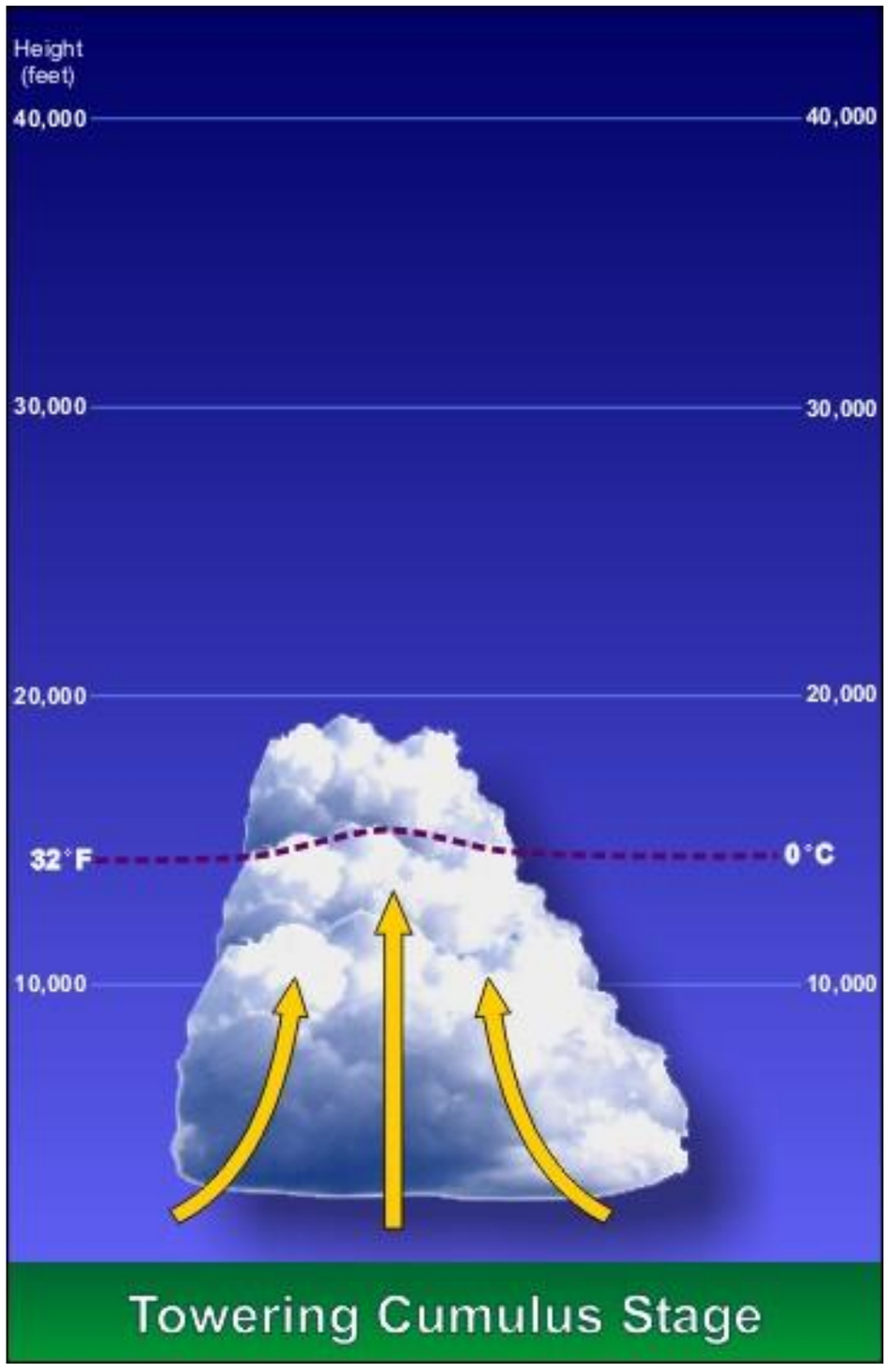


Warm Air Thunderstorm

- Doesn’t involve cold air at all!
- Caused by uneven heating of Earth’s surface
- Less violent and last less than hour
- Usually occur in summer

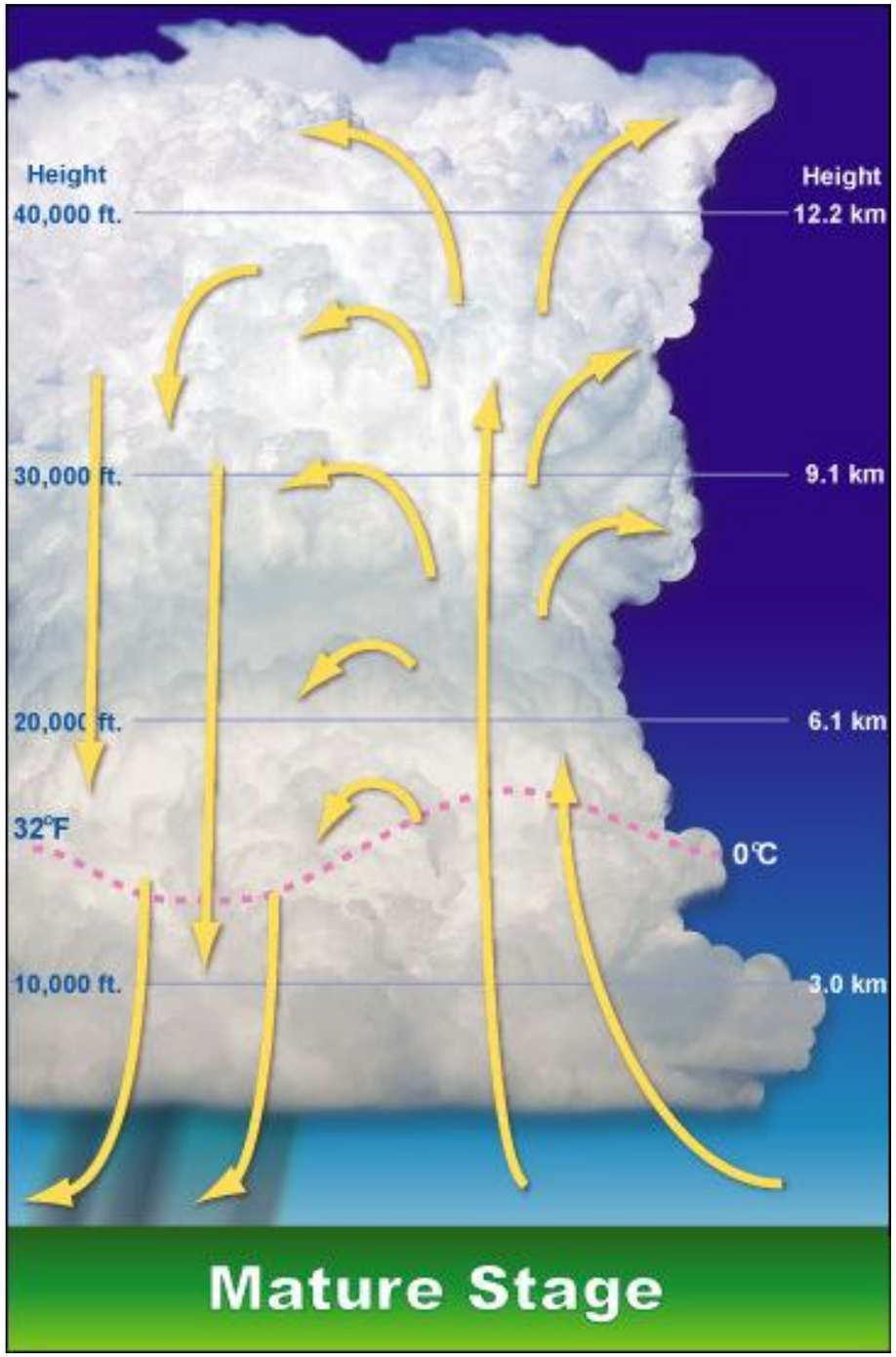
Most Thunderstorms occur in three stages: Cumulus, Mature, and Dissipating

- Cumulus: strong updrafts blow warm, moist, air higher until the vapor condenses, forming a cumulus clouds



Mature

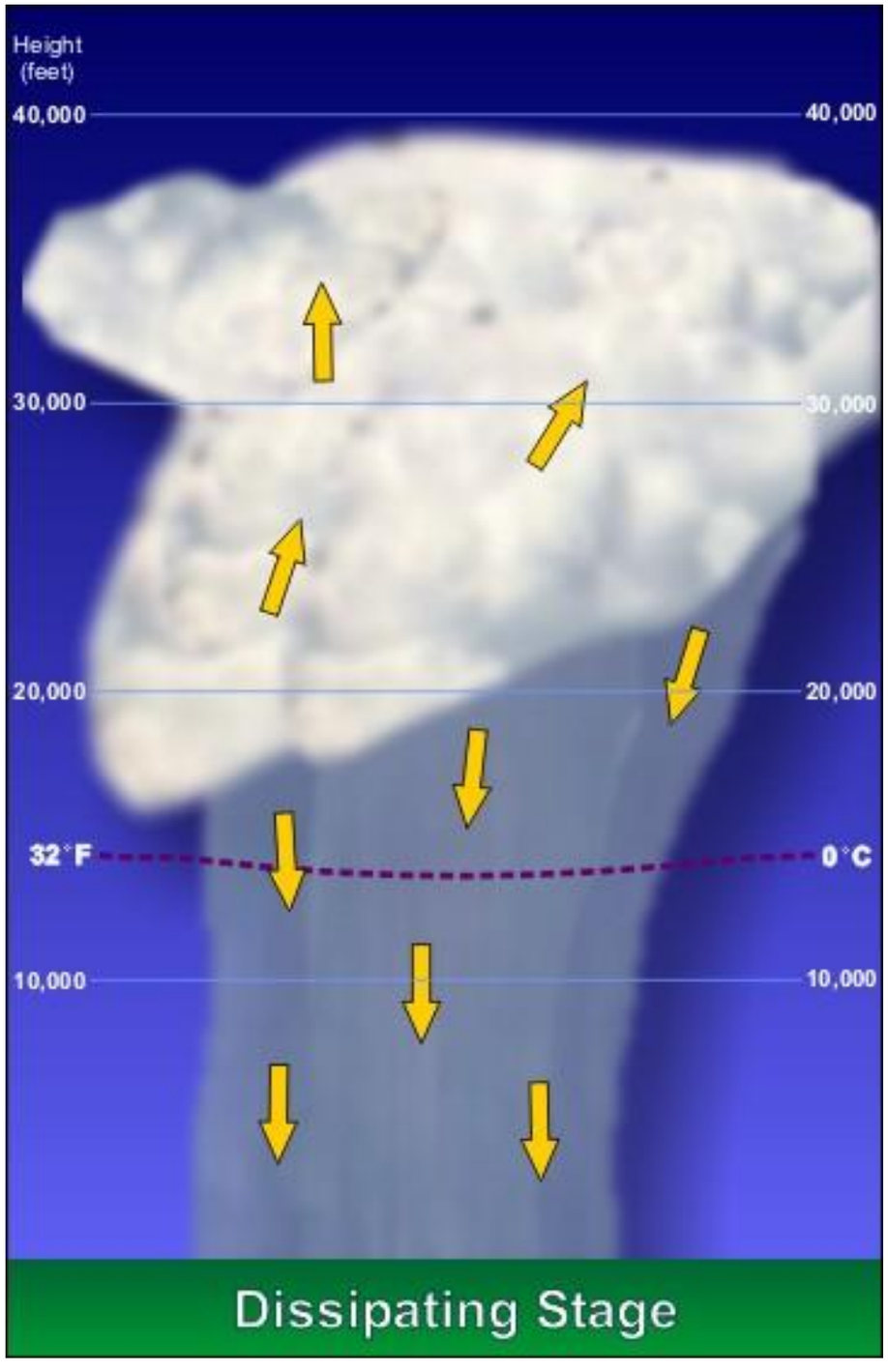
- Mature: violently rising, warm air forming cumulonimbus clouds
- Updrafts continue and downdrafts begin as rain starts to fall
- Thunder and lightning begin



Dissipating

- Dissipating: strong downdrafts stop warm, moist air currents from rising.
- Water vapor supply suddenly decreases so the cell dies down
  - If the storm passes over new areas of warm water then new cells can begin again

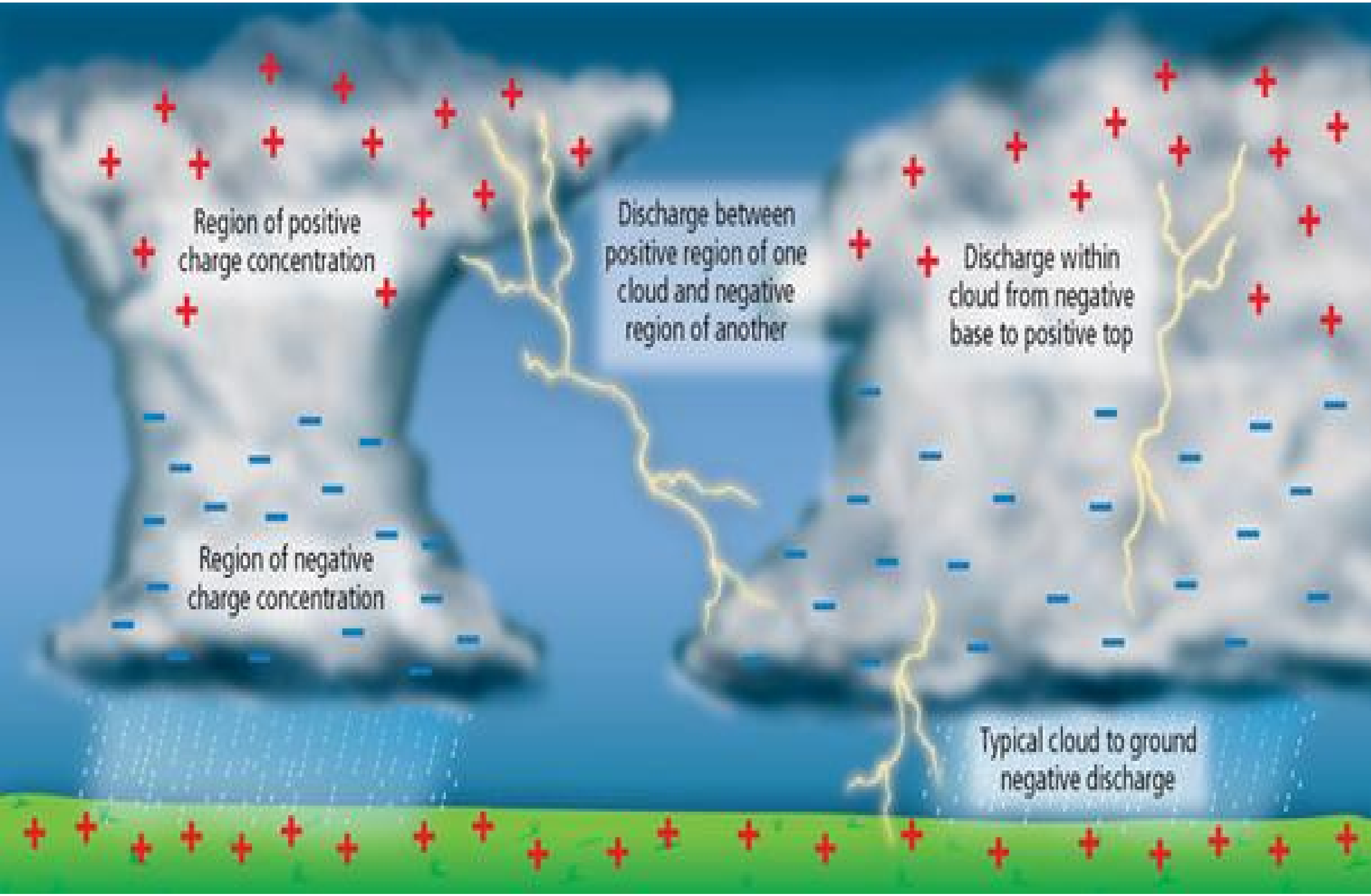
http://vimeo.com/86112567



Lightning

- What causes lightning?
  - As your updrafts carry air into the cloud, different charges separate in the cloud.
  - Negative charges near the bottom and positive charges near the top.
  - Negative charges will rush toward ground, at the same time positive charges near ground rise toward cloud
- When they meet a lightning bolt will occur

http://www.glumbert.com/media/slomolightning


Region of positive charge concentration
Discharge between positive region of one cloud and negative region of another
Discharge within cloud from negative base to positive top
Region of negative charge concentration
Typical cloud to ground negative discharge

Thunder

- The extreme heat from lightning causes air to expand and collapse resulting in a loud noise
- The air expands faster than speed of sound and creates a sonic boom.

Tornado

A rapidly spinning column of air that has high winds, low pressure and touches the ground.

- **The center of a tornado is characterized by its low pressure**

How to form a tornado

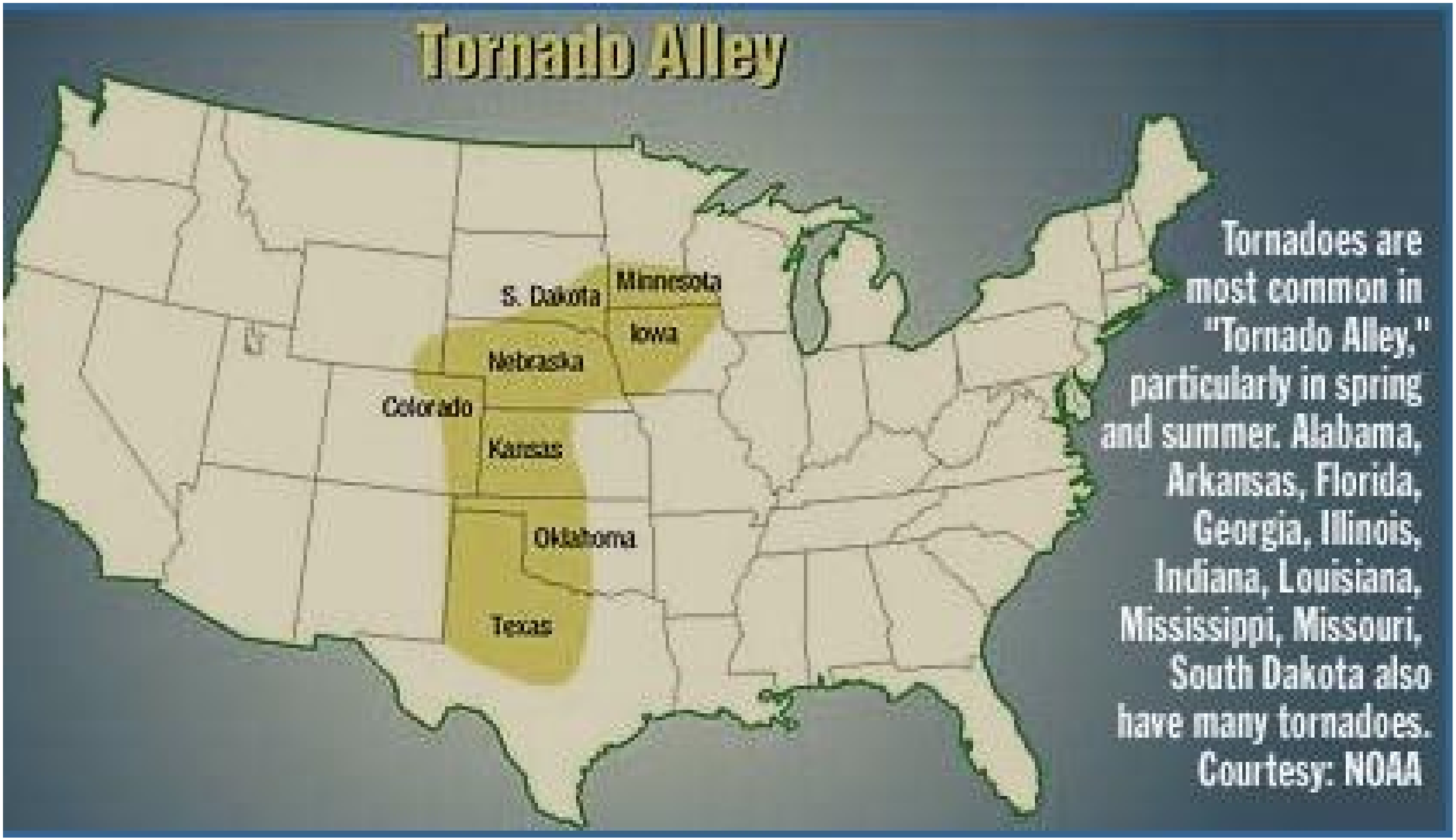
1. Creating horizontal rolling winds

2. Rolling winds hit an updraft and start to tilt upward.

3. Rotating winds now in clouds

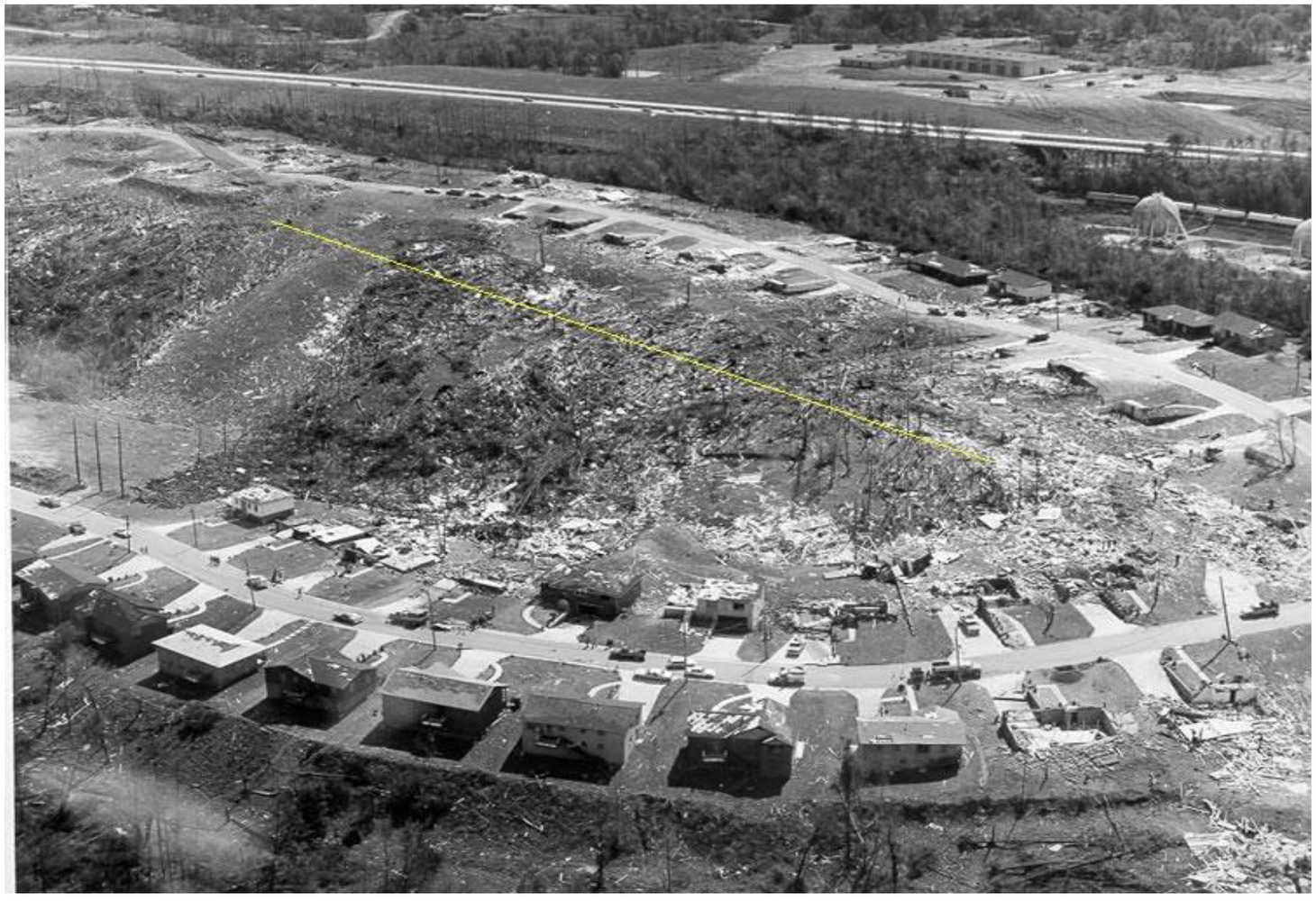
4. Rotating winds can touch down and form tornados

Tornado Alley: South Central and Midwestern United States



Tornado Intensity: EF0 – EF5

- Measured on the Fujita Tornado Intensity Scale
  - Measures how much damage is done by the tornado and wind speed



Scale	Wind speed		Relative frequency	Potential damage	
	mph	km/h			
EF0	65–85	105–137	53.5%	Minor damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.	
EF1	86–110	138–178	31.6%	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.	
EF2	111–135	179–218	10.7%	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.	
EF3	136–165	219–266	3.4%	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.	
EF4	166–200	267–322	0.7%	Extreme damage to near-total destruction. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.	
EF5	>200	>322	<0.1%	Massive Damage. Strong frame houses leveled off foundations and swept away; steel-reinforced concrete structures critically damaged; high-rise buildings have severe structural deformation. Incredible phenomena will occur.	

Tornado Warning System

Watch	Warning
• Conditions are conducive to the development of tornadoes in and close to the watch area. • Large area • Can last 3-5 hours	• A tornado has been sighted by spotters or indicated on radar and is occurring or imminent in the warning area. • Small area • Can last 30 min – 1 hour

http://www.outsideonline.com/outdoor-adventure/video/Top-10-Tornado-Videos.html