

Extreme Weather Phenomena

Thunderstorms, Tornadoes,
Hurricanes, Monsoons, Blizzards

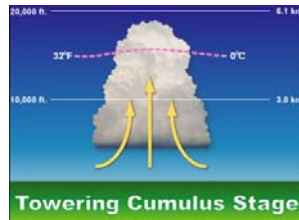
Thunderstorms

- Warm, humid air fuels all thunderstorms.
- Warm air rises
- Clouds form as warm air carrying moisture rises within cooler air
- As the warm air rises, it cools
- The moist water vapour begins to condense
- As the moisture condenses, energy is released keeping the air warmer than its surroundings, so that it continues to rise

- If enough instability is present in the atmosphere, this process will continue long enough for cumulonimbus clouds to form, which support lightning and thunder.
- All thunderstorms, regardless of type, go through three stages

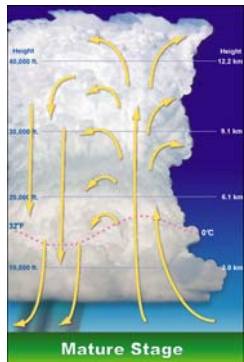
Cumulus (Developing) stage

- Moisture is lifted upwards into the atmosphere
 - A cold front moves in
- The moisture rapidly cools into liquid drops of water
- Cumulus clouds form

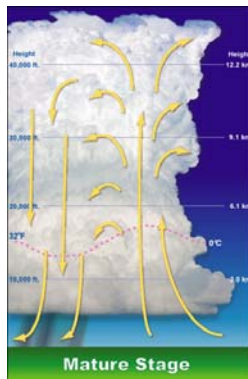


Mature Stage

- **Warm air rises into the cloud and condenses**
- The condensation releases energy causing it to still be warmer than the surrounding air and thus keeps rising
- An **updraft** is created pulling in more air from below

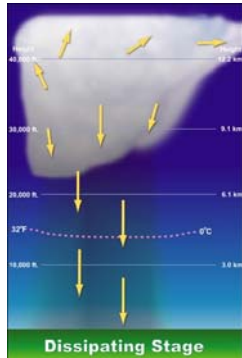


- The water droplets combine and freeze to become ice particles
- When they are too heavy they fall
- If they melt when they fall we get rain, if not, hail
- The falling precipitation cools the air underneath the storm creating a **downdraft**



Dissipating stage

- The **downdraft has cooled the air so much that the updraft of warm air stops**
- The rain continues until the supply of moisture has run out
- The thunderstorm is over



Tornadoes



- Tornadoes are the most violent storms on Earth
- Winds spiraling into them can vary from 60 km/h to as high as 500 km/h
- A tornado is a violently rotating column of air in contact with the ground resulting from a thunderstorm

How a Tornado Forms

- Tornadoes form in within a thunderstorm's updraft.
- Small cyclones of air in the updraft intensify
- The air pressure in the center of the cyclone is lower causing it to spin faster and narrower
- A funnel cloud appears

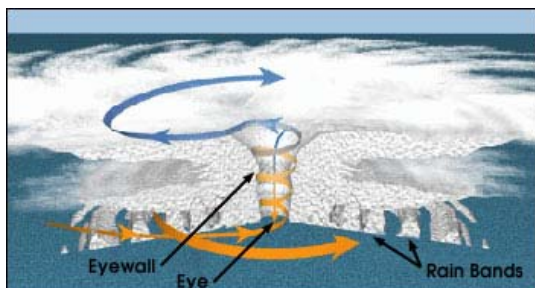
Intensity of Tornadoes

- 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.

	Estimated Wind Speed	Typical Observations
EF-0	65-85 mph	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF-1	86-110 mph	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF-2	111-135 mph	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.
EF-3	136-165 mph	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.
EF-4	166-200 mph	Devastating damage. Whole frame houses Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF-5	Over 200 mph	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m; high-rise buildings have significant structural deformation; incredible phenomena will occur.

Hurricanes, Typhoons, Tropical Cyclones

- Spinning storms formed over the ocean



- The main characteristics of a hurricane, are:
 - Hurricanes have no fronts
 - Hurricane winds weaken with height
 - The centers of hurricanes are warmer than their surroundings
 - Hurricanes and tropical systems form under weak high-altitude winds.
 - Air sinks at the center of a hurricane
 - Hurricanes' main energy source is the latent heat of condensation
 - Hurricanes weaken rapidly over land

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 or typhoon
 - Maximum sustained winds exceed 64 knots (74 mph).

Monsoon

- A system of winds that causes torrential rain and extensive flooding

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
