Weather and Climate Unit Notes

Name:_____
(DO NOT LOSE!)

FOCUS: WEATHER AND THE ATMOSPHERE

Weather: The state of the atmosphere at a given time and place, with respect to variables such as…

- - Temperature
- - Moisture
- - Wind
- - Air Pressure

Climate: The average weather of a particular part of the world at different times of the year.

Atmosphere: The layer of gases surrounding Earth; composed mainly of nitrogen and oxygen.

Importance of the Atmosphere

- Keeps planet warm (Greenhouse effect)
- Provides oxygen to breathe (makes respiration possible)
- Protects us from small meteors
- Has ozone that protects us from radiation (UV)

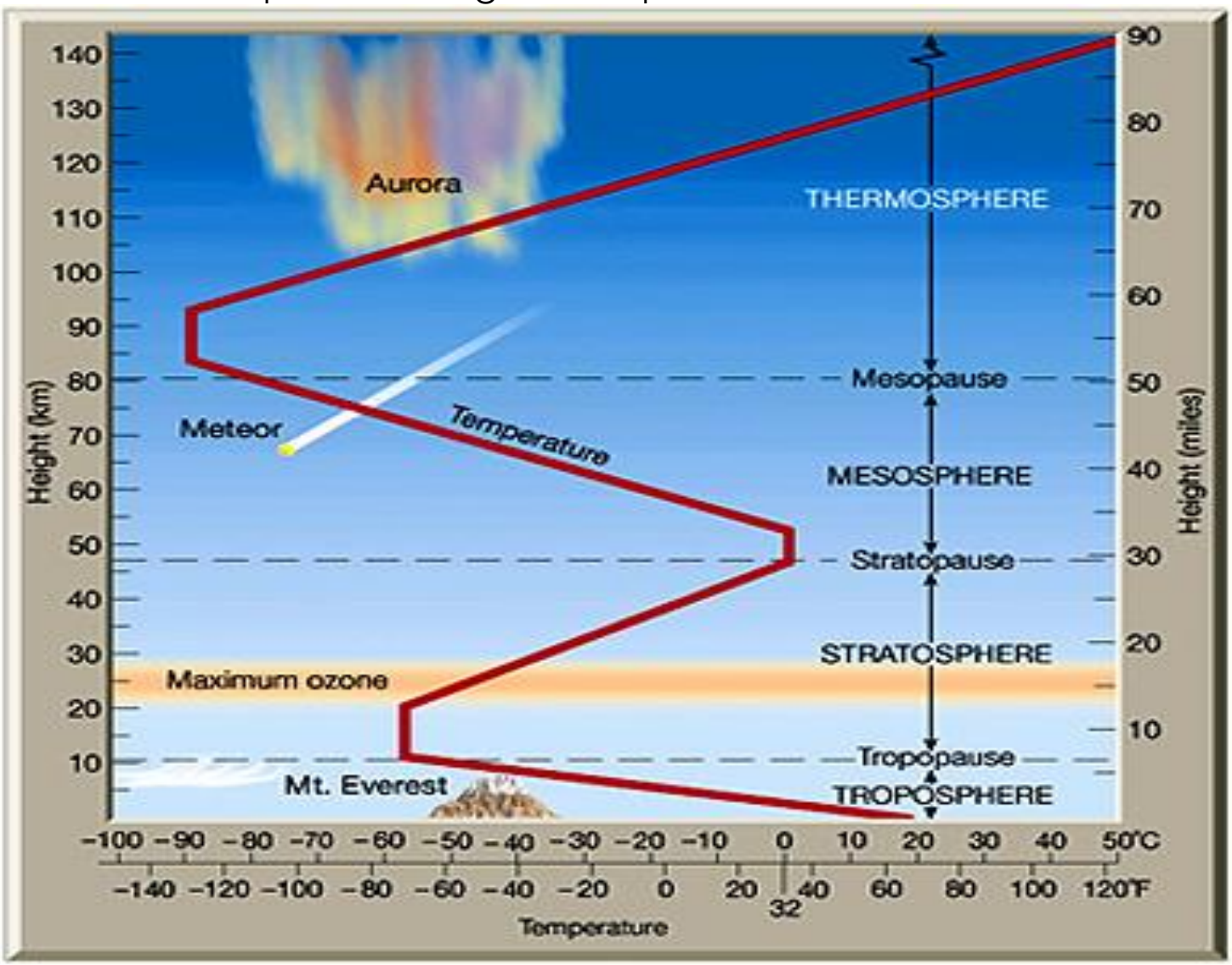
Without atmosphere, smell, taste, sound, and combustion are not possible.

The atmosphere is made of

- - 78% Nitrogen Gas
- - 21 % Oxygen
- - All other gases 1%
  - Argon .7%
  - Carbon Dioxide .2%
  - Neon

- Helium
- Methane
- Krypton
- Hydrogen
- Xenon

- Title: Layers Of Atmosphere
- Spread these 5 bullets out over a page. Draw relevant things after titling layer.-
  - - Troposphere – Weather occurs here, life, air travel.
  - - Stratosphere - Ozone found here.
  - - Mesosphere – Meteors burn up here
  - - Thermosphere – Space shuttle orbits here, Aurora borealis
  - - Exosphere – Merges with space, some satellites here.



New Area of Focus: Air Quality and Pollution

Air Pollution can be

- Global (Global Warming)
- Regional (Acid Rain)
- Local (Smog)

To avoid carbon monoxide poisoning, Do not…

- Run a car in a closed garage
- Burn charcoal indoors or in a tent
- Run a generator indoors
- Burn anything without ventilation

Ozone Layer

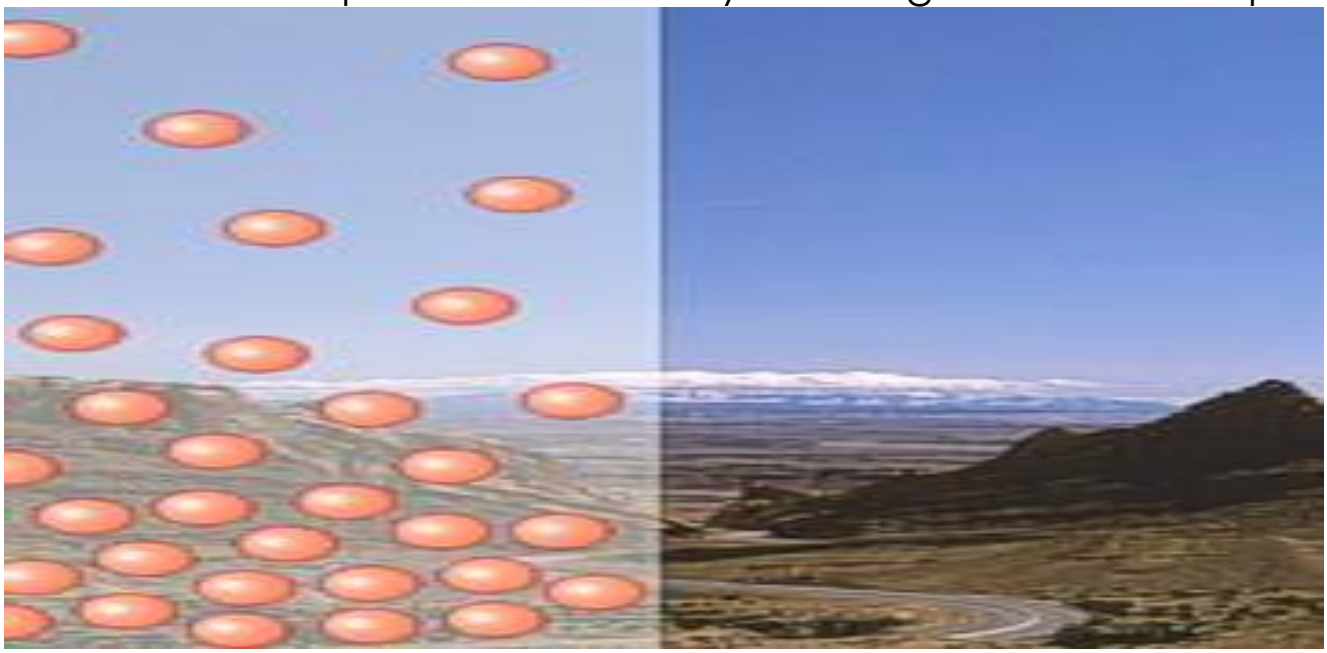
- - Layers of atmosphere
- - Gas made of 3 oxygen atoms (O3)
- - Absorbs 99% of suns harmful UVB rays
- - Chloroflurocarbons, (CFC's) made by humans in aerosols destroy Ozone
- - Humans have created a hole in the ozone layer.

Ways to avoid skin cancer

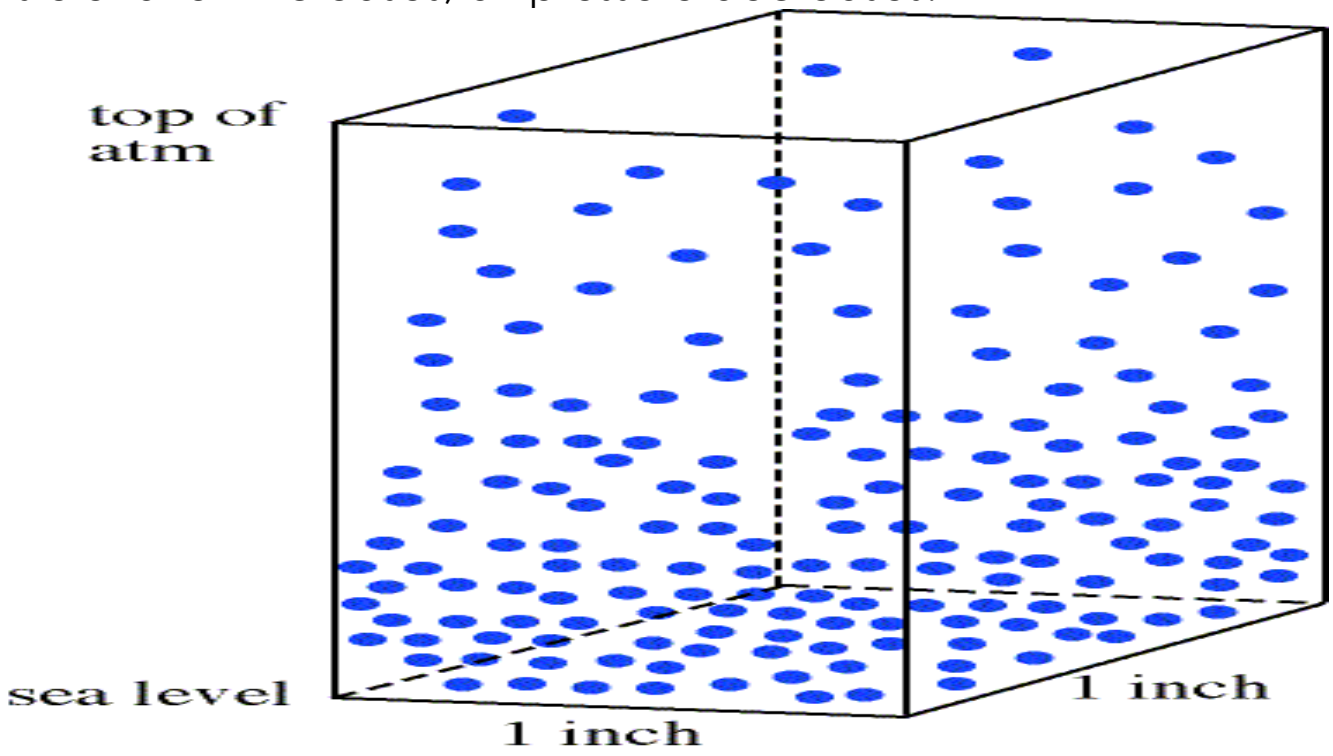
- Don't sunbathe. The sun is radiation
- Tanning also increases your risk
- Avoid the sun, especially between 10-4PM
- Seek shade
- Wear a shirt (thicker and darker)
- Wear sunglasses
- Be especially wary fair skinned people

New Area of Focus: Air Pressure, The factor that controls the weather.

Air Pressure: The pressure caused by the weight of the atmosphere.

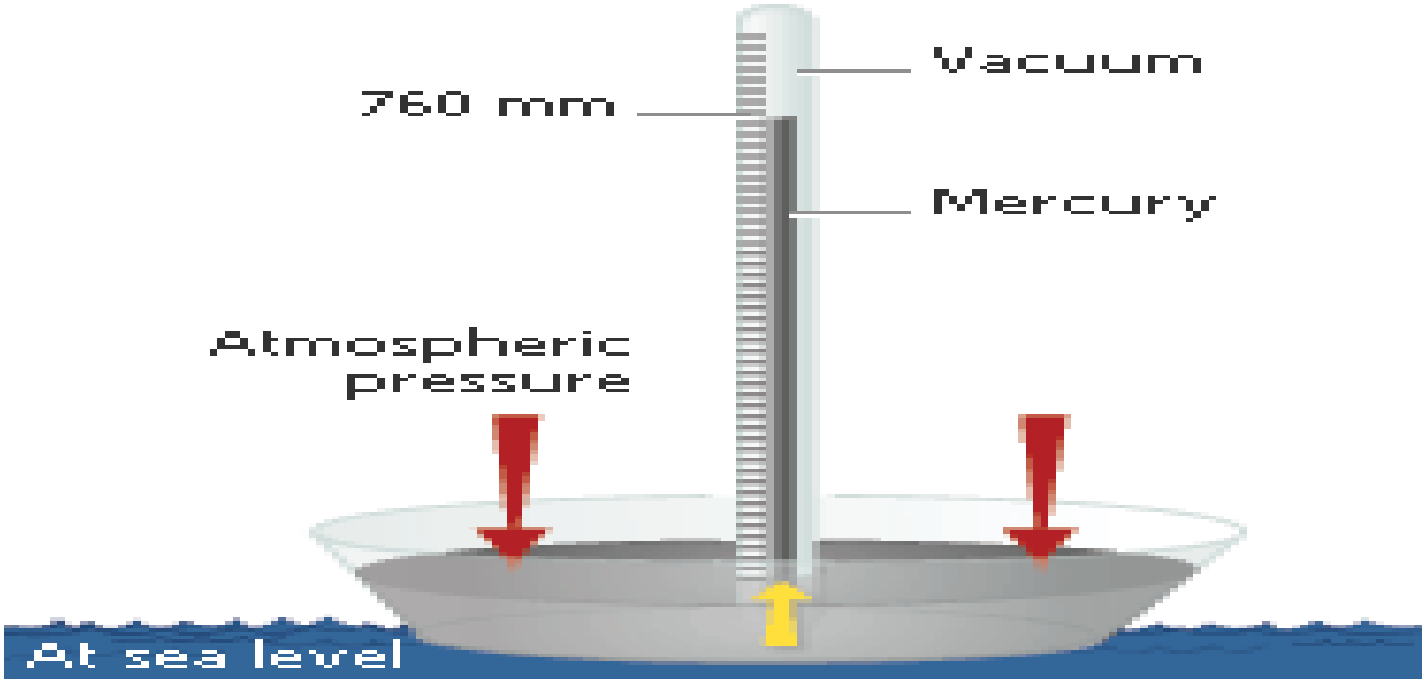


As elevation increases, air pressure decreases.



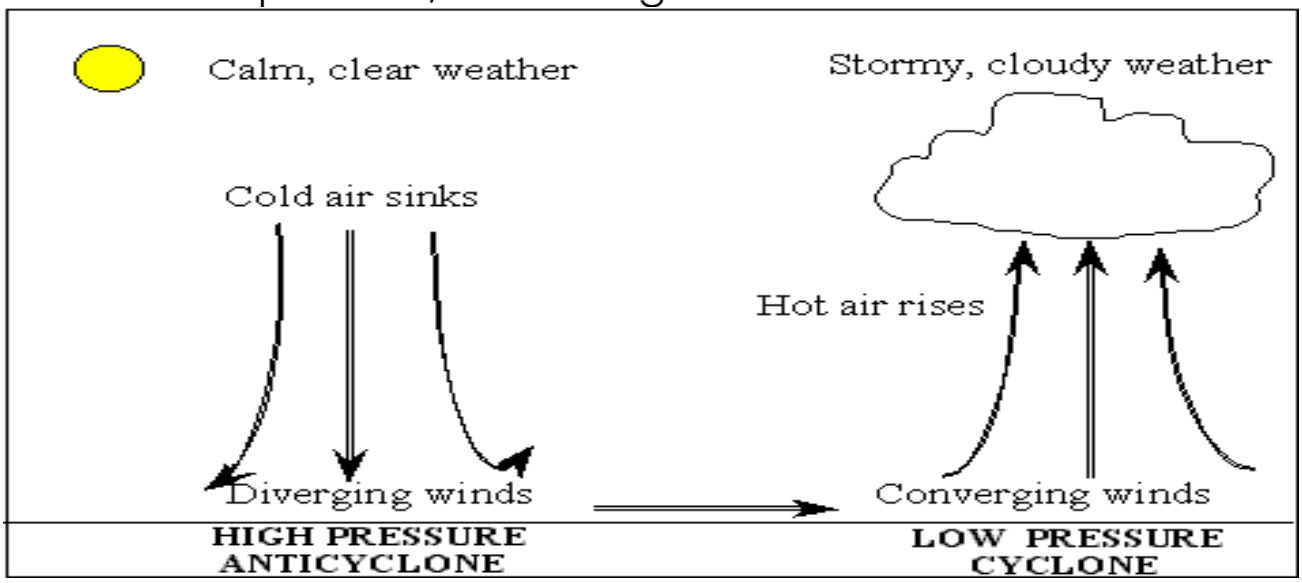
As you increase in elevation, pressure decreases. Inverse relationship

Barometer – Instrument that measures air pressure.



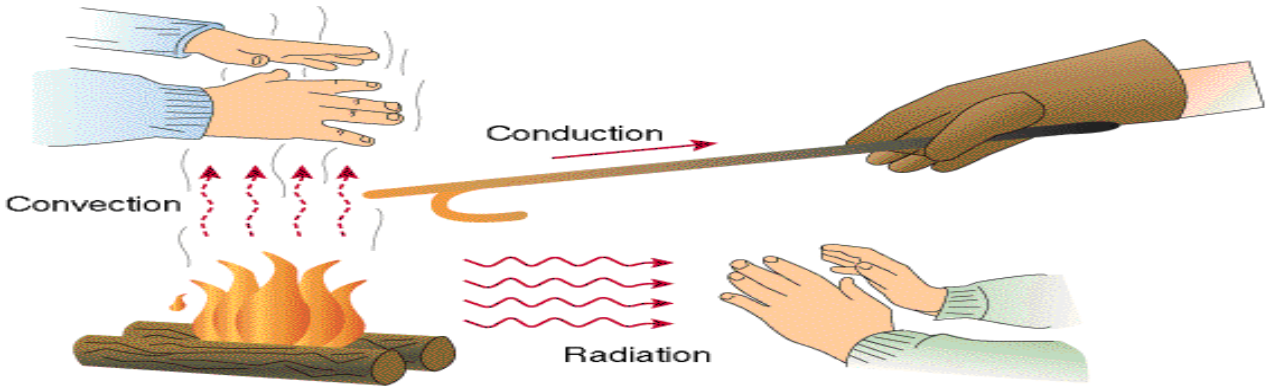
Air Pressure drives the wind and creates the weather.

Warm air rises, cool air sinks.
Warm is low pressure, Cold is High Pressure.



- Most importantly, wind travels from areas of high pressure to areas of low pressure!

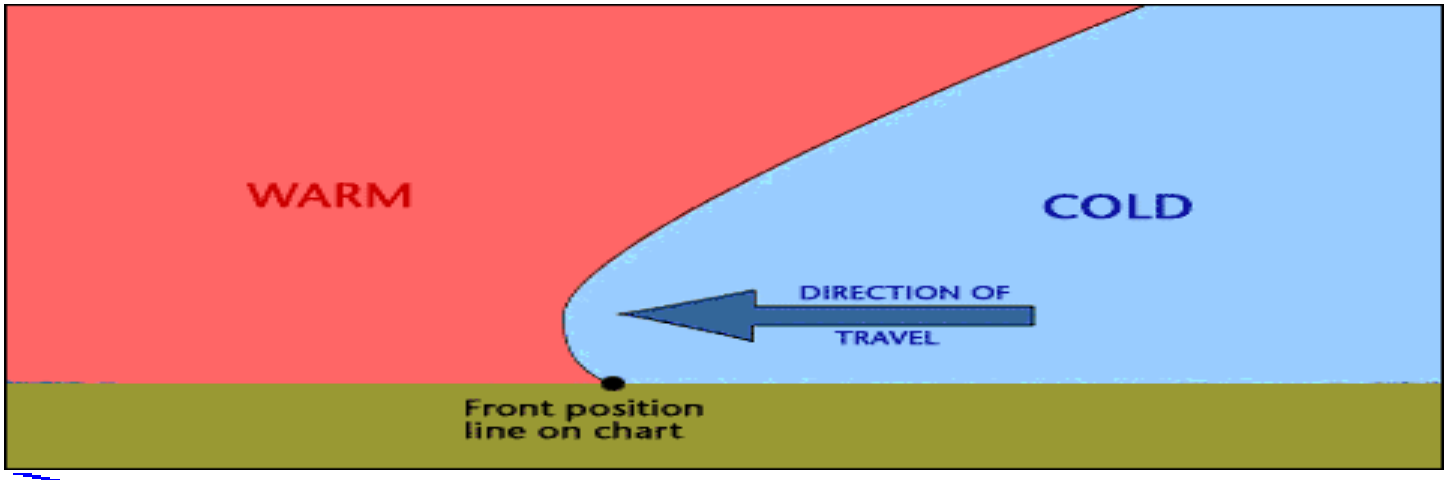
Pictures for heat transfer

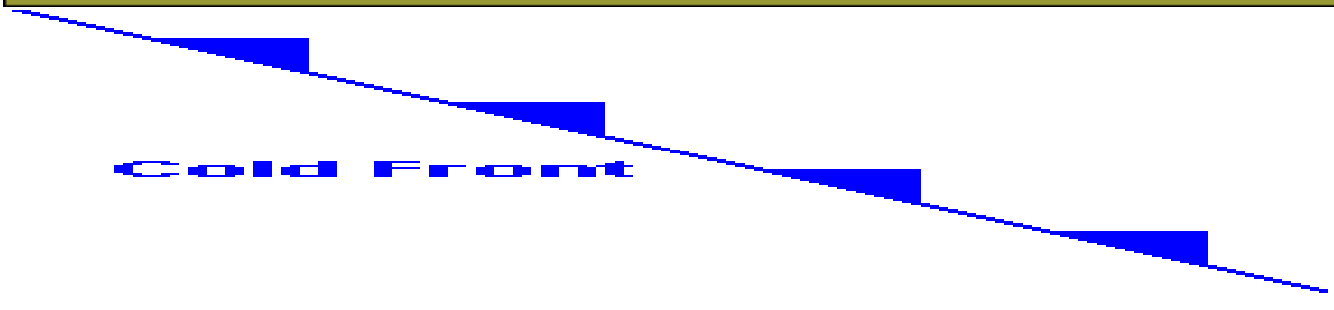


Convection: Vertical circulation in which warm rises and cool sinks.
--Flow of heat by this circulation.
Conduction: The movement of heat from one molecule to another.
Radiation: Energy that is radiated or transmitted in the form of rays or waves or particles.

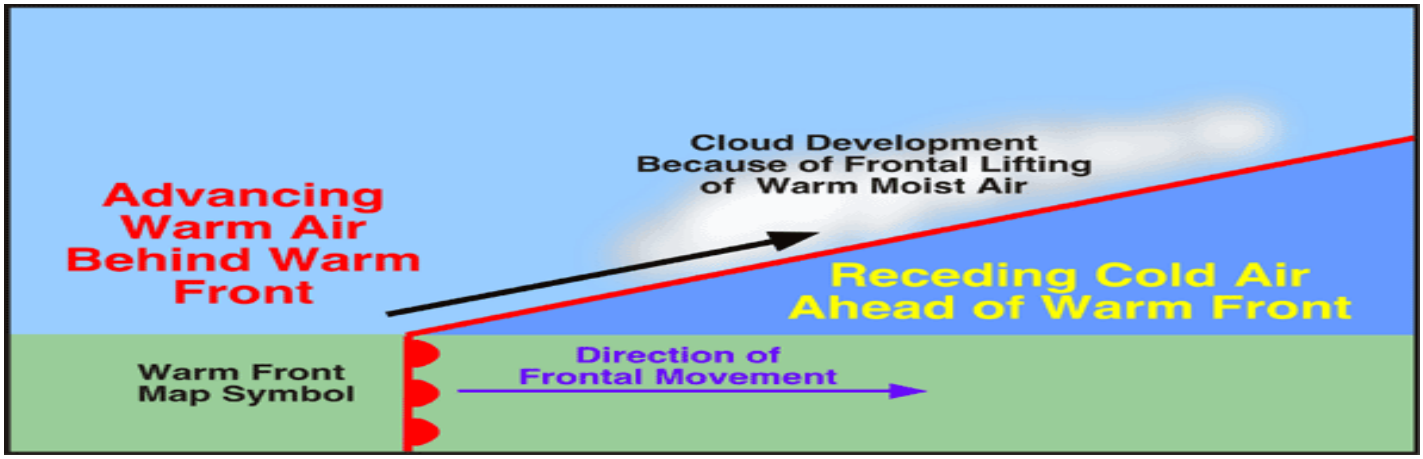
Warm Fronts and Cold Fronts, caused by air pressure.

Cold Front: Form where cold air moves towards warm air. Creates rain storms.

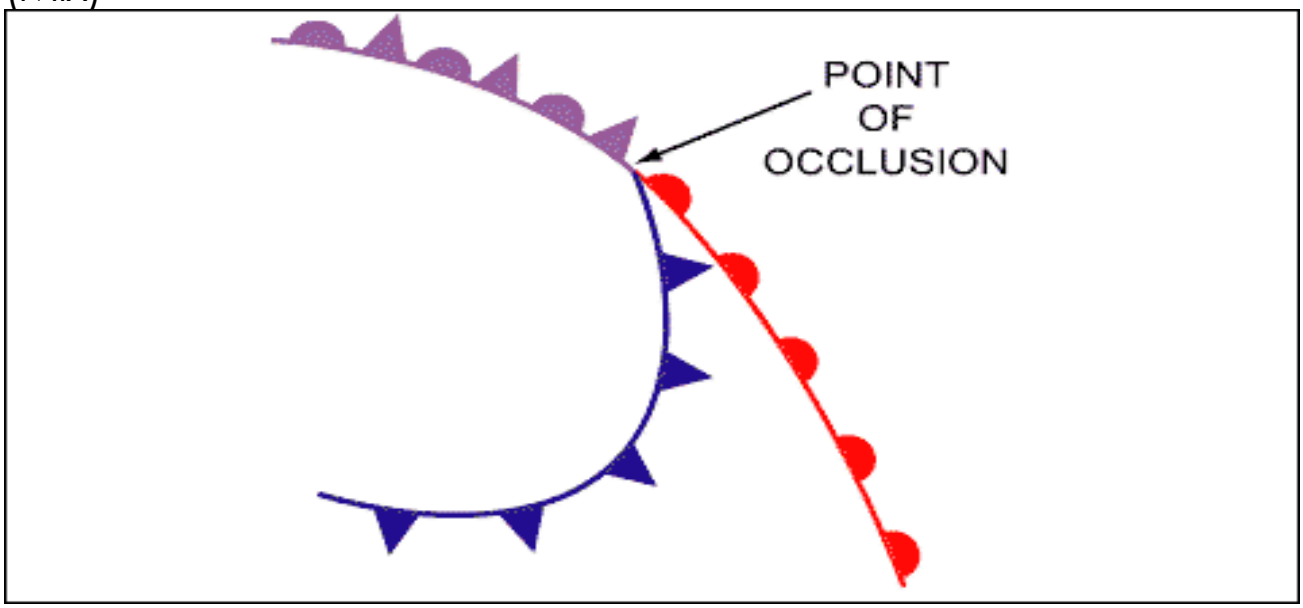




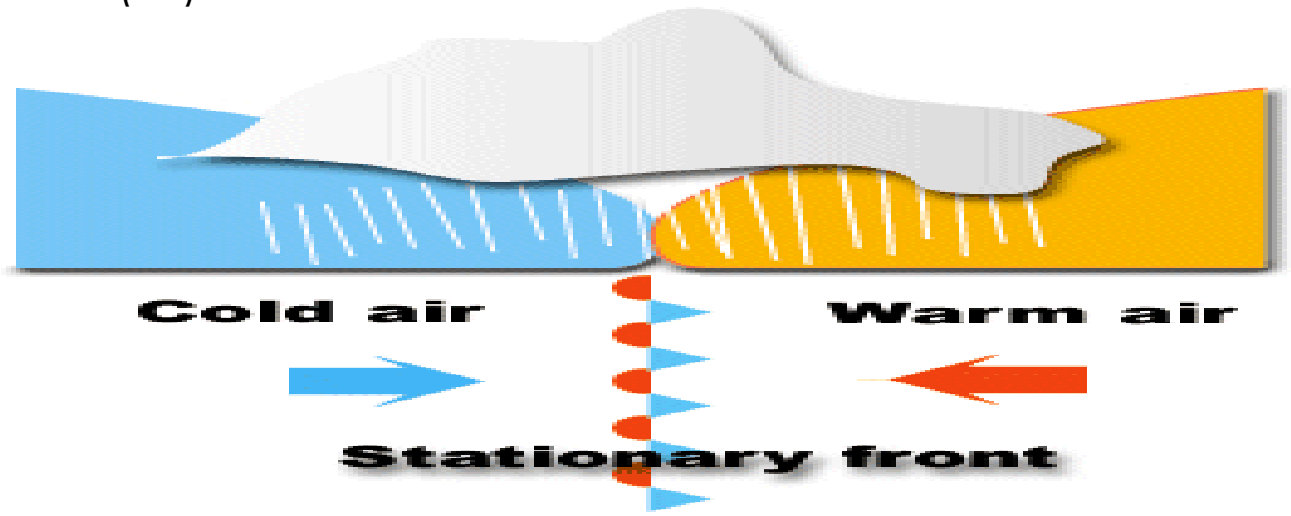
Warm Front: Form where warm air moves towards cold air.



Occluded front: When a cold overtakes a warm and forces it up (Mix)



Stationary Front: When cold and warm cannot overtake each other (tie)

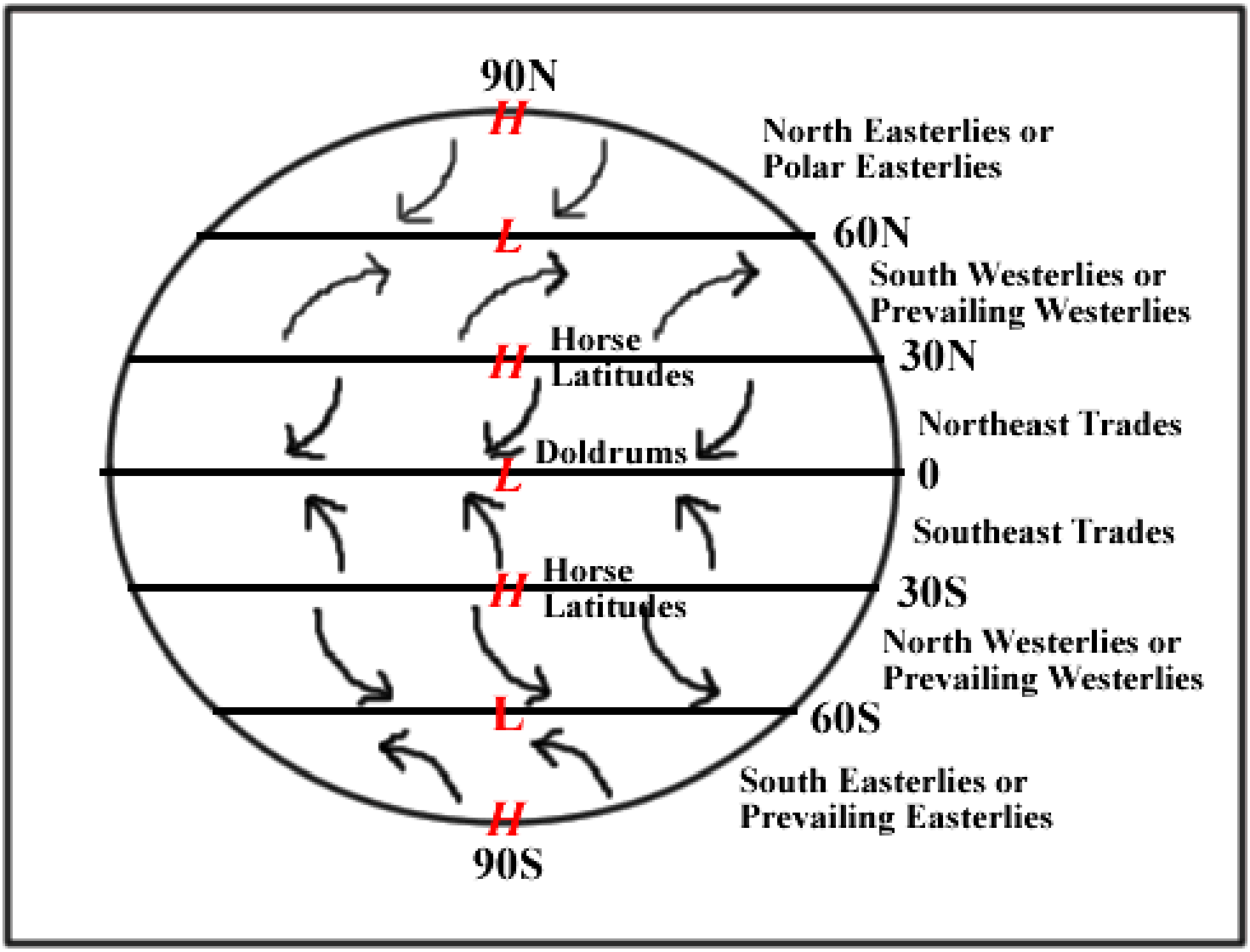


Wind

- - The movement of air, from high pressure to low pressure.
- - The wind is caused by the different temperatures (and therefore air pressure differences) around a planet - this is caused by the Sun.
- - Temperature differences over the land and over seas.
- - The topography of the land (Mountain Effect)

Global Winds

- - Doldrums
- - Horse latitudes
- - Trade Winds
- - Prevailing Westerlies
- - Polar Easterlies

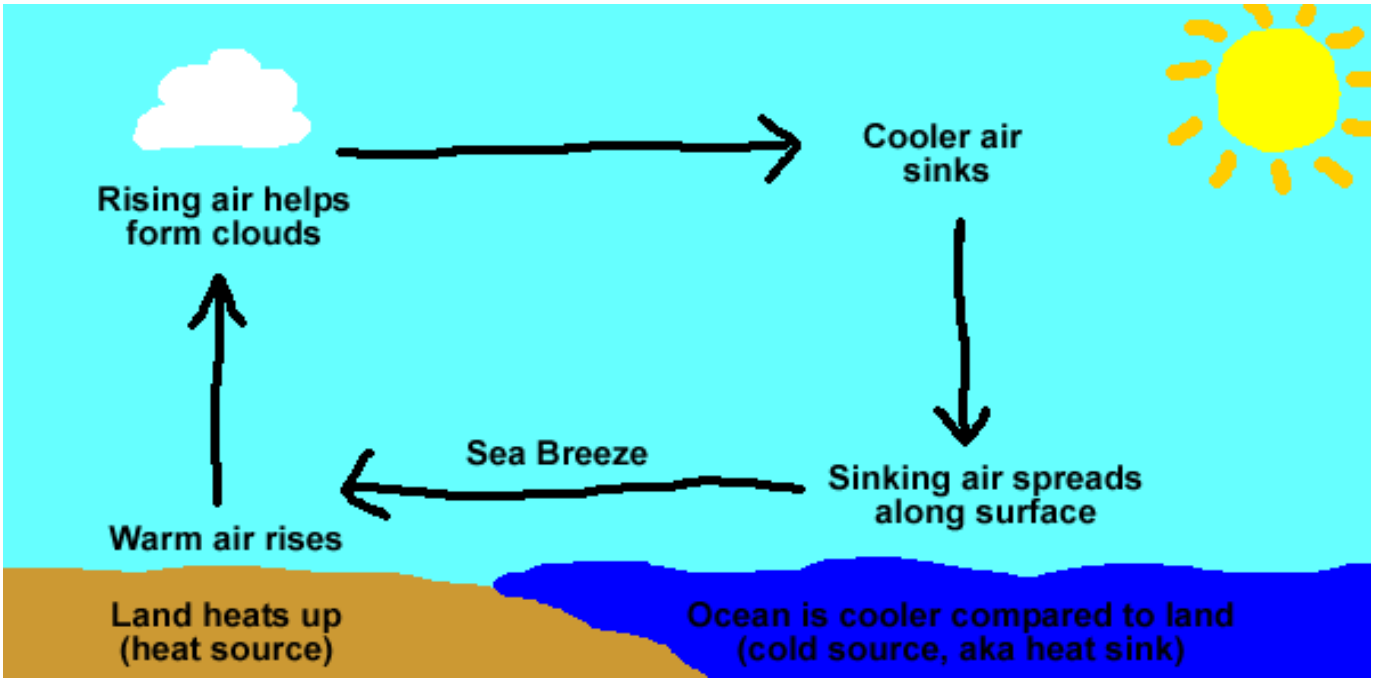


The rotation of the Earth (which causes the Coriolis force).

- Coriolis Force – Rotating body deflects.

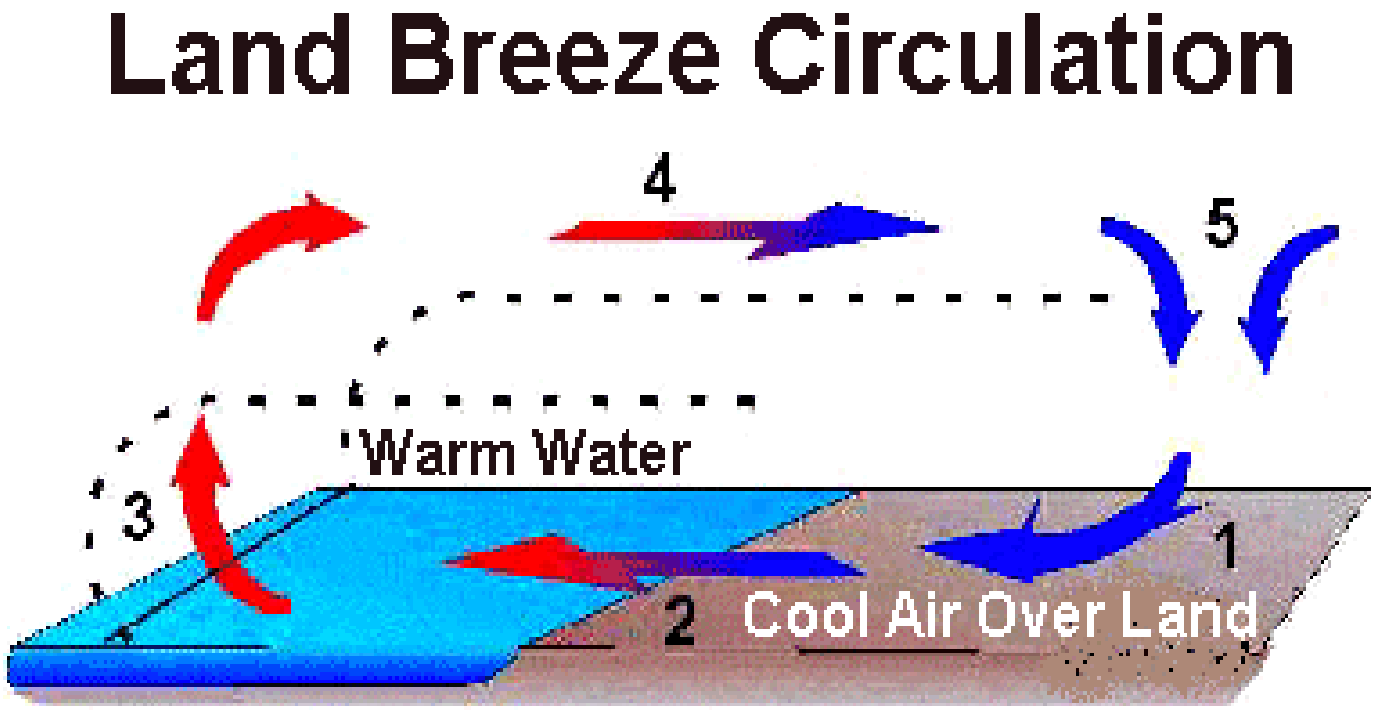
The Jet Stream: Any of the high-speed, high-altitude air currents that circle the Earth in a westerly direction.

Sea Breeze (Day)- The breeze that blows from the sea toward the land during the day,

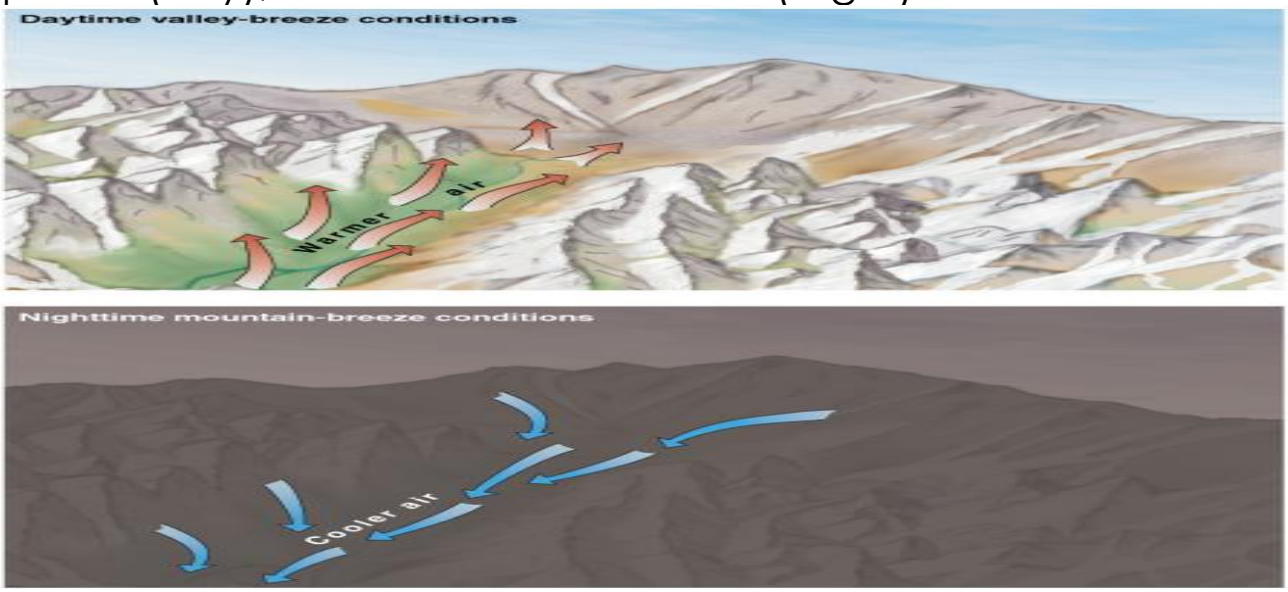


Caused by air rising over the warmer land (day) and is replaced by cooler air from above the sea.

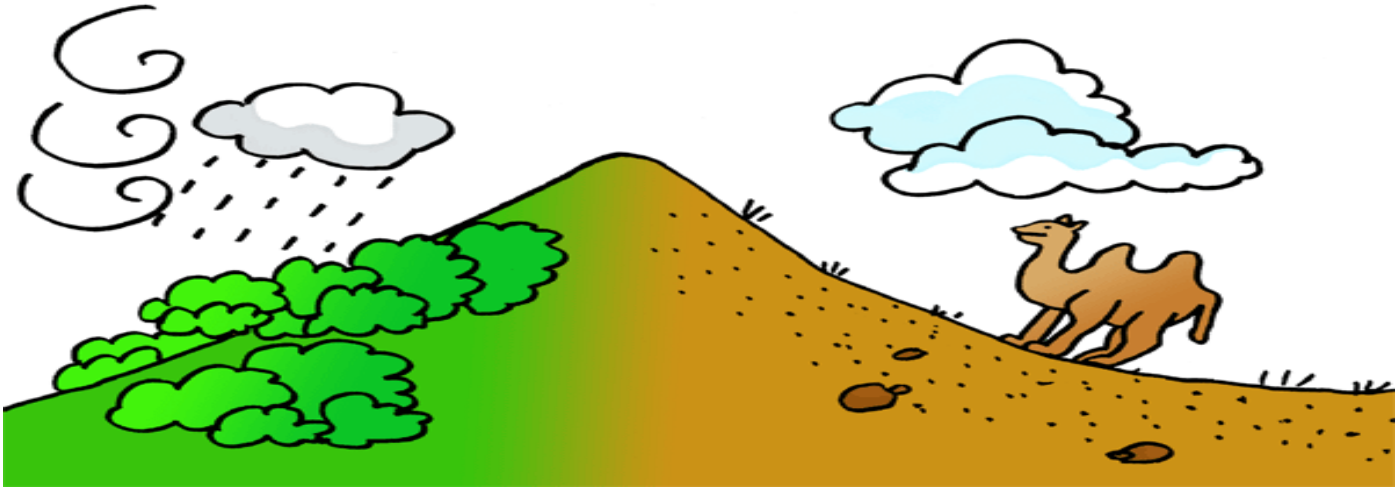
Land Breeze (Night): The breeze that blows from the land toward the sea.



Mountain Winds: Mountains can create strong winds. Warm air rises up Mtn. (day), Cool air sink down Mtn. (Night)



Mountain Rain Shadow Effect:

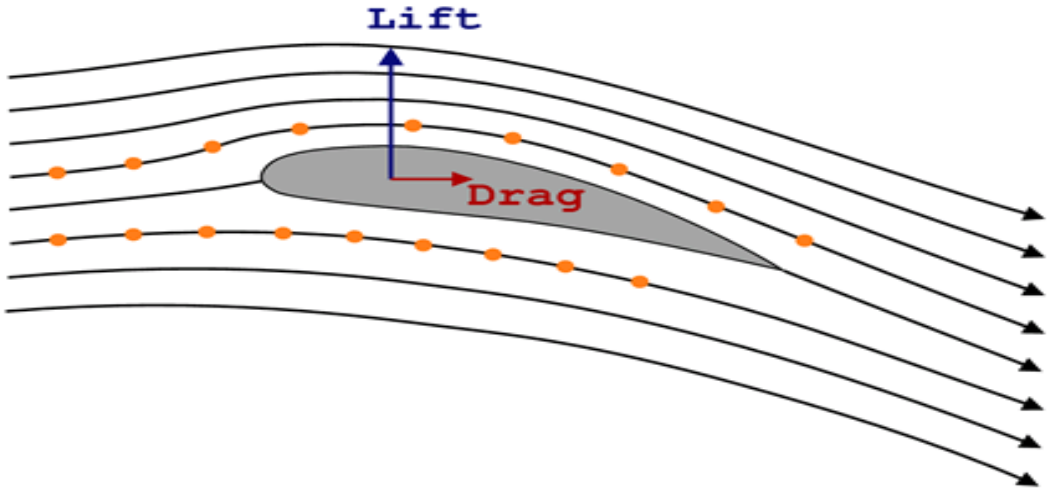


Wind Chill - The cooling effect of wind and temperature combined. The higher the wind, the cooler it gets.

Flight.

- Simple combination of Bernoulli's Principle and Newtons 1st law of motion.

- Air flows faster over the top of the wing than the bottom making less pressure, higher pressure underneath pushes the wing up.



Dangerous Weather Systems

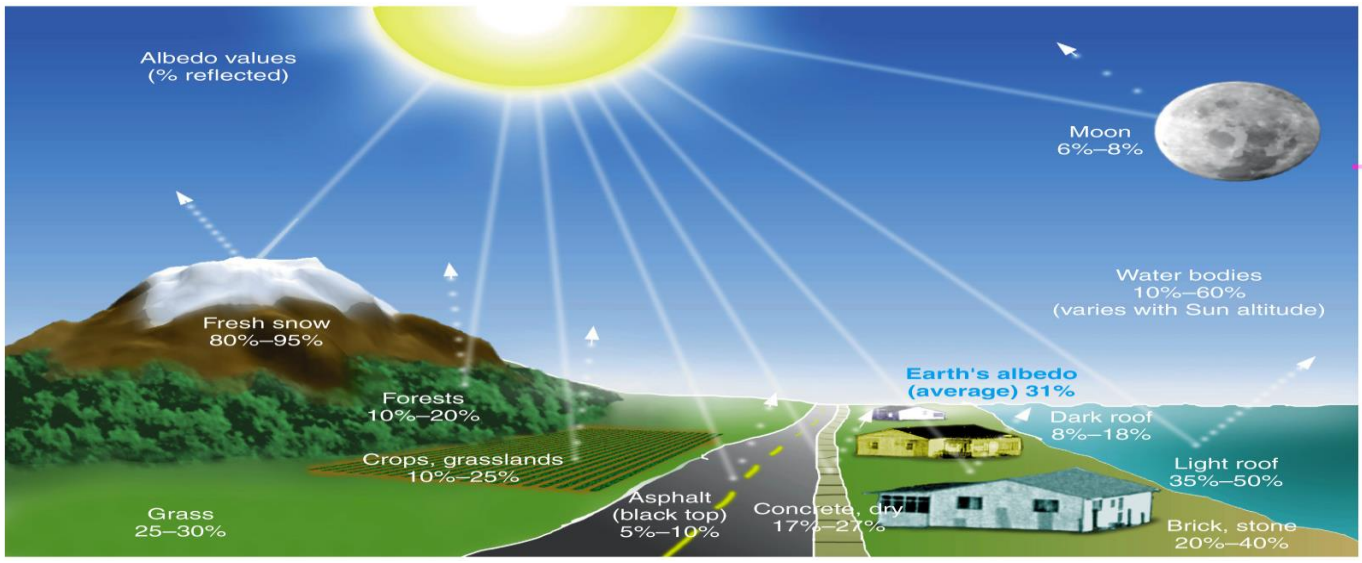
Storms: Rapid changes in air pressure cause a disturbance.

- Hurricanes
- Tornados
- Blizzard
- Microburst
- Thunderstorm
- Ice Storm

New Area of Focus: Light and Temperature

Light: An energy wave.
Black absorbs all colors of the spectrum while white reflects.

Albedo: The reflectiveness of a surface.



Dark colored materials heat up quicker than light colored materials. Air above dark colored surfaces heats up quicker.

Temperature: A measure of the average kinetic energy (motion) of individual molecules in matter.

- 100 degrees Celsius = Water Boils
- 0 degrees Celsius = Water Freezes

Thermometer: A measure of the heat from expanding and contracting liquids or coils.

WHAT CAUSES THE SEAONS?

- The tilt of the earth's axis 23.5 degrees
    - Summer = Northern Hemisphere is tilted into more direct light.
    - Winter = Northern Hemisphere tilts away from the direct light.

Different parts of the world have seasons at different months of the year.

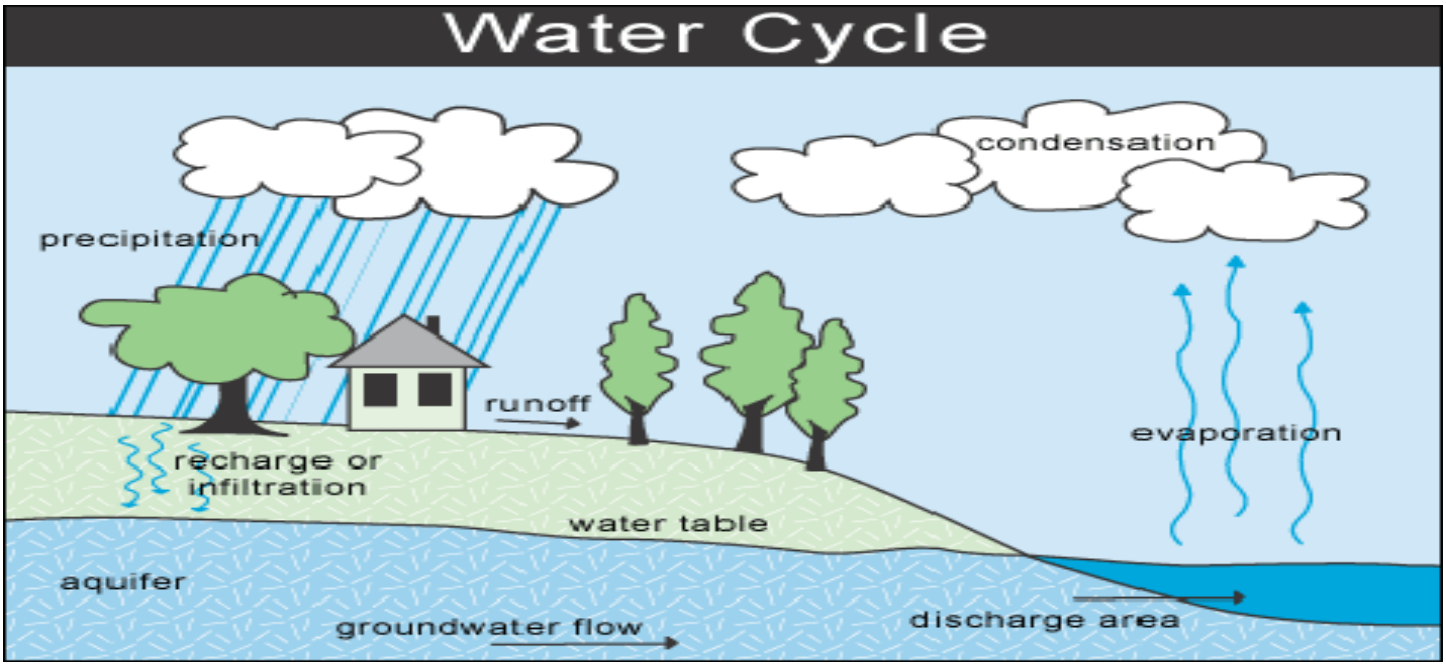
Part III: Earth the water planet

- High Specific Heat: Hydrogen bonds absorb heat when they break, and release heat when they form.

The Oceans
-Heat and cool the earth.
-The oceans influence climate by absorbing solar radiation and slowly releasing heat needed to drive the atmospheric circulation. (High Specific Heat).
-Warm seas and wind are moved to the icy poles
-Humidify and dry the planet.
-Control the wind speed and direction.
-Part of the water and carbon cycle
-Phytoplankton in ocean produces half the oxygen
-Releases aerosols (small particles) that influence cloud cover, fall as rain, and absorbing carbon.

- El Nino: A warming of the surface water of the eastern and central Pacific Ocean, occurring every 4 to 12 years and causing unusual global weather patterns.
  - Generally occurs in winter.
  - Winds get weaker, thus ocean gets warmer.
  - Thunderstorms that normally occur on the equator move eastward.
    - Southwest U.S. gets more water, Australia and Indonesia gets less (maybe).
- La Nina: Unusually cold temperatures in Pacific. Brings the opposite of El Nino.

The hydrologic cycle: The continuous movement of water on, above, and below the surface of the Earth.



Evaporation – Substance changes from a liquid state to gas state (requires energy).

Condensation – Water vapor (gas) turns back to a liquid. (energy required / cold) -cloud formation.

Precipitation – Water that is so heavy it falls as liquid / solid.

Sublimation – Solid state turns directly to a gas state skipping liquid phase.

Evapotranspiration – Water released by plants into air.

- Non-living to the living, and back again.

Surface run-off: The water flow which occurs when soil is full to capacity and excess water travels over the land.

Percolation: The slow movement of water through the soil.

Groundwater discharge: Water that has been underground seeps back into the oceans, or into rivers or lakes.

Humidity: Wetness in the atmosphere
Evaporation: Water turns from liquid to gas.
Condensation: Water turns from gas to liquid

Dew: moisture condensed from the atmosphere, esp. at night, and deposited in the form of small drops upon any cool surface.

Dew Point: The temperature to which air must be cooled for saturation to occur.

Sling psychrometer: Device used to measure humidity.

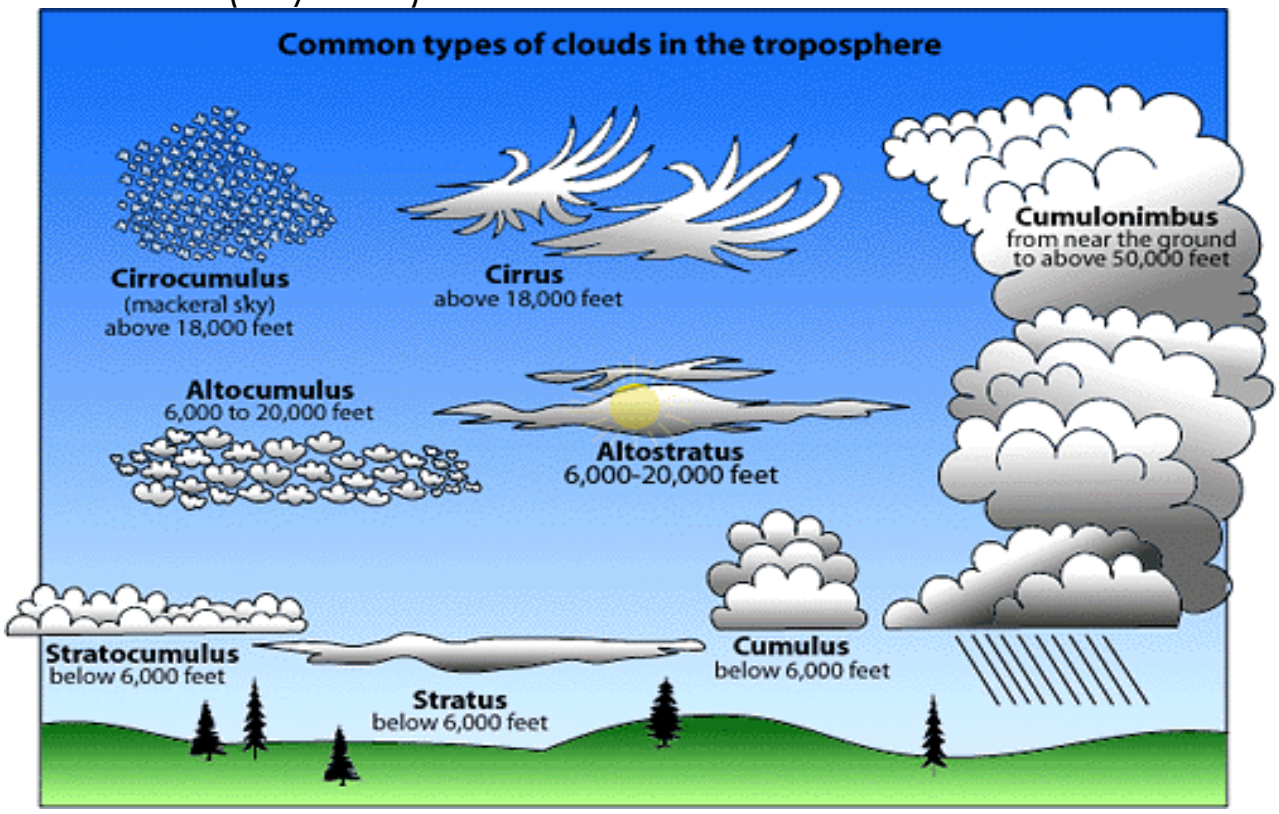
Cloud: A visible body of very fine water droplets or ice particles suspended in the atmosphere at different altitudes.

Clouds

- Water molecules attach to a condensation nuclei.

Fog: A cloud bank that is in contact with the ground.
In really dry places, morning fog can be collected. Desert animals take advantage of dew.

- The three main types are
  - - Cirrus (Wispy)
  - - Cumulus (Puffy)
  - - Stratus (Layered)



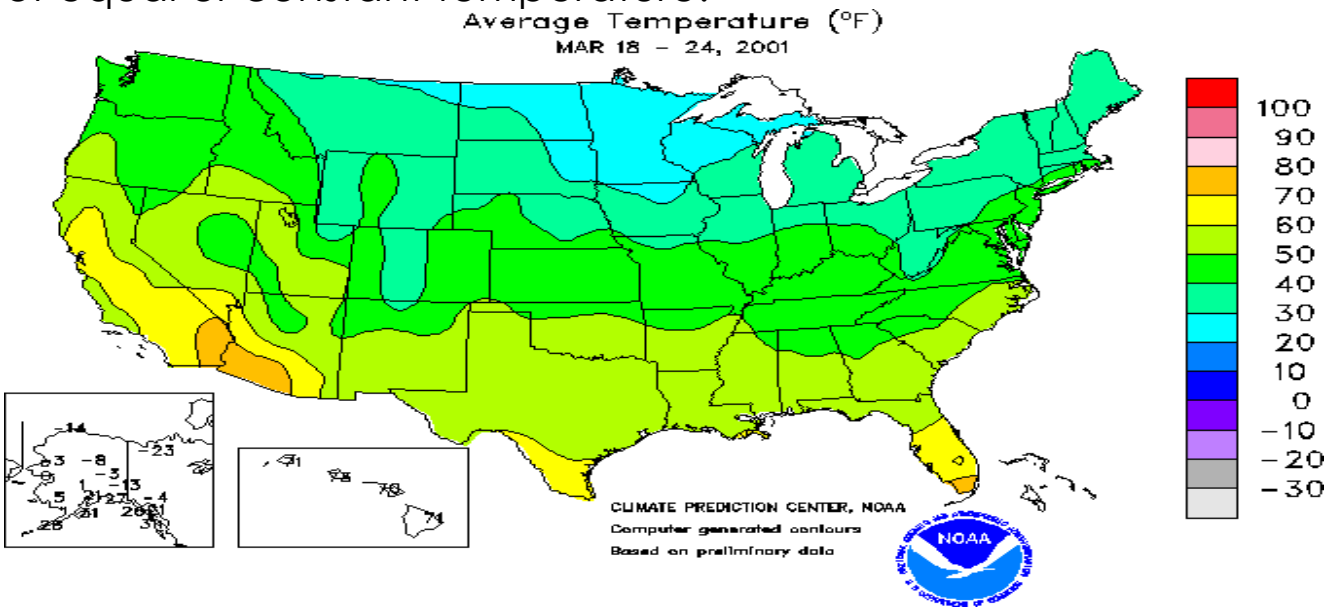
- **Cumulonimbus**
  - Very tall
  - Dense, heavy, dark massive thunderstorms
  - hard showers, explosive top, great vertical development

Meteorology: The study of atmosphere that focuses on weather process and forecasting.

- Most common weather tools
  - - Thermometer

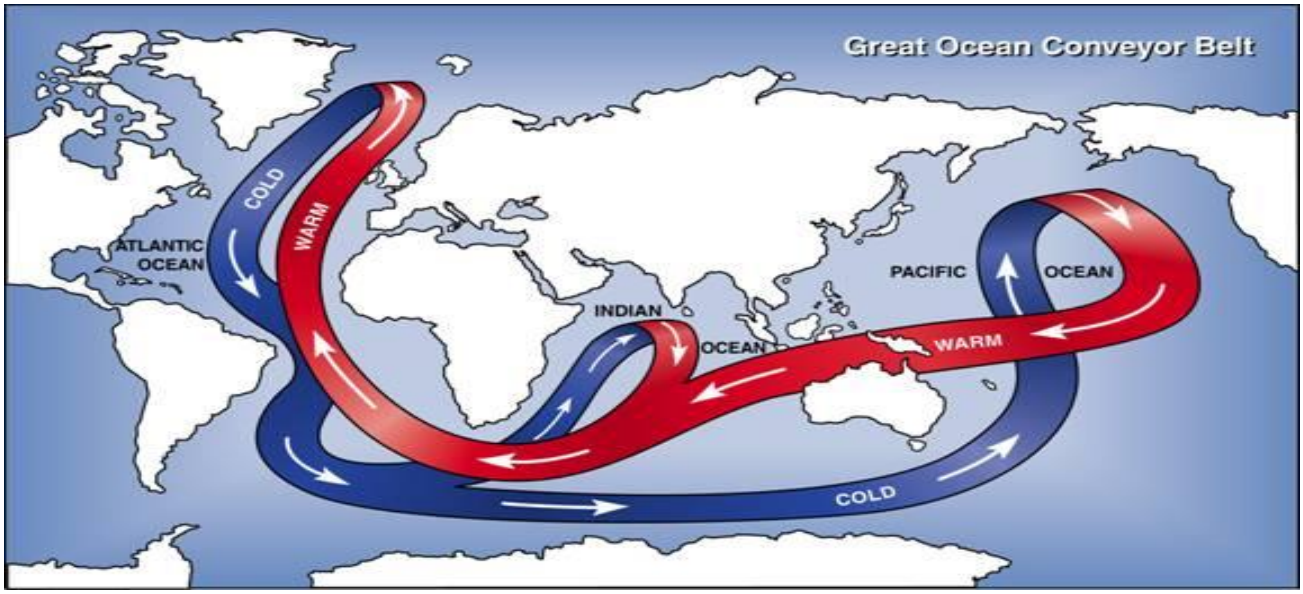
- - Wind Vane – Wind direction
- - Anemometer – Wind speed
- - Barometer – Measures air pressure
- - Rain Gauge: Measures rainfall.
- - Snow / rain equivalent = One inch of rain is about 10 inches of snow and vice versa.
- - Satellites: Provide larger view of weather.

Isotherm- A line drawn on a weather map or chart linking all points of equal or constant temperature.



Ocean currents from tropics keep Arctic from growing too large.

Ocean currents from poles keep tropics from becoming to warm.

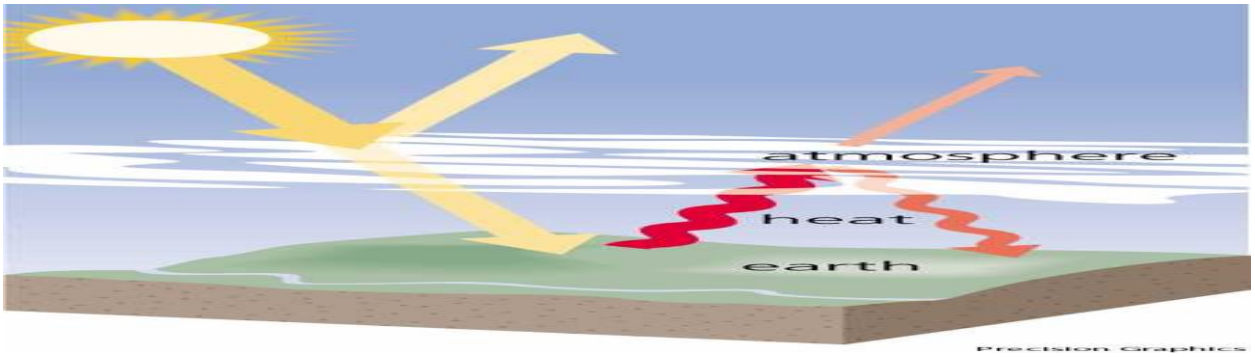


NEW AREA OF FOCUS: ENHANCED GLOBAL WARMING / Climate Change

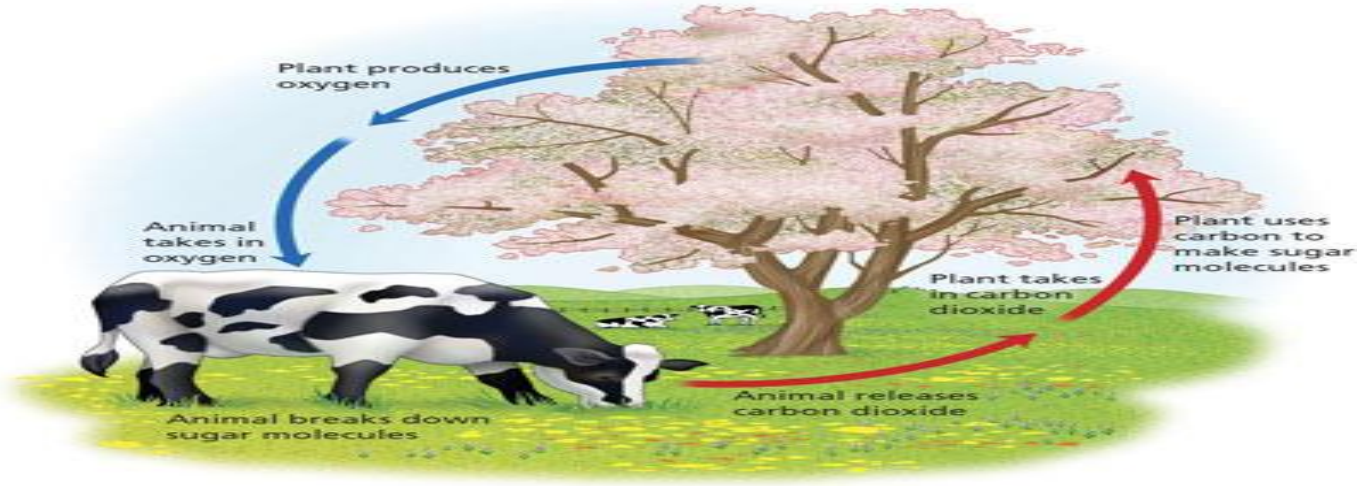
Specifically: Enhanced global warming or Anthropogenic Global Warming.

- Global Climate Change: The gradual warming of the Earth caused by the greenhouse effect.
  - The result of man-made emissions of greenhouse gases such as carbon dioxide.

- Greenhouse Effect: Trapping of Earth's heat at or near the surface



The natural carbon dioxide oxygen balance on our planet.



These fossils fuels when burned release carbon dioxide that has been locked away under the Earth for millions of years into the system.

Increases in carbon dioxide levels in the atmosphere traps in more of the Earth's radiant heat causing planet to warm.

- The Effects of global warming – The big 6
  - - Spread of Disease
  - - More Hurricanes (warmer water)
  - - Long droughts and intense heat waves
  - - Rapid Ecological Changes
  - - Economic consequences
  - - Polar Ice Caps Melt and Sea Level Rise
  - - Arctic species will lose habitat / become extinct.

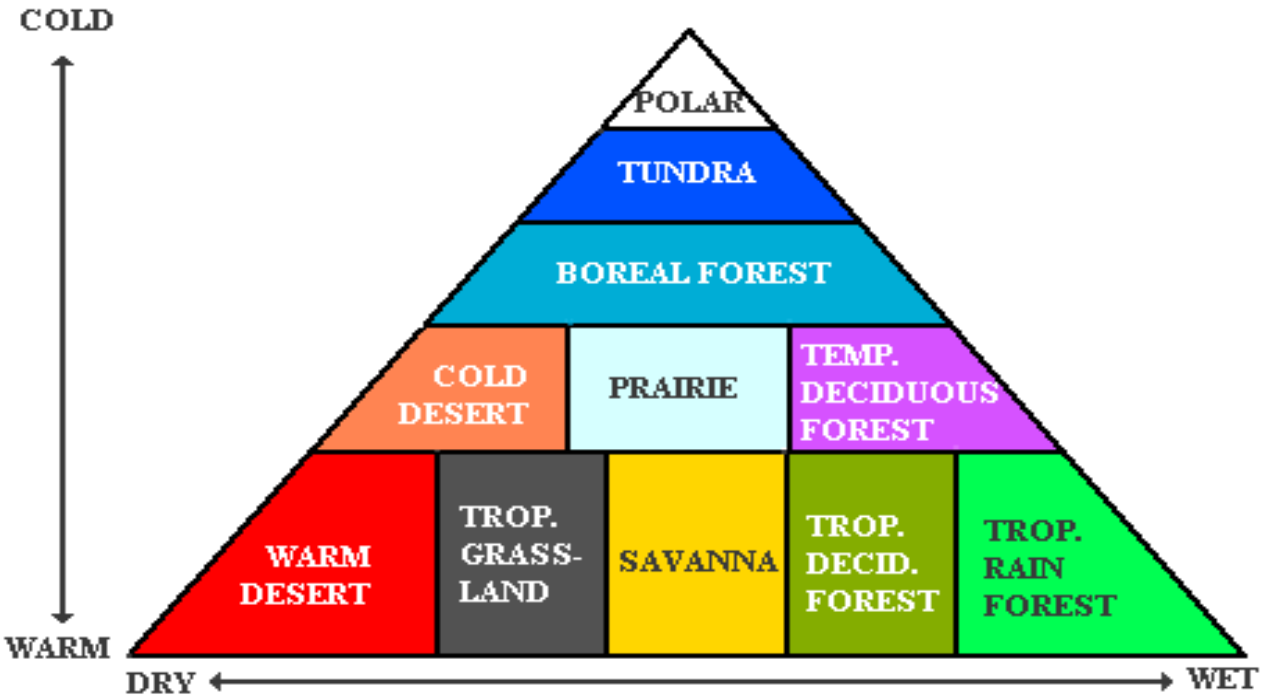
Cartoon of these three

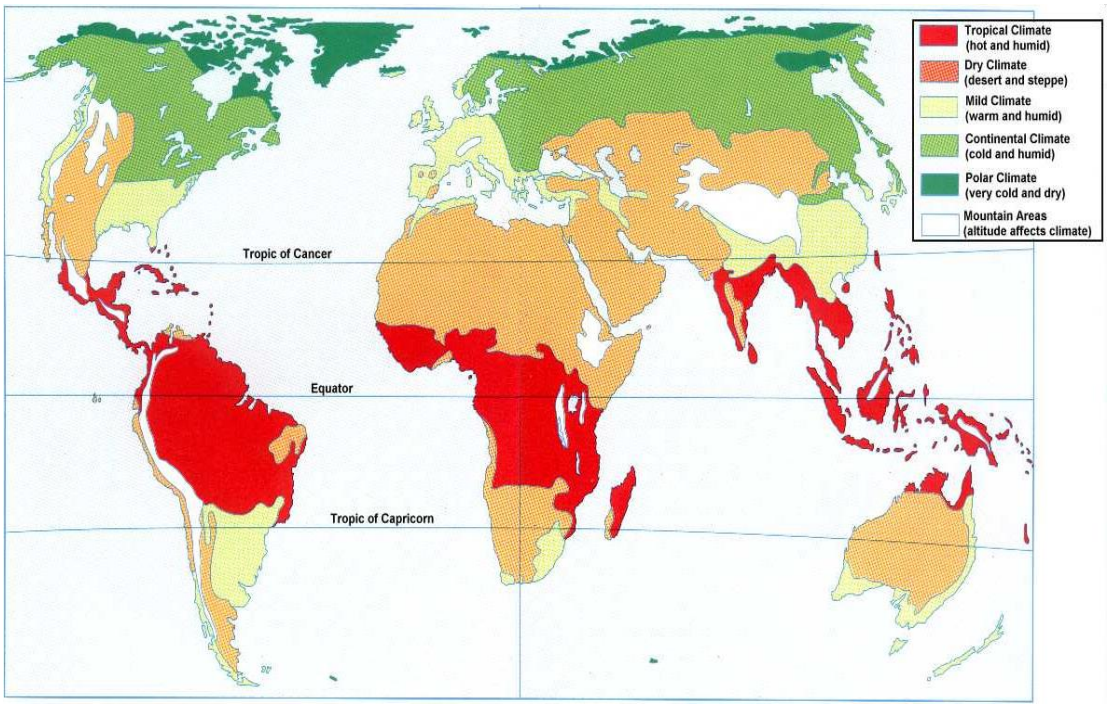
Richard Alley Wallace Broecker John Christy

NEW AREA OF FOCUS: BIOMES

A biome is a large, distinctive complex of plant communities created and maintained by climate.

Rainfall and temperature determine the type of biome.





Marine Biome: Covers ¾ of globe, oceans, coral reefs, estuaries.

SAVE THIS FOR THE UNIT ASSESSMENT