

Physical Oceanography



- Surface tension
- Viscosity
- Light transmission
- Sound transmission
- Pressure
- Thermal properties of water
- The Hydrologic Cycle



Surface Tension

- Measure of the tendency of surface molecules of a liquid to cling together
- Very high for water
- Only higher is Mercury

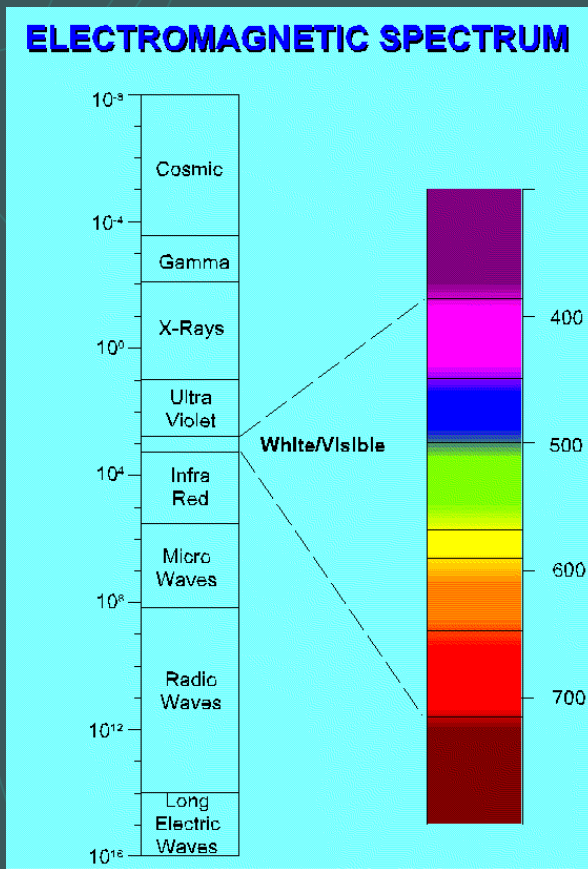
Viscosity

- The tendency to resist flow
- How is water's flow different to animals?

Viscous to small organisms

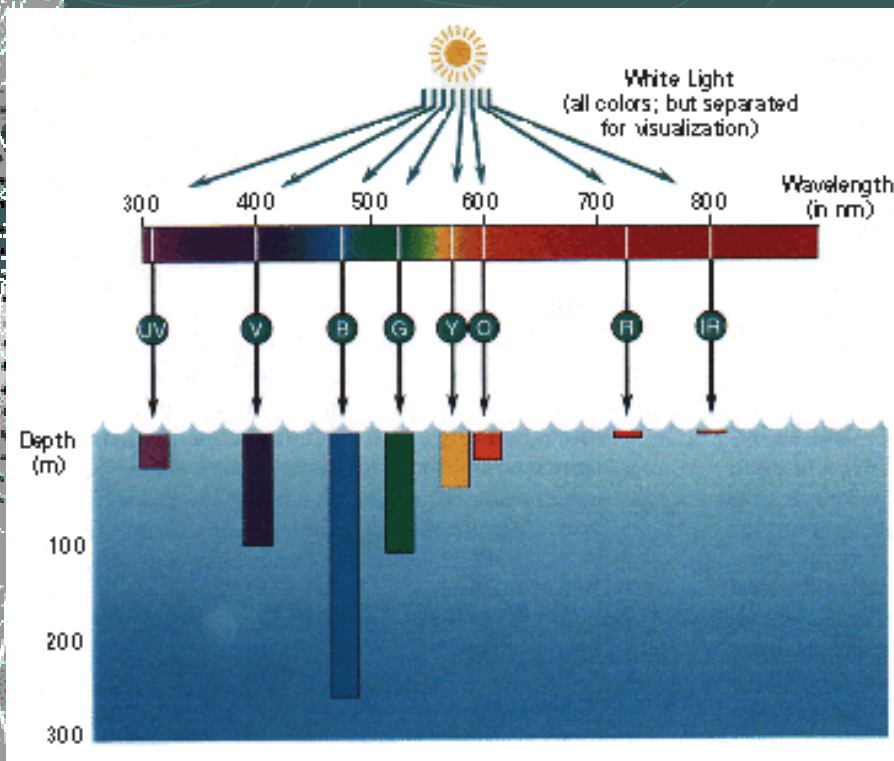


Light Transmission



- ROY G BIV
- Light is absorbed as you go down
- Order?
- ROY G BIV
- Blues and greens are last

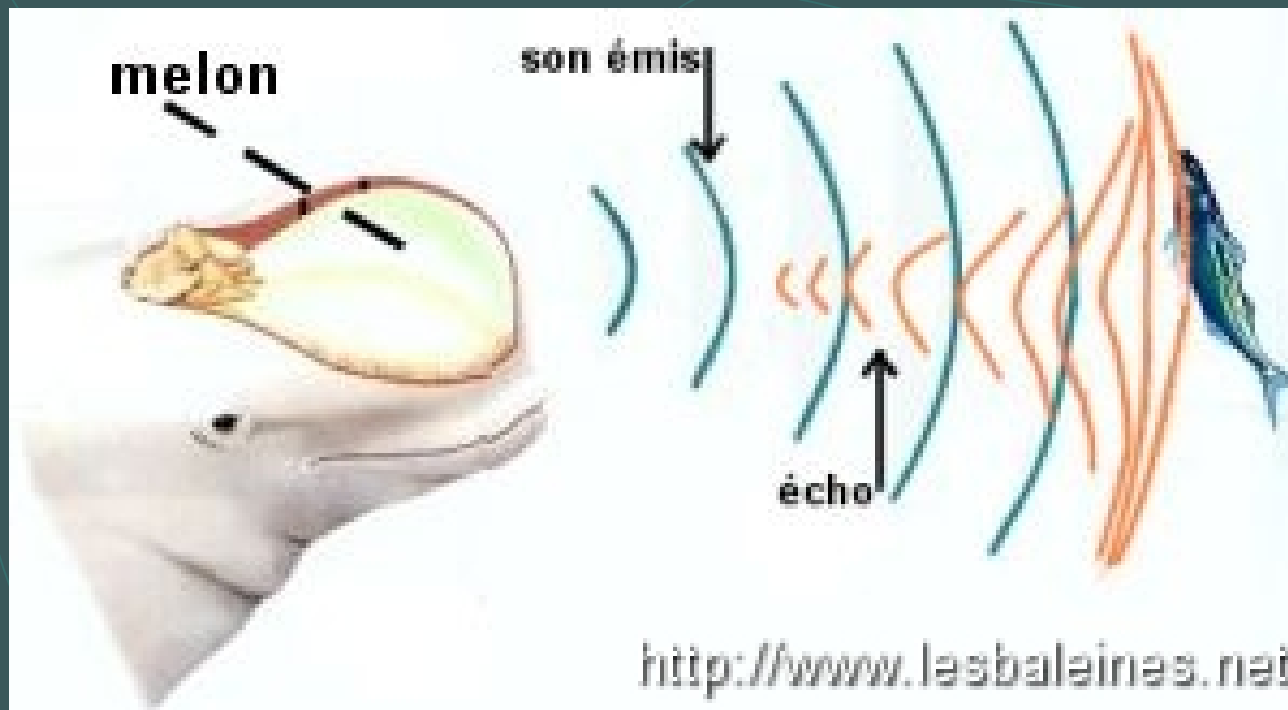
Light Transmission



- Light absorption with depth
- 1 meter 50%
- 100 meters 99%
- 1000 meters 100%

Sound Transmission

- Sonar - detection used underwater
- Marine animals use echolocation



Sound Transmission



- Have you ever tried listening under water?
- Sound travels 4 x faster in water
- Sound velocity increases with:
 - Pressure
 - Temperature
 - Salinity



Pressure

- 14.7 lbs/in² at sea level
- Every 10 meters/ 33 feet it increases 1 atmosphere
- 0 m/ 0 ft 1 atm
- 10 m/ 33 ft 2 atm
- 20 m/ 66 ft 3 atm
- 30 m/ 99 ft 4 atm

Thermal Properties of Water

3 phases

● Solid

● Liquid

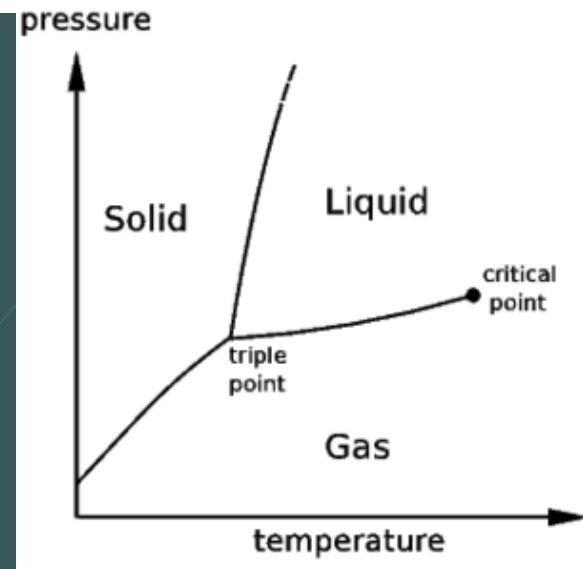
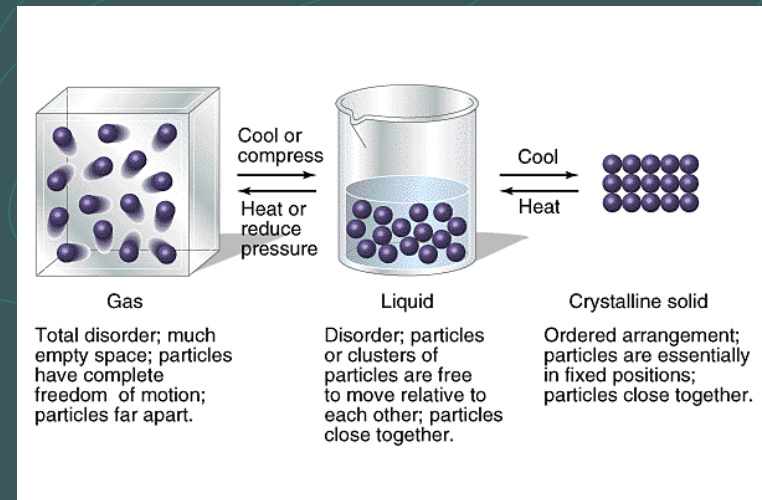
● Gas

● Melting

● Evaporation

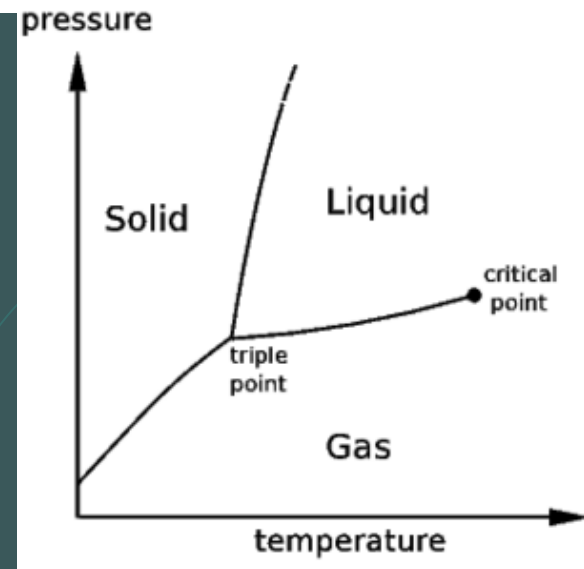
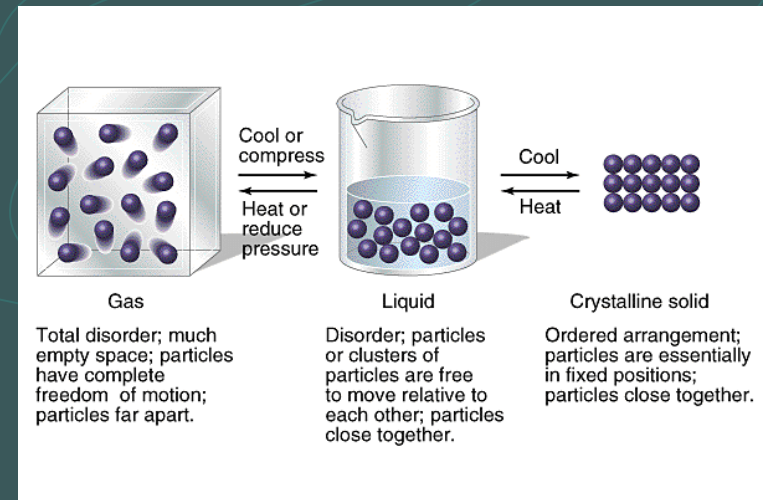
● Fusion

● Condensation



Thermal Properties of Water

- Specific heat capacity - ability of substance to store heat
- Heat is added to break molecular bonds
- Latent heat of evaporation = Latent heat of condensation

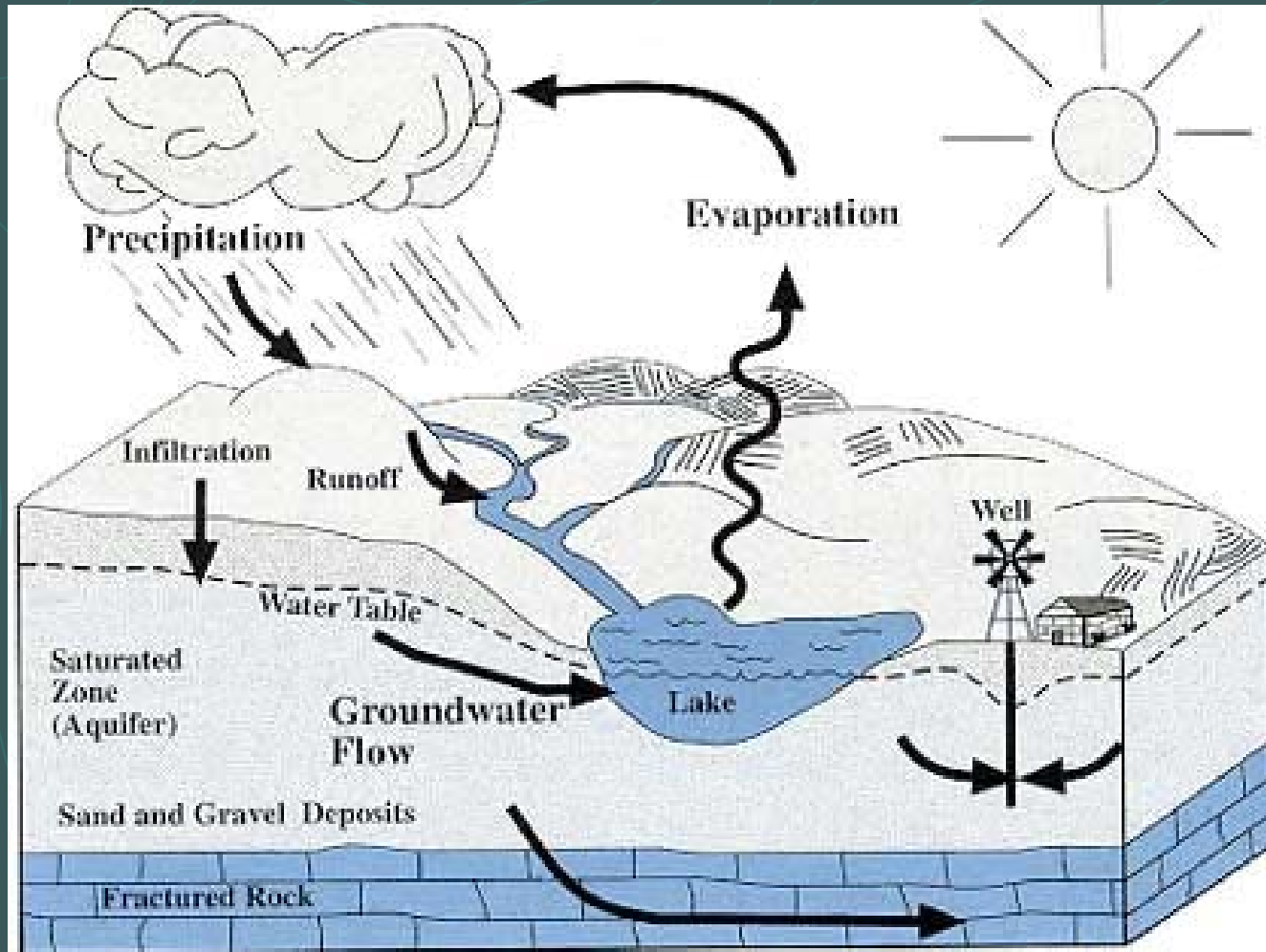




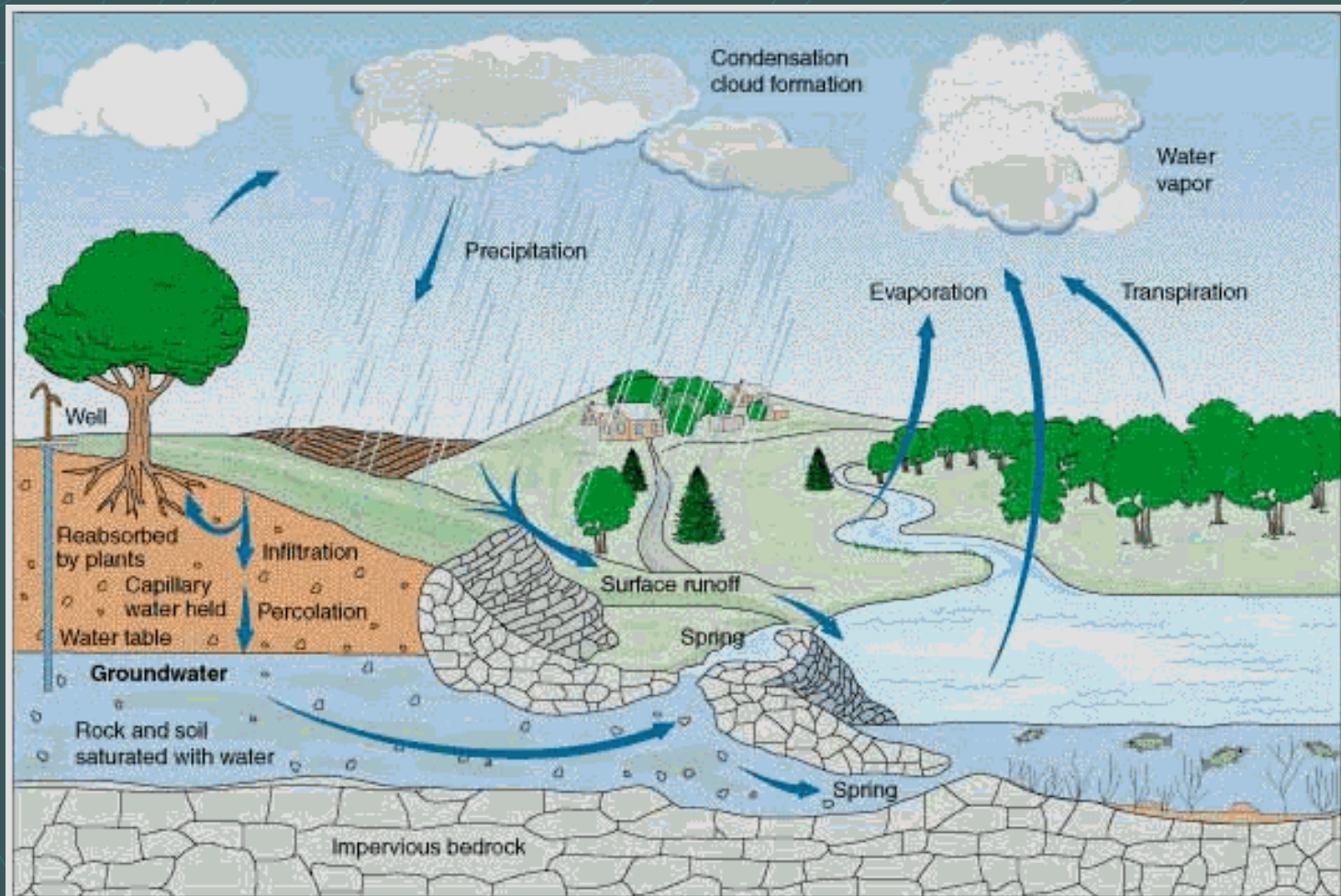
The Hydrologic Cycle

- Upper 1 meter (33 ft) evaporates every year
- Water distribution:
 - 97% in the oceans
 - 2% in glaciers
 - 1% in ground water, rivers, lakes
- Glacial periods allow water to go to the glaciers (sea level ↓)
- Global warming causes coastal erosion (sea level ↑)

The Hydrologic Cycle



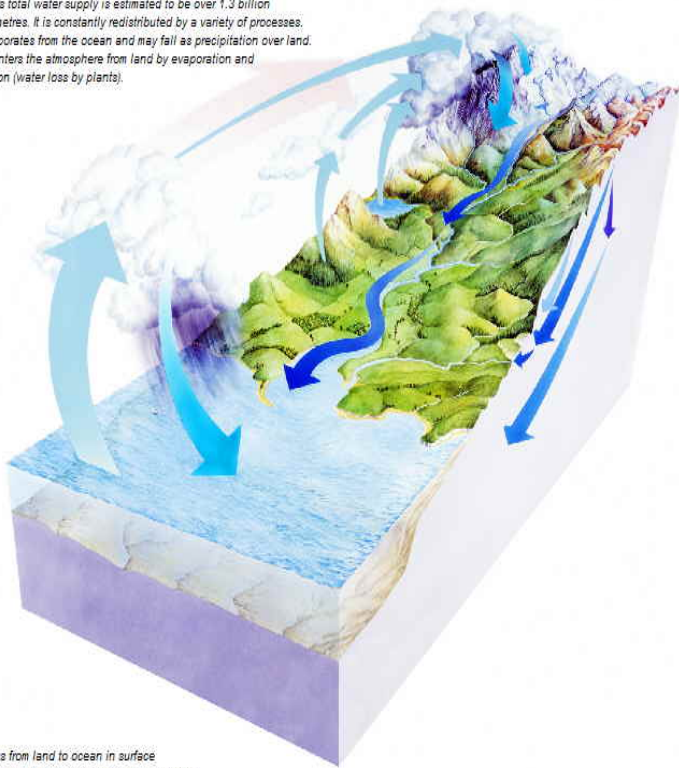
The Hydrologic Cycle



The Hydrologic Cycle

Water Cycle:

The Earth's total water supply is estimated to be over 1.3 billion cubic kilometres. It is constantly redistributed by a variety of processes. Water evaporates from the ocean and may fall as precipitation over land. Water re-enters the atmosphere from land by evaporation and transpiration (water loss by plants).



Water flows from land to ocean in surface rivers and streams. It also travels through soil and rock as groundwater. There is 30 times as much fresh water below ground than in lakes, rivers and inland seas.

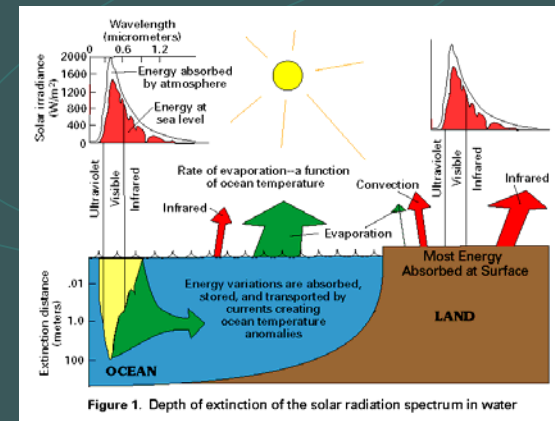
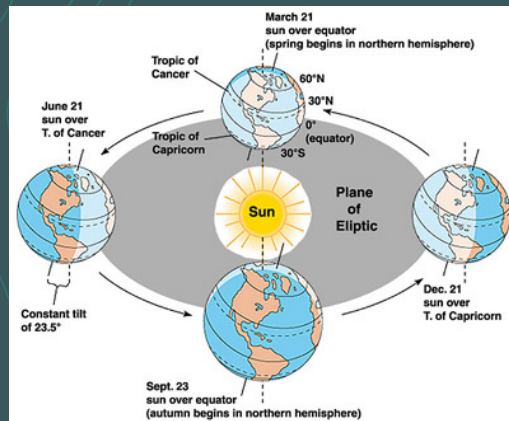
- Redistributes heat globally
- Constant source of fresh water
- Constant cleansing atmosphere (pollution)



Additional Sections

- Air-Sea Interaction
- Ocean Circulation
- Waves and Water Dynamics
- Tides
- Coast Beaches and Shoreline Process

Air-Sea Interaction



- Unequal solar radiation creates unequal atmospheric pressures
- Atmospheric pressure differences create wind

Air-Sea Interactions

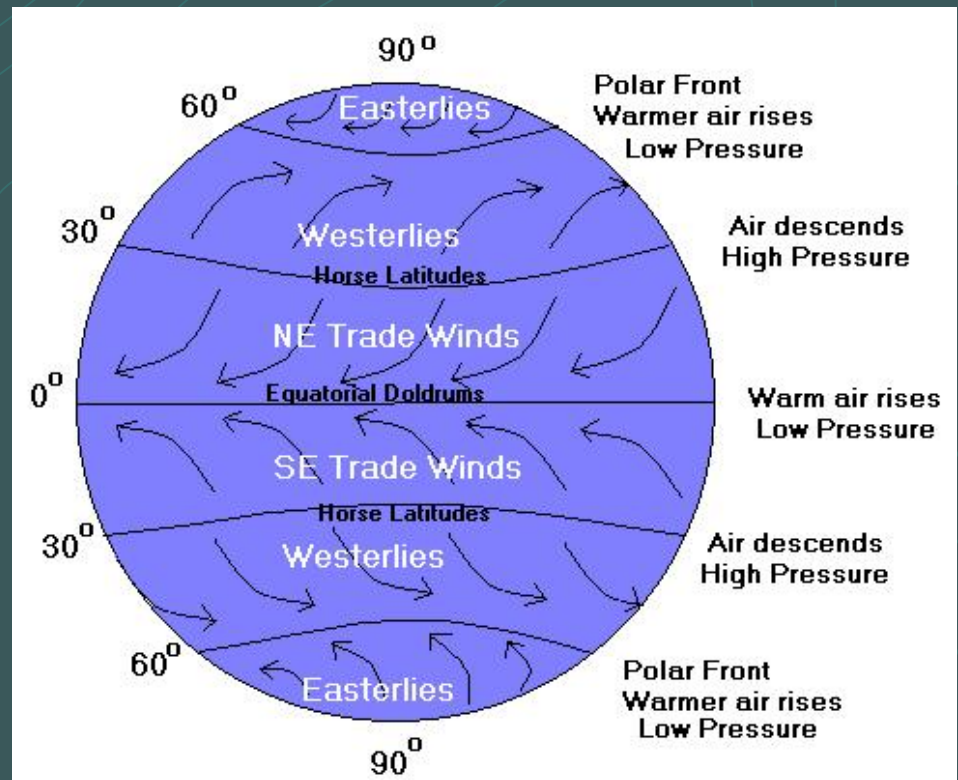
- Winds go from high to low pressure

- Coriolis Effect

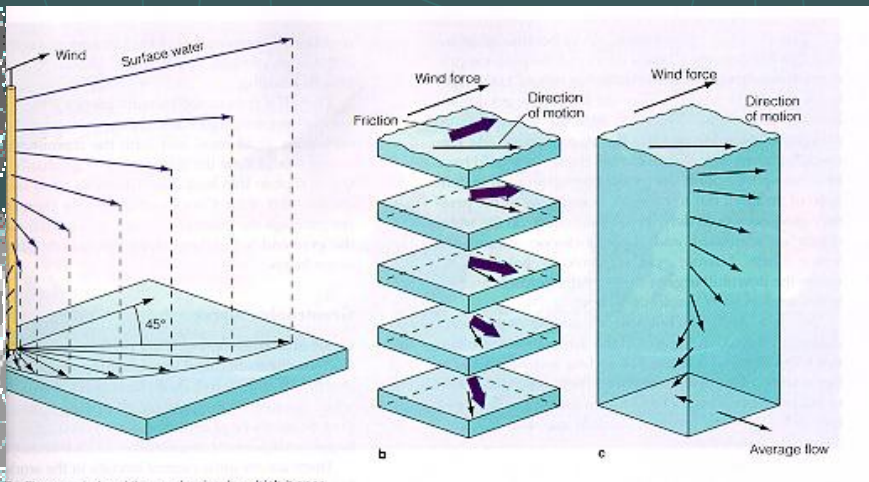
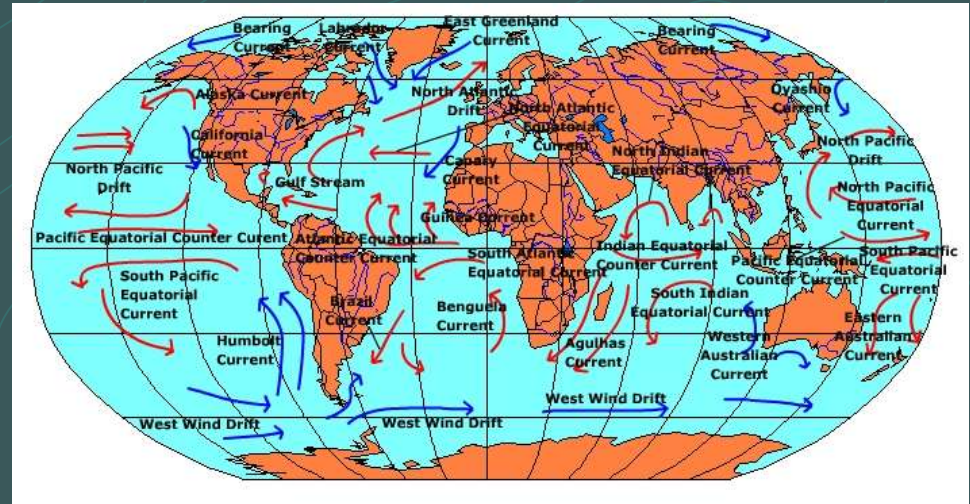
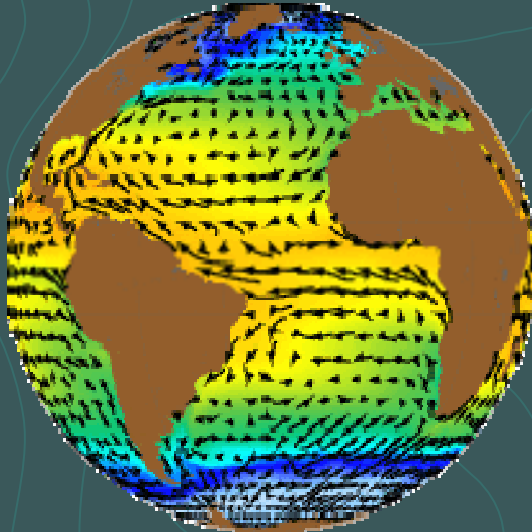
- Circulation around high pressure

 - Clockwise North H.

 - Counter-clockwise South H.

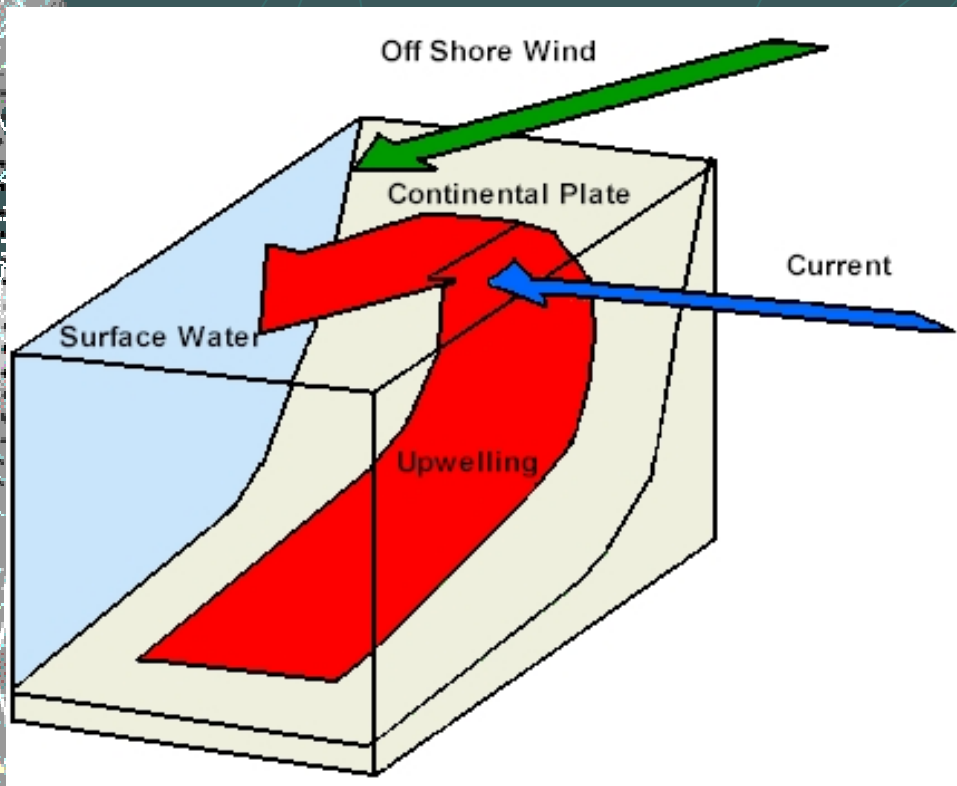


Ocean Circulation



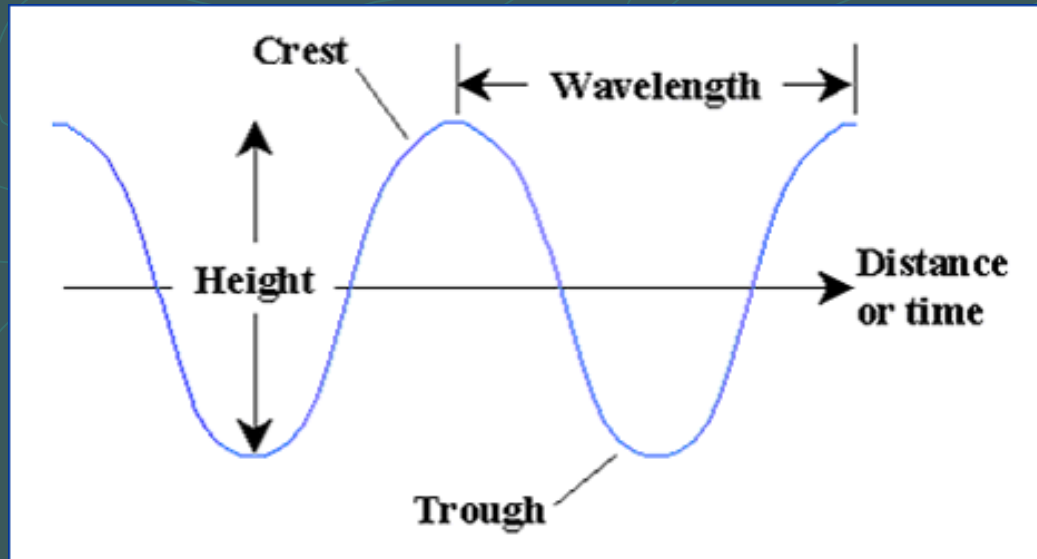
- Ekman Spiral - watermass transport in the layer (90° right of wind N.H.)
- El Nino

Ocean Circulation



- Upwelling - rising of water rich in nutrients toward the surface, usually the result of diverging surface currents

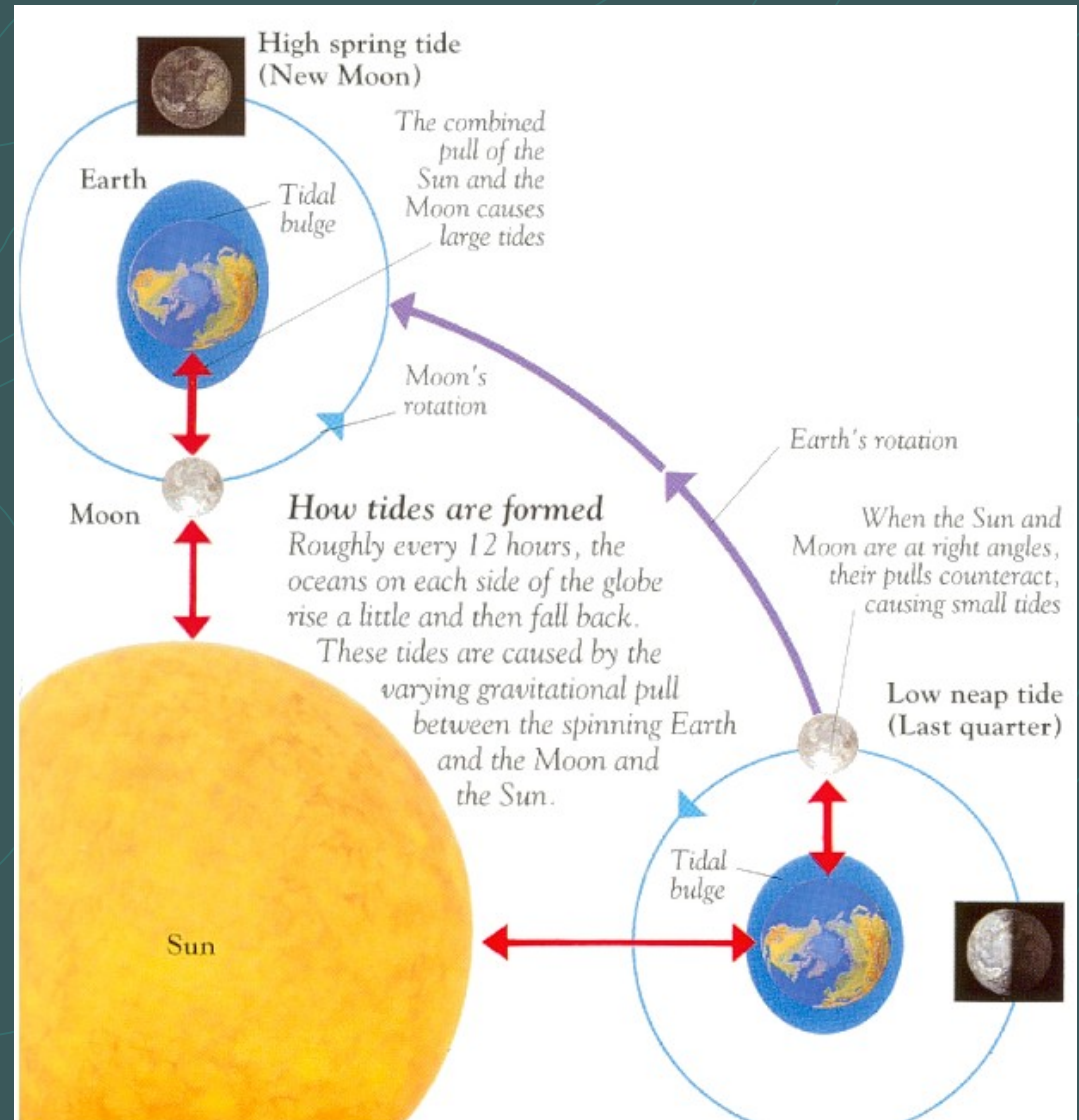
Waves and Water Dynamics



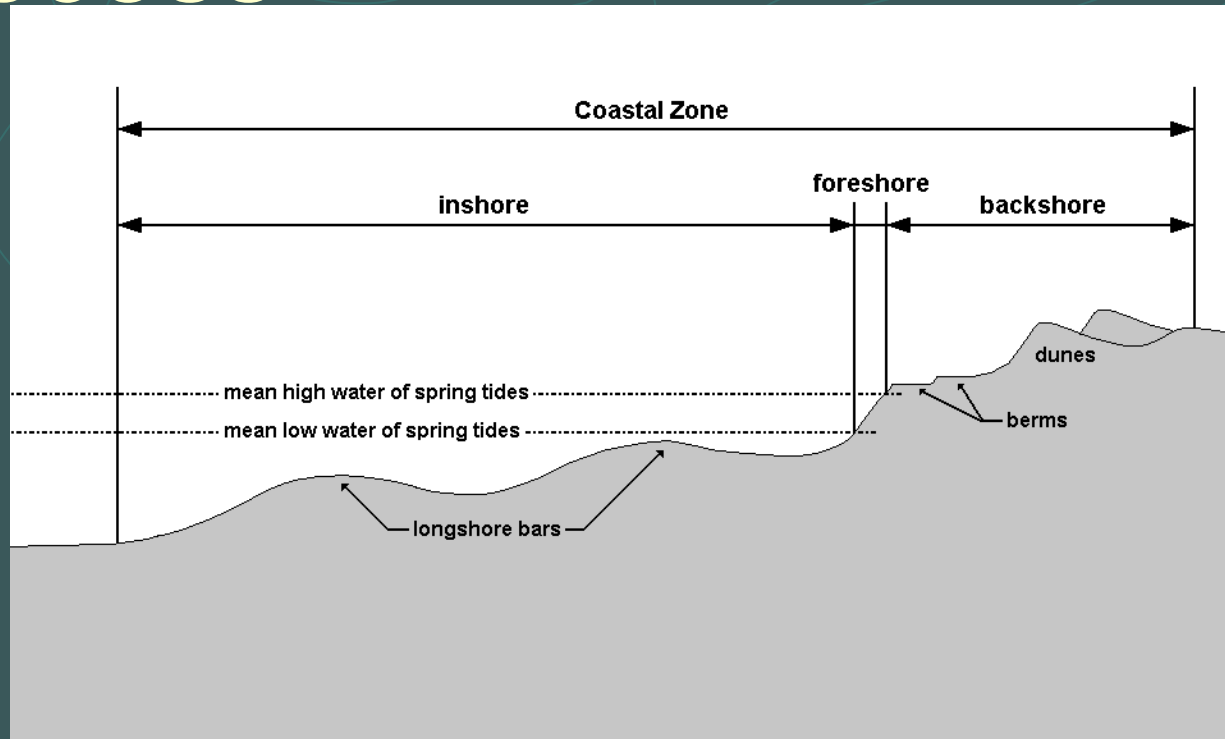
- Waves “feel bottom”
- Examples: swell, spilling, plunging, surging, refraction, orthogonals, storm surge, tsunamis, internal waves

Tides

- Tidal range - difference between high and low tide
- Moon's orbit is 29 1/2 days



Coast Beaches and Shoreline Process



- Long shore currents - parallel to the coast
- Rip currents - perpendicular to the coast