The Hydrologic Cycle, Pt. 1

Ecology

Question of the Day

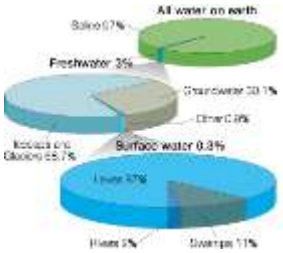
- What percent of the Earth's surface is freshwater that is available for human needs?

Water is everywhere

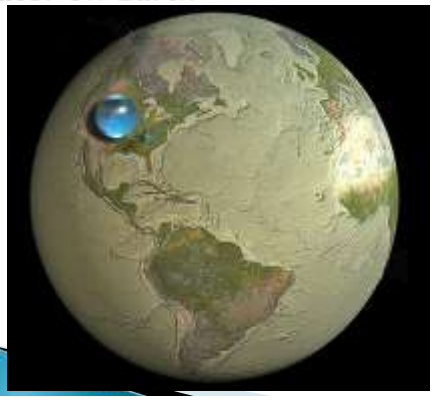
- Water covers 71% of the Earth's surface

Freshwater on Earth

- 97.5% of the water on Earth is salt water
- 2.5% fresh
  - Mostly in polar ice caps or glaciers
  - .77% accessible groundwater



Water on Earth



The Uses of Water (more later)

- Drinking water
- Water for industry
- Crop irrigation
- Transportation
- Recreation
- Waste processing + sanitation
- Habitats for wildlife

Water Infrastructure

- Dams, canals, reservoirs, aqueducts, sewers, treatment plants, water towers, irrigation systems, desalination plants

Water and Inequality

- Developed countries
  - Waterborne diseases under control
  - Vast cities in deserts
  - Irrigation allows for lots of agriculture

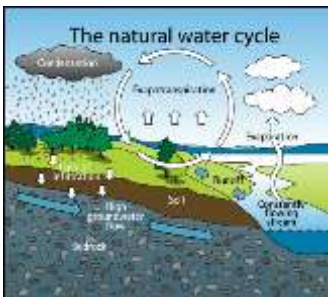
- Developing countries
  - 1.1 billion lack safe drinking water
  - 2.6 billion lack sanitation
  - 1.7 million die/year due to waterborne diseases

Water Problems

- Groundwater aquifer depletion
- Rivers and seas drying up
- Sinkholes
- Diminishing surface water
- Conflicts over water

The Hydrologic Cycle

- Earth's water cycle
  - Evaporation
  - Transpiration
  - Condensation
  - Precipitation
  - Infiltration / percolation
  - Runoff



Evaporation

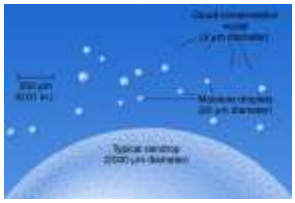
- Particles gain kinetic energy
- Free themselves and enter the atmosphere

Transpiration

- Water vapor exits through leaf pores

Condensation

- Opposite of evaporation
- Water molecules join together
  - Form fog, dew or clouds
- Need a surface to gather on
  - Aerosols: particles in the air that promote droplet formation

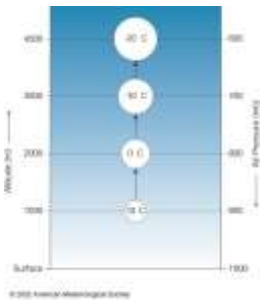


Natural Water Purification

- Only water molecules evaporate
  - Leave behind salts, solids, pollutants
- Water vapor CAN pick up pollutants in the air

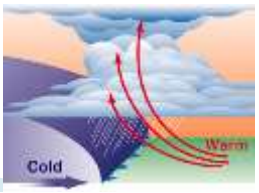
Precipitation

- Warm air can hold more water
- Warm air rises
- Expands as it rises
  - Adiabatic cooling
- Condensation occurs
- Descends
  - Adiabatic warming



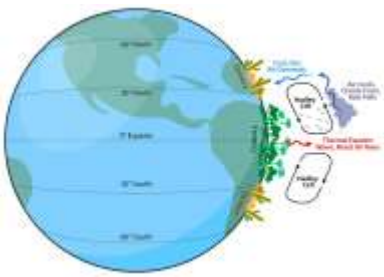
Cold Fronts Often Cause Precipitation

- Cold front moves in
  - Pushes warm air upward
- Warm air cools
  - Condensation, precipitation



Convection and Hadley Cells

- Direct sun at equator
- Warm, wet air rises
  - Rain falls as it condenses
- Dry air falls on subtropical regions
  - Deserts

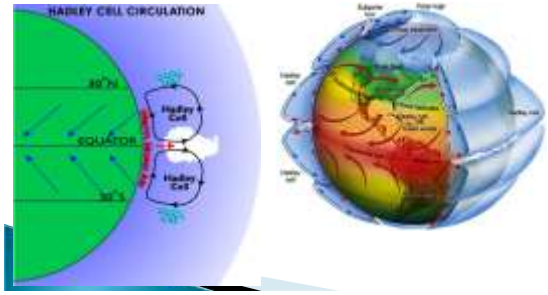


Global Air Flow Patterns

- This pattern occurs across the globe due to adiabatic warming / cooling

Trade Winds

- Because the Earth is rotating, winds are deflected, causing the trade winds.



Rain Shadow

- Moisture-filled trade winds encounter a mountain
- Forced up and over the mountain
  - Causes cooling, high precipitation – desert on other side