Physical Geography Chapter 6

Water is special:
- Dissolve just about anything – Polar nature
- Transports minerals, food, etc and deposits
- Supplies nutrients

Surface tension of water allows for capillary action to occur

Water expands when it freezes - Hydrogen Bonds

Water is slow to heat and slow to cool- Heat capacity

Hydrosphere – Earth's water is in all 3 states

Hydrologic Cycle- closed system globally
- The circulation of water from one part of the general system to another
- Basically Evaporation, condensation, precipitation, transport

Storage Areas of the Hydrologic Cycle:

1. Atmosphere
2. Oceans
3. Freshwater Bodies
4. Plants/ Animals
5. Open spaces beneath surface
6. Glacial Ice

Water in the atmosphere
Closed system →Reflects water budget
(losses are gains, etc)

Latent Heat of Vaporization (and Condensation)
540 cal /g – responsible for powering the earth's storms
(Hurricanes, Twisters, Cyclones, storms)

Saturation – air at a given T holds all it can hold
(reached capacity)
- Shower – condensation on walls, etc.
  The capacity varies with Temperature

Dew point – the temperature at which condensation takes place

Humidity

Amount of water vapor in the air

1. Absolute Humidity – measure of the mass of water vapor that exists within a given volume of air (g/m^3, gr/ft^3)

2. Specific Humidity- mass of water vapor per mass air (g/kg)

(Both of the decrease with height from earth)

Absolute will vary with altitude (due to T), while specific will not.

Relative Humidity – Ratio between the amount of water vapor in the air and the amount the air can hold

If T and Absolute Humidity are known, RH can be determined

T = 30° AH = 20 g/m^3

$RH = \frac{20g}{30g} = 67\%$

Two factors are Important in the Horizontal Distribution and variation of Relative Humidity:

1. Water surfaces have more water (duh), land surfaces are drier
2. Temperature of Area
   (Hi – less humid, Lo more humid)

At any one point in the atmosphere, RH varies with the amount of water vapor. Increases can be from:

1. Evaporation
2. Temperature Increases/Decreases

Our perspiration rates tie into this ⇒ Atlanta (90% RH) at 95°
Tucson (15% RH) at 95°

Sources of Atmospheric Moisture

Evapotranspiration

⇓ ⇓

Bodies of water | from plants

Rates of Evaporation

Affected By:
1. Amount of Accesible Water
2. Degree to which the air is saturated with H_20 (dry air is better)
3. Temperature also affects rate (hotter air, more space)
4. Wind – increase evaporation

Potential Evaportransporation – idealized conditions in area under which there would be sufficient moisture for all possible evapotransporation to occur

$\Rightarrow$ Greatest in dry areas Figure 6.5

Condensation

Process by which gas is changed to a liquid

Depends On:
1. RH of the air
2. Degree of cooling
3. Presence of condensation Nuclei

Condensation Nuclei: tend to be hygroscopic
Dust, smoke, etc
Aid in condensation – sea air can condense at 92% RH

Fog
Water vapor condenses on nuclei:

Can affect transportation more than anything

1. Radiation Fog- Surface Inversion Fog
   - Occurs on a cold, clear calm night in mid lats
   - Outgoing radiation cools surface, to dew point
   - Wind can blow it away, may be diurnal
   - Fog burns off from the ground up!
2. Advection Fog- occurs through the movement of warm, moist air over a colder surface, either land or water
   - Usually less localized, also diurnal
   - Can form over large lakes/oceans in the summer (oceans- sea fog)
3. Upslope Fog- during early morning hours, warm air may ascend up a slope.

Other minor forms
1. Dew- forms at the surface (on car, leaf, etc)
2. White Frost forms when below 32º F (sublimation process)
3. Rime – super cooled droplets form – on air planes

Clouds: Most common form of condensation
- Source for all precipitation
- Important too, for they absorb incoming radiation, reflect it, or scatter/ diffuse radiation
- Cool adiabatically- lifted air, expands, and cools 10 º C/1000m (56 ºF/ 1000') (falling air- adiabatic heating)

Insert pretty cloud drawings here:

Pre condensation lapse Rate (Dry Adiabatic Rate) – 10ºC/1000m
Post condensation lapse Rate (Wet Adiabatic Rate) - 5ºC/1000m

- Rates do vary (3.2ºF/ 1000')

The temperature of air that is descending and being compressed always increases at the dry adiabatic rate.

Distribution of Precipitation

- Horizontal
- Latitude Zones
- Variability

<u>Forms of Precipitation</u>

>Collide, capture and fall

1) Rain: most common

>2.5 to 6 mm diameter

>Drizzle: seldom falls vertically, carried by wind

2) Snow: form geometric shapes

3) Sleet: frozen rain, falling to Earth (passes through a cold layer of air and freezes)

4) Hail: forms in cumulonimbus clouds, updrafts

5) Freezing Rain or Glaze: freezes onto a cold surface