

## Atmospheric Moisture

When atmosphere contains enough moisture, water vapor may condense to form:

- Haze
- Fog
- Cloud
- Rain
- Sleet
- Hail
- Snow

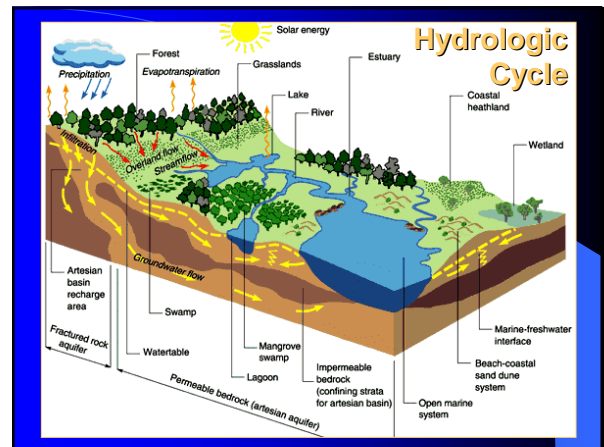
## Water on Earth

- Water vapor is a colorless, odorless, tasteless, invisible gas that mixes freely with the other gases in the atmosphere
- Evaporation – the conversion of moisture from liquid to gas. Involves molecular escape: molecules of water escape from the liquid surface into the surrounding air.
- Evaporation can take place at any temperature, but higher temperatures cause molecules to move faster and collide more forcefully.
- Depends on three factors:
  - Temperature of water and air
  - Amount of water vapor already in the air
  - Whether the air is still or moving

## Land and Water

Ocean	Area (M)	Area (Sq Miles)	Volume (Cm <sup>3</sup> )	Volume (Miles <sup>3</sup> )	Average Depth (M)	Average Depth (Fathoms)
Pacific	178,670	724,320	710,000,000	170,000,000	3,950	6,900
Atlantic	106,400	409,280	365,200,000	87,000,000	3,400	6,300
Indian	74,800	288,310	292,310,000	70,000,000	3,900	7,200
Arctic	14,000	54,000	17,100,000	4,100,000	1,200	2,600

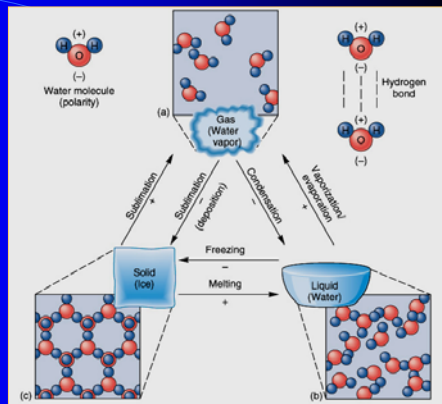
\*Data in thousands (000) includes marginal seas.



## Evapotranspiration

1. Transpiration – the process whereby plants give up moisture through their leaves.
2. Evapotranspiration – total amount of water vapor entering the air from land sources; plants, soil, and other inanimate objects.
3. Potential Evapotranspiration – the amount of evapotranspiration that would occur if the ground at the location in question was saturated all the time.

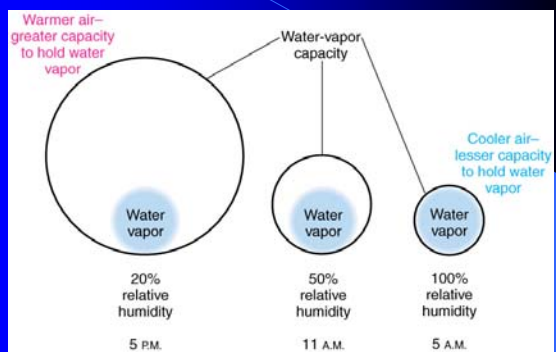
## Three States of Water



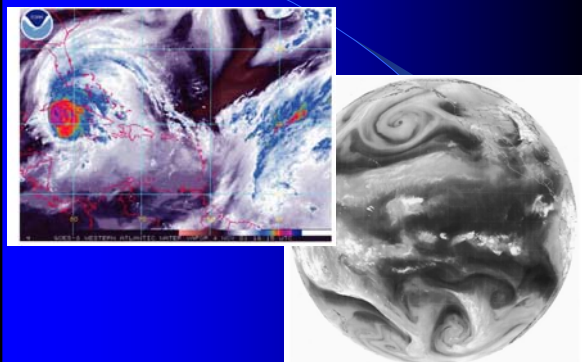
## Humidity

- Relative Humidity
  - Saturation
  - Dew point
- Expressions of Relative Humidity
  - Vapor pressure
  - Specific humidity
- Instruments

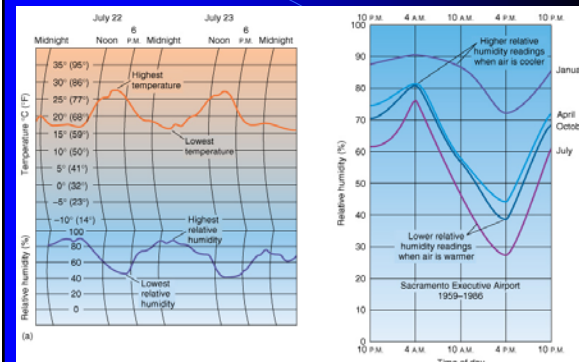
## Relative Humidity



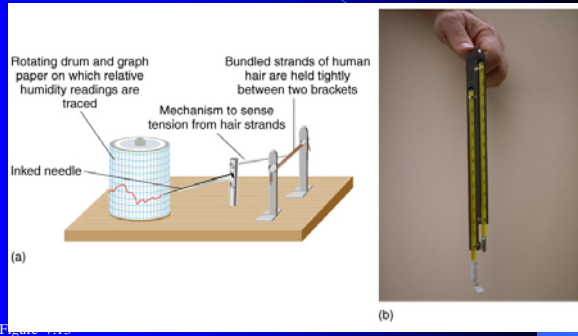
## Water Vapor in the Atmosphere



## Humidity Patterns

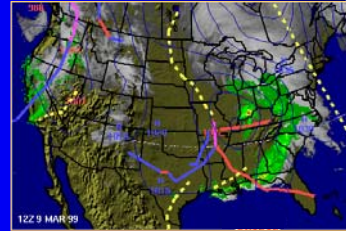


## Humidity Instruments

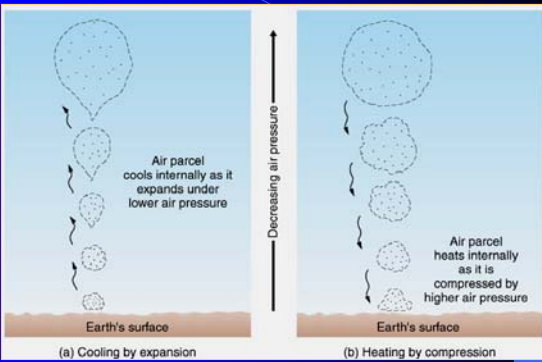


## Atmospheric Stability

- Adiabatic Processes
- Stable and Unstable Atmospheric Conditions

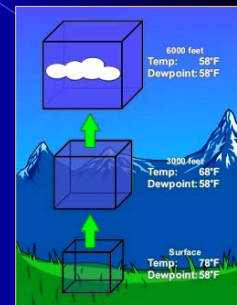


## Adiabatic Processes

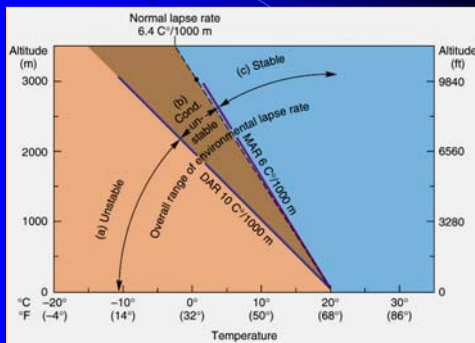


## Adiabatic Processes

- Dry adiabatic rate
  - 10 C° / 1000 m
  - 5.5 F° / 1000 ft
- Moist adiabatic rate
  - 6 C° / 1000 m
  - 3.3 F° / 1000 ft



## Stable and Unstable Atmospheric Conditions



## Clouds and Fog

- Cloud Formation Processes
- Cloud Types and Identification
- Fog



## Clouds and Fog

**Clouds** - collections of minute droplets of water or tiny crystals of ice. visible expressions of condensation. Classified by two factors - form and altitude.

- at any given time, 50% of Earth is covered by clouds.
- not all clouds precipitate, but all precipitation comes from clouds.

## Clouds and Fog

- precipitation only comes from clouds that have "nimb" in their name.
- receive both insolation from above and terrestrial radiation from below, then either absorb, reflect, scatter, or reradiate this energy.

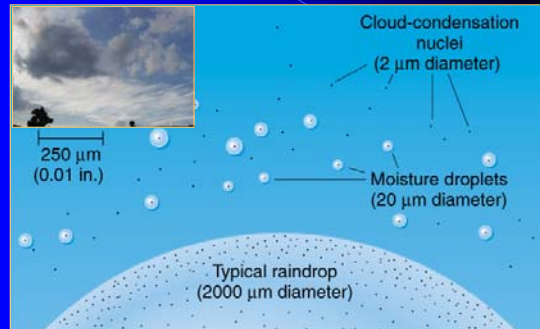


## Cloud Formation Processes

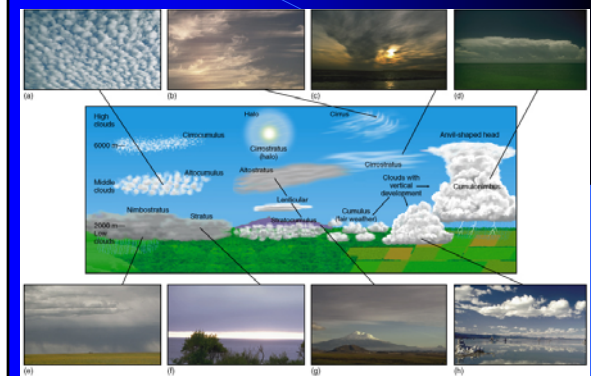
- Moisture droplet
- Cloud-condensation nuclei



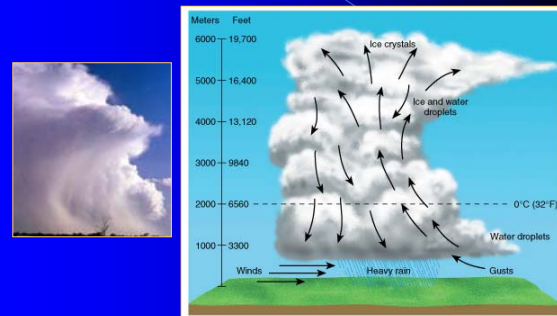
## Moisture Droplets



## Cloud Identification



## Cumulonimbus Development



## Fog



- Advection fog
- Evaporation fog
- Upslope fog
- Valley fog
- Radiation fog

## Advection Fog



## Valley Fog



## Radiation Fog

- Radiation processes dominate
- Thermal, moisture fluxes
- Dynamics and turbulence weak
- Local-scale processes more important

