Moisture Variables (and Thermodynamic Variables)

ATM 209

Mixing ratio: (w) The ratio of the mass of water vapor present to the mass of dry air containing the vapor (units: g/kg):

$$w = \frac{M_v}{M_d}$$

Saturation point: In meteorology, when no additional water vapor can be added to the atmosphere in a vapor phase; any additional H_2O results in condensation (gas to liquid), or deposition (gas to solid).

Saturation mixing ratio: (w_s) The ratio of the mass of water vapor assuming a parcel is saturated with water vapor to the mass of dry air containing the vapor.

Specific humidity: (q) The ratio of the mass of water vapor to the mass of moist air *containing* the vapor:

$$q = \frac{M_v}{M_d + M_v}$$

Relative humidity: (RH) The ratio of the actual mixing ratio of a sample of air at a given temperature and pressure to the saturation mixing ratio of air at the same temperature and pressure:

$$RH = \frac{w}{w_s} * 100\%$$

Dew point temperature: (T_d) The temperature at which moist air must be cooled (with constant pressure and mixing ratio) in order that it shall become saturated with respect to water.

Wet bulb temperature: (T_w) The temperature to which air may be cooled by *evaporating* water into it at constant pressure until it is saturated (this raises the dew point and lowers the temperature to T_w).

Lifting condensation level: (LCL) The pressure level to which unsaturated air would have to be lifted (decreasing pressure) in a dry adiabatic expansion to produce condensation (i.e., the level of a cloud base, or a potential cloud base).

Potential temperature: (θ) The temperature that a parcel of air would have if it were moved (compressed or expanded) from a given pressure and temperature to a pressure of 1000 mb. (Note: the dry adiabats on a "Skew-T" are lines of constant potential temperature)

Equivalent temperature: (T_e) The temperature that a parcel of air would have it:

1. Expanded (ascended) adiabatically until saturation, then continued expanding until all its moisture precipitated out, then
2. Returned to its original pressure.

(Note: The equivalent temperature will always be equal to or greater than the actual temperature)

Equivalent potential temperature: (θ_e) The temperature a parcel would have if it were taken from its *equivalent* temperature to a pressure of 1000 mb following a dry adiabat.

Wet bulb potential temperature: (θ_w) From the wet bulb temperature, follow a moist adiabat down to a pressure of 1000 mb.