Humidity

- **Humidity is defined simply as the amount of water vapor in the air.**
- **Relative humidity is the most familiar measure of water vapor content.**
    - **The problem with relative humidity and the reason it is not used in meteorological analysis is that it is dependent on temperature.**
        - **Even if the moisture content is unchanged throughout the day, the relative humidity will change because of its dependence on temperature.**
- **A moisture index which is not dependent on temperature is known as the 'dew point' (T_D).**
    - **The temperature at which the atmosphere becomes saturated is the dew point temperature.**
        - **The higher the dew point temperature, the more water vapor that is in the air.**
        - **If the air temperature is equal to the dew point temperature, the relative humidity is equal to 100%.**
        - **The dew point temperature can *never* exceed the air temperature.**
        - **The dew point temperature is usually given in degrees Fahrenheit.**
- **Assuming the air temperature is 80°F or above.**
    - **If the dew point temperature is:**
        - **80°F or higher ---→oppressive**
        - **70°F - 79°F ----→very uncomfortable**
        - **60°F - 69°F ----→uncomfortable**
        - **50°F - 59°F ---→comfortable**
        - **Lower than 50°F -----→very comfortable**

Adiabatic Processes

- **An 'adiabatic process' is one in which temperature changes but no heat is added to or removed from a substance.**
- **Important to the formation of clouds.**
- **In an adiabatic process, expanding air cools and air being compressed warms.**
- **As a parcel rises, it expands due to lower atmospheric pressure surrounding it.**
    - **Air pressure decreases the further you get from Earth's surface.**
- **As a parcel descends toward Earth, it compresses due to higher atmospheric pressure surrounding it.**
    - **Air pressure increases the closer you get to Earth's surface.**

- **When a parcel expands, there are fewer molecular collisions within the parcel because of the greater space the parcel occupies. As a result, temperature decreases.**
- **When a parcel compresses, there are more molecular collisions within the parcel because of the lesser space the parcel occupies. As a result, temperature increases.**
- **The rate at which a rising air parcel cools is known as the 'adiabatic lapse rate' and is equal to 1.0°C/100 m (or 5.5°F/1000 ft.).**

Environmental Lapse Rate

- **The 'environmental lapse rate' (ELR) is different from the 'adiabatic lapse rate' in that the environmental lapse rate measures temperature changes in the vertical for a large mass of air, instead of an air parcel.**
    - **In other words the environmental lapse rate measures the overall decrease in temperature with increasing height.**
    - **The value of the 'ELR' in the troposphere is variable and does not have a fixed value.**

Forms of Condensation

- **Dew is a liquid which condenses on a surface.**
    - **Most likely to form on clear, windless nights.**
    - **When the temperature cools to the dew point, dew forms.**
- **Frost is similar to dew except that it occurs when the temperature is below freezing.**
    - **Frost involves the phase change from water vapor to ice, without going through the liquid phase.**
- **Fog is a cloud at Earth's surface.**
    - **Forms when the air temperature lowers to the dew point.**
- **Steam fogs occur when very cold, dry air interacts with warm, moist air over a body of water.**
- **Radiation fogs occur when the temperature at night cools to the dew point.**
    - **Most likely to form on cloudless nights.**
    - **Dissipate within a few hours of sunrise.**
    - **Forms often in the Central Valley of California.**
- **Advection fogs develop when warm, moist air moves horizontally (i.e., advects) over a cooler surface.**
    - **The air as a result cools.**
        - **If the air cools to the dew point, fog forms.**
        - **Common during the summer months over the San Francisco Bay area.**
- **Upslope fog develops when air moves upward along a mountain range.**
    - **As a result, it expands and cools adiabatically.**
        - **If the air cools to the dew point, fog forms.**

- **Common along the eastern edge of the Rocky Mountains in Colorado.**
- **The city of Denver, Colorado, being on the foothills of the Rocky Mountains, frequently observes upslope fogs.**

An Aside

- **As an air parcel expands, it cools due to fewer molecular collisions. BUT:**
    - **Why is cold air denser than warm air considering that as volume increases, density decreases as prescribed by 'Density = Mass/Volume' (D = M/V)?**
- **It has to relate to the speed of the molecules.**
- **Warm air molecules move at a higher speed than cold air molecules. This is due to the kinetic energy of the molecules.**
- **Warm air molecules take up a higher spatial magnitude than cold air molecules.**
- **As a result, the density of warm air is lower than that of cold air.**

Helpful Links:

http://ww2010.atmos.uiuc.edu/(Gh)/guides/maps/sfcobs/dwp.rxml

http://apollo.lsc.vsc.edu/classes/met130/notes/chapter6/adiab_cool.html

http://apollo.lsc.vsc.edu/classes/met130/notes/chapter6/adiab_warm.html