Review of Thermodynamics (continued)

Topics:
- Saturation vapor pressure
- Moisture parameters

Saturation vapor pressure (continued)

\[ e_s > e_{xi} \] at all temperatures. This makes intuitive sense, since liquid water evaporates more readily than ice sublimes. Conditions that are saturated with respect to liquid water are supersaturated relative to ice. The magnitude of the difference in saturation vapor pressures is a maximum at -12 °C. A major consequence of this property is that an ice particle in an atmosphere of liquid water saturation will grow by vapor deposition, since it lies in a condition of supersaturation with respect to ice.

Moisture parameters

1. Vapor pressure — Partial pressure of water vapor.

2. Mixing ratio — Ratio of the mass of water vapor to the mass of dry air,

\[ w = \frac{m_v}{m_d} \]

and

\[ w = \frac{e}{p-e} = \frac{e_p}{p} \]
3. Specific humidity — Ratio of the mass of water vapor to the mass of moist air,

\[ q = \frac{m_v}{m_v + m_d} \]

In practice, the abbreviation for mixing ratio can be \( w \), \( r_v \), or \( q_v \).

4. Relative humidity — Ratio of mixing ratio to its saturation value at the same temperature and pressure, usually expressed as a percentage,

\[ RH = 100 \frac{w}{w_s(p, T)} \approx 100 \frac{e}{e_s} \]

5. Dew point temperature— Temperature to which air can be cooled at constant pressure until saturation is reached.

6. Wet bulb temperature — Temperature to which air can be cooled at constant pressure by evaporating liquid water into it until saturation is reached.