HUMIDITY VARIABLES

The following terms are all used to indicate humidity, the amount of moisture or water vapor in the atmosphere:

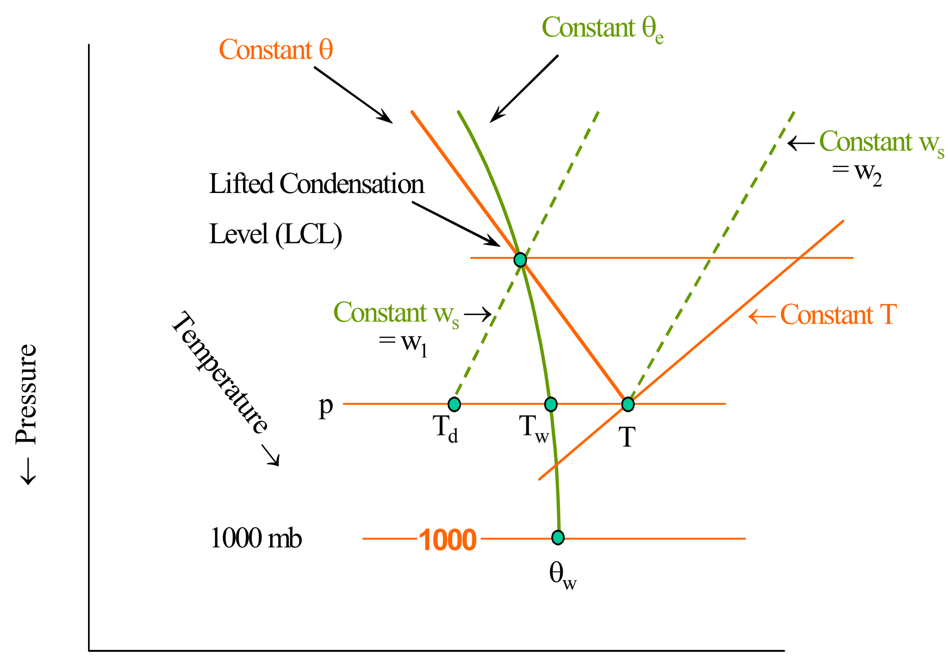
Symbol	**Units**	**Name**	**Definition**
ρ_v	kg/m^3	absolute humidity	partial density of water vapor
n_v	molecules/m^3	absolute humidity	number density of water vapor
e	mb	vapor pressure	partial pressure of water vapor
w	g/kg	mixing ratio	ratio of mass of water vapor (M_v) to mass of dry air (M_d)
q	g/kg	specific humidity	ratio of mass of water vapor (M_v) to mass of moist air (M)

$$w = \frac{M_v}{M_d} = \frac{\rho_v}{\rho_d} \qquad q = \frac{M_v}{M} = \frac{\rho_v}{\rho} \qquad w \approx q \qquad (M = M_v + M_d) \qquad (\rho = \rho_v + \rho_d)$$

(Each of the above quantities can be expressed as the **saturation** quantity with the addition of an *s* subscript. This is the maximum value that the quantity can reach at a given temperature and pressure when the air is in **equilibrium** with an underlying flat water surface, and indicates that the air can hold no more water vapor.)

RH	%	relative humidity	$RH = \frac{w}{w_s} = \frac{e}{e_s}\left(\frac{p-e_s}{p-e}\right) \approx \frac{e}{e_s}$
T_d	°C	dew point temperature	temperature to which air must be cooled at constant pressure for it to become saturated with respect to a plane surface of water. $e_s(T_d) = e$, or T_d is the temperature at which w_s becomes equal to w. Therefore $RH = \frac{w_s(T_d, p)}{w_s(T, p)}$
T_w	°C	wet bulb temperature	temperature to which a parcel of air is cooled by evaporating water into it at a constant pressure until the air is saturated with respect to a plane surface of water.

These variables can be illustrated on a skew T- log p diagram as shown on the next page.



In this example, for a parcel with temperature T, dew point T_d, and pressure p:

$$w = w_s(T_d) = w_1$$

$$w_s = w_s(T) = w_2$$

$$RH = \frac{w_1}{w_2}$$

A parcel rising from point (T, p) will go up the dry adiabat (constant θ line) until it reaches the LCL, and will then ascend along the moist adiabat (constant θ_e line).