Wet-bulb Temperature and Dewpoint Temperature from Air Temperature and Relative Humidity

Note: This calculation is very complex and requires knowledge of algebra.

From the user, an air temperature (T), a relative humidity (rh), and a station pressure (p_{sta}) are given. The air temperature must be converted to units of degrees Celsius ($°C$), and the station pressure must be converted to units of millibars (mb) or hectopascals (hPa). To see how to convert temperatures and pressures, see the links below:

http://www.wrh.noaa.gov/slc/projects/wxcalc/formulas/tempConvert.pdf

http://www.wrh.noaa.gov/slc/projects/wxcalc/formulas/pressureConversion.pdf

Then, the saturated vapor pressure (e_s) can be calculated using the formula from the link below:

http://www.wrh.noaa.gov/slc/projects/wxcalc/formulas/vaporPressure.pdf

Next, the equation for calculating relative humidity:

$$rh = \frac{e}{e_s} \times 100$$

can be solved for the dewpoint temperature:

$$T_d = \frac{237.7 \ln\left(\frac{e_s \times rh}{611}\right)}{7.5 - \ln\left(\frac{e_s \times rh}{611}\right)}$$

The dewpoint temperature will be in units of degrees Celsius (°*C*). To see how to convert temperatures, see the link above.

Next, a wet-bulb temperature (T_w) must be calculated. The best way to do this is by using a Skew-T diagram which is used by the National Weather Service and other meteorologists for determining the current state of the atmosphere. A blank Skew-T diagram can be found here at this link:

http://www.eos.ubc.ca/courses/atsc201/BrooksCole/MetSciEngr/BlankSoundings/Skew-T.pdf

For information on how to read and understand a Skew-T diagram, see the link below:

http://www.theweatherprediction.com/thermo/

For finding the wet-bulb temperature, first find the elevation of your location. Next, at the elevation of your location, plot the air temperature (in degrees Celsius) and the dewpoint temperature on the chart. Take the air temperature up the dry adiabat line and the dewpoint temperature up the theta line until they meet. At the point where they meet, come back down the moist (or wet) adiabat to the elevation of your station. This will be the wet-bulb temperature.