Relative Humidity and Dewpoint Temperature from Temperature and Wet-Bulb Temperature

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

From the user, an air temperature (T), a wet-bulb temperature (T_w), and a station pressure (p_{sta}) are given. The temperature values must be converted to units of degrees Celsius $(℃)$.

Also, the station pressure must be converted to units of millibars (mb) or hectorPascals (hPa).

To see how to convert temperatures and pressures, see the links below:

http://www.srh.noaa.gov/elp/wxcalc/formulas/tempConvert.pdf

http://www.srh.noaa.gov/elp/wxcalc/formulas/pressureConversion.pdf

Then, an actual vapor pressure needs to be calculated. To accomplish the calculation, a vapor pressure related to wet-bulb temperature (e_w) and a saturated vapor pressure (e_s) must be calculated first using the equations below:

$$e_s = 6.112 \times e^{\left(\frac{17.67 \times T}{T+243.5}\right)} \quad e_w = 6.112 \times e^{\left(\frac{17.67 \times T_w}{T_w + 243.5}\right)}$$

Where e is the number e.

Then, an actual vapor pressure (e) can be calculated using the equation below:

$$e = e_w - p_{sta} \times (T - T_w) \times 0.00066 \times \left(1 + (0.00115 \times T_w)\right)$$

Finally, a relative humidity (rh) and a dewpoint temperature (T_d) can be calculated using the equations below:

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

$$T_d = \frac{243.5 \, \log\left(\frac{e}{6.112}\right)}{17.67 - \log\left(\frac{e}{6.112}\right)}$$