Appendix 1:
Common Meteorological Calculations

Temperature Conversions:

To convert between Fahrenheit (F), Celsius (C), and Kelvin (K):

$C = (F - 32) * (5/9)$

$F = (9/5) * C + 32$

$K = C + 273.15$

Pressure Conversions:

To convert between millibars (mb) and Pascals (Pa):

$mb = Pa / 100$

Wind Conversions:

To convert between miles per hour (mph), knots (kts) and meters per second (mps):

$mph = kts / 0.868391$

$mph = mps / 0.44704$

To find the zonal (u) and meridional (v) wind, given the wind speed (wspd) and direction (dir) in degrees:

$u = - wspd * \sin (3.14159 * dir / 180)$

$v = - wspd * \cos (3.14159 * dir / 180)$

The units of u and v will be the same as the units of wspd.

Moisture Variables:

To compute the vapor pressure (vappres) in millibars, given the dewpoint (dewp) in Kelvin:

$vappres = 6.11 * \exp (5423. *(1/273 - 1/dewp))$

To compute the saturation vapor pressure (satvappres) in millibars, given the temperature (temp) in Kelvin:

satvappres = 6.11 * exp (5423. *(1/273 – 1/temp))

To compute the mixing ratio (mixrat) in grams per kilogram, given the vapor pressure (vappres) and the station pressure (pres), both in millibars:

mixrat = 622 * vappres / (pres – vappres)

To get the saturation vapor pressure (satmixrat), substitute the saturation vapor pressure (satvappres) for the vapor pressure (vappres).

To get the relative humidity (rhum) in percent, given r the vapor pressure (vappres) and the saturation vapor pressure (satvappres), both in the same units:

rhum = 100 * vappres / satvappres

To get the height of the Lifted Condensation Level (zlcl) in kilometers, given the temperature (temp) and dewpoint (dewp) in either Celsius or Kelvin:

zlcl = 0.125 * (temp – dewp)

Potential Temperatures:

To compute the potential temperature (theta) in Kelvin, given a temperature (temp) in Kelvin and a pressure (pres) in millibars:

theta = temp * pow((1000/pres), 0.28571)

To compute the virtual potential temperature (thetav) in Kelvin, given the potential temperature (theta) in Kelvin and the mixing ratio (mixrat) in grams per kilogram:

thetav = theta * (1 – 0.00061 * mixrat)

To compute the equivalent potential temperature (thetae) in Kelvin, given the potential temperature (theta) in Kelvin and the mixing ratio (mixrat) in grams per kilogram:

thetae = theta + 2.5 * mixrat

Apparent Temperatures:

To compute the wind chill temperature (wchill) in Celsius, given an air temperature (temp) in Celsius and a wind speed (wspd) in meters per second:

wchill = 33.0 – pow ((wspd + 2)/2, 0.21) * (33.0 – temp)