Unit 6 ATM401, ATM601 and CHEM601

Application, analysis, and evaluation

1. **All students**: A cloud of mostly supercooled droplets exists at -10^oC. The ambient air is at saturation with respect to water. Calculate the supersaturation with respect to ice for a single ice crystal that spontaneously forms in that cloud in percent.

2. **All students**: The initial state of an air parcel is $p = 1013.25hPa$, $T = 25^oC$, $q = 14g/kg$. Determine the saturation vapor pressure, specific humidity, relative humidity, virtual temperature, and virtual potential temperature. If the air parcel ascends dry-adiabatically, at what pressure level would you have saturation?

3. **ATM601/CHEM601:** Determine the virtual temperature at a location whose air temperature is 25^oC and saturation vapor pressure is $42hPa$, air pressure is $1015hPa$, and relative humidity is 50%. By how much does the use of virtual temperature rather than air temperature affect the calculated air density? What do you conclude from your results? Determine the mixing ratio r, relative humidity RH, virtual temperature T_v, the potential temperature, and virtual potential temperature.

4. **ATM401:** Assume an outside and inside temperature of -15^oC and 21^oC, respectively, and an inside water-vapor pressure of $1.915hPa$. Assume that good water-vapor exchange between inside and outside and that no sources and sinks of water vapor exist. Compare the relative humidity inside and outside.