Tutorial 5

Vertical properties of the atmosphere

1. Lifting Condensation Level (LCL)

   For given temperature, T, and realtive humidity, f at the ground level, calculate coordinates (temperature, T_{LCL}, pressure p_{LCL} and height z_{LCL}) of the Lifting Condensation Level.

   Check the validity of an estimate given by: Bolton, D., 1980: The computation of equivalent potential temperature. *Mon. Weather Rev.*, 108, 1046-1053.

   $$T_{LCL} = \frac{1}{\frac{1}{T-55} - \frac{lnf}{2840}} + 55,\ [K]$$

   Calculate the height of LCL, z_{LCL}, for a given temperature, T_0, and dew point temperature, T_{d0}, at the ground. Compare with the approximate value: $z_{LCL} = 120 \cdot (T_0 - T_{d0})\ [m]$.

2. Adiabatic and pseudo-adiabatic change of temperature

   Assume that a parcel of air is saturated with water vapor at the ground level ($z = 0m$, $p = 1000hPa$) where the temperature is T_0. The parcel is lifted vertically. Calculate the change of tempereture, i.e. $T(z)$ assuming that the change is realised in (1) moist adiabatic or (2) pseudo-adiabatic way.

3. Calculate the amount of water (specific mass q_l and LWC) condensed during adiabatic vertical lifting of moist air. Consider moist adiabatic and pseudo-adiabatic temperature lapse rates.