The hypsometric equation is

\[ z_2 - z_1 = \frac{RT}{g} \ln \frac{p_1}{p_2}. \]

The 3-cell model of surface pressures and winds reveals we tend to have low (L) pressure at 60°N and high (H) pressure at 30°N. In between, the surface geostrophic wind is westerly (i.e., from west to east). That’s the surface wind. It does not directly tell us how that wind varies with height. Let’s look at that. In the following, keep in mind the following facts:

- Pressure decreases with height and is proportional to mass
- An isobar is a line or surface of equal pressure
- Between any two isobaric surfaces is a fixed amount of mass
- The hypsometric equation shows the thickness between two isobaric surfaces is proportional to layer mean temperature
- The geostrophic wind is the balance of PGF and Coriolis, and Coriolis acts to the right following the motion in the NH

The picture below shows a vertical cross-section from north to south, between 60°N and 30°N. The isobaric surface \( p \) is drawn, consistent with lower pressure to the north and higher pressure to the south. The geostrophic wind at the black dot is westerly as shown in the plot at right.

1. Consider the pressure at points A and B, representing the same height above sea level. At which location is the pressure higher, A or B? **Ans:** B.

2. It is colder to the North. Draw the isobaric surface \((p - \Delta p)\) that goes through the next black dot up. Draw the implied geostrophic wind at right. Make sure that tilts and arrow lengths are drawn correctly relative to level \( p \). Then, do the same for the third black dot \((p - 2\Delta p)\).
The Northern Hemisphere midlatitude westerly geostrophic wind increases with height in the troposphere because it is colder to the north.

It stops increasing with height if it stops being colder to the north. Where does that happen? Why?

Temperature differences make pressure differences make winds. But what does a west-east wind do to decrease a north-south temperature difference?

NOTHING.