Thermal wind
(Ch. 3.4)

Geostrophic wind

in height coordinate

\[ u' = -\frac{1}{\rho f} \frac{\partial p}{\partial y} \]

in pressure coordinate

\[ u' = -\frac{1}{f} \frac{\partial \Phi}{\partial y} \]

Thermal wind \textit{how would horizontal temperature distribution affect wind shear?}

\[ \frac{\partial p}{\partial y} = ? \]

\[ \frac{\partial \Phi}{\partial y} = ? \]
Thermal wind (Ch. 3.4)

Thermal wind

*thickness of a layer between two isobaric surfaces in terms of the layer mean temperature* \(<T>\)

\[ \Phi(p_2) - \Phi(p_1) = \]

take differential w.r.t. \(y\)

\[ \frac{\partial \Phi(p_2)}{\partial y} - \frac{\partial \Phi(p_1)}{\partial y} = \]

by using the definition of geostrophic wind

thermal wind (zonal)

thermal wind (meridional)

how is horizontal temperature gradient related to vertical shear of geostrophic wind?
Thermal wind
(Ch. 3.4)

Exercise

draw thermal wind vector given the distribution of temperature

sketch temperature distribution given the geostrophic wind at two levels \((z_1 \text{ and } z_2, z_2 > z_1)\)
what would be the sign of temperature advection in the layer between \(z_1\) and \(z_2\)?