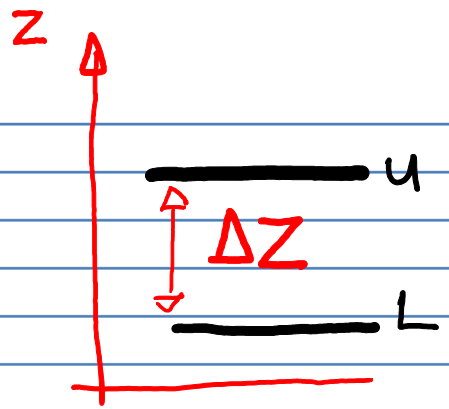
THERMAL WIND.



$$(u_g, v_g)_u = \frac{g}{f}\left(-\frac{\partial z_u}{\partial y}, \frac{\partial z_u}{\partial x}\right)$$

Climatologically $\partial z_u / \partial y < 0$, giving westerlies

$$(u_g, v_g)_L = \frac{g}{f}\left(-\frac{\partial z_L}{\partial y}, \frac{\partial z_L}{\partial x}\right) \quad \text{AND} \quad \boxed{\vec{V}_T = \vec{V}_{gu} - \vec{V}_{gL}}$$

Differencing,

$$(u_T, v_T) = \vec{V}_T = \frac{g}{f}\left(-\frac{\partial\, z_u - z_L}{\partial y}, \frac{\partial\, z_u - z_L}{\partial x}\right)$$

But $z_u - z_L = \Delta Z = \left(\frac{R_d}{g} \ln p_L/p_u\right) \overline{T_v}$

So $$\vec{V}_T = \frac{R_d}{f} \ln p_L/p_u \left(-\frac{\partial \overline{T_v}}{\partial y}, \frac{\partial \overline{T_v}}{\partial x}\right)$$

$$\vec{V}_T = (u_T, v_T) = \frac{R_d}{f} \ln \frac{p_L}{p_4} \hat{k} \times \nabla_H \overline{T}_v$$

$$\left| \vec{V}_T \right| = \frac{R_d}{f} \ln \frac{p_L}{p_4} \frac{\partial \overline{T}_v}{\partial n_T}$$

where $\hat{n}_T$ is $\perp$ to thickness lines

$$\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 1 \\ \frac{\partial \overline{T}_v}{\partial x} & \frac{\partial \overline{T}_v}{\partial y} & 0 \end{vmatrix}$$

SPECIAL CASE

COLD

$\vec{V}_T$ $\nabla_H \overline{T}$

MILD

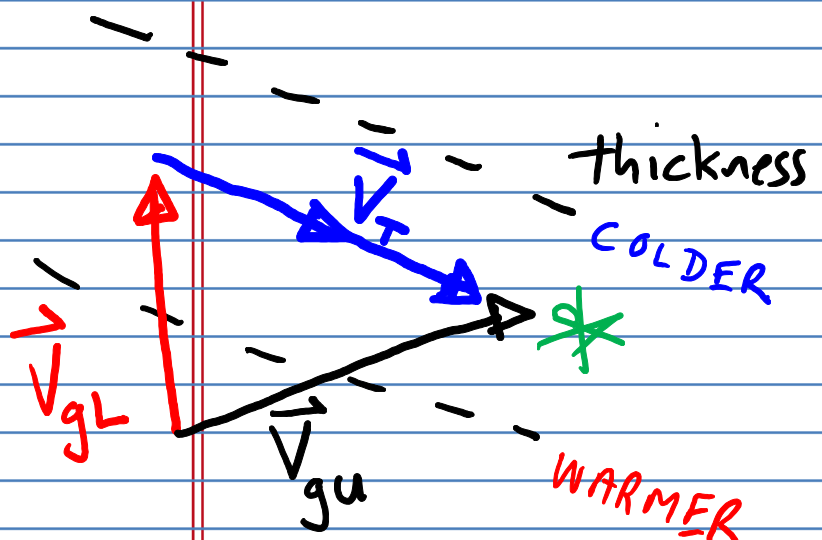
510

516 dam

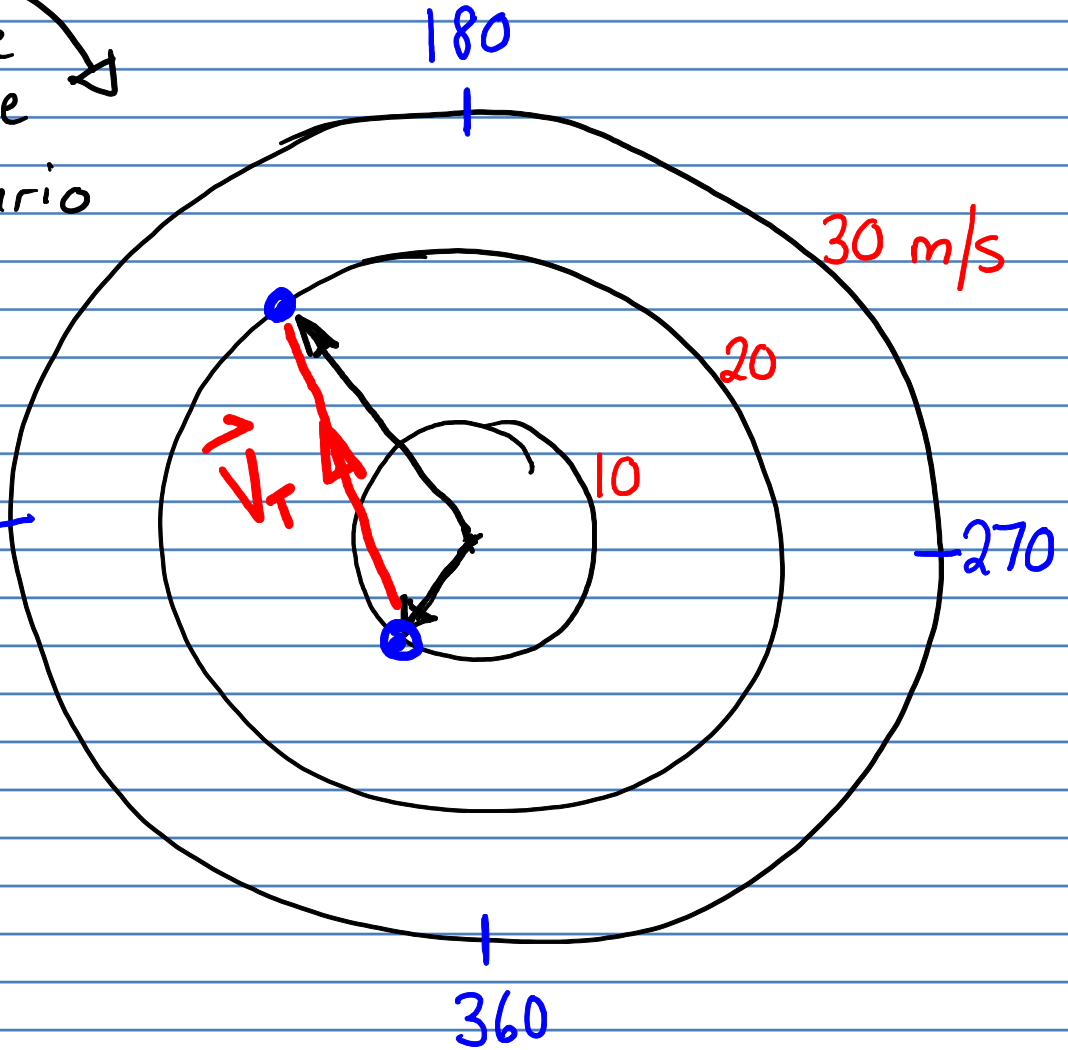
$\nabla_H \overline{T}_v$

THE HODOGRAPH

plots wind vector as function of height



not the same scenario



Let 850 hPa wind be NE at 10 m/s

700 SE at 20 m/s

* this is a "veering wind" and is associated with warm advection

PLOT HEEL OF WIND VECTOR AT ORIGIN