The pressure at the bottom of a hydrostatic column of atmosphere can be found by integrating the hypsometric equation such that,

$$p(z_b) = p(z_t) \exp\left(\frac{g}{R} \int_{z_b}^{z_t} {T_v}^{-1} dz\right)$$

$$= p(z_t) \exp\left(\frac{g \Delta z}{R \overline{\overline{T_v}}}\right), \qquad (1)$$

where z_t and z_b are the heights of the top and bottom of the column, respectively, $\Delta z = z_t - z_b$, and $\overline{T_v}$ is the mean virtual temperature in the column Δz. A similar expression for the height at some pressure level p_b is

$$z(p_b) = z(p_t) + \frac{R}{g}\int_{p_b}^{p_t} T_v \, d\ln p$$

$$= z(p_t) + \frac{R\overline{T_v}}{g}\ln\left(\frac{p_t}{p_b}\right), \qquad (2)$$

where p_t is a pressure level at which the height is known. Equations (1) and (2) show that if $p(z_t)$ and $z(p_t)$ are fixed, then $p(z_b)$ and $z(p_b)$ decrease in magnitude as the mean temperature in the column increases. Thus, relative pressure and height minima/maxima on some height or pressure level, respectively, must lie below relatively warm/cold columns of air.