(a)

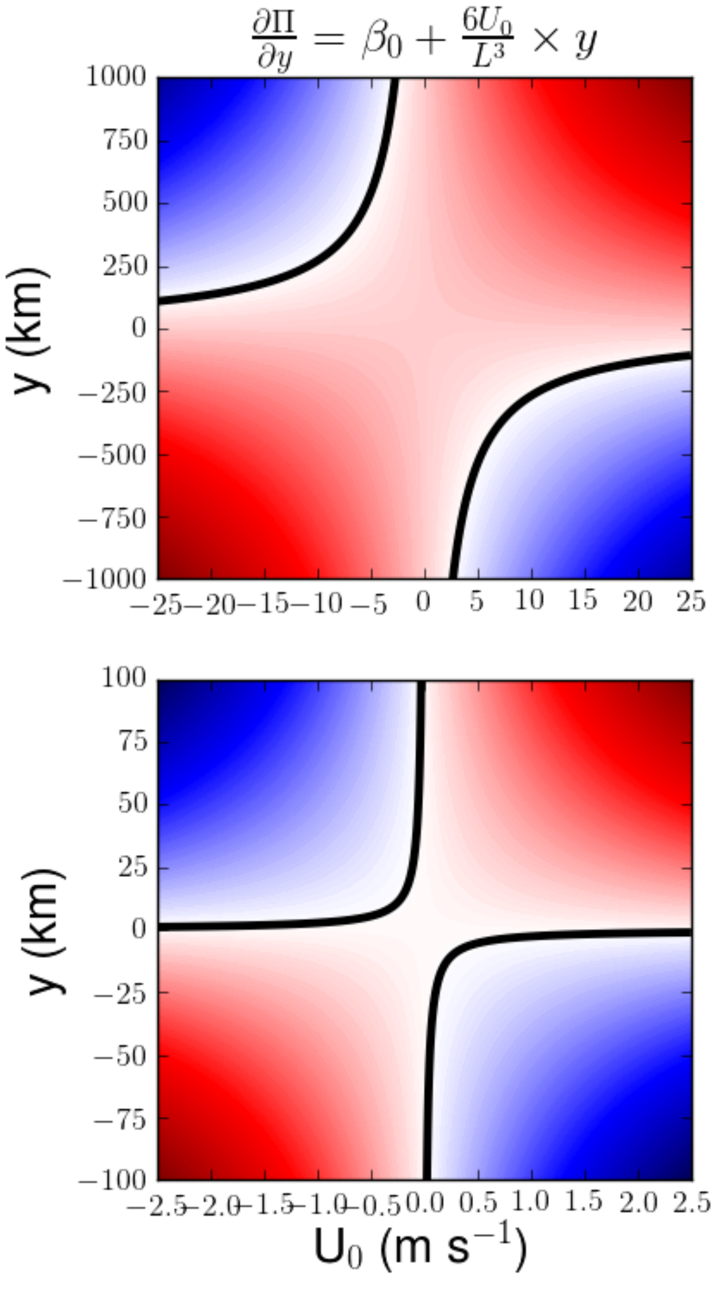

Figure 1. Potential vorticity (PV) gradient for different values of U_0 the across domain with L = 1000 km (upper panel) and L = 100 km (lower panel). The black thick lines represent the regions where the PV gradient is zero. Reddish colors indicate positive values.

For the domain with L = 1000 km, the flow becomes potentially unstable when $|U_0|$ is higher than approximately 2.70 m s^{-1}. In contrast, when we decreased the domain's width in one order of magnitude, the flow is potentially unstable when $|U_0|$ is higher than approximately 2.70x10^{-2} m s^{-1} .

Obs: I found the critical value of $|U_0|$, finding it for PV gradient zero at |y| = L.

$$|U_0| = \frac{\beta L^2}{6}$$

(b)

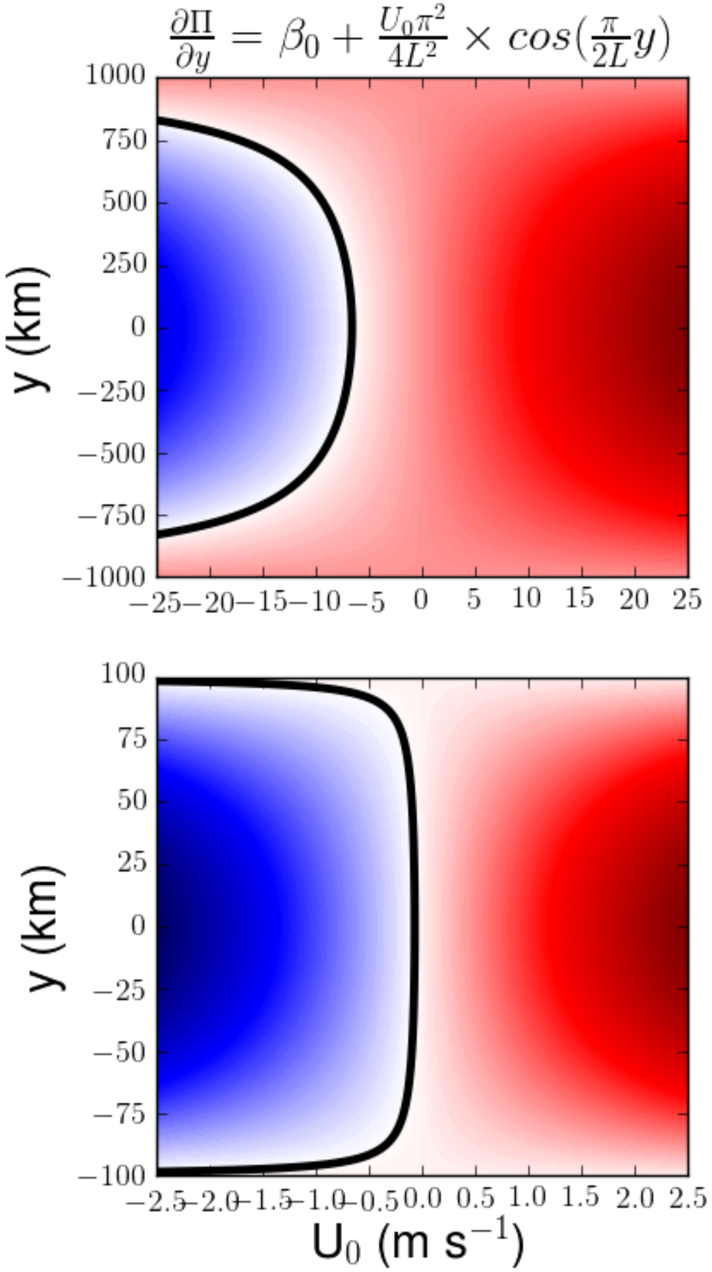

Figure 2. Potential vorticity (PV) gradient for different values of U_0 the across domain with L = 1000 km (upper panel) and L = 100 km (lower panel). The black thick lines represent the regions where the PV gradient is zero. Reddish colors indicate positive values.

For the domain with L = 1000 km, the flow becomes potentially unstable when U_0 is lower than approximately 6.56 m s^{-1}. In contrast, when we decreased the domain's width in one order of magnitude, the flow is potentially unstable when U_0 is lower than approximately 6.56x10^{-2} m s^{-1} .

Obs: I found the critical value of U_0, finding it for PV gradient zero at y = 0.

$$U_0 = \frac{\beta \, 4L^2}{\pi^2}$$