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AOS 311

Lecture Summary for April 10th

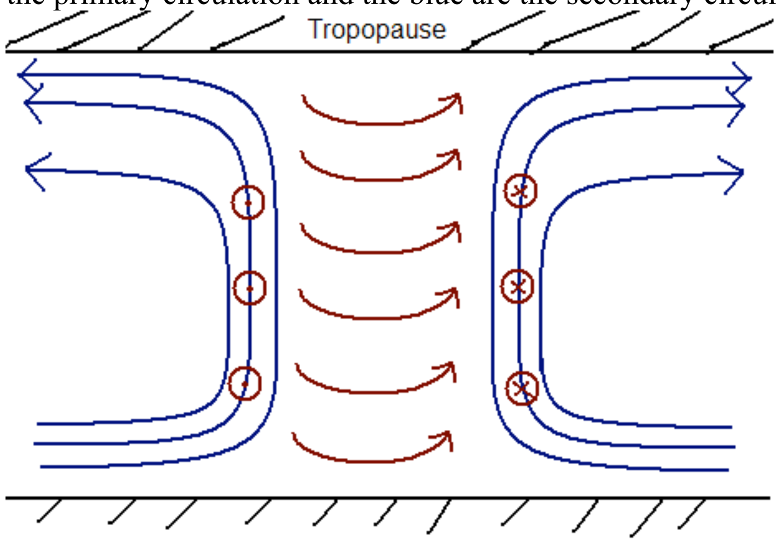
In lecture we began by defining d as the Ekman depth, where $d=(2k/f)^{1/2}$, and H is the height of the tropopause. From there we integrated a form of the barotropic vorticity equation to give us:

$$\frac{D\zeta_g}{Dt} = f\left[\frac{w(H) - w(d)}{H - d}\right]$$

We then make an approximation and rearrange the right hand side giving us:

$$\frac{D\zeta_g}{Dt} = -\frac{\zeta_g}{\tau_e}$$

where $\tau_e = \sqrt{\frac{2H^2}{f\,k}}$ is the time it takes for the vorticity to decrease to e^{-1} of its original value. If we integrate the equation above we get a function that gives us the barotropic spin down time: $\zeta_g(t) = \zeta_g(t_0)\exp(-t/\tau_e)$. Using the following values H=10km, $f=10^{-4}$ s^{-1}, and $k=10m^2s^{-1}$ we see that τ_e scales to approximately 4 days for the system to spin down. This spin down is caused by the divergence. We also went over secondary circulation which we define as the circulation created by friction, diabatic heating and advection. In the diagram below the atmosphere is neutrally buoyant and the red arrows and circles are the primary circulation and the blue are the secondary circulation.



The diagram below is a system that is stably stratified above the boundary layer (d) when this occurs the top half of the secondary flow will spin down first because the stratification does not allow a mass transport vertically.