Lecture summary for 21 February 2018 by Andrew Kieckhefer

Related Reading: Cushman

Definitions/Equations:

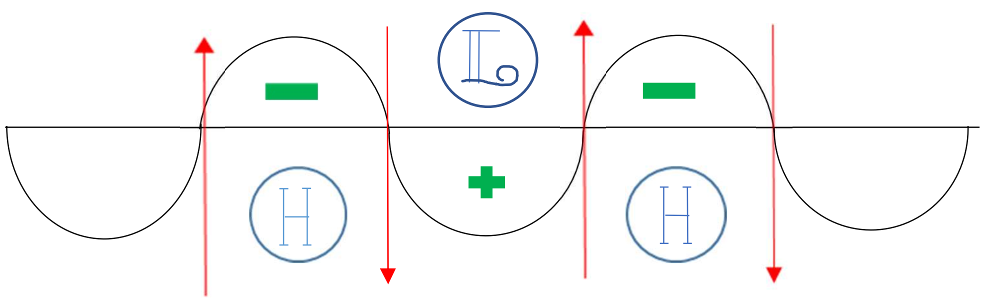
Shallow Water System: Fluids, atmospheric or oceanic, composed of a horizontal length scale that is longer than their depth scale.

$\Psi = \frac{-A}{k^2}\, sinkx$ where A = amplitude and k = scale effect. $\frac{-A}{k^2}$ produces a cosine looking wave.

k = $\frac{2\pi}{L_x}$ where L_x = wavelength

Summary:

When graphing our stream function, we must find relations in minima/maxima and relate our stream function to wind and vorticity. Given a stream function where A > 0 we look at the following wave.



The red arrows depict meridional winds, alternating in orientation. L indicates a low in the stream function while H indicates a high achieved in the stream function. Vorticity maxima and minima are depicted with + and – respectively. They depend on the size of the amplitude (A).

The space scale (k) relates to our wavelength (L_x). When the space scale (k) is large, the stream function wavelength (L_x) and amplitude are small. In this case the stream function amplitude (A) is small. This relation results in a small disturbance with small stream function abnormalities. The opposite occurs with a small space scale (k). A large wavelength (L_x) results in stronger meridional wind velocities.

In a shallow water system hydrostatic balance holds, shown by scaling $\frac{H}{L}$<1. The divergence, represented by u=u(x,y) and v=v(x,y) does not reference depth, **maintaining 2D divergence.** Proven further, $\frac{\partial u}{\partial z} = \frac{\partial v}{\partial z} = 0$. The system is boussinesq, so $\rho = \rho_0$. Friction may be ignored, Ek <<1 while R_0 and R_{oT} ≤1. The Rossby numbers may be **less than or equal to one**, flow is not perfectly geostrophic.