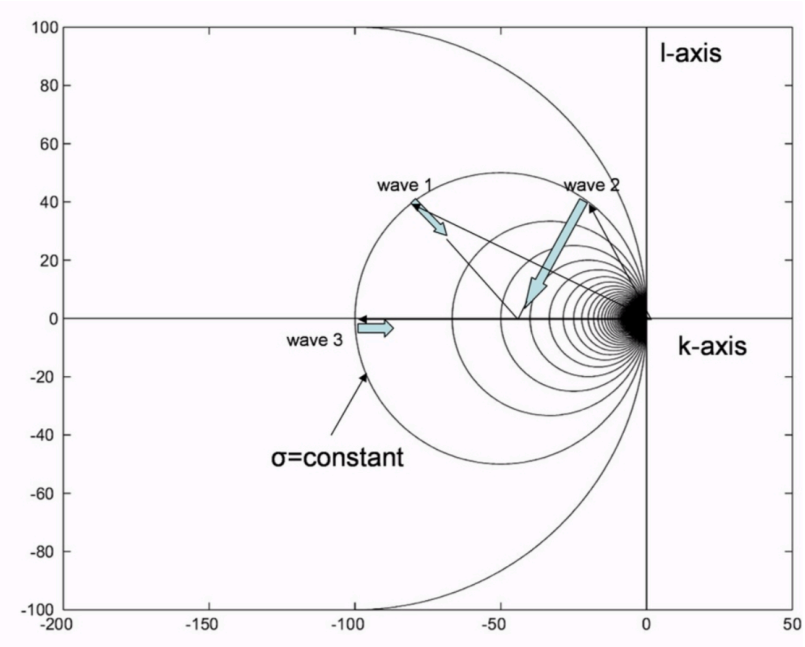
MAST-693 and CIEG-693 Homework #4 (due May-20, 2020)

The dispersion relation of barotropic Rossby waves can be sketched in horizontal wave number space k (positive to the East) and l (positive to the North). Allowable wave numbers (k,l) for a frequency σ trace a circle in wave number space whose center is on the negative k-axis. The radius becomes small as σ becomes large. Thin black arrows indicate 3 distinct wave number vectors (magnitude and direction) while blue double arrows indicate the direction (not magnitude) of group velocity vectors.



1. (10 pts) Does the graph above relate to planetary or topographic Rossby waves? Justify your choice(s).

2. (10 pts) Where does the center of the circle reside for (a) planetary (f larger North than South) and (b) topographic (H smaller North than South for f>0) Rossby waves?

3. (10 pts) Sort the 3 waves shown in the figure by the magnitudes of (a) their wavelenth (short to long), (b) phase velocity (slow to fast), and (c) group velocity (slow to fast).

4. (20 pts) Sketch the three waves in the (x,y) plane assuming that they were all generated at x=y=0 by indicating lines of constant phase. [Hints: Start with the group velocity vector as emanating from the generation region x=y=0 than draw three lines of constant phase for each of the 3 waves. Recall that wave numbers are vectors with magnitude and direction.]