12.804 — Waves on the Gulf Stream — Ocean data

Purpose:

Examine waves on the North Wall of the Gulf Stream and compare their properties to a simple PV front model.

Data:

Copy `~glenn/front/gstr.m` to your directory. This program allows you to retrieve digitized north wall positions from an achive at URI. The program asks for the year and initial day and then the number of days to return. You get back arrays `year, day, lon, lat` which you can look at. In some cases, due to missing files, you will not get as much data back as requested — this shows up when it prints out the minimum and maximum day. You just have to work around the missing blocks.

To do/ think about

· Find the phase speed of waves and their characteristic scales.
· Compare to waves on a barotropic front.
· Compare to a simple $1\frac{1}{2}$ layer model:

$$\nabla^2\psi - \frac{1}{R_d^2}\psi = \begin{cases} q_0 & y > \eta \\ -q_0 & y < \eta \end{cases}$$

or, in terms of the basic state and perturbations,

$$\nabla^2\Psi - \frac{1}{R_d^2}\Psi = \begin{cases} q_0 & y > 0 \\ -q_0 & y < 0 \end{cases}$$

$$\nabla^2\psi' - \frac{1}{R_d^2}\psi' = -2q_0\eta\delta(y)$$

The kinematic equation for the front linearizes to

$$\frac{\partial}{\partial t}\eta - \Psi_y(0)\frac{\partial}{\partial x}\eta = \psi'_x(x,0,t)$$

Consider waves of the form

$$\eta \sim e^{\imath k(x-ct)}$$

$$\psi' \sim \phi(y)e^{\imath k(x-ct)}$$