Physical Oceanography
Problem 5
Due: September 28, 2015

This problem is based on the sigma section across the Gulf Stream on page 140 of Knauss. The numbers given for this problem are approximately as shown there although simplified. Assume the density is constant with sigma equal to 26 everywhere above 200m. Consider the region between 400 and 500 km and assume this is in the x (east-west) direction. Assume that the slope of the isopycnals between 200m and 1000m is \(8 \times 10^{-3}\), the average density difference between water columns between 200 and 1000m depth at 400km and 500 km is 1.2 kg m\(^{-3}\) and the pressure gradient is zero at 1000m depth.

(a) What is the slope of the sea surface?

(b) Assuming the only force present is the pressure gradient force, how long will it take for a parcel at rest at 100 m depth and starting at 500km to move westward to 400 km?

(c) What would your answer to (b) be if you did this at 1000m depth?

(d) If in addition to the pressure gradient force, there is also a Coriolis force with \(f = 0.0001/\text{s}\). What is the direction and magnitude of the flow at 100 m depth?

(e) Would the velocity at 600m depth be larger or smaller than your velocity for part (d)? Why?

From Knauss (see pic on page 2):