Homework #4
Introduction to physical oceanography

1. Calculate and plot the particle trajectories for an inertial oscillation under the influence of bottom friction. We calculated the velocities in class, and you need to calculate the particle trajectories from that. You may make reasonable assumptions regarding the initial velocity field.

2. Search textbooks (open university book is a good start) and the web for two different coastal upwelling zones. Print a plot of the sea surface temperature and sea surface color (from satellite data, explain what this surface color is) near the coast for these areas. What do you see? Why?

3. Acceleration again: Consider an Eulerian flow $u = a(x+y), v = a(x+y)$ where a is a constant coefficient. Sketch what the flow looks like. If this flow is due to a channel changing its width, what would the channel orientation be, and what is width of the channel as a function of the long-channel distance? Find the acceleration of fluid particles in the x and y directions, expressed in terms of Eulerian quantities, and in terms of Lagrangian quantities.

4. Suppose the pressure in an ocean basin, centered at a latitude of 40N, is measured to be $p'(x,y,z) = (sin(\pi x/a)sin(\pi y/a)Hg\rho_0$, where $H = 1m$, $g = 9.8m/s^2$, $\rho_0 = 1024kg/m^3$, $a = 2000km$. The ocean domain at which the above pressure field is given is at $0 < x < 2000km$, $0 < y < 2000km$. Calculate the geostrophic velocities as function of x, y. Plot the geostrophic velocity field consistent with this pressure field. Plot the velocity as vectors whose size is proportional to the speed, and whose direction is that of the velocity at each point. Calculate and plot the stream function in this case. what are the stream function units?