EAS 4305/6305 Physics and Chemistry of the Oceans
Homework #6: **Due October 11th**

Dynamic height and geostrophic circulation based on hydrography

Building on the results from HW#5, we calculate and visualize geostrophic circulation based on zonal (east-west) transect. This is motivated by the German Meteor expedition during 1920s where many zonal transect is taken across the Atlantic Ocean, with the purpose of assembling the geostrophic circulation in the Atlantic based on the hydrographic (T-S) measurements.

1. **35°N transect.** Make a (colored) contour map of dynamic height anomaly (Z') across the North Atlantic at 35°N (35.5°N would be ok) as a function of longitude and depth. Plot the Atlantic basin only. Briefly comment what you see.

2. **Calculate northward (y-) component geostrophic velocity at 35°N.** To do so, you have to take the derivative of Z' field in zonal (x-) direction. The relevant formula is;

$$v_g = \frac{g}{f}\frac{\Delta Z'}{\Delta x}$$

   where Δ (delta) indicates differences taken with values of neighboring grid points. Once you compute the velocity field, **make a (colored) contour map of the geostrophic velocity.** Briefly comment what you see.

3. **Define another zonal (east-west) transect at different latitude (and/or different basins).** Repeat 1 and 2 for that transect.

4. **(optional for extra credit) Define a meridional (north-south) transect at a constant longitude,** and calculate the zonal (east-west) geostrophic velocity. For example, you can do this to map the eastward circulation of Antarctic Circumpolar Current. Repeat 1 and 2 for that transect.