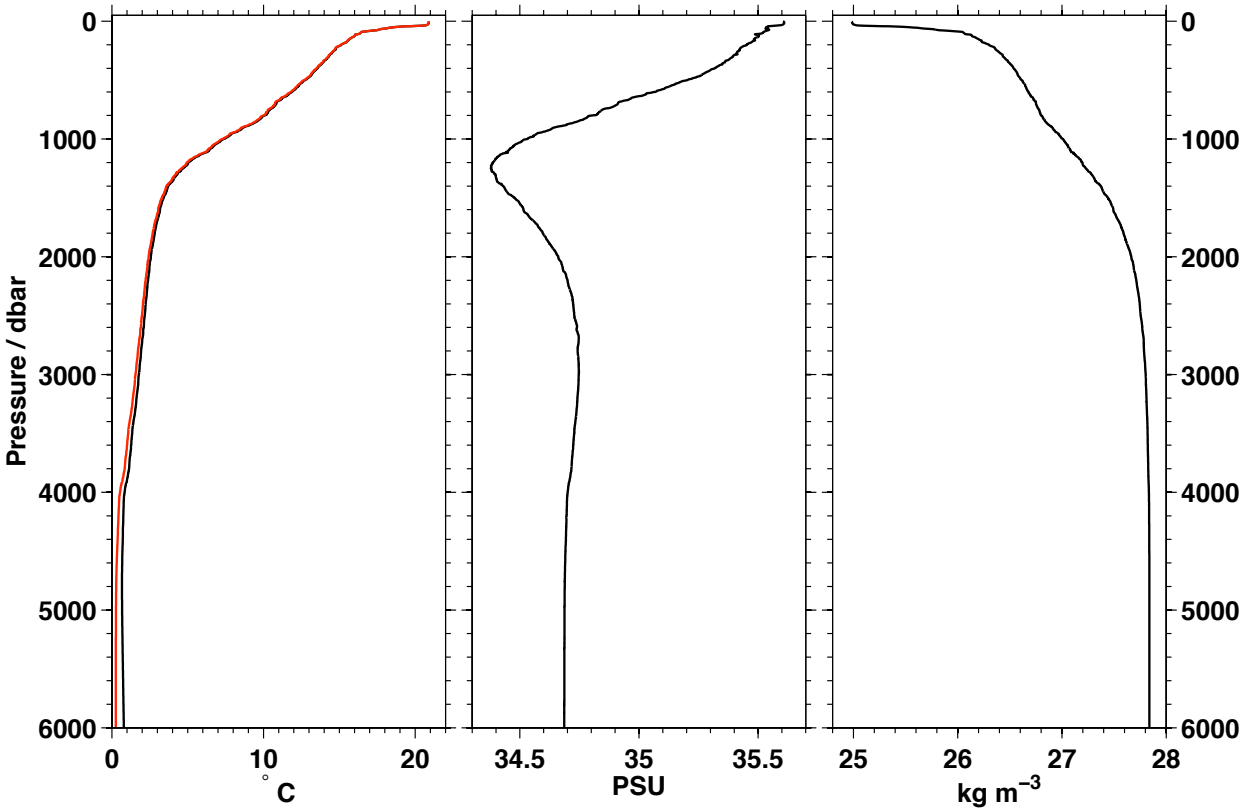
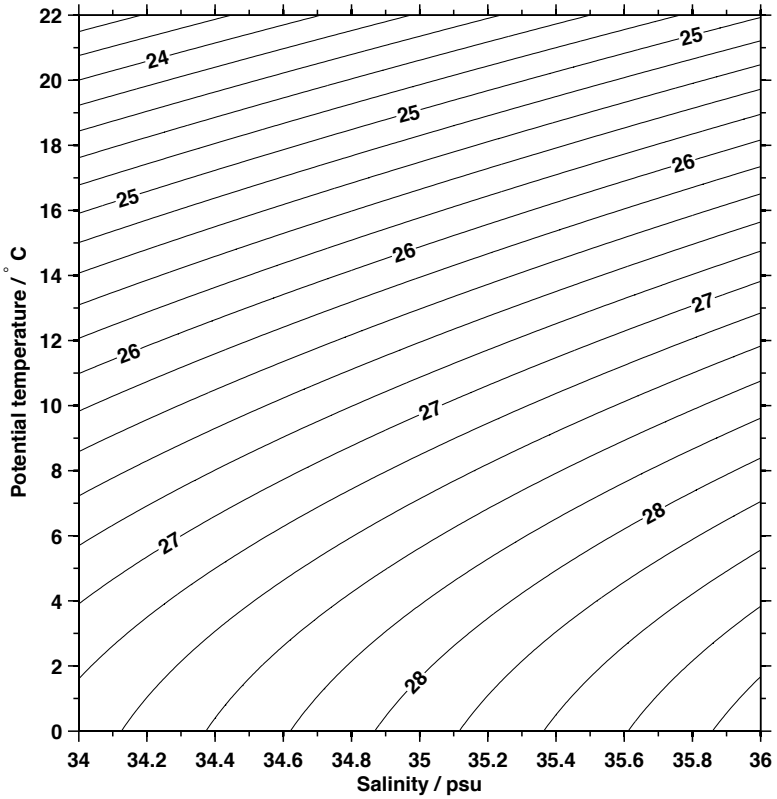
Homework # 3, Due October 14th

1) Below are profiles from a mystery location.



a. Of the two profiles in the left panel, one is temperature and one is potential temperature. Identify which is which.
b. The maximum pressure plotted here is 6000 dbar. It's important to keep in mind the actual depth of the instrument when making these measurements (so you don't smash into the bottom). Using a rough estimate of the average density, what's the maximum depth? [show your work on attached sheets]
c. In the potential density profile (right panel), label the surface mixed layer and pycnocline. Is the mixed-layer shallow or deep compared to typical values? What time of year might this profile have been taken?
d. In the blank panel (next page) draw a T-S diagram that goes with these profiles.
e. Based on your T-S diagram, discuss in a few sentences what type of water masses are present here, and where they might be coming from.
f. Where do you think this profile might be from? (Chapter 4 of DPO has some helpful T and S sections). Justify your answer with a few sentences.



2) As the earth warms, rising sea-level will threaten many low-lying coastal areas throughout the world. A rise of only a meter may be enough to render many small islands totally uninhabitable. For the following questions you may need to use the following values: $\alpha = 3 * 10^{-4}\ ^{\circ}C^{-1}$, $c_\rho = 4000$ J /(kg ˚C) , average ocean surface area = $3.6 * 10^{14}\ m^3$, average density = 1025 kg/m^3.

   a. Assuming surface heating is distributed in the top 1000 meters of the ocean, how much "extra" heat flux into the ocean would be required to produce a global sea level rise of 1 meter by 2100?

   b. The actual observed extra heat input over the last decade is approximately 2 W/ m^2 (though it is likely to accelerate). What sea level rise would this value produce by 2100?

   c. How much glacial ice would need to melt to produce the same sea level rise?

   d. The volume of the Greenland ice sheet is approximately $3 * 10^6\ km^3$. Under the more pessimistic warming scenarios, the entire thing could melt. How much would this raise global sea level?