Chemical Oceanography
Spring 2017
Problem Set#3

Assigned March 28, 2017
Due: April 11, 2016 at 3PM

Directions: These problems require use of Ocean Data View and the accompanying GLODAP bottle dataset. The ODV lab/class should have familiarized you with the use of ODV and how to access the GLODAP V2 data included. Any other technical problems, please contact Professor Altabet (maltabet@umassd.edu). Plots should be saved as jpeg files and then inserted into a PowerPoint file which then can be annotated and sent to Prof. Altabet for grading. Make sure to optimize the visual presentation using at least 300 dpi resolution. The submitted graphics need to include the property sections for problems 1-4 and the property-property plots with corresponding regression lines and equations for each stoichiometric ratio estimate.

After starting ODV and opening the GLODAP bottle data collection file, load the view file "A16S_ChemOce" using the "load view" command making sure it is in the path "ODV_local\data\GLODAPv2\ GLODAPv2_bottle.Data\views". You should see a salinity section for the South Atlantic and 6 property-property plots. **Important Note**: This 'canvas' may extend horizontally beyond your screen. Scroll to the right and left to check. Can resize plots to fit on your screen if you wish.

Part 1 (2.0 pts) Identify on the salinity section the major water masses present and trace approximate boundaries. Make sure you get this right before going on by checking in *Emerson & Hedges* or asking myself. On the Temp vs Sal plot, identify their corresponding end-members.

In a short paragraph, describe the hydrography of this section and how this relates to the sinusoidal shape of the Temp-Sal plot. On the other plots, calculate the stoichiometric relationships between C:AOU:N:P only where linear relationships are apparent. In a short paragraph, explain why some plots fail to show a neat linear trend.

Part 2 (2.0 pts) Sequentially, change the z variable in the section plot to TCARBON, ALKALI, AOU, NITRAT, PHSPHT, pCFC-11, DELC14, pCO2, OMEGAC (calcite saturation state). Include each of these plots in your submitted work.

In a short paragraph, discuss the geographic/depth distribution of these properties and how they relate to each other and the distribution of water masses along this section. Make sure to discuss the use of pCFC-11 and DELC14 for aging water masses and their limitations. How does water mass age qualitatively relate to the other parameters, citing specific features of the plots? How does the the distribution of OMEGAC relate to pCO2 and what predictions can you make about where high %CaCO3 would be found in seafloor sediments.

Part 3 (2.0 pts) Using the 'Sample Selection Criteria', restrict the data displayed to those points with potential density anomaly (sigma-theta) greater than 27.8 . Remember to check the box that applies the restriction globally.

Which water masses are present? Calculate the stoichiometric relationships between C:AOU:N:P. Why does the potential density anomaly restriction improve the linear relationship between the properties plotted? What are the apparent preformed nutrient concentrations (NO_3^- and PO_4^{-3}) and if >0 what are their origins? Describe how you estimated preformed nutrient concentration. By examining the slope of the linear relationship between alkalinity and DIC (if there is one), determine if $CaCO_3$ dissolution is affecting the ratios with C? If so, attempt a correction describing your approach in a short paragraph.

Part 4 (1.0 pts) Do the same as in Problem 2 for the potential density anomaly range 27 to 27.7. You do not need to repeat 1) description of method for $CaCO_3$ dissolution correction and 2) explanation of why linear relationships are improved. You still need to quantitatively estimate the contribution of $CaCO_3$ to the observed stoichiometry, though.

Part 5 (1.0 pts) Do the same as in Problem 3 for potential density anomaly range 25 to 26.4 .

Part 6 (2.0 pts) Assemble all stoichiometric calculation results (as C:AOU:N:P) from questions 2-4 into a table with potential density anomaly ranges as the column heading. Compare in a paragraph to values expected from Redfield stoichiometry. Briefly discuss any differences between potential density anomaly ranges.