

Chemical Oceanography
Spring 2009
Problem Set#3

Assigned March 31, 2009
Due: April 14, 2009 at 4PM

Directions: These problems require use of Ocean Data View and the accompanying GLODAP bottle dataset. The ODV lab should have familiarized you with the use of ODV and how to access the GLODAP 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 along with a text file. Make sure to optimize the visual presentation using at least 300 dpi resolution. The submitted graphics need to include the salinity sections for problems 1-4 and the property-property plots with corresponding regression lines and equations for each stoichiometric ratio and remineralization rate estimate.

After starting ODV and opening the GLODAP bottle data collection file, load the configuration file "A16S_ChemOce". 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.

Problem 1 (1.5 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 Millero or asking myself or Prof. Ryan. 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.

Problem 2 (2.5 pts) Using the 'Selection Criteria', restrict the data displayed to those points with sigma-theta greater than 27.7. Which water masses are present? Calculate the stoichiometric relationships between C:AOU:N:P. Why does the sigma-theta 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 TDIC and TALK (if there is one), determine if CaCO_3 dissolution affecting the ratios with C? If so, attempt a correction describing your approach in a short paragraph. Also estimate the rate of PO_4^{-3} remineralization with a brief description of your method for doing so. Is it better to use ^{14}C age (radiocarbon age) or CFC age for these water masses?

Problem 3 (2.5 pts) Do the same as in Problem 2 for the sigma-theta range 27 to 27.5. Leave out 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.

Problem 4 (2.5 pts) Do the same as in Problem 3 for the sigma-theta range 25 to 26.5 .

Problem 5 (1.0 pts) Assemble all stoichiometric calculation results (as C:AOU:N:P) from questions 2-4 into a table with sigma-theta ranges as the column heading. Compare in a paragraph to values expected from Redfield stoichiometry. Also calculate organic C remineralization rates for each sigma-theta range and list them with P remineralization rates in the same table as the stoichiometric results. Briefly discuss any differences between sigma-theta ranges.