Earth System
Science Data
Discussions

Interactive
Comment

Interactive comment on "Data recovery of A06 and A07 WOCE cruises" *by* N. M. Fajar et al.

Anonymous Referee #3

This paper uses a multiple linear regression technique and cross-over analysis to correct total Alkalinity (At) and total inorganic carbon (Ct) from a WOCE cruise in the 1990s along lines A06 and A07 for use in climate studies.

The paper is original in its approach to correcting the At and Ct data. It is also of interest for the possibility of using these data to look at decadal changes in ocean carbon variables. Some of the logic appears circular and is hard to follow, for example: using uncertain pH and Ct measurements from the cruise to calculate At, and then asserting that the pH calculated from this At and Ct is reasonable and hence the Ct/At ratio is valid. Why wouldnt the At calculated from pH and the associated Ct then return a similar value of pH, and how is this proof of the validity of the Ct/At ratio? This question is key to the logic pyramid of the paper and needs to be addressed in more detail for the paper to be published. Other points that should be addressed:

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Interactive Discussion

Discussion Paper

The 3-DwLMR multiple regression method of Velo et al. 2011 is used to calculate new At values. The authors need to describe this method in a little more detail since it is a key step in the paper. Many details can be left to the Velo et al. paper, but at the very least it should be noted what variables are part of the regression. At, as the authors note, is correlated to silicate, salinity, even temperature. Which of these variables (or all of them) are used in the regression? How are the original At values used in the regression? What is the quality of the other data from the cruise used for the regression?

Both the above regression and the Ct/At ratio imply some type of systematic (as opposed to random) error both in measurement of [H+] and Ct. The authors should elaborate, if possible, on the suspected problems with the A06/A07 which contributed to a systematic error. If the errors are not systematic, is the present technique valid?

A reference, or some reasoning, should be given for the 2100 umol/kg value for Ct in deep Atlantic waters.

There is alot written of GLODAP, CARINA, and CCHDO. What is the relation between the three? Noting that some of the columns are in different order for GLODAP and CARINA is irrelevant. Do the different variables stored for GLODAP and CARINA make any difference in the present work (including regression and crossovers)? Does it make a difference that some of the cruises were taken from GLODAP and some from CARINA? Have the data used for the crossovers already been adjusted based on previous crossover analyses? CCHDO, to my understanding, contains the official version of WOCE cruises. Would the authors recommend that this official version include the corrections detailed in the present paper? Should GLODAP and/or CARINA incorporate the corrections, or are these corrections only suitable for certain research applications?

Figures 6a,b appears to show the A06 line and MOC2 Ct/At ratio and pH to be almost exactly the same (to within error?). Is it possible that the crossover analysis for Ct has led to an adjustment factor which simply mimics the structure of the MOC2 cruise?

What kind of decadal change do the authors expect between the two occupations of A06 as compared to errors which may be introduced by the procedure outlined in the paper? Will any results from the comparison be significant (larger than correction technique errors)?

Table 1 and Figure 4 both show results for crossovers from adjusted At and from original Ct. The At results are a check of the linear regression method. The Ct results are actually used as a correction factor for the Ct data. Another set of tables/figures should be added showing the crossover analysis of the corrected Ct data to show the effectiveness of the adjustment to the Ct data (similar to the check of the At data).

Similarly, Figure 1 shows calculated pH values for A06/A07, but measured values for MOC2. It would be instructive to also show the measured values for pH for A06/A07. The authors note that the calculated pH values are 'suitable' (suitable should be defined), but how different are they from the measured values? Where would the differences between measured and calculated pH come from, since At was calculated from the measured pH?

The language of the paper is sometimes hard to follow e.g., on page 108: 'However, idem that happened in At crossover analysis, not all the cruises has given an offset.' might be 'However, similar to the At crossover analysis, not all cruise comparisons give an offset.' From the affiliation of the authors, it is quite possible that English is not a first language for the writer of the manuscript, but some effort should be made to clean up the syntax.

The above example brings up the question of why do some crossover analyses not result in an offset? Does that mean the crossover analysis yields a 0.0 offset, or that no offset can be calculated for some reason?

Interactive comment on Earth Syst. Sci. Data Discuss., 4, 99, 2011.