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Earth System Science Data Discussions

Interactive comment on "Atlantic Ocean CARINA data: overview and salinity adjustments" *by* T. Tanhua et al.

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The reviewer is correct in that this is almost a North Atlantic data set. In fact, the original meaning of CARINA was: CARbon In the North Atlantic. During a meeting in 2006 it was decided to expand CARINA to cover also the Arctic Ocean, the Nordic Seas and the circumpolar Southern Ocean. However, there are few data available for large parts of the Atlantic Ocean, something we hope will improve in the future, but that we were not able to change for this project. Although the idea of adjusting data to achieve a consistent data set might offend the purist, we believe that the adjustments applied by the CARINA group are conservative. In case of doubt, we always tried to

do no adjustment, rather than to apply an adjustment that is not justified. Further, we did not apply adjustment blindly after the results from an inversion, crossover analysis or similar, rather those results were used as a guidance, and all adjustments were manually, and somewhat subjectively, confirmed by the whole CARINA team. The original data (i.e. without any adjustments applied to them) are also available in the CARINA data base.

Since we are publishing the CARINA effort in a special issue, i.e. it is easy to access companion articles, we choose to leave most of the methods to a special paper, the method paper by Tanhua et al. Only modification of the methods has been addressed in the individual CARINA papers.

The reason we use constant pressure surfaces for the salinity crossover analysis is that salinity is an integrated part of the density, i.e. any systematic differences in salinity would lead to systematic biases in density, which would affect the crossover analysis had it been done on density surfaces. For all other parameters, the crossover analysis was performed on density surfaces, except for the Nordic Seas where the density gradient was deemed to be too small for reliable comparisons. Furthermore, for one of the automatic methods to assess crossover biases, the cnaX method, the cruise to cruise bias was always determined on surfaces of equal pressure, density and temperature. This information was available to the analyst when the adjustments were determined. The cnaX scripts also calculates biases both as multiplicative and additive offsets. The rationale behind using the one or the other is discussed in Tanhua et al., (2009b), and this in now pointed out in this manuscript. This text to the theme is available in Tanhua et al., (2009b):

The offset were quantified as multiplicative factors for nutrients, oxygen and CFCs, and as additive constants for salinity, DIC, and alkalinity. There are several reasons for this division between additive and multiplicative offsets. Firstly, multiplicative offsets eliminate the problem of potentially negative values for any variable with measured concentration close to zero, i.e. in the surface water for nutrients, or oxygen concentrations in

low oxygen areas. Also, for nutrients and oxygen analysis, problems in standardization are the most likely source of error, hence a multiplicative offset is deemed as appropriate. For DIC, alkalinity and salinity an additive adjustment seemed most likely, due to, for instance, biases in the reference material used. Similarly, since pH is a logarithmic unit, only additive offsets can be considered.

Minor comments: We do refer to: These files are in WHP-exchange format (http://whpo.ucsd.edu/formats/exchange/index.html,) where the first lines consist of the condensed metadata.

The second set of numbers after the slash in Table 3 was in one instance a typo (29HE19920714), and for cruise 317519930704 it is noted in the footnote “a” that this is a division between stations.

The year markers in Figure 2 is in the middle of each group of observations. This is now mentioned in the figure caption.

We realize that it is difficult to see with any accuracy where the cruises went in Figure 3. However, more detailed maps, i.e. with variable resolution, are available on the website http://cdiac.ornl.gov/oceans/CARINA/Carina_table.html, the summary table. I hope that in the final version of the manuscript, there will be a full page devoted to each of the panels in Figure 3 in order to make this figure more useful, i.e. readable.

References:

Tanhua, T., van Heuven, S., Key, R. M., Velo, A., Olsen, A., and Schirnick, C., 2009. Quality control procedures and methods of the CARINA database, Earth System Science Data Discussions, 2, 205-240.

Interactive comment on Earth Syst. Sci. Data Discuss., 2, 241, 2009.