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Discussions

Interactive comment on "Detecting anthropogenic carbon dioxide uptake and ocean acidification in the North Atlantic Ocean" *by* N. R. Bates et al.

Anonymous Referee #1

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Review of "Detecting anthropogenic carbon dioxide uptake and ocean acidification in the North Atlantic Ocean" by N.R. Bates, M.H.P. Best, K. Neely, R. Garley, A.G. Dickson, and R.J. Johnson.

This manuscript by Bates et al., discusses observations of dissolved inorganic carbon and alkalinity at the hydrostation S and BATS, just off Bermuda. These measurements are sufficient (together with the hydrographic properties) to define the carbonate system at this location. This time-series provides one of the longest (perhaps the longest) records of carbonate system observations at one location in the ocean, and the data are therefore very valuable for the understanding of the trends in carbon uptake during the, roughly, last 3 decades. The manuscript not only discusses the anthropogenic carbon uptake, but also changes in ocean pH, buffer capacity and calcium carbonate

saturation state. The data record is impressive, both with regard to the overall quality of the data, as well as the length of the record. These facts by itself provide some justification for the publication of this manuscript. This paper could be viewed as "just one in a series" of papers discussing the carbonate system record at the BATS site, but this paper provides an important extension of the data series, both forward and backward in time (i.e. the inclusion of historic data from locations close by), and can therefore be justified as an important contribution to the science regarding the ocean uptake of anthropogenic carbon. The paper deserves to be published in Biogeosciences, once the authors have considered the (minor) comments I have made below.

The authors refer to Supplementary information. However this information is not available to me from the BGD site.

The authors argue for a linear trend in sea-surface pCO2 values from the mid-1970's to 2011, and show this with data (although the error bars on the earlier data points are significant). Why should one find a linear increase in pCO2 in the sea surface when the atmospheric CO2 concentrations have increased at an exponential rate during this time period?

Also, by carefully viewing Figure 6, there seems to be a deviation from the linear increase trend of pCO2, DIC etc during the last 2-3 years. The authors, probably rightfully so, argue that sufficiently long time series is required in order to be able to assess a trend with some confidence (as opposed to shorter time variability). However, it would be interesting to read a discussion on the deviation from the long time trend during the last few years, even though this would turn out to temporal variability.

Minor comments: It would be useful to have a map of the BATS site in relation to the stations occupied during TTO and GEOSECS.

For the TTO data, there are two different versions of the carbonate variables available at CDIAC; the original data, and data that have been recalculated and adjusted to better match manometric measurements and more recent measurements in deep water

(Tanhua and Wallace, 2005). Which data did the authors use for this study, and why? Several different adjustments have been proposed to the DIC data from GEOSECS. Did the authors use any of these adjustments? The GEOSECS data has been shown to have large biases, (Peng and Wanninkhof, 2010).

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Figures 5 and 6: These are busy, and central, figures. They should be printed larger than in this ms. so that the details can be more easily seen. I don't understand why symbols with almost identical colors are used for the same panels. This makes them very difficult to distinguish from each other (e.g. pCO2 and Revelle factor in the 4th panel, but this is true for almost all panels).

References: Peng, T.-H., and Wanninkhof, R.: Increase in anthropogenic CO2 in the Atlantic Ocean in the last two decades, Deep Sea Research Part I: Oceanographic Research Papers, 57, 755-770, 2010. Tanhua, T., and Wallace, D. W. R.: Consistency of TTO-NAS Inorganic Carbon Data with modern measurements, Geophys. Res. Letters, 32, L14618, 2005.

Interactive comment on Biogeosciences Discuss., 9, 989, 2012.