

## ***Interactive comment on “Multi-decadal uptake of carbon dioxide into subtropical mode water of the North Atlantic Ocean” by N. R. Bates***

**Anonymous Referee #1**

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Review of the manuscript Submitted to Biogeosciences

Title: Multi-decadal uptake of carbon dioxide into subtropical mode water of the North Atlantic Ocean. Author: N.R. Bates MS No.: bg-2011-448 MS Type: Research Article

Decision: This manuscript is acceptable for publication after revisions

General comment:

In this study, N Bates evaluates and analyzes multi-decadal changes of the the oceanic CO<sub>2</sub> system in the North Atlantic, more specifically at BATS station near Bermuda and within the subtropical mode waters, STMW. This manuscript follows previous analysis focused on seasonal to interannual variability at the same location. Although the observed changes of DIC in STMW has decreased in very recent years (Fig 2A), the

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analysis seems to confirm previous results, the increase of CO<sub>2</sub> in STMW is faster than in surface waters. In addition to CO<sub>2</sub> uptake variability in relation with NAO, the study also presents results that concerns ocean acidification (Figure 1), but this is not discussed. Regarding the discussion and conclusion (and Abstract), I suggest to focus the paper on the CO<sub>2</sub> fluxes, add a plot of alkalinity observations (in Figure 1), delete the results and description associated to acidification (Figure 1d,e and section 3.2). This specific topic, acidification, should be presented in another manuscript.

After corrections and clarifications (see specific comments below), I recommend this paper for publication.

Specific comments:

C1: Abstract: In the results section, the author evaluate not only the DIC changes but also pH and other properties related to ocean acidification. These results should be include (one sentence) in the abstract if (and only if) author wants to include acidification in the discussion section. However, I think this could be a topic for another manuscript.

C2: Almost all oceanographers know the location of BATS. However I think it is important to show a map and locate BATS station (in relation to large scale circulation ?).

C3: Introduction: Author referes to Atlantic Multidecadal Oscillation. However, I would prefer to call this index Atlantic Meridional Variability (AMV, Metzl et al., GBC 2010); the terminology -Oscillation- should refer to an identified periodical variation. But for this index, there is not yet a clear period identified as far as I know (including back to historical data of IXX th century).

C4: Page 12453, line 5. Thomas et al (2009) is not in reference list. Maybe Thomas et al 2007 or Thomas e al (2008, GBC) ?

C5: Page 12455 line 19 (and other place): Reference to Bates et al., 2011. Is this manuscript has been revised, accepted ?

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C6: Page 12455 line 22: HgCL2 or Hg2Cl ???

C7: Page 12458, line 5. Author indicates that Alkalinity did not change over time. However, I remember a story, from the same author, where large anomalies in ALK have been observed for short period. It would be interesting to add ALK data in Figure 1 to complete the full oceanic CO<sub>2</sub> system (and if author agrees delete the pH, Omega plots that are not discussed in the paper).

C8: Page 12458, line 15. Thomas et al (2009) is not in reference list. Maybe Thomas et al 2007 or Thomas et al (2008, GBC) ?

C9: Page 12459, line 14. What is number 30, a reference ?

C10: Page 12461, line 1. For anthropogenic CO<sub>2</sub>, author lists a number of 0.692 Pg with a reference to Figure 3b. This is not clear to follow this discussion (when looking at numbers listed in figure 3).

C11: Page 12463, line 2; I apologize for the delay of this review, but I my feeling is that it is not to late... please correct reference Bates et al 2022 (2002 ?).

C12: Page 12464, line 28. Again check reference Thomas et al 2007 in this discussion..

Figure 1: the legend indicates results from 1983 to 2011, but this is 1988 to 2011.

Figure 1b: legend indicates both DIC and salinity normalized DIC but nDIC is not plotted on the figure.

Figure 2: again, legend indicates results from 1983 to 2011 instead 1988 to 2001

Figure 3: for Figure 3e, the DIC difference is positive (should be referred as the difference between STMW and surface).

Figure 3: correct axis references: DIC diff, DIC diff

Figure 3: I don't see the red symbols (NAO) on figure 3f

Figure 3: I don't understand the plots in Figure 3e and 3f. For example, in Figure 3e  
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DIC-diff of about 22 umol is related to NAO around -1.8. In Fig 3f the same DIC-diff is associated to NAO around -1.3.

Final comment: as usual in such impressive analysis of ocean CO<sub>2</sub> observations, I recommend author to refer a location where these data are archived (e.g. CDIAC ?)

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Interactive comment on Biogeosciences Discuss., 8, 12451, 2011.