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Biogeosciences Discussions

Interactive comment on "Controls on the spatial distribution of oceanic delta;¹³C<sub>DIC</sup>" *by* P. B. Holden et al.

Anonymous Referee #1

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General comments

This study describes and evaluates an ensemble of simulations with the GENIE earth system model aimed at simulating the carbon cycle on timescales of thousands of years (glacial-interglacial cycles). It first evaluates the ensemble results during the pre-industrial period, and then studies the main processes governing the uncertainty in the distribution of DIC and d13C in the ocean both during the pre-industrial period and the recent industrial era.

The model simulates well the carbon cycle variables and the method demonstrates that different processes drive the uncertainty of the penetration of DIC and d13C in the

ocean, which is important when compared to data.

This is a well presented and useful study, both to describe and evaluate the ensemble which will be used in the future, and to analyse the different processes governing the DIC and d13C penetration in the ocean. This last point could nonetheless be studied in slightly more details, to better explain why different processes explain most of the variance for DIC and d13C.

Specific comments

1. The study of the different main processes which explain the uncertainty in the DIC and d13C distribution in the ocean is very interesting, but the reasons why it is so should be discussed in more details.

2. Results during the pre-industrial: The variables are only given for the Atlantic (Figure 4), why not the Pacific as well? It would be good to have the results plotted for both basins and the comparison with data discussed.

3. As DIC is an important variable of the carbon cycle and discussed later in the manuscript, its distribution in the ocean should also be plotted, either in Figure 4, 5 or an additional figure. Alkalinity could also be plotted and its distribution discussed.

4. Figure 5: the observations for d13C should be plotted either on Figure 5 or another figure, it is not convenient to compare the results with other papers. Is there a reason not to include and discuss more recent data such as the GLODAP d13C data as well?

Technical corrections

5. P.11857 (section 5.3), line 18: something is missing before “important here”

6. P. 11867 (section 8), line18: “Suess” instead of “Seuss”

7. References: there are a few errors at the beginning of the references: - Antonov et al., 2006: remove “Salinity” after “edited by:” - Bondeau et al., 2007: doi is written twice - Eby et al., 2012: doi is written twice, “and EMIC” should be “an EMIC”

BGD

9, C5194–C5196, 2012

8. Figures: The labels of the color bars on Figure 4 are too small, they should be bigger. They could also be made slightly bigger in Figures 3, 6 and 7. The x and y labels are also generally too small (Figures 3, 4, 5, 6 and 7), and sometimes missing. Although in some cases they are obvious, it can still be useful and in some cases they are necessary, such as in the latitude-depth plots. Finally, concerning the units, instead of mol/kg it would be easier to have micromol/kg and the units (permil) should be better specified in Figures 6 and 7.

Interactive comment on Biogeosciences Discuss., 9, 11843, 2012.