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Climate of the Past Discussions

Interactive comment on "Carbon isotopes support Atlantic meridional overturning circulation decline as a trigger for early deglacial CO₂ rise" *by* A. Schmittner and D. C. Lund

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Thank you for your comments. In our response below some of your original comments/questions have been put in quotes.

"Methods: While I agree that a 1ka uncertainty is not a problem for this sensitivity study, I do think that age models of records not previously published should be provided. Age control points can be added on Figure 6. If radiocarbon reversals occur over the study interval, that can be noted on the core location table."

Most age models are from published data except one core from the Brazil Margin (90GGC), and some cores for which the radiocarbon calibration was updated (see

Table 1), which is part of a manuscript that is currently in review (Lund et al., Paleoceanography). This manuscript, which we'd be happy to provide to the editor and/or reviewer, had positive reviews and we expect it to be accepted for publication soon. For this reason we do not include a detailed description of the data here. However, if the reviewer or the editor feel that it would be important to include this information here, please let us know and we will reconsider. Also, we chose not to include age markers in Figure 6 as it is already quite busy and additional symbols would make the figure cluttered with different symbols.

P5 line8: Thanks. We've modified the sentence accordingly.

Line 13: We cite Boyle and Keigwin but could not find the Yu reference.

Line 22: Good point. We have rephrased the sentence to refer only to the onset of the planktonic d13C minimum.

Lines 25-28: We reference now Saenko et al. (2004), who examine the Atlantic-Pacific seesaw of ventilation in this model in detail.

P6 line 11: We have rephrased this sentence to make it clearer.

We now include other metrics (rms error, bias, and ratio of standard deviations) none of which, however, considers evolution.

"Is the ability to do this compromised by poor age control?"

Yes, in order to do this right error estimates for the age models would be needed, which are not available currently. Such estimates require substantially more time and effort than we have for the revision of this manuscript.

"Is this a likely reason for the poor temporal match in MD97-2120, NIOP905, 17JPC? Or does the model simply not simulate the evolution well?"

This is difficult to say. My guess would be both. But, as mentioned above, a proper analysis of the temporal evolution would require error estimates on the age models.

We have included a note on the temporal mismatch with MD97-2120 and NIOP905.

"I understand that in some cases the poor temporal correlation is related to the modern control. Might this be often the case, and if so, why does the value after 2500 years show a correlation?"

Again, it is difficult to say in which cases the modern control causes biases. The choice of 2500 years is subjective but we don't think the results depend strongly on this choice. Given the approximate errors in the age models of $\sim$1,000 years we want to avoid a time period close to the transitions. In some of the records (e.g. panels A, B, E, P of Fig. 7) the changes seem to be later than in the model, but most of those differences are probably within the error of the age models. A more systematic analysis would require age model error estimates.

"P7, top. more detail on these processes might be helpful."

I'm not sure which processes the reviewer refers to.

"Page 8, line 1, typo "largest" effect"

Thanks. Corrected.

"Page 8 line 16. Since the time evolution of the signal is not well simulated, perhaps be more specific. The d13C difference after 2500 years is similar to the late LGM-late HS1 difference?"

We have rephrased this sentence accordingly.

"Line 23 – not clear to me that there is robust evidence for a weaker LGM circulation although many believe that to be the case."

We agree. Our hypothetical phrasing of the sentence is inteded to highlight the uncertainty in the LGM circulation.

"Page 9 – would be useful to highlight where (in space) the differences in biological

pumping are most pronounced."

Figures 3 (top right Delta_DIC_org) and 5 (bottom Delta_d13C_rem) show where respired carbon (d13C) changes. Figure S2 in Schmittner and Galbraith shows the changes in the distribution of preformed nutrients.

"Lines 8-10. Unless this other mechanism is discussed here, I might change the ending."

We have re-written this paragraph.

"Figures – In addition to adding age markers to Figure 6, this figure could be improved -perhaps when there are two records on the same panel they can be shown in different colors with matching label?"

Good idea. Done. Thank you :-)

"I think streamfunction figures, comparable to Fig 4, would be a useful addition and would clarify the connection of isotope changes to circulation changes, discussed in some instances (e.g. upper South Atlantic)."

We've added a streamfunction figure (new Fig. 2).

Interactive comment on Clim. Past Discuss., 10, 2857, 2014.