

Interactive comment on “Last Glacial Maximum and Deglacial Abyssal Seawater Oxygen Isotopic Ratios” by Carl Wunsch

Anonymous Referee #2

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1 Summary

In this manuscript, the author extends his salinity-only analysis (Wunsch, 2015) to the pore-water measurements of the oxygen isotope ratio $\delta^{18}\text{O}_w$. Using “standard control theory”, he arrives at the same conclusion as Müller et al. (2015) – who use a Markov Chain-Monte Carlo (MCMC) approach – and as in his previous work: A very cold, highly saline abyssal ocean during the Last Glacial Maximum (LGM) is possible, but not required by the existing data. This conclusion is important as it gives lesser weight to a constraint that has been imposed on many attempts to reconstruct the deep-ocean circulation during the LGM.

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2 Major comments

I recommend to (1) add some more detail to the description of the method such that – although short – it can stand it by itself and (2) rephrase or shorten paragraphs that sound (pardon me) a bit like a text book (see below).

P. 5: What is the relevance of the subsections "Identification" and "State Estimation and Control" for the current manuscript? They sound a bit "text book-like". With respect to the identification problem, which assumption is made in the end and what is the concrete solution that is proposed?

P. 6: Is the "fuller discussion of controllability and observability" essential, or is the present discussion sufficient? This is another "text book-like" statement that may confuse the reader.

Are really all Figures 7 to 16 needed, or could one select one or two prominent examples?

3 Minor comments

Throughout the manuscript, the same symbol $\delta^{18}\text{O}_w$ should indicate the oxygen isotope ratio of pore water (or seawater). Furthermore, a true percent sign should be used.

P. 3, lines 11-13: [...] and represent the values that any estimate of the core values through time, $c(z, t), 0 < t < t_f$, must converge to within error bars [...]

P. 3, line 18: should refer to Table 2 (p. 16)

P. 4, line 7: introduce abbreviation "RTS" here

P. 16: The caption of Table 2 needs to be checked for the use of LaTeX and punctuation.

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In the present version of the manuscript, the figures are generally too small and consequently the text is barely readable, especially the annotation of the axes.

Figure 1 (also in Figures 7 to 16): The horizontal axis should be clearly marked as "Time/(ka BP)" or "Time [ka BP]", and it should start at -100 ka BP (kilo-years before present) to make it easier to the reader to recognize the last glacial cycle and the LGM.

Figure 11: It should probably read $\delta^{18}\text{O}_w$ instead of $\delta^{18}\text{O}_{sw}$.

Figure 13: not clear which figure one should compare to (Figure 7?)

Figure 14: It should probably read $\delta^{18}\text{O}_w$ instead of $\delta^{13}\text{C}_w$.

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