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Climate of the Past Discussions

Interactive comment on "A Last Glacial Maximum world-ocean simulation at eddy-permitting resolution – Part 1: Experimental design and basic evaluation" *by* M. Ballarotta et al.

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First of all, I would like to thanks the anonymous referee #1 for taking time to read this manuscript and provide interesting comments and suggestions on this part 1.

He/she argued that :

1/ the goal of the study where not sufficiently answered (paragraph 1), "The comparison of the LGM simulation with the present-day (PD) simulation is flawed, since the two OGCM runs were driven by different methods." & "The approach chosen in this study, however, is not acceptable." 2/ "The integration time of 150 years is by far too short to draw any firm conclusions on deep ocean T/S, the MOC or the meridional heat fluxes."

3/ "In order to demonstrate improvement of the glacial ocean simulation by using an eddy-permitting model, the authors should compare their high-resolution model results with an analog simulation using a non-eddy-permitting OGCM forced with identical glacial boundary conditions." 4/ "it is unclear how evaporation was treated. Was it prescribed or calculated by a bulk formula?"

1/ The main motivations of the study are to investigate whether the eddy-permitting oceanic simulations improve the results with regard to coarse-resolution models and paleo-proxy reconstructions. However, in this first part of the study, we describe the experimental design that is set up to carry out the investigation, and include some diagnostics of the eddy-permitting simulations of the LGM and the present-day PD. The main motivations are indeed addressed in the second part of the study, and this first part consists in evaluating if a glacial state is modeled by our eddy-permitting experiment. In oder to clarify this point, the goal of the present paper (not the goal of the study part 1 & 2) can be mentioned in the introduction.

We have chosen to compare our LGM model results/ surface state with respect to a present-day ocean/near surface state. In such simulations, the model is not strongly drifted from the climatology, like it could be with long climate model runs. So, our experimental design is made of the same ocean model forced by 1 surface state representing an LGM state and 1 almost "real" present-day state (the PD run is forced with a kind of "observational data", that, in fact, is the result of atmospheric model and assimilation techniques). The method used to drive the two runs are thus not fully different. The model are driven a glacial and inter-glacial surface states using the same bulk method but no surface restoring is applied in the LGM simulation since the main goal is to evaluate the surface state.

2/ It is true that 150 years is not enough to have firm conclusion about the deep ocean. It might strongly be close to the initial conditions state. The deep ocean analysis can be remove from the manuscript, as suggested by the reviewer.

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3/ This comparison between eddy-permitting/coarse resolution models is done in the part II. Additional investigation could be added in the manuscript by using the ORCA1 LGM simulation to identify the improvement introduced by the higher resolution.

4/ the evaporation is indeed computed via bulk formulation which may have some impact on the salinity drift. However, similar trend in the global salinity has been noticed in the simulation by Brandefelt and Otto-Bliesner (2009) and has been attributable to the sea-ice formation and release+vertical mixing of brine.

To conclude, parts 1 and 2 could be gathered to form a paper evaluating the impact of the high resolution.

Interactive comment on Clim. Past Discuss., 9, 297, 2013.