Equilibrium simulations of Marine Isotope Stage 3 climate by Guo et al. - second review:

In the revised manuscript, the authors made progress in reducing the amount of the manuscript and in clarifying the significance of the study. New analysis and discussions on the sensitivity experiments are presented, showing changes in SSS, sea ice, and the depth of the AMOC in response to lowering of CO2 and the flattening of the Laurentide ice sheet. The anomalies in SSS and sea ice are small compared with other climate model, and emphasises the importance of model comparison. In total, I'm satisfied with the revised manuscript, and recommend this paper for publication after several specific comments are revised.

Specific comments

1 Introduction

P2L4: "illusive" -> "elusive"?

P2L28: I found another MIS3 modelling study, which conducted a simulation of 32ka with COSMOS AOGCM (Gong et al. 2013). You may cite this paper as well.

2 Method

P4L29: I noticed that the Laurentide ice sheet is merged with the Cordilleran ice sheet. While the shape of the MIS3 ice sheet is highly uncertain, other studies also show separated Laurentide and Cordilleran ice sheets before LGM (e.g. Abe-Ouchi et al. 2007). Furthermore, some studies shows a significant impact of merging of these two ice sheets on the climate (e.g. Lofverstrom et al. 2014). Given these background, it is worth mentioning the uncertainty in the reconstruction of ice sheet as well.

3 Result

P7L1: Why don't you remove "leading to more open ocean convection" from this sentence? Indeed, the increase in sea ice plays an important role in increasing the formation of AABW, but it doesn't have to be via open ocean convection.

P8L5: It would be better to say "The reduced level of CO2 during the MIS3 causes a lowering of SST and an expansion of sea ice." , as changes in ice sheet can have a significant impact on the SST at some regions (e.g. Northwestern Pacific e.g. Fig. S13e).

P8L19: It would be better to say "The cooling in the North Pacific is *partly* associated with ~" since the cooling is also induced by the lowering of CO2.

4 Discussion

P11L23: I'm not sure about this sentence. As the authors describe, some studies suggest a vigorous AMOC during the LGM, however there are also several other studies suggesting a weak AMOC during the LGM (e.g. McManus et al. 2004). These studies should also be referred.

P11L28: "at *the* LGM"

P14L5: probably “160 ppmv” rather than “180 ppmv”

P14L15:Thank you for adding these figures. They are very useful in comparing the results with other models and also should increase the impact of this paper. Indeed, the changes in sea surface salinity (SSS) are small compared with other climate model studies (e.g. Fig. 3d in Klockmann et al. 2016). These results imply the importance of model comparison.

P17L11: probably “Fig. S11” -> “Fig. S13”

Figures

Fig. S4: I agree that the anomaly field is distorted by the difference in the land-sea mask between MIS3 and PI. However, Fig. S4 is still difficult to interpret. It would be better to show the results of MIS3 and PI in different figures. In addition, putting the labels on the contour may help the readers to identify the difference between MIS3 and PI.

Fig. S12-14: Please describe the period of the sensitivity experiments used to calculate the anomaly figures.

Abe-Ouchi A, Segawa T, Saito F (2007) Climatic Conditions for modelling the Northern Hemisphere ice sheets throughout the ice age cycle. Climate of the Past, 3, 423-438, doi: 10.5194/cp-3-423-2007.

Gong, X., Knorr, G., Lohmann, G., and Zhang, X. (2013) Dependence of abrupt Atlantic meridional ocean circulation changes on climate background states, Geophys. Res. Lett., 40, 3698–3704, doi:10.1002/grl.50701

Löfverström M, Caballero R, Nilsson J, Kleman J (2014) Evolution of the large-scale atmospheric circulation in response to changing ice sheets over the last glacial cycle. Climate of the Past, 10, 1453-1471, doi:10.5194/cp-10-1453-2014.

McManus JF, Francois R, Gherardi JM, Keigwin LD, Brown-Leger S (2004) Collapse and rapid resumption of Atlantic meridional circulation linked to deglacial climate changes. Nature, 428, 834-837, doi:10.1038/nature02494.