

Reply to editor (Dr. Menviel)

We are grateful to Dr. Menviel for having interests in our paper. We have modified the manuscript following the editor's minor comment. We have also uploaded our model result on <https://ccsr.ori.u-tokyo.ac.jp/~tadano/>, which was pointed out by the editor in the first submission. Lastly, thank you very much for spending your time in evaluating our manuscript.

Reply to Rev.1 (Dr. Guo)

We are grateful to Dr. Guo for his thorough and constructive comments, which helped to improve the quality of the manuscript. As listed below, we have taken all the comments into account in the revised manuscript. Thank you very much for spending your time in evaluating our manuscript.

> It is up to the authors to decide, but I wonder if it would make sense to also address the role of 'surface wind' in the title? I understand that the authors have a main focus on the cooling effect, but dynamically these two effects are competing with each other, and the authors have also repeatedly described these two effects in the abstract.

We decided to remove the subtitle following the editor's suggestion to make the title simple.

> Figure 1b: should spell out that the grey line shows the sea level equivalent values.  
Corrected.

> Figure 1e: please consider adding a legend/symbol to indicate that large/small Pa/Th values correspond to strong/weak AMOC.  
Corrected.

> L10, L40: should both be 'Atlantic Meridional Overturning Circulation' – to be consistent with that in the title.  
Corrected.

> L31: summer insolation and concentration of CO<sub>2</sub> were relatively large during MIS3? Should be the opposite.

We modified the sentence as follow to clarify we were comparing MIS3 with MIS4.  
"Then, the glacial ice sheets shrank during the mid-glacial period (MIS3), when the summer insolation and the concentration of CO<sub>2</sub> were relatively large compared to MIS4 "

> L75: should refer to Figure 1 before the reference.  
Corrected.

> L256: The increase of SSS due to the changes in E-P, according to Figure 9, does not occur in the deep water formation region in this model; should probably mention this.

In Fig. 8, red color shows a decrease in precipitation (or E minus P). Hence, the E minus P *does* increase in the deep water formation region, especially over the Irminger Sea. Therefore the southward expansion of ice sheet can cause an increase in SSS over the deepwater formation region by affecting the E-P.

> L275: should stress that it is the "winter" sea ice covers...  
Corrected.

> L446: "provided"

We modified the word "provided" to "compliment" following the editor's suggestion.

> L420-444: it seems the authors removed the bullet points; should then the format be adjusted accordingly? The editor can probably provide some instructions on this.

We reorganized this part following the editor's suggestion.