Response to the editor

We thank the editor for pointing this information about the study of Zhang et al (2014), in particular for the reference to their Extended Data Figure 5a which is highly relevant for the study presented in the present manuscript. As we found that the southern branch clearly appears for LGM conditions only (i.e. when the LIS has its full LGM size), we have included the information pointed out by the editor and modified our comment as follows:

"However, the mechanism highlighted in Zhang et al. (2014) is primarily driven by the simulated northward shift of the westerlies when the Northern hemisphere ice sheet altitude gradually increases. Under full LGM conditions, a split of the northern westerlies in two zonal-oriented branches appears around the Laurentide ice sheet. The southward displacement of the jet stream simulated in our study when the LIS altitude gradually increases well supports the existence of the southern branch as shown in Zhang et al. (2014) for the LGM, but their northern branch remains absent from our all simulations."

We also realized that the discussion of previous studies was not very well organized. We have therefore also reorganized section 5.2, so as to highlight the following messages:

- Changes in westerlies can have an impact on the AMOC (and these changes may in turn impact the ice-sheet surface mass balance)
- Response to LGM conditions (ice sheets and ocean state) are very model dependent

We have also moved the paragraph concerning the potential impact of the choice of an LGM land-sea mask for our experiments (as previously requested by Reviewer 2) in section 5.1 ("Glaciation scenario").

We hope the Editor can now be satisfied with the way we relate with these previous model studies, in the context of our own results.