

## ***Interactive comment on “How might the North American ice sheet influence the Northwestern Eurasian climate?” by P. Beghin et al.***

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The study investigates the atmospheric processes through which the LIS can influence the northwestern Eurasian climate and the surface mass balance. The surface mass balance is evaluated with a state of the art ice sheet model (shallow-ice approximation).

The Northern Hemisphere ice sheets and their interactions through the atmosphere-ocean coupling is not quite elaborated in section 5.2. The models show basically a northward and southward shift in the atmosphere circulation, but this has a seasonal component. One shall include more literature on that (many experiments are documented on this and even the authors had worked on this), also some dynamics like the glacial anticyclone, that becomes most pronounced over the Laurentide Ice Sheet in the winter months. At higher levels, the winds are generally linked to the f/h-contours

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and the vorticity dynamics. In boreal winter, the jet splits into a northward branch over Alaska/Arctic, while the other branch turns southward in all models I know (please correct me if I am wrong). The flow pattern is also linked to the low-level katabatic winds. As far as I can see, some work shall be done in terms of analysis of the new experiments and their interpretation in light of the existing literature. The authors are familiar with the earlier work of Roe and Lindzen and others. Why not to elaborate the different effects? For me, the discussion is too much on the surface at this point.

I think, the authors shall furthermore point to the limitation of the study (fixed SST and sea ice). The discussion on this point is more confusing than clarifying. In the answer to ref#2 it is stated "Our approach must be therefore considered as a first-step before including the analysis of more complex processes including feedbacks between the different components of the Earth system." Is it possible to estimate the effect? An altered ice sheet would lead a substantial SST change in the North Atlantic Ocean which might be taken into account in an AGCM experiment. If this is not possible for whatever reasons, and given the strong uncertainty for the FIS (because of the SSTs and sea ice), I strongly suggest to show the LIS results which are probably more robust. The Nordic Sea as well as the Barents-Kara sector are strongly influenced by the LIS and thus the surface mass balance.

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Interactive comment on Clim. Past Discuss., 11, 27, 2015.

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