

Interactive comment on “A note on the influence of atmospheric model resolution in coupled climate–ice-sheet simulations” by Marcus Löffverström and Johan Liakka

Anonymous Referee #2

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Review of “A note on the influence of atmospheric resolution in coupled climate–ice-sheet simulations”:

The manuscript examines the effect of atmospheric resolution on ice sheet modeling forced with climate model output. The theme is certainly relevant for the emerging research on coupled ice-sheet/climate modeling, both in the context of future climate projections as well as paleo-research, and timely due to launch of international collaborative projects such as ISMIP6. To my knowledge, this topic has not been directly addressed in a systematic way like this before.

The method applied consists in forcing an ice sheet model (SICOPOLIS, using the

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Shallow Ice Approximation), with climate output of different resolutions corresponding to the LGM. The ice sheet model is started from zero thickness. PDDs are applied for the surface mass balance calculation.

General comment: I would like to see more analysis of the climate model in addition to see the results of applying it as forcing to the ice sheet model. I'll explain in the following. The outcome of the study, namely the identification of a threshold resolution beyond what the climate simulation quality is compromised, is a very interesting result. For this reason, I would urge the authors to expand on the reasons (that is, physical processes lacking, misrepresented, and/or well-captured in the model at each resolution) for this threshold. In other words, what makes the low-resolution model unable to capture the essence of the LGM climate?

Introduction: The topic is very well introduced/motivated and the literature review is a great piece of work.

Comment on methodology: The method relies in strong assumptions and approximations. The simulation target is to reproduce the reconstructed LGM ice sheets (by Peltier et al.) by building them from zero thickness under a steady-state LGM forcing. In reality, there was a history of building up these ice sheets, so they are not the effect of a constant LGM climate. However, the method seems an efficient reasonable approach for the objective of the manuscript, and seems to work in the identification of a threshold for “minimum required resolution”.

Other comments: It is difficult to follow the precipitation discussion due to the choice for the color bar. Polar latitudes have low precipitation rates, please use a suitable color bar, albeit the loss of resolution for the tropical area. I would remove the words “a note” from the title after expanding the manuscript with further climate model analysis. Also, the study does not include “fully” coupled climate–ice-sheet simulations in the sense that the climate model is not influenced by the ice sheet model in any way. The authors probably chose the wording “in coupled (...) simulations” in the context of motivation,

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but the title can be misleading about the content of the actual study. I would replace the title for e.g. "On the influence of atmospheric resolution on climate-model-forced ice sheet simulations"

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-235>, 2017.