The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2020-89-RC3, 2020

The Cryosphere Discussions

Interactive comment on "Large and irreversible future decline of the Greenland ice-sheet" *by* Jonathan M. Gregory et al.

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Received and published: 9 August 2020

This paper presents important results about the irreversibility of the Greenland ice sheet based on a full coupled ice sheet-general circulation model. Although this paper is quite technical and is likely not accessible for a nonspecialist, it is well written, clear, innovative and certainly deserves to be published in TC. It notably confirms that the retreat of the ice sheet impacts more the future projections at the beginning of the simulations than the melt-elevation feedback, as shown by Le clec'h et al. (2019) using models at higher resolution.

However, in addition to the remarks of the 2 other reviewers, I have some additional minor remarks before acceptance of the paper.

1. In addition to Fig1, it should be interesting to show the differences/biases with the "reference". In the legend, is it MAR forced by MIROC5? or ERA?

2. Lines 183-187: The near-surface climate from RCMs forced by a GCM can not be compared directly with the near-surface climate from the forcing GCM as RCMs simulate their own boundary layer climate and are even able to correct near-surface GCM biases. As FAMOUS-ice is forced by near-surface climate from GCM, it is normal that there are differences with the RCMs simulations. The RCM are only sensitive to the free atmosphere climate from GCMs. Therefore, this section should be a bit rephrased to explain this issue.

3. Lines 314-317: one of the more important results of this study is the necessity of a full coupling with atmosphere to evaluate tipping point of the Greenland as changes in topography impacts on precipitation and cloudiness as negative feedback. I fully agree with this statement (as we have found the same when MAR has been coupled with GRISLI in Le clec'h et al.) but I have some reserve about the robustness of these simulated atmospheric changes in view of the spatial resolution (7.5°x 5°) used by the FAMOUS AOCGM. I understand the use of such a huge resolution in this study but an evaluation of these fields over current climate (by comparison with ERA-Interim) will be very useful to evaluate the ability of FAMOUS to simulate precipitation and cloudiness. At such resolution, how many pixels are there over the ice sheet and what is the topography over current climate. Finally, do changes in the Greenland topography impact on only the local climate over Greenland or the climate at a larger scale? This issue linked to the very low resolution used should at least be mentioned in the conclusion (Lines 478-486).

Le clec'h, S., Charbit, S., Quiquet, A., Fettweis, X., Dumas, C., Kageyama, M., Wyard, C., and Ritz, C.: Assessment of the Greenland ice sheet–atmosphere feedbacks for the next century with a regional atmospheric model coupled to an ice sheet model, The Cryosphere, 13, 373–395, https://doi.org/10.5194/tc-13-373-2019, 2019.