The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2020-28-RC1, 2020

The Cryosphere Discussions

Interactive comment on "Exploring the impact of atmospheric forcing and basal boundary conditions on the simulation of the Antarctic ice sheet at the Last Glacial Maximum" *by* Javier Blasco et al.

Anonymous Referee #1

Received and published: 12 April 2020

The paper by Blasco and others entitled "Exploring the impact of atmospheric forcing and basal boundary conditions on the simulation of the Antarctic ice sheet at the Last Glacial Maximum" presents an interesting modelling simulation of the behavior of the Antarctic Ice Sheet under different boundary conditions. I am not a numerical modeler but from my perspective the methods, approach, and analysis were well explained – I was able to understand what they were trying to accomplish. In other words the paper is well written. The authors use a suite of numerical predictions of the growth of the ice sheet in order to determine how different basal friction parameters and precipitation

and temperatures influence the predicted size of the LGM Antarctic Ice Sheet (probably not a surprise). The model setup appears to be able to replicate the present day ice sheet, building confidence that the model produces a realistic representation of the ice sheet. In addition, the size of the LGM Antarctic ice sheet is within the range of other reconstructions. Their main finding is that with lower basal friction values the ice sheet is smaller and more dynamic and the opposite is true for higher basal friction values. One important outgrowth of their work is the suggestion that most of the differences in possible ice-sheet configurations is most pronounced along the ice-sheet margins – and these locations are important for understanding the past behavior of the ice sheet (as opposed to interior sites where most of the current ice-core records are located). I think the paper provides an important contribution to our understanding of the possible past behaviors of the Antarctic Ice Sheet and will be of interest to the community. I recommend publication after minor (if any) corrections. A couple items to "chew on": 1.) The authors assume a relaxation time of 3,000 years for the GIA component (Page 5, line 8). The community is undergoing a shift in ideas on the rheology of the Earth beneath the Antarctic Ice Sheet (e.g. Whitehouse et al., 2019; Barletta et al., 2018). How sensitive is your model to this relaxation time? What happens if you use a weaker rheology? 2.) This might just be a reflection of my ignorance with models but your model is allowed to run for 80 ka (Page 6, line 12), I assume to reach some sort of equilibrium but how do we know that the ice sheet was in equilibrium. How important are the dynamics of the ice sheet leading up into the LGM for its LGM behavior? 3.) Page 3, line 3 – please give a reference for "ablation and basal melting were probably negligible at the LGM." Probably, but you could use some justification of this assumption. Other minor editorial suggestions: 1.) Page 2, line 14 – remove "up" 2.) Page 9, line 12-13: "...grounding-line from thickening, as a..." 3.) Page 9, line 14: "...viscosity such as GISS-E2-R-150..." 4.) Page 9, line 15: "...Amery Trough." 5.) Page 9, line 24: "...temperatures, which result in low viscosities. Therefore..." 6.) Page 10, line 10: "...pronounced; however, inland..." 7.) Page 10, line 30 – Please explain what you mean by "specially determinant"

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2020-28, 2020.