

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2022-109

Anonymous Referee #1

Referee comment on "The predictive power of ice sheet models and the regional sensitivity of ice loss to basal sliding parameterisations: a case study of Pine Island and Thwaites glaciers, West Antarctica" by Jowan M. Barnes and G. Hilmar Gudmundsson, The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-109-RC1>, 2022

This paper presents a suite of synthetic simulations of the Amundsen sea sector of the Antarctic Ice-Sheet. The objective is to study the sensitivity of centennial scale ice-sheet simulations to the basal friction law formulation.

The results show that the predicted volumes and rates of volume change are sensitive to the friction law, but also to the exponent m , with complex patterns at the regional scale. However they found that all simulations follow the same trajectories (i.e. mass loss or gain) for a given perturbation, giving some confidence that ice-flow models have some predictive skills at these time-scales.

The paper is well structured and written and the results are convincing. I have only few minor comments.

First, effective pressure dependent friction laws, by definition, depends on the basal water pressure, and thus this requires a specific model. However, it's only in the discussion section that we learn the assumption that has been made, i.e. perfect connectivity. This assumption should already be presented in the model set-up section.

Second, for the *Decreased Melt Branch* experiments, I suspect that this perturbation might lead to an advance of the grounding lines? However, the friction parameters are not constrained by observations in initially floating areas, so the differences between the simulations might more depend on the assumptions for the different priors than on the friction law or m ?

Minor comments :

- Page 8, line 171 : « *a slight change had to be made in order* ». Please explain here what are this slight changes ; I think we read latter that this is changes in the prior ?
- Page 13, last paragraph : I don't understand the meaning of the first two sentences.