

The Cryosphere Discuss., referee comment RC1
<https://doi.org/10.5194/tc-2022-225-RC1>, 2023
© Author(s) 2023. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on tc-2022-225

Clara Burgard (Referee)

Referee comment on "Modelling Antarctic ice shelf basal melt patterns using the one-layer Antarctic model for dynamical downscaling of ice–ocean exchanges (LADDIE v1.0)" by Erwin Lambert et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-225-RC1>, 2023

The authors present the new simple model LADDIE that can be used (1) as a high-resolution parameterisation to link hydrographic properties in front of an ice shelf and melt at its base and (2) as a method to use information from coarse ocean models resolving the circulation in ice-shelf cavities to simulate high-resolution basal melt patterns. The authors present the model and its tuning (done on the Crosson-Dotson ice shelf) and then evaluate it on two ice shelves with different characteristics: Crosson-Dotson and Filchner-Ronne.

This model is an advancement compared to "classic" parameterisations in the sense that it includes 2D effects like the Coriolis force and provides the possibility to include fine-scale bathymetric characteristics in the resulting melt patterns. The topic is timely as the representation of basal melt in models remains a large source of uncertainty for future Antarctic ice-sheet projections. In particular, LADDIE enables the resolution of fine-scale channels and regions near the grounding line, where high melt occurs, and which are therefore crucial when forcing ice-sheet models. Its application therefore has the potential to improve the forcing of ice-sheet simulations.

The manuscript is pleasant to read and the procedure to set up and evaluate the model is thoroughly described. I am curious to see how the application of LADDIE will change the behaviour of ice-sheet simulations when it will be ready for a more widespread use!

Before publication, however, I think that a few points need to be addressed to clarify this manuscript and make it more robust, especially concerning the evaluation procedure. I hope it is only a matter of restructuring and reformulating and does not involve redoing a major part of the analysis. I realise there are a lot of remarks but they come from sincere interest in the study. I hope that the authors can use them constructively and am looking forward to reading a clearer revised manuscript!

My comments are enclosed in the attached pdf.

Please also note the supplement to this comment:

<https://tc.copernicus.org/preprints/tc-2022-225/tc-2022-225-RC1-supplement.pdf>