Geoscientific
Model Development
Discussions

Interactive comment on "Improvements in one-dimensional grounding-line parameterizations in an ice-sheet model with lateral variations" *by* David Pollard and Robert DeConto

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We thank the two reviewers for their careful and insightful comments and suggestions, and plan to respond to them fully.

First, as requested the model name and version number (PSUICE3D v2) will be added to the title, and full archive information will be given in the Code and data availability section.

In response to the major remark of reviewer 1 (Frank Pattyn), we have added results for the MISMIP3d intercomparison. This is a great suggestion and provides an addi-

tional test of our new model modifications. We are able to achieve improved results both for MISMIP+ and MISMIP3d relative to other models. In doing this we found that best overall results are obtained with an additional physical modification, by determining the buttressing factor as the least-buttressed value over all orientations (0 to 360 degrees) at each point (but still with the Schoof velocity direction determined by the new grounding-line orientation algorithm). Results with some alternate modifications along these lines will be given in Appendix A.

As suggested by reviewer 2 (Stephen Cornford), we will mention the reasonable results of the model in the ABUMIP intercomparison, consistent with the findings here for larger-scale Antarctic applications.

All minor suggestions of both reviewers will be implemented:

- More scope on grounding-line flux parameterization will be added in the introduction.

- A sketch of the new grounding-line orientation scheme will be added in Fig. 1.

- The minor improvement in crevasse-depth calculation will be moved to Appendix C, with a figure showing that results are affected insignificantly.

- The green-yellow color scale used for buttressing factors was chosen to match that in Furst et al. (2016), but can definitely be changed. As requested we will change it to a new scale (yellow-red), distinct from others in the paper to distinguish this variable from others.

- The term "rigorous" will be replaced by "physically complete" and "realistic".

- The value of the rheological coefficient A in our MISMIP+ experiments will be specified.