Geoscientific

Model Development
Discussions

[GMDD]

Interactive

comment

Interactive comment on "Description and validation of the ice-sheet model Yelmo (version 1.0)" *by* Alexander Robinson et al.

Anonymous Referee #1

Received and published: 14 November 2019

General comments

Robinson et al. present a new ice sheet model. Using a zero-order hybrid SIA/SSA scheme, it is computationally inexpensive compared to higher-order and full-Stokes models. The manuscript is nicely written and provides a thorough description of the physics and its implementation in the model. In addition, the Yelmo model is available on a git repository with sufficient information to run it for a few standard configurations. The paper is worth publishing although I have a few comments and suggestions that could be considered.

Main specific comments

- Most readers would probably like to see a more in-depth discussion on how the model

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[Discussion paper]

perform for a real ice sheet configuration. While I applaud the authors for performing the EISMINT and MISMIP experiments since they are very informative on the model behaviour, I also think that the Antarctic ice sheet experiments are a bit weak and are briefly described (e.g. length of the simulation?). First, it could be nice to have more diagnostics in addition to the sole map of surface velocities (topography error but also other fields such as basal temperature / hydrology?). It is not necessary to show a perfect match with observations (which is most of the time achievable with a dedicated tuning), but it is interesting to see the bias structure to see if it is similar to other models with a similar complexity. Second, and more importantly, it could be very nice if you could discuss transient simulations. Since the model is suited for long integrations, some glacial-interglacial simulations (even with an idealised forcing) would be very interesting. If this is not possible, alternatively, you could maybe do the InitMIP experiments, since they are relatively easy to set up, and discuss your model results with respect to what is shown in Seroussi et al. (2019)?

- Unless I am mistaken, the model does not contain an isostasy model. This is certainly a limitation and might prevent its use for glacial-interglacial applications. Do you plan to account for this in the future?

- Since you use an adaptive time step, a dedicated section could be very useful.

- Running Yelmo on my computer, I was not able to reproduce the results you show for the Antarctic ice sheet with the standard configuration file provided at the zenodo link. It is minor since I was simply digging for more info (basal drag coefficient value, trends, basal temperature etc.). Consider updating the configuration files for consistency with the results shown in the manuscript.

Other specific comments

- P11L22-25 Since beta=f(ub) for non-linear friction laws, does this mean that you have to do iterative loops (relaxation) to estimate beta for a given time step?

- P14L13-20 The reader should be reminded that these experiments are SIA only.

- P15L8-10 Why is the motivation behind this choice of model parameters. You did the Antarctic experiments with a linear friction law, it would have been more useful to use the same model configuration for the two examples shown, wouldn't it?

Technical corrections

- P2L7 Typo (millenial).

- P2L7 Not only for palaeo, future multi-millenial change of ice sheets is also of interest

- P7L9 n=3?

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-273, 2019.