# Review of The Utrecht Finite Volume Ice-Sheet Model (UFEMISM version 2.0) – part 1: description and idealised experiments

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**Summary:**

The revised manuscript by Berends et al. addresses most of the points raised by the reviewers. The authors added many technical details (e.g on MPI in Sect. 3.1 or on I/O in Sect 3.2), the recommended references, additional explanations for the experimental design (e.g. on MISMIP 2D extension in Sect 4.2) and more detailed discussion on the limitations of the model (e.g. the frequent mesh update induced numerical diffusion in Sect 4.3 or the weak scalability for inter-nodal applications in the discussion Sect. 5), which seems to be subject of future work.
For instance, the authors added a new section 2.5 on energy conservation (l 304ff) based on model v1.0, a paragraph on ice front boundary conditions (l. 166ff) and similarities of DIVA with SIA/SSA (l. 197ff and l. 220ff), as well as a paragraph on elaborating the difficulties in comparing the two model versions (l. 619ff). In the appendix also some figures (Figs. B1 and C1) were added to better explain the discretization and remapping schemes.

**General assessment:**

While the authors address most reviewer concerns in the response and the revised manuscript, the additional speculations and discussions are still based on the original set of experiments. I was hoping that some additional test simulations were possible to quantify the effects of the size of the problem (see below) or the mesh refinement frequency on scalability (Sect. 3.1) or of a wider mesh around the grounding line (Sect 4.3).

The authors now emphasize that DIVA is the default stress balance approximation used in the experiments (and not BPA). As outlined earlier in the review, there is some fundamental critique in parts of the ice model community on the applicabilty of DIVA in general, and it is therefore good to gain some more experience. However, the authors mention in their response, that “validating the equations themselves” would not be the focus of their manuscript.

**Detailed comments:**

l. 166: “UFEMISM currently does not include a stress boundary condition at the ice front for any of the momentum balance approximations. Instead, it uses the “infinite slab” approach…”

Doesn’t this imply numerical diffusion of the front? And if yes, how would you then define a calving front (line segment) in the model, e.g. for calving experiments?

l. 424: “Another contributing factor could be that the model set-up used for the scaling test was too ‘small’ (i.e. had too few vertices), so that the communication latencies between cores begin to dominate the total computation time.”

This would be worth a few test simulations, not over the full length.

**Typos and recommendations:**

l 141: Antarctic ice sheet → Antarctic Ice Sheet (also l 427)
l. 198. we used ~~to~~ DIVA
l. 468: extrapolation→ extrapolated
l. 485: “perfect restart” → this would be a prerequisite of reproducibility from (intermediate) restart states
Fig C1: panel C may not be needed