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Dear authors:

Here is my review for the manuscript entitled “**Capabilities and performance of Elmer/Ice, a new generation ice-sheet model**” for publication in *Geoscientific Model Development*.

General comments: the manuscript is a good summary of the state of the art developments that Elmer/Ice has shown in the past decade. It is clearly written, to the point, with clear figures and clear development of the technical capabilities. I find no issue with the technical developments exposed in the model, as they are fairly standard and well-known by now in the ice sheet modeling community. I believe this model is a great example of good engineering meeting good science targets, and its implementation has resulted in great advances in terms of grounding line dynamics in particular. As such, I recommend this manuscript be published, as it will be very useful for other ice sheet modelers to calibrate against, and for new modelers to come up to speed with the state of the art in ice sheet modeling.

Detailed comments:

- p1690.l1: this is a strong statement. The wording in the key uncertainties section of the report is more nuanced.
- p1690.l12: not sure what is meant by this statement. What is an ice-sheet model? I would not define one by its scalability. The term is in my opinion voluntarily vague, and should probably remain so.
- p1694.l10: "very very" not needed.
- p1695.l1-2: please provide citations to this effect.
- p1699.l3: "based the positive" – > "based on"
- p1718.l10: the normals are uniquely defined along edges of elements in 2D, or faces in 3D. If the boundary conditions are applied on these faces, and not at the nodes, this should not be an issue. Please elaborate on this further, as it is not clear why you are

evaluating your boundary conditions at the nodes.

- p1718.l6: by repeating the algorithm, zigzagging is probably going to appear. Please discuss how you avoid these issues in your model.
- p1721.l12: please explain the one order of magnitude statement. It would seem that if the solvers are scalable, more than one order magnitude improvement should be reachable?

Figures:

figures are clear and concise, captions are descriptive and to the point.

Sincerely yours,

Dr. Eric Larour,
Project lead for the Ice Sheet System
Model (ISSM)