

The clarity and structure of the manuscript of Memon et al has benefitted from the last revision. What remains is a major problem in the (description of the) physics. It is the same problem as in the last revision, where I asked if the viscosity was adjusted with the basal friction parameters.

On the transition from page 7 to page 8 (numbering in the manuscript with change tracking), the authors state

“The stress field in both models is a consequence of gravity acting on the specific ice geometry and thereby initially identical (differences arise only by discretization method). [...] This allows us to scale down the obtained friction parameters HiDEM receives from Elmer/Ice (in our case using the factor  $10^{-4}$ ) so as to increase the sliding speeds and thereby reduce the physical time (in our case 100 s) needed to evaluate the resulting fractures [...]”

Actually, the stress field results from the balance of gravity and the forces acting on the boundaries, such as basal friction, the support from the bed, and lateral forces. Thus, reducing basal friction generally affects the stress field.

In the HiDEM description paper, Åström et al. (2013), [www.the-cryosphere.net/7/1591/2013/](http://www.the-cryosphere.net/7/1591/2013/) are aware of the relevance of viscosity when rescaling the equations for acceleration and scale their model parameters accordingly.

Page 1593:

“Computational problems arise, however, from the fact that the time step length is limited by the rapid timescale of the brittle failure events to approximately  $10^{-4}$  s, while the relevant time scale for viscous flow of ice is much longer. To cover both relevant time scales in a single simulation is impractical. It is however possible to use lower viscosities and thereby higher strain rates and re-scale the simulation time to match ice behaviour as long as the viscous flow timescale remains slow compared with that for fracture events (Riikilä et al., 2013). “

Page 1595:

“The particle model parameters are set such that the resulting viscosity is  $10^5$  times lower than in the Elmer model, leading to  $10^5$  times faster strain rate, i.e. strain rate is proportional to the inverse of viscosity. “

I recommend involving Jan Åström more closely on this issue, and refer to my comment from the previous iteration:

In section 3.3 step 3, it is stated that

“HiDEM scales down the obtained friction parameters it receives from Elmer/Ice (in our case using the factor  $10^{-4}$ ) so as to increase the sliding speeds and thereby reduce the physical time (in our case 100 s) needed to evaluate the resulting fractures.”

At this point more information on how the stress field is preserved in this scaling and which parameters are affected by the scaling would be very helpful, especially to other scientists planning similar couplings. Is viscosity scaled as well? Any other constants or fields? Is this a

feature of HiDEM, or is this done in the transfer scripts? Can you provide evidence of the successful rescaling of the equations?

Specific comments:

Page 1 line 4, 17 maybe replace “involved models” with “models”

There are quite many unnecessary qualifiers spread over the document. I’ve listed some below.

Page 1 lines 4 and 5 “and in the worst case even lead to sub-optimal CPU utilization” – maybe just write “and can lead to sub-optimal CPU utilization” and leave it to the reader to define their own worst-case scenario (I’d often put lost simulations higher on my list of nightmares).

P4 line 2 “coupling and on models description” – maybe “coupling and on the models”

Line 31 “were simulated by different models in an offline coupling” – maybe “were simulated by a sequence of different models in a one-way coupling”

P5 line 21

“surface that is ~~being~~ meshed”

P7 line 11 I’d suggest:

“~~a relatively small glacier, like Kronebreen,~~ in this part of the workflow”

P8 line 33, I’d suggest:

“the ~~identified~~ tasks are well-segregated and do not overlap each other.”

P10 line 8

“the ~~created~~ workflow”

P11 L 4

“the ~~involved~~ applications”

P15 L 3

The listing is not to be found in the manuscript.

P20 L 8

“the ~~used~~ models”

P20 L 13/14 I think, this sentence can be removed

“For instance, ... already implied here”