

Interactive comment on “The effect of the north-east ice stream on the Greenland ice sheet in changing climates” by R. Greve and S. Otsu

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General

This paper present (1) the effect of the NEGIS on the large-scale dynamics of the Greenland ice sheet, and (2) the effect of the surface meltwater induced basal sliding on the response of the Greenland ice sheet to the future global warming.

This paper is fairly well written. However, it seems to confuse us in several points. For example, as the Anonymous Referee 1 commented, it is unclear how the two main topics relate each other. The latter topic is too sudden.

My recommendation is, accepted after ‘minor revisions’ (very close to ‘major’).

Not a few points I want to comment are already mentioned by the other two referees, therefore I will not repeat them and I mention only the essence of my opinion.

Major points

First of all, you do not mention clearly that your model lacks an ability to express ice stream dynamics (higher-order stress terms). You must declare it at the very beginning. In addition, you have to discuss influence on the conclusion of the paper by lacking the higher-order stress terms, since this paper focuses on ice-stream areas. Including such a discussion, the focus of this paper should be much clearer.

Some previous studies of global warming simulation present that Greenland ice sheet will melt from southern part, as you show in Fig. 14. Thus NEGIS is not a good region to discuss its effect on whole mass balance of the ice sheet, under a short-term global warming experiment, because surface topography is not changed so much. Therefore, as both referee pointed out, you should mention clear reasons to focus on NEGIS in your paper.

As I said, the section of the surface melt induced basal sliding is very sudden. Also, it may not be consistent to introduce the surface... method only to the global warming experiment. Especially in the extreme case (18,19), it is no reason to assume that such speed-up occur only after the present day. Moreover, as the Anonymous Referee 1 pointed out, the text lacks how or why you chose large values for γ . For example, it is interesting to compare how much the surface velocity is affected using same figure as Fig. 9. Therefore, you should justify your experiment configuration in detail.

Minor points

Did you tuned the geothermal heat flux at the four ice-core sites at every experiment? Or the values in the text are used throughout the experiment? In the former case you should mention which experiment apply the distribution of the geothermal heat flux shown in Fig. 3. In the latter case, you should mention: which experiment you used

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for tuning (maybe 1) and influence on the basal temperature at NGRIP (at least) by the sliding enhancement, even if it is negligible.

Tables 2, 3: Add one column to indicate the sliding enhancement factor for each experiment.

Although it is beyond the scope this paper, I want to know how simulation is improved by using 10km resolution from 20km model. Otsu (2007) includes some discussion on the results by the both models (e.g., effect of including the surface meltwater induced basal sliding). I think it good idea to briefly comment about it in the text.

Very minor: Where is the origin of your model domain? I think it is at (44W, 90N).

Figs. 4 and 8, right panels: It is better to mask out the no-ice area (or ocean) instead using the color of 0-50.

Fig. 9, left panel: Drawing the line of the boundary of NEGIS area in the right figure would help to compare both panels clearly.

There is no comparison with previous studies of global warming simulations. You should state and discuss whether and why your simulation is modest, average or intense among those studies.

Interactive comment on The Cryosphere Discuss., 1, 41, 2007.

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