I read this excellent manuscript with great interest.

You've taken the next big step in ice-sheet modelling!

The manuscript is in good shape and can be put on the discussion stage `as is'.

I had some difficulties fully understanding what the set of time-dependent control model parameters actually was. Was \beta^2 kept constant in time? If not, how did it change with time. I saw no discussion of this in the manuscript.

I think it is indeed possible to get `negative buttressing' as you find. I found this to happen in my own previous model calculations (Gudmundsson TC, 2014).

Thank you for submitting this important work to TC!

Hilmar

Dear Hilmar

Thank you very much for your kind and encouraging words, and for directing me to your paper, I will take a look at this.

Regarding time-dependent parameters (\beta^2 and boundary stresses) for the majority of the results they are constant in time, as was mentioned in the paragraph at line 131, but I agree this was not discussed in depth. I have added a brief sentence at line 171 to make this more clear and to direct the reader to section 6.2, where we do explore time-dependence.

The background to this is that I actually had initially intended to invert for time-dependent \beta and boundary stresses, but I realized that it first needed to be established that such dependence significantly reduced the cost function to justify the additional degrees of freedom. I believe that I show in 6.2 that introducing time-dependence does not sufficiently decrease the cost function to argue that any inferred trend is “significant”, though I admit I do not have the theoretical framework to assess significance. As far as I know such rigour has yet to be developed (?) which I mention at the end of 6.2.

Thank you for accepting this submission for Discussion.

Dan