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The Cryosphere Discussions

Interactive comment on "Ice-stream response to ocean tides and the form of the basal sliding law" *by* G. H. Gudmundsson

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This is a very interesting and innovative paper following up on earlier work by Gudmundsson and other authors. The idea to use the tidal response of RIS as a natural experiment to deduce something about the non-linearity of the sliding law is certainly a good one. To follow up his earlier model with a more comprehensive one is also of great value, as it gives earlier conclusions more substance. I therefore recommend that this paper be published in TC, after addressing the comments below:

I would like the final TC paper address the following:

1) Can you make clearer why visco-elasticity is important here? Would a purely Stokes Flow model also produce these results? 2) You promise a future parameter study, but

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I think this could be expanded at least a little bit. How sensitive are your results to the value of m. Clearly m=1 won't work and m=3 looks good. How well constrained is that? 3) Is the Stokes Approximation of ignoring inertial terms valid in a visco-elastic model? 4) I think a figure of the model domain would add to the paper 5) You should give a few more technical details on the model, such as spatial resolution, number and type of elements, shape functions, etc. This doesn't need to be in great detail, but something that a reader with FEM background might find interesting.

Some detailed and minor comments:

be consistent with spelling 'ice-stream' or 'ice stream' p2 l4: conduced -> conducted p2 l5: it would be better to say that you are using Stokes Eqn., because all components of the equilibrium equations would also include inertial terms in the momentum balance p6 l2: gives -> give p6 l3: can you give an indication where those sites are (relative to yours)? p6 l7- : you point out some confusion in the literature about the seismicity. It might be ok to make that point, but it has so little to do with your paper that I would just delete that whole paragraph. p8: a reference for eqns (4) and (7) is in order p9 l2: proprieties -> properties p9 l7: K should be the elastic or Young modulus, not the shear modulus p10: 'Fracture and Creep of Ice' by Schulson and Duval, sec. 4.2.2 has a nice discussion on this issue. It might be worth looking at and referencing. p11 l7: mach -> match p11 l20: Is 'Floating condition' actually a good term here? When I read that, it seems to imply that you impose floatation, locally, whereas you actually apply the correct pressure boundary condition. p 12: Could you just explain in a sentence why the pressure boundary condition has to be applied this way, i.e. why can it not be directly specified? p 12: You might also mention here that you are no longer subject to the geometric assumptions of beam theory. p13 l22: give a reference for the value p14: I also find it interesting that the semidiurnal tidal response is larger in the accelerating phase, which seems to be a feature in the data as well p14 l26: complicate -> complicated p15: It would be worthwhile to compare the result with velocities obtained with the same rheological choices, but no tidal forcing p18 l21:

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conducing -> conducting p18 l25: constrains -> constraints

Interactive comment on The Cryosphere Discuss., 4, 2523, 2010.