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# *Interactive comment on* "Interaction of marine ice-sheet instabilities in two drainage basins: simple scaling of geometry and transition time" *by* J. Feldmann and A. Levermann

**Anonymous Referee #2**

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In this paper the effects of melt perturbations applied to an ice shelf in a flow-line setting with no transverse variations are investigated. I find some aspects of this work puzzling and must ask for a better description of how the perturbation was applied. As it stands it looks as if it the work might be fundamentally flawed.

In a flow line situation, and for a vertically integrated models, an unconfined one-horizontal dimensional (1HD) ice shelf is 'passive', i.e. any changes in the geometry of the ice shelf do not affect the force balance at the grounding line. Melting the ice shelf away will therefore not cause any changes in grounding line position. So why is it that ice shelf melt causes grounding line retreat in 1HD as claimed and analysed by the authors?



The authors write: 'The steady-state ice sheet is then perturbed locally by applying melting beneath the ice shelf. . .' This then, according to the authors, results in a retreat. The model is clearly 1HD as they also write: 'The model is set up in flow line, hence there is no variation in cross-flow direction'. Periodic boundary conditions are applied in the y direction, and, I assume, no friction along the sides.

If this really is the setup then it is physically impossible for melt applied over the ice shelves to cause any changes in force balance at the grounding line. So something is wrong here. Either the model is producing incorrect results and the whole paper is based on some numerical artefacts, or, I hope, I'm not understanding correctly something about how the perturbation is applied.

Is it possible that the ice-shelf melt is somehow also applied some (small) distance upstream of the grounding line? Or are the stresses within the ice shelf not exactly correct, for example due to incorrect implementation of the boundary condition at the caving front, therefore erroneously leading to some buttressing at the grounding line? This then wcould explain why the grounding line retreats. But these would then also be serious mistakes in the code.

Expecting clarifications!

Interactive comment on The Cryosphere Discuss., 8, 4885, 2014.