

Interactive comment on “Are seasonal calving dynamics forced by buttressing from ice mélange or undercutting by melting? Outcomes from full-Stokes simulations of Store Gletscher, West Greenland” by J. Todd and P. Christoffersen

Anonymous Referee #1

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I think that overall this is a fine paper, easy to follow, well written and clearly documented. It makes a significant contribution to the overall question of how ice mélange and marine terminus undercutting by melting along the calving face exposed to the ocean influence calving rates and retreat or advance of Greenlandic outlet glaciers. I don't think that the study settles any issues, but it still provides important knowledge and experience on the subjects. I also think that it may be that a false dichotomy is being implied without intending to be implied: is it really fair to say that ice mélange back stress is more or less important than marine face undercutting? The two pro-

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cesses both have the potential to be important, and is it really fair to imply that they are in "competition"? As the paper clearly points out: the results hold for Store Glacier most precisely and may not apply to other situations. This might be pointed out more emphatically in the abstract (if it is not).

page 3529, line 23 - "annual formation and collapse" of mélange. What is specifically meant by formation and collapse? e.g., does collapse mean "dispersal" or does it mean something else, and does formation mean that a previously empty fjord is then filled with icebergs?

page 3535 line 25 - why is it necessary to apply a scaling factor? How would results change if no scaling were done?

Just a strange comment: The Norse were in Greenland before the Inuit. The Inuit apparently replaced the Dorset people who the Norse found in Greenland when they arrived before the Inuit. (At least, this is what I have heard or read.) So, is it really fair to use an Inuit word for ice mélange rather than an Indo-European word? In fact, if there were to be appropriate attribution to the original native languages of Greenland, would an Icelandic term (representing a close approximation to Norse of Greenland) be better than both ice mélange and sissusak? Is there a Dorset word for the same type of ice? Anyway, something that occurred to me now and then. . .

Out of curiosity: Is it possible that bending moment at the ice front (due to sea water pressure alone) could cause the calving face to become non-vertical? If so, how does the rate of rotation of the vertical face due to bending moment of sea water compare to the effective rotation rate caused by a typical ice-front melting profile?

This wasn't clear to me at about page 3541: Does the model predict "ice mélange formation"? or is the presence or absence of ice mélange as a boundary condition on the ice front independent of what calving is actually happening at the ice front in the model?

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page 3542: in the discussion, is it fair to say that submarine (presumably on the vertical or nearly vertical ice front) is “less important” in all cases of all possible glaciers? ...or is this a result that could be more or less specific to the regime of the Store glacier? Is it possible to evaluate how representative the results of the present study are in determining a generality about the relative importance of the ice melange vs the submarine melting? I see that this is somewhat answered on the next page. . .

Interactive comment on The Cryosphere Discuss., 8, 3525, 2014.

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