

Interactive comment on “Testing hypotheses of the cause of peripheral thinning of the Greenland Ice Sheet: is land-terminating ice thinning at anomalously high rates?” by A. Sole et al.

Anonymous Referee #2

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This paper provides a thorough assessment of possible causes for the recent observed thinning of many of Greenland’s outlet glaciers: changes in surface mass balance; enhanced basal lubrication by increases in the volume of surface melt water draining to the bed; and reduction in back pressure; acting on the glaciers caused by weakening, breakup, or flotation of their marine termini. Comparison of observed thinning rates with melt rates calculated from positive degree days shows that thinning of many regions of slow-moving ice can be explained by increases in surface melting, but not the more rapid thinning of many outlet glaciers. Moreover, it is clear that thinning rates on many tidewater glaciers that flow over deep beds into the ocean are far larger than those for glaciers flowing over shallow beds. Consequently,

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the rapid thinning is most probably caused by changes near the calving front of these tidewater glaciers that cause a reduction in back pressure further upstream.

These conclusions are in good agreement with those from other recent papers which they complement nicely by providing a more rigorous, statistical assessment of the three potential causes of the thinning. The fact that the tidewater glaciers are most susceptible to rapid thinning caused by force perturbations propagating upstream from their marine termini has two important ramifications: (i) We need to identify what changes in the ocean might have caused these perturbations, and what caused the ocean changes; (ii) Total “tidewater” retreat of these glaciers will be limited to the inland extent of their deep beds.

These should help to focus future research, particularly in the hostile funding environment that is highly likely in the near future.

Interactive comment on The Cryosphere Discuss., 2, 673, 2008.

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2, S318–S319, 2008

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