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The Cryosphere Discussions

Interactive comment on "Multi-decadal marine and land-terminating glacier recession in the Ammassalik region, Southeast Greenland" *by* S. H. Mernild et al.

Anonymous Referee #2

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The below is an expanded comment from my earlier comment. Only one comment is a bit redundant. Mernild et al., (2012) provide a valuable and detailed comparison of the changes in the glaciers of the Ammassalik region of Greenland. The value is in the level of detail and the fact that they contrast three types of glaciers that have different climate sensitivities ice caps, outlet glaciers and the ice sheet land terminating sections. It is unusual to have a study focused on all three in a region. This will be a valuable contribution. Two areas need particular attention:1) More detailed and critical discussion of the dynamic changes of GIS outlet glaciers that has led to the acceleration and retreat. 2) The retreat is largest for the five largest glaciers, which because of greater basal depths would be most susceptible to enhanced submarine

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melting via warmer water intruding beneath the ice. A comparison of the response of these five versus the smaller sixteen outlet glaciers where we would not expect submarine melting to be significant is needed, and could yield important insights.

532-10: However the land terminating duplicated.

532-14: change- “values” to “recession.”

533-11: Johannessen et al (2011) rely on a statistical correlation between the ice-front position and the surface air temperature to determine that meltwater lubrication is partly responsible, they have no observations of meltwater lubrication of the base. Only that higher air temperatures lead to retreat is what is demonstrated. Anderson et al (2011) in a much more detailed look at velocity, where actual observations are used find “that relative changes in glacier speed due to meltwater input are small, with variations of 45% in melt producing changes in velocity of 2–4%. This does not indicate air temperature is not important just that enhanced meltwater lubrication is not. Thomas et al (2009) note outlet glaciers have “periods of glacier acceleration and rapid thinning initiated by flotation and break-up of lightly grounded glacier snouts or break-up of floating ice tongues. Nearby glaciers without deep beds are thinning far more slowly, suggesting that basal lubrication as a result of increased surface melting has only a marginal impact on Greenland outlet-glacier acceleration”. This would also suggest in your study that the largest glaciers should be most affected and the smaller glaciers not by submarine melting. The data set in this paper is uniquely suited to try and address this.

533-21: “sparsely not accurate”- replace with –“not been comprehensively”

534-12: remove e.g.

534-13: change “going” to “dating”

534-14: provides the opportunity to “map” glacier change.

538-12: remove-“was also”

538-13: End sentence at (Figure 3A). Howat and Eddy (2011) for GRIS outlet glaciers noted a a transition. . ..

538-20&21: Remove "equal to".

538-26: Why in the face of rising recession rates is area change declining? Which measure has a higher confidence factor.

539-12: Possibly add. The mechanism is increased submarine melt from water leading to glacier thinning, increased flotation, reduced resistive stress and acceleration.

540-6-10: Johannessen et al (2011) do not show more melting leading to percolation, they only note higher air temperatures and assume the next step. Obviously air temperatures are involved as this has driven retreat of land terminating sections and GIC, but it does not have to be via meltwater lubrication for which you offer no evidence. The best surface velocity observations in the region Anderson et al (2011) indicate it is limited.

540-10 and Figure 4: The five largest, fastest glaciers have the greatest recession and area loss. These same five glaciers would have the largest area exposed to submarine melting. This would be true as a ratio as well, depth is key for submarine melting enhancement. The submarine meltwater enhancement has not been expected to be important on smaller marine terminating outlet glaciers, due to the shallow depth of the glacier bases. That the five glaciers most susceptible to basal melting have the largest response, can be coincidental, but contrasting these five to the other 16 which should be more sensitive to surface mass balance issues may yield important difference or not. Show the differences in Figure 4 plotting lines for the five, the other sixteen and all 21.

541-1: "its" to "solar radiation"

542-11: Remove "-both . . .GIC"

543-22: End sentence at "since 1986. This is almost. . ..

References:

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