

Interactive comment on “Warming of waters in an East Greenland fjord prior to glacier retreat: mechanisms and connection to large-scale atmospheric conditions” by P. Christoffersen et al.

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I thank the referees for their helpful reviews. I concur with their assessment that this paper is well-written, sound and valuable. Both reviewers give recommendations to improve the impact of the paper, and I strongly agree that a graphical comparison between model and in situ data is needed. In addition, I suggest adding bathymetry to one of the figures (possibly as the background for Figure 2) so that the trough, and potentially others on the SE coast can be identified, as well context given to the circulation patterns discussed.

Further, I think an expanded discussion of the results in terms of the broader context of

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forcing of recent glacier change in Greenland is desperately needed. The results essentially extend those of Holland et al. 2008 from the west coast to the east, providing a more global perspective on widespread change. This should be pointed to. Similarly, it seems strange that these oceanographic patterns should be discussed in terms of only changes at one glacier, albeit that's where the CTD data is. Couldn't these forcing explain changes along the entire SE coast, as documented in the works cited? Finally, little change has been observed to the north of the Denmark Strait. Is this consistent with the spatial-temporal pattern of forcing you elucidate?

In summary, I ask the authors perform minor revisions on this work in line with my comments above, detailed points below, and those of the reviewers. In addition, please respond to each review as a reply to the discussion in the TCD thread.

Sincerely, Ian Howat

Detailed Points:

In numerous places: "East Greenland" or "East Coast" should only be in caps if a proper noun, but not a modifier. Should be "east Greenland" and "east coast".

page 2/line 2: "with ocean reanalysis *model estimates*" ? need to define "reanalysis"

2/3: "east Greenland"

2/4: misleading.the hydrographic data only show that 2004 survey was warmer than a survey in 1993, while "warming" implies a trend.

2/7: again, "reanalysis" of what? I suggest actually naming the model in line 2 and then you need only name it later.

2/21: "long term" is ambiguous. Why not just say it was "close to balance"?

2/23: why "can"? They do.

3/12: "timescales"

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4/6: "...2004, together with..."

4/6: write out acronym "NEMO"

4/7: "...model, to..."

4/7: "...elucidate air-sea and ice-ocean interactions." Vague. We already know they interact, so what about the interactions will be elucidated?

4/8: NAO already defined.

4/9: "...and, furthermore, the latter data were acquired..." or, better, break into 2 sentences with the 2nd beginning with "Furthermore, the latter data ...".

5/9: "...icebergs allowed the station..." Awkward.

5/26: what makes it "primitive"? relative to what?

Section 2.2: Much of this description seems unnecessary for the scope of the paper - I suggest removing much of the model detail, since it is given in the cited works, and focusing only on the relevant and/or novel attributes of the model to this application.

9/10: "...both meaningful and informative." Vague. Exactly how is it meaningful and informative for your analysis?

11/16: This delay between ocean warming (from SST's) and glacier retreat/acceleration for the entire SE coast has been previously noted (Howat et al. 2008, J. Glac.) and was attributed to the effect of basal topography, as initially slow retreat from basal highs could lead to faster, larger retreats into over-deepenings. This progression is supported by modeling work (e.g. Nick et al. 2009, Nature Geoscience).

11/25: "east Greenland"

11/25: would this effect the entire east Greenland coast, or should this be specified more narrowly? (i.e. central and southern east Greenland?). This is important considering the differing of behavior of northeastern glaciers.

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12/10: "east coast"

12/15: give these statistics of significance.

14/15: Same issue with "warming... between 19993 and 2004" as in the abstract. The model estimates are what's needed to establish this as a trend and not temporally random variability.

15/1: "Subtropical waters ... *are* found...".

15/13: "subtropical waters *flow* "

15/28: Seems appropriate somewhere soon after this statement to link this conclusion to the similar result of Holland et al. 2008, Nature Geosci, providing a more regional context for this forcing.

Figure 2: What is the color scale representing?

Figure 8: The arrows are almost illegible. Maybe make them white, expand the figures and/or make the arrows smaller?

Interactive comment on The Cryosphere Discuss., 5, 1335, 2011.

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