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The Cryosphere Discussions

Interactive comment on "A new glacier inventory for 2009 reveals spatial and temporal variability in glacier response to atmospheric warming in the Northern Antarctic Peninsula, 1988–2009" *by* B. J. Davies et al.

B. J. Davies et al.

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Re: Manuscript No, tc-2011-102 "A new glacier inventory for 2009 reveals spatial and temporal variability in glacier response to atmospheric warming in the northern Antarctic Peninsula, 1988-2009".

Dear Professor Gudmundsson, The authors thank Matt King for his informative review on our manuscript and are pleased that he found the work to be significant and of great value to the community. We have amended the manuscript as suggested, and our

responses are detailed below. Significant improvements include:

- Supplementary methods are included in the main text, leaving only Figure S1 and Tables S1 and S2 in the Supplementary Methods.

- We have worked hard to distil and condense the information conveyed, and have reduced the manuscript by 600 words to 8400.

- All the small typographical errors have been amended.

- Changes to figures have been amended as suggested.

- Figures will be larger in the final published version.

- More detail on the use of the SPIRIT DEM has been added to the "Data sources" section. Specific responses are detailed below.

Yours sincerely,

Bethan Davies

The authors present a comprehensive summary of the characteristics of the glaciers of the northern Antarctic Peninsula. This represents a significant body of work which will be of great value to the community. They also summarise recent changes (from 1988) and make some preliminary conclusions about the relation between these changes and climatological forcings. I think this paper is in good shape. Even as a non-expert on many aspects I found the text clear and interesting. I only have only a number of more minor comments.

P3543L6: "last 50 years" is really from the last data in Turner et al, so that leaves the last decade unreported. -Reworded to, "from 1950 to 2000".

L8: this "thermal limit" is, I believe, just suggested not bound up in some theoretical basis? -Theoretical. This has been noted in the manuscript.

L13: add "part of" to "Larsen Ice Shelf" or specify A, B. -Amended.

L27: "focused" -Amended.

P3544L8: throughout the paper I think a number of proper nouns are introduced which I do not think are actually widely recognised places. ie, Western Antarctic Peninsula is surely western Antarctic Peninsula, as is Eastern, Northern, etc. This applies to the title also. Graham Land is the "northern Antarctic Peninsula" I think (I imagine the SCAR gazetteer agrees). - This is policy for Cryolist publications.

P3546L6: the study of Gille appears to only consider ocean north of 60S, so it's a stretch to push that to the study region. Needs some rewording. - Noted in manuscript.

P3548L6: which version of the SPIRIT DEM was used (v1 or v2). Was the SPIRIT correlation mask used? If so, how were gaps filled? If not, then how were spikes removed? - V2 was used. The SPIRIT correlation mask was not used. Holes and gaps/spikes were filled using hydrological "fill" tools in the GIS.

P3550L20: Could you not obtain these from ASTER? - We did not have access to this.

L24: "proxy for ice thickness" needs a reference. - The reference is Paul et al. 2010 and this has been moved to the end of the sentence for clarity. We have also cited Haeberli and Hoelzle 1995.

P3553L14-18: why is this comparison done - that is, why are the correlations expected? I think the critical information may be in the supplementary text and belongs here. The same question applies to the comparisons on ELA values in Section 4.3. Please introduce the tests with some context and the purpose. - Sentence added, "The relationship between glacier elevation, length, area, and slope was investigated, as these parameters may control glacier recession and behaviour."

P3555L16: new sentence before 2nd ELA_mean (ie, missing full stop). - Amended.

P3555L25: I found the obvious missing - that the flow is generally perpendicular to, and away from, the central Trinity Peninsula spine. I think this was mentioned earlier, but here it should be repeated. - Amended.

P3557L9: it is noted in table 9 caption that there is little data for 1997. this is stated implicitly at L14, but should be discussed more clearly here with cross reference that values in Table 9 for 1997 are likely unreliable. - Noted in the manuscript.

P3558L15: how do the authors partition "atmospheric" from "climatic" in this setting of land terminating glaciers? - "Atmospheric" is deleted for clarity

L18: "regionally" - explicitly here this is especially by elevation? - Noted in manuscript.

P3559L2: "reaction to climate warming" - this looks like a loose remark. The connection has not been established, and indeed the issue of accumulation variation is raised within the paper. - Amended to read, "Overall, the largest shrinkage in the Antarctic Peninsula is in small, land-terminating mountain glaciers that are less the 1km2."

Need full stop after "1km2" - Amended.

L6: "margins *of*" - Amended.

L22: table 8 should be table 9 I think. - Amended.

L24: "probabilistic" begs the question of how this was done. It should be described. - Added to uncertainty section in methods: by summing the square root of the squares of individual uncertainties.

L27: should be net surface lowering, or not area-averaged surface lowering. - Amended.

P3560L15: "both from ..." does not make sense. - Sentence deleted

P3561L9: there is no figure 9 - Deleted - it should have referred to Fig. 8 which is cited later in the sentence.

P3563L3: "was therefore caused by" - I do not think this has been established. -We have highlighted that this is in response to recession from the pinning point.

L21: this conclusion here seems likely, but it has not come into the earlier discussion.

I think it should be introduced earlier that 1988-2001 values may well be dominated by 1995-2001 period. However, Table 9 suggests the opposite in terms of area loss. I'd appreciate if the authors made this very clear. - This was clearly discussed in section 6.2, "Impact of the disintegration of PGIS".

P3567L6: again, southward extrapolation of the results of Gille. I think Meredith and King would be sufficient. - Amended – Gille reference removed.

L12: thinning terminus also steepens the glacier. want to discuss? - Added, noted in manuscript.

P3568L13: "*s*tudy" - Amended

P3572L21: journal is J of Climate - Amended

Table 9 caption: "*The* error margin"; "As *the* analysis"; "divides, *the* error" - Caption shortened and this sentence removed.

Most figures: font size is in general too small, often crazily so. detail is there on zoom of pdf, but many fonts could be reasonably increased e.g., lat, lon on Fig 1 and other maps. - These figures will be reproduced full size on the final version and text size has been increased.

Fig1: add other Antarctic bases - O'Higgins, etc. - Research bases within the study area are marked. O Higgins is beyond the study area.

Fig 2 caption: one of the "accumulation area" should be ablation I guess. - Amended

Fig 3D: looks like 2 or more populations to me.

Fig 4: specify year of snapshot in caption. - Amended

Fig 6: strange x axis units of "months to Feb" does this mean "months before Feb 2009". Why not just year?? - Calculated in months over the course of study period. This is important, as various glaciers were analysed at slightly different times, depending on

the acquisition date of the satellite image.

Supplementary material: in general I found this under-cross referenced in the text. In fact, I think most of the supp text could go in the main body. There is overlap and much of what is written seems arbitrarily separated from the main text. - Supplementary methods have been added to the text. Tables S1 and S2 remain in the supplementary information.

Table S2: specify ArcGIS version. - Amended

Interactive comment on The Cryosphere Discuss., 5, 3541, 2011.