

## ***Interactive comment on “Diagnosing the extreme surface melt event over southwestern Greenland in 2007” by M. Tedesco et al.***

**M. Tedesco et al.**

Received and published: 4 September 2008

This is an excellent, detailed and insightful paper concerning Greenland Ice Sheet melt anomalies of summer 2007. The paper makes a useful incremental advance in knowledge, and should be of broad interest to TC readers. I strongly recommend publication once the minor issues listed below have been attended to.

Reply: We thank the reviewer for his/her positive words

The authors should add in their Introduction the recent new evidence attributing recent warming and increased melt/runoff in Greenland in the last 15 years to global warming: E. Hanna, P. Huybrechts, K. Steffen, J. Cappelen, R. Huff, C. Shuman, T. Irvine-Fynn, S. Wise & M. Griffiths (2008) Increased runoff from melt from the Greenland Ice Sheet: a response to global warming. *Journal of Climate* 21, 331-341, doi:

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10.1175/2007JCLI1964.1.

Reply: We now mention this paper and have added it to the reference list. However, it seemed more appropriate to refer to it in the Conclusions and Discussion section.

p.386, lines 20-21 (& elsewhere): Please give all trends as percentages rather than just values, and comment on their statistical significance.

MARC)/XAVIER: The reviewer wants a conversion, something like %/decade, referred to the base period mean. I don't have the mean so I can't do it here.

Reply: We appreciate the suggestion. However a reference for melting index (and consequently expressing MI in terms of %) is not introducing any additional information and would only increase confusion, differently from melt extent where the ice sheet surface can be used. However, we added a comment on the statistical significance.

p.388, l.12: Please comment on the significance of the +22 W m<sup>-2</sup>; -2 incoming longwave radiation anomalies

The maps in Figure 2 now show regions with significant flux anomalies as hatched. Significant anomalies are taken as those with a magnitude at least twice the standard deviation. The text now includes references to significance based on the revised maps.

Note also that for completeness, we also include a new figure (Figure 3) that shows modeled meltwater production anomalies from MAR. It demonstrates consistency between the location of peak melting anomalies from the satellite analysis, the location of peak anomalies in the net surface heat flux, and modeled meltwater production. Significant anomalies in meltwater production are assessed in the same way as for the modeled energy fluxes.

p.388, l.15: Re. incoming shortwave radiation anomalies, "generally negative" is rather vague - please tighten up, and comment on the significance, of these anomalies.

Reply: The text has been altered to "...anomalies of shortcoming radiation are

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negative over most of Greenland, particularly over its western side where they may exceed -15 W m<sup>-2</sup>.

p.391, ll.9-10: typo - change "southeastern" to "southwestern".

Reply: Corrected

p.391, l.12: After sentence "While the NCEP/NCAR data also document southerly air-flow over the south-WESTERN part of the Greenland Ice Sheet...", I suggest inserting a reference to the in press paper by Hanna et al. (2009)\* that examines the 500 hPa geopotential height anomalies over Greenland in more detail and found that summer 2007 was exceptional in the entire 60 years of NCEP/NCAR reanalysis data: \*E. Hanna, J. Cappelen, X. Fettweis, P. Huybrechts, A. Luckman, M.H. Ribergaard (2009) Hydrologic response of the Greenland Ice sheet: the role of oceanographic warming. Hydrological Proc. (Invited Paper for Special Issue on Hydrological Effects of Shrinking Cryosphere), in press. (A preprint of this paper, which was accepted in April 2008, is available to at least one of the authors.)

Reply: We now mention the Hanna 2008 paper, and have also included a new figure (Figure 5) showing anomalies in 500 hPa winds and temperatures fields from the NCEP/NCAR reanalysis for the summer of 2007

p.391, ll. 18-20: "Interestingly, the 2007 surface mass balance...as simulated by MAR is the most negative of the period 1979-2007 (Fettweis 2007)." The authors should add that this is a model-dependent result, as e.g. Hanna et al. (2005, 2008, updated) find 2007 is only the 2nd or 3rd lowest, not the lowest SMB year.

Reply: We already clearly state that the mass balance estimate is based on the MAR. To further emphasize that this is a model-based estimate, we edit the following sentence to say "While strong melt contributed to this negative modeled mass balance anomaly &#8230;" .

Lettering on Figures 1, 3 & 4 needs to be enlarged to be made easily legible

Reply: Done

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Interactive comment on The Cryosphere Discuss., 2, 383, 2008.

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