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Comment

## ***Interactive comment on “Estimation of the Greenland ice sheet surface mass balance during 20th and 21st centuries” by X. Fettweis et al.***

**Anonymous Referee #1**

Received and published: 11 June 2008

### **General comments**

This paper is an interesting contribution to an important subject. The scope of the paper fits the general scope of this journal. I have some comments concerning the methods (see below). This comment is written after reading the comments made by J. Bamber. Therefore, I do not make some comments I would have made if I hadn't read J. Bamber's review (for example, the lack of discussion of the results in the light of previously published estimates of GrIS SMB changes).

The paper should be publishable after the reviewers' remarks have been taken into account.

**Specific comments** The authors do not always explain choices they make concerning

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the methods they apply. They should discuss in more detail the following points:

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- The choice of the precipitation region is somewhat strange because it includes, in its northern part, a region where the signal is anticorrelated to the GrIS mean precipitation. Could the region be limited to its south-eastern part?
- How sensitive are the results you present to the choice of the region?
- Section 3, page 229, line 17: "These parameters are computed over 1970-1999 by using de-trended... time series to minimise the dependence on the reference period...". It would be interesting to see what impact the use of de-trended series has on the results. Are the parameters  $a$  and  $b$  very different from those obtained when using the raw time series in calculating the regression? Using de-trended time series can in principle give strange results. Imagine two time series  $X = t + \sin(2\pi t/T)$  and  $Y = -t + \sin(2\pi t/T)$ , with the total length being much longer than  $T$ . Using the de-trended time series would then yield  $Y = X$ , while using the raw series would yield  $Y = -X$ . Of course one wouldn't expect such a pathologic behaviour for the GrIS SMB, but I think this should be addressed.
- Why do you normalize to have the time series vary between +1 and –1. Wouldn't it be better to normalize such that the standard deviation is 1? What would be the impact on the results?
- Page 232, line 19 (Melt-induced outlet glacier acceleration): Probably not the only process yielding accelerated glacier flow in a warmer climate (e.g. buttress effect).
- In a warmer climate, the albedo of the Greenland ice sheet will be different. The same is true if there is more or less precipitation. Therefore, the sensitivity to temperature variations will also change. Can you estimate how important this effect would be?

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## Technical comments

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- The meaning ogf the sentence starting with "The boundaries of these regions ..." (page 228, line 20) is not clear to me. Please reformulate.
- Equations 5 and 6 are in reality parts of equation 4.
- Figures 5 and 6 are not easy to read. You could use different types of trait, in particular bold, in addition to the colours.

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Interactive comment on The Cryosphere Discuss., 2, 225, 2008.

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