

# ***Interactive comment on “Surface Mass Balance of the Antarctic Ice Sheet and its link with surface temperature change in model simulations and reconstructions” by Quentin Dalaiden et al.***

## **Anonymous Referee #1**

Received and published: 2 July 2019

The authors present the ability of CMIP5 GCMs to be used, together with ice core and d18O proxies, as a tool to reconstruct by data assimilation Antarctic temperature and SMB. They explore regionally the relation between these two variables by using different reconstruction techniques, and conclude that using both SMB and d18O proxies is most optimal. Doing this they can now better reconstruct SMB in the last two centuries.

The paper is well written, with clear figures and a new, at least to me, approach in reconstructing temperature and SMB far back in time based on physical models. The results are robust, well presented, sufficiently new and original, and I do not feel that any information is missing. I therefore strongly recommend publication in The Cryosphere.

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However, I do have some comments on the clarity of the paper and would also recommend to make the data assimilation explanation more clear, as I will explain below.

#### Minor comments

P1, Title: To me the title does not really catch the main conclusions and content of the manuscript. To me, the paper comes across as a new temperature and SMB reconstruction based on a new/better technique. Do the authors feel that the main content of the paper is the link of SMB and temperature? The current title seems to “state the obvious”, and did not really attract me at first to review the manuscript.

P1, Abstract, l7: This sentence is confusing, as d18O and temperature could also be the same. You mean the SMB-temperature relationship is stronger than the relationship between d18O and temperature? Maybe write out this sentence and omit the -dash.

P1, Abstract, l13: This is not clear. Which reconstruction method is used for the SMB?

P1, Abstract, general: The abstract (and title) should be reconsidered. The abstract is the first thing people read, and should be instantaneously clear. I had to re-read the abstract several times to understand it. Of course I understood it after reading the whole manuscript, but the abstract should be standalone in my opinion.

P3, l17: what is meant here with “estimated by d180”? This relation comes out of the blue.

P10, Figure 3: Where does the very low reconstructed value for West Antarctica in ~1700 come from?

P11, Figure 4: Please change the y-axis and x-axis labels. Slope West/Slope East is unclear.

P12, Figure5: why is this shown in a contour plot? To me this is confusing. Can't you make a scatter plot (such as Fig. 7) showing the correlations?

P17, Discussion and conclusions: Same comments for this section as for the abstract:

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I miss a clear emphasis on the main conclusion of the manuscript. How can these datasets be used in future work? What's the relevance of the study? What's the most important take-home message? I expect that the authors can easily strengthen the relevance of the study by giving this some extra thoughts.

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