

Interactive comment on “The modelled surface mass balance of the Antarctic Peninsula at 5.5 km horizontal resolution” by J. M. van Wessem et al.

Anonymous Referee #2

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Comments on “The modelled surface mass balance of the Antarctic Peninsula at 5.5km horizontal resolution” by van Wessem et al.

The paper presents surface mass balance of the Antarctic Peninsula using RACMO 2.3 coupled with a Firn Densification Model. The resolution of RACMO is greatly improved from 27 km to 5.5 km and it is able to resolve finer details of the spatial variability in SMB. The modeled results are compared with in-situ measurements.

General comments:

The abstract needs to be tightened. Currently, it is too long. Please focus on what is new and the important numbers. The paper is easy to read, but it fails to capture the reader's attention. The figures do not appear in the text in order. For e.g. Fig 11 comes

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after Figure 4 in 5107 while Fig 5 is called for the first time in 5108. The text lacks organization. At least two of the figures can be combined together.

At several places, the paper mentions increase in surface melt and temperature but modeled results show otherwise. This needs to be clarified.

This paper is important because it presents modeled surface mass balance estimates at a significantly high resolution over the Antarctic Peninsula. However, there are several points that need clarification and the text needs to be better organized.

Specific comments:

I am not a big fan of how the data are binned in elevation ranges in this study, if I understand it correctly. If possible, please provide a separate figure of the bins and the observations included within them. It will also be helpful to have the years of the in-situ measurements.

Throughout the text, both ‘Fig’ and ‘Figure’ are used.

What is erosion of drifting snow?

Abstract Ln 15: Sublimation is considered to be the largest ablation term with 100 mm we yr⁻¹. Snowmelt is high but refreezes but still considerable 200 mm we yr⁻¹. This is confusing because the snowmelt term seems to be larger than sublimation. If that is not so, then you need to clean up the sentence.

Line 25: Snowmelt has a decreasing trend? You mean less snowmelt even when temperature is increasing? Please clarify why this is so.

Introduction: Line 20: Please find a better way to define ‘towards/away’? Better to use gain or loss perhaps?

Page 5101: Ln 17: thickness change –do you mean elevation change?

Page 5102: Ln 5: It would be nice to know what exactly is different in the 27 km and

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the 5.5 km here in terms of any changes in the Physics. You refer to Lenaerts paper, but it is useful to have it here too. Did the 27 km have the FDM coupled to it? You can summarize these things in one place maybe in section 2 and shorten the introduction if necessary. Why does the period start from 1979?

5103, Line 11: Das et al., 2015 and 2013 are more recent references to show direct evidence of sublimation over steep slopes.

5104: Ln 13: What are the minor issues in the internal snow model? Please be specific.

5105: Ln 8: Not sure what is meant by time of the measurement not known? You mean date is not known or the hour of a day is not known? How many datasets are there with this problem? Should such observations be used at all?

5105: Ln 10: Here and elsewhere spell out Sect. as Section. Or does the journal recommend this?

5106: Figure 2: In some of the bins, RACMO has a lower spread in values than observed. I ask this because the resolution is high. Is it topography? How are the observations spreading out in the locations?

5107: Ln 7: Here it clearly shows you need to have a figure for the 27 km comparison as well.

5113: Ln 16: I did not quite get why a persistent surface inversion would favor surface deposition. Please clarify.

Comments on the figures:

The captions need to be more concise. Please do not include methodology in the captions. Figure 1: I think you should use a gray scale for elevation and a different color for the floating ice shelves. It is very hard to see the in-situ locations.

Figure 2: Fig 4: A small location figure would be helpful.

Figure 6: The comparison between the modeled results and in-situ measurements is a
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little hard to understand because the color scale is not linear. For e.g the green on the color scale covers a range of 200-700. Although I am impressed by the comparison in most cases, there could be important differences that may become more apparent with the right choice of color bar. It would be nice to use a linear scale and break up the regions into different panels if necessary.

Fig 7: A comparison with 27km RACMO will be useful.

Figure 11: What is the point of this figure? Should there be any correlation between an ice core at James Ross with other regions far away from it?

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