

## ***Interactive comment on “An updated and quality controlled surface mass balance dataset for Antarctica” by V. Favier et al.***

**Anonymous Referee #1**

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The authors present a new surface mass balance (SMB) observation dataset and made it accessible. The relevance of this work is their attempt to make an as complete as possible dataset, including observations that were made during efforts commenced in the International Polar Year. Furthermore, the authors applied a vigorous quality control that has been described in earlier work. The novelty of this work is their analysis of the coverage of this dataset, which clearly shows where on Antarctica new SMB observations are most lacking.

To my opinion, this paper is well written, although at points the wording is inadequate. I have only minor comments; I recommend it for publication after addressing these comments.

C1888

### Major comments

Many locations in Antarctica are mentioned, the authors expect the reader to have a detailed map. Please include a map with the locations mentioned. Alternatively, add these names in Figure 1a or b. However, I expect that this figure becomes unreadable with additional information.

Section 2.3: I know, it is not the scope of this paper, but why is isotopic data rejected ('B') even if the accumulation is clearly enough to separate annual layers and these layers are identified by multiple isotopic parameters? Furthermore, do you see possibilities to include data using ground penetrating radar (GPR)? It is mentioned later, but please spend a few sentences on possibilities, problems and limitations here.

Section 2.4, Figure 4a: It is informative to add a third quantity here, the distribution of points covered by observations. You can calculate this by counting the DEM points (which are already shown in Fig 4a) that have at least one observation within 15 km and with less than 200 m elevation difference (values are my own choice, take different if needed). You can plot it on the same scale as the white histograms. By adding this, the reader get an idea how well surveyed Antarctica is (It is poorly surveyed).

### Minor comments

P 3668 L8: Remove 'important'. Overemphasizes.

P 3668 L16: 'correctly' is not the right word, there is nothing wrong with the observations. The mean SMB is not well represented by the observations. (correct also in P3676 L23).

P 3668 L19: 'remains' I don't have the feeling that this priority is broadly felt. Please change into 'is' or 'must be'.

C1889

P 3669 L1-6: These studies have all different time windows. That is something that has to be mentioned in text. Rignot 2011 and Helsen 2008 seems to conflict, but this paper is not the right podium to dwell on which might cause this differences. However, this paragraph provides not the strongest motivation for this work. You can mention that the integrated SMB is in de order of  $2 \cdot 10^3 \text{ Gt yr}^{-1}$ , equivalent to about 5 mm eustatic sea level change - an enormous number - which provides reason enough to need precise estimates of the Antarctic SMB. Consider rewriting this first paragraph, it is poorly formulated.

P 3669 L24: Van de Berg 2006 provides a calibrated model result, not an estimate using interpolated observations.

P 3690 L25: There is no strict rule on this, but I prefer the abbreviation SU for sublimation, ER for erosion and RU for runoff, respectively.

P 3671 L27: 'Fixed trajectory' Please reformulate. A scientific traverse is not like particle trajectory and every traverse becomes 'fixed' at some point of time for planning reasons. I suspect that the authors want to say that Motoyama and Fujii more or less revisited the traverse made by Fujiwara and Endo.

P 3672 L19: 'So we now have ... spatial variability' Please reformulate, too informal.

P 3672 L20-22: The current use of both snow and ice in this comment is unclear. Since the density of ice is well known, the comment between brackets makes this information appear to be non-crucial. However, if snow depth is measured, for example, at a stake, this snow depth must be converted in to a snow mass. Here, the snow density is critical information. However, if this latter situation is mend in this comment, remove '(several data were originally presented in cm of ice per year)' here and include a comment like 'Several data are observations of snow depth, which had to be converted into water equivalents.' Additionally, you can mention that some data was expressed in a different dimension, e.g. cm of ice per year.

P 3672 L24: Consider rephrasing to: 'Other specific characteristics were also add to the metadata, for instance, ...'

P 3673 L6-L14: It reads as easy as a novel... Please make it more formal by stating

C1890

that for Bull 1971 metadata are missing - a reason for rejecting - and that part of the dataset can be traced as originating from known traverses.

P 3674: Make subsection 2.4 into a separate section 3.

P 3674 L12-28: Several spaces are missing here.

P 3675 L27: 'May' → can

P 3675 L29-1: 'At higher elevations, between 1800 and 4000 m a.s.l., ...'

P 3677 L6: 'inaccurate'. Models are not perfect, but inaccurate is a too negative judgment and moreover conflicts with P3681 L18. Reformulate.

P 3677 L4-5: Reformulate subsection heading, for example, 'Criteria for comparison data'

P3678 L12-14: Add these lines to the preceding paragraph.

P3679 L5: Figure 1b is important: '... the 10 dataset listed in Table 5 and shown in Figure 1b along ...'

P3680 L1-2: Make subsection 3.2.1 section 4.2 and reformulate title. For example, 'ERA-40 data and interpolation technique'

P3680 L3: The number of observations in the subset is information that should be given in section 3.1.

P3680 L21: Another similar study is Lenaerts (2012).

P3680 L20-24: I don't understand whether ablation observations are excluded from traverses, or that traverses with blue ice areas are excluded. In case of the first meaning, I don't understand the argument.

P3681 L3: Renumber: 3.2.2. becomes 4.3.

P3681 L4-5: Remove 'The Antarctic SMB ... measurements', unnecessary repeat of information.

P3681 L18: 'correctly'? Reasonably well at most. Reformulate.

P3682 L12-20: (Finally...) Move this part to the discussion and conclusions section. For example, insert this in P3683 between lines 24 and 25.

P3682 L21: Conclusions (add plural).

P3683 L5: 'weaker', wrong word. Less.

C1891

P3684: Consider removal or reformulation of the discussion on the better overall estimate of Antarctic SMB. It states that field data are required, but no additional comments are made about that. Furthermore, it makes little sense to discuss future papers or work that others should do. It makes sense to discuss how the existing knowledge gaps can be filled and how the presented dataset can be used, but that is not becoming clear from this paragraph. Reformulation is needed.

F1a: Consider drawing data listed in Vaughan and others (1999) in grey, so that new data are clearly visible. Keep the data from Bull (1971) in white.

F2: Add legends for the green lines.

F4a: What is the scale of the distribution of surface elevation?

F6a: Extend the y-range to slightly larger than 3000.

F7: Adjust font of labels and remove legend, or include all lines in it.

Additional reference:

Lenaerts, J. T. M., M. R. van den Broeke, C. Scarchilli and C. Agosta: Impact of model resolution on simulated wind, drifting snow and surface mass balance in Terre Adelie, East Antarctica, *Journal of Glaciology* **58**, 211, 821-829, doi:10.3189/2012JoG12J020, 2012.

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Interactive comment on The Cryosphere Discuss., 6, 3667, 2012.