Dear editor,

This letter accompanies the revision of manuscript essd-2021-22R1, originally entitled by “The AntSMB dataset: a comprehensive compilation of surface mass balance field observations over the Antarctic Ice Sheet”.

We would like to thank you for giving us the opportunity to re-revise our paper. We would also like to thank the two reviewers for their further comments, which are very useful for improving our paper. We have carefully revised the paper to take into account all of the points.

In the following, comments are addressed in the same order as in the reviews. The comments are in black fonts and our responses are in blue fonts. We also include the revisions with track-changes as an additional material for reviewing reference. I hope these responses will be helpful to you and the reviewers for re-evaluating our manuscript.

Best regards,

Yetang Wang

Response to reviewer 1

Thanks for your further evaluate our paper, and supporting publication.

Response to reviewer 2

I thank the authors for taking all my remarks and suggestions into account and for their work.

I think the paper is now ready for publication, except for a few items that I think would need double check:

[major]

Fig. 5d: I am surprised by this result as in Gorte et al. (2020), ice-core standard deviation of annual SMB was estimated much lower than ERA5 standard deviation. Can you double check? Can you show a map of the model standard deviation bellow the observations on Fig. 5c to verify the pattern?

Response:

We have carefully checked Figure 5. Following your advice, a map of standard deviation of ERA5 simulated time series has been added below the observed SMB standard deviation (ice core/stake farm) on Fig.5c.

In Fig.5d, we present the ratios of ERA5 standard deviation to annual observed SMB. Obviously, if the ratio value is smaller than 1, standard deviation of observations is larger than ERA5. At most of sites (>85%), the standard deviation of annual observed SMB is larger than ERA5 standard deviation. In addition, the maximum value of the ratio of standard deviation from ERA5 to observation does not exceed 1.5. We also have redrawn the whole Figure 5.

2. Fig 7a and 7b: there is a problem of consistency between the 2 figures. E.g. observations around South Pole are lower than the model in Fig. 7a, whereas ERA5-observation is negative around South Pole on Fig. 7b. And the problem exists almost everywhere.

The ERA5-observation pattern of Fig. 7b seems very strange, and the dry-wet inland-margin pattern is not seen in Fig. 7c.

I suspect that the difference in Fig. 7b is computed against a constant value of SMB, or something like that?

Response:

Sorry for the errors in the figure, and thanks for your criticism. In the original Fig.7, we use each multi-year averaged measurements including GPR for the 20th century. As the reviewer previously pointed out, GPR is continuous and the number of points are arbitrary. As a result, the observations and ERA5 modelled values on grid cells are not consistent. The difference of a lot of observations at the same grid cell is computed against a constant value of modelled SMB. In the revised version, we has corrected them as follows, and then we have re-drawn Figure 7.

ERA5 field data are bilinearly interpolated over a 30km Cartesian grid. If the values from observation points located in the same grid cell (30×30 km), we average them, and extract the corresponding value of this grid cell. At last, we obtain 1217 model–observation comparisons. They are presented in current Fig.7a and b. To make Fig.7c clearer, we have deleted the error bars of observation in each 200m elevation bin.

As Fig.7b and c shows, dry biases occur in inland Antarctica, especially on the regions with elevations above 3000m. In addition, parts of Ross Ice Shelf also show dry biases. Wet biases largely are present over the East Antarctic margins.

You should correct the associated text when you have the corrected map.

Response:

Changes have been made in the text.

Also there are white dots on Fig.7b whereas there is no white in the colormap?

(e.g. on the Larsen ice shelves)

Response:

They have been corrected.

[minor]

1. Fig. 5a and 5b: use symetric scales around 0 and symetric colormap (here the white is on the positive part)

Response:

Thanks for your good advice, and we have redrawn this figure.

2. Fig 5d: use darkblue for values higher than 1, as the white is misleading.

Done

3. Fig 7a: use a continuous colormap for SMB (e.g. the colormap of Fig. 5c), not a divergent colormap.

Response:

As you suggested, we have changed this using a continuous colormap.