

The Cryosphere Discuss., referee comment RC1  
<https://doi.org/10.5194/tc-2021-317-RC1>, 2021  
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## **Comment on tc-2021-317**

Anonymous Referee #1

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Referee comment on "Brief communication: Impact of common ice mask in surface mass balance estimates over the Antarctic ice sheet" by Nicolaj Hansen et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-317-RC1>, 2021

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In their manuscript entitled "*Brief communication: Impact of common ice mask in surface mass balance estimates over the Antarctic ice sheet*" Hansen *et al.* investigate surface mass balance estimates derived from different RCMs using their ice masks and compare these to estimates derived over a common ice mask. The study shows differences between modeled results on basin scale and highlights the need for a common ice mask protocol.

Addressing differences between ice masks and the implications of these is of great concern. One thing is understanding the differences between models over a common area but understanding differences between integrated model results is equally important; as the authors point out differences between modeled results is more or less equivalent to the Antarctic mass imbalance.

While I support publication of the present study (after revision), conveying the message of community efforts is needed moving forward, I think the authors could do a few things to help the reader fully understand the impact of the ice mask issue.

**Main comments**

- Understanding why there are differences between the ice masks seems relevant to investigate in this study. The authors spend a few lines in the beginning of the Methods on the background for each model, but we need more information on the native ice masks, what are they made from? Do they have a time stamp? How do they deal with ice shelves, grounded ice? etc.? etc.? Asking (and answering ...) these questions and more provides a better understanding of "problems" with the native ice masks – being too old, old coarse, etc. Perhaps this can be used for more easily defining a concrete recommendation in addition to the 3 steps already defined?
  
- There is a tendency when reading the manuscript that the "truth"/true AIS mask is the common mask. See for instance Table 1 and L 71 – "...smallest deltaSMB integrated over the 27 basins...". Why the comparison to the common ice mask? The answer is of course easy, it's what is common. However, throughout the study there is an implied desire for deltaArea and deltaSMB to be as small as possible, but that does not make much sense as the extent of the common is likely some distance from real world observations. However, I understand that without a new ice mask/product ready to be used, the authors need something to compare against – and in reality, it is highlighting the differences between models that needs to be conveyed. A way of addressing this, and conveying the need for a common usable product, would be to investigate/digitize the coastline of a few selected basins where differences are both small and large. As the comparison is based on regrided data to 0.11 degr., the resolution should just need to be better than this for now. These areas of interest could be displayed as a new figure 2 or be added as panels to figure 1. The main text should include a paragraph outlining the problem between real world observations, ice masks of each model, and comparison to a common ice mask (due to the lack of a new...). This could be used to better convey why a comparison to the common mask is used for now. Following this, the remainder of the text (wording/phrasing) should be reassessed in this perspective.
  
- Throughout there is a discussion on the delta-values, however, each model has an uncertain associated. To make an even stronger case I think the authors should include the SMB uncertainties in table 1 and use this as a basis for a discussion on delta vs uncertainty. As the authors mention in the Introduction there is a range in the SMB values, but also in the uncertainties (listed 80 - > 122 gt/yr) equal to 3.7 % - 4.7%, which to me seems very, very low, in particular given the results of this study.
  
- Also, this study builds on the publication by Mottram *et al.*, 2021, and although I am not a fan of adding unnecessary text for the sake of adding to the length, this manuscript could do with adding more on the findings/problems encountered by Mottram *et al.* Some of the suggestions below this.

## **Specific in-lines comments**

L12: how do their anomalies compare?

L18-23: this is an example of where more info from Mottram2021 would be good, what are the key findings etc. Here we are dealing with area/ice mask, but what else cause differences?

L28: "in most of the result" why not all? Please ensure consistency throughout

L28-34: Does this difference cause problems for the comparison? This kind of falls back on the description of the native grid of each model.

L37 (and L26): how does re-gridding affect the results? Any differences for any of the models? Did you check for consistency and that no biases were introduced?

L50: re-highlight that this is based on the re-gridded versions

L54: what is the ensemble mean? This is not defined until now – maybe it is included in Mottram21, but values and over what grid should be included here. Need to clearly convey the difference between ensemble mean and 4<sup>th</sup> column in table 1

L55-56: Or parts of the periphery of the ice sheet that has lower SMB are cut off?

L57-58 incl rightmost column in table 1: I understand from a sea level contribution perspective it is interesting to include the numbers/highlight in impact, but in the introduction, you clearly stated that your ice mask comparison includes shelves etc. I agree that it should be included, it warrants a follow-up, but there is a need to mention this in the Methods – what is defined as grounded ice and are there differences in grounded ice extent in the native ice masks?  
Clearly defining the ground ice also becomes an issue in the discussion L80-87(see also below)

L83-85: To some extent it makes sense to compare against IMBIE2 but is it a full-on apples-to-apples comparison? Is there “another” common extent for the ground ice only? In which case the comparison makes sense (grounded v grounded), but from reading the manuscript I am not sure where the numbers for the comparison originate from. Please clarify in the methods, results, and here in the discussion

L 85-87. Reads unclear, is something missing.  
add “. ”after zero

L92: is it also a melt v precip issue? Perhaps worth clarifying?

L93: where does 63 come from?

L94-98: this brings back the point about the origin of each native ice mask. Following this discussion/mentioning of post-creation modification can be discussed/added.

L105-124: I really like this part. As part of Step 2, I would suggest/recommend proper surface delineation with a specific year associated, e.g. Antarctic summer 2018/19, or what compares well with the remainder datasets, e.g. REMA, etc., to ensure a common data platform that can "easily" be updated every X years. I realize that some datasets such as RGI are getting "old", but I will encourage pursuing more recent data/time stamps for the grids, DEMs, etc., and hope that/encourage other data producers will update their data too.

L117: incl. "the" before tool

### **Tables:**

Table 1 caption: what does "the ensemble mean (from Mottram21)" refer to? I don't follow. I suggest including parentheses around the column headers to help the reader figuring more clearly out what is part of what

Table 1 SMB column: add uncertainties - a key discussion point is also deltaSMB versus uncertainty of each estimate

Table 2 incl caption: add an extra row summarizing the total, even though it is in table 1, and instead of colors then just have deltaSMB in black below the magenta. Adding this will make it easier to compare the basin to the total.

### **Figures:**

Fig1:

Difficult to differentiate between colors

See suggestion above on adding a new observation data to this or a new figure.

Also, perhaps include a blow-up of selected areas around the ice sheet showing both "good" and "bad" examples and the grounded ice extent.

## **References:**

Looks good