Minor comments on tc-2022-52

- In the captions of Figures A1 and A2, add “Cross-hatched areas represent regions where this trend is significant ($p < 0.05$)”.

We have added the suggested text to the captions of Figures A1 and A2.

- Lines 210-211: Aren’t the estimates from Kuipers Munneke et al. (2012) based on regional model simulations? If so, I would not call them “observations”. Even melt products derived from microwave data should probably not be called “observations”.

We have changed the sentence in line 211 to read:

“Historical (1979-2015) surface melt in CESM2 has increased across much of the AIS (Fig. 5e), a trend that is absent from both regional climate model estimates of melt volume and microwave satellite observations of melt duration and area (Kuipers Munneke et al. 2012).”

Kuipers Munneke et al. (2012) derive melt volumes from RACMO2 but also compare a RACMO-derived “cumulative melt surface” (the product of melt duration and melt area, CMS) with microwave satellite observations. In section 4 they describe a negative trend in both RACMO and observed CMS. Thus, we feel it is appropriate to mention that the positive melt trend in CESM2 is unmatched by regional climate model estimates *and* observations.

- I suggest renaming section 3.4.1 “Comparison of the mean SMB with other products”, or something similar pointing to the mean.

We have changed the name of section 3.4.1 to: “Comparison of the mean surface mass balance with other products”.

- L. 231-238 and 296-304: First, the word “signal” in this context is not very clear to me (also in other sentences throughout the manuscript). Is “xx% of the total SMB signal” equivalent to xx% of the total SMB? (“signal” may be used for trends or variances). Second, it is not clear to me how to calculate these percentages given that the SMB is the sum of positive (precip) and negative (sublimation, runoff) terms, so that I would expect e.g. +110% for precip and -10% for runoff for a total of 100%. This needs to be clarified in the revised manuscript.

Thanks for pointing out this confusion. To clarify, we have added a new section to the Methods:

SMB component comparison

To compare the relative importance of each SMB component during different time periods and from different model output we divided each component by the sum of the magnitude of all components, which we call the "SMB signal" throughout Section 3. For example, the contribution of runoff to the SMB signal was determined by:

$$runoff_{contribtion} = \frac{|runoff|}{|precipitation|+|evaporation/sublimation|+|runoff|},$$

where *precipitation* is the sum of both solid (snowfall) and liquid (rainfall) precipitation. This creates a standardized method to compare the relative importance of each SMB component among different models and scenarios.

We believe that this is the best way to compare the relative importance of each SMB component. If we maintain the positive contribution of precipitation and negative contribution of evaporation/sublimation and runoff, at the end of the SSP5-8.5 scenario we find that snowfall is +321% of the mean SMB and runoff is -304% of the mean SMB. From this it is not clear that the relative importance of precipitation is decreasing.

- L. 274-276: "According to CESM2, increasing atmospheric temperatures throughout the 21st century are expected to increase precipitation across the AIS, and thus corresponding with future increases in AIS SMB". The end of this sentence does not sound good to me (note that I am not a native speaker).

We have changed this sentence to: "According to CESM2, increasing atmospheric temperatures throughout the 21st century are expected to increase precipitation across the AIS, which will correspond with future increases in AIS SMB".

- L. 282-287: $\frac{d\ SMB}{dT}$ should be $\frac{d\ SMB}{d\ T}$ or $\frac{d}{dT}\ \frac{d\ SMB}{dt}$.

Because we are looking at the total change in SMB with respect to the total change in near surface air temperature over the 21st century (not taking a time derivative) we believe that the correct way to write this is: $\frac{\Delta SMB}{\Delta T}$. We have changed all instanced of $\frac{d\ SMB}{dT}$ to $\frac{\Delta SMB}{\Delta T}$ in lines 282-287.

We have also changed the phrase: "The rate of change in SMB with temperature ($\frac{d\ SMB}{dT}$)" to: "The 21st century change in SMB with respect to change in temperature ($\frac{\Delta SMB}{\Delta T}$)" to clarify this calculation.

- Caption of Fig. 8: to make things clearer, you could specify "(left axis, solid)", "(right axis, dashed)".

We have made this change in the caption of Fig. 8.

- L. 399: "in the latest iteration of estimating future AIS contribution" was kind of correct in the previous version as it was implicitly pointing to ISMIP6 (Seroussi et al., 2020), but this is no longer meaningful for Siahaan et al. (2022) which is a single study.

We have updated the first two sentences of the final paragraph (lines 367-369) to read:

“Recently, there has been some work done to couple ice sheet models and ESMs (Siaahan et al. 2021). However, even in the latest iteration of estimating future AIS contribution to sea level rise, Antarctic ice sheet models are largely simulated as a stand-alone, meaning they require climate forcing (Seroussi et al. 2020).”