

Dear Nico,

Thanks again for your comments and your balanced approach to handling our manuscript. We also thank the reviewers for their thoughtful and engaged review of our manuscript. Our responses to your comments are in blue following each of yours.

Dear Ben Galton-Fenzi and co-authors,

First of all, I thank the two reviewers for their second evaluation of your manuscript. Reviewer #1 recommends accepting your manuscript as it is. In contrast, Reviewer #2 still thinks that the manuscript is problematic and that there were more interesting things to analyse in this model ensemble than the multi-model mean melt rate. I doubt that you will be willing to follow this direction and entirely change the content of your manuscript. Based on my own review and Reviewer #1's evaluation, I do think that there is value in presenting the RISE results through the multi-model mean melt rate. Several points raised by Reviewer #2 are nonetheless very relevant, and I am asking you to revise your manuscript as detailed below.

1- "realistic ice-shelf/ocean state estimate [...]" may not be the most appropriate title, as (i) "realistic state estimate" is usually dedicated to ocean simulations with some kind of data assimilation, which is quite far from this ensemble that even includes a pre-industrial simulation, and (ii) "Realistic" is a claim that is not supported by a thorough evaluation of the model outputs in comparison to observations (e.g., 3D temperature and salinity). As such, the title of this manuscript and the name of the RISE project may sound somewhat problematic. Please consider changing the title to something like "Ice-shelf/ocean multi-model state estimates of Antarctic basal melting and drivers"? Then you can still mention the RISE project in the abstract and/or introduction because this name has been widely advertised in the community.

We have considered your request and agree the title was inappropriate. The new title of the manuscript is "Multi-model Estimate of Antarctic Ice-Shelf Basal Mass Budget and Ocean Drivers"

2- These sentences in section 4 are still overselling the method (see Reviewer #2's comments and my previous review): "The MMM thus serves to reduce individual biases and smooth out uncertainties, likely resulting in a more reliable representation of the State Estimate of basal melting and ocean-drivers. The Multi-Model Mean (MMM) estimate of Antarctic ice shelf basal melting therefore likely surpasses the performance of any individual model in our ensemble". Please specify that only a part of the uncertainty can be expected to be removed here. The structural uncertainty shared by models, like an inappropriate physical parameterisation of ice-shelf basal melting or common biases in the bathymetry or ice topography, will of course remain problematic in the MMM. Furthermore, the last sentence of the quote should be either removed or supported by analyses as there could still be a few models that are better tuned than the others and that therefore surpass the MMM.

The last sentence has been removed, and additional information has been added to clarify the uncertainty inherent in the MMM, as follows.

The text has been changed from:

"The MMM thus serves to reduce individual biases and smooth out uncertainties, likely resulting in a more reliable representation of the State Estimate of basal melting and ocean-drivers. The Multi-Model Mean

(MMM) estimate of Antarctic ice shelf basal melting therefore likely surpasses the performance of any individual model in our ensemble.”

to:

“The MMM thus serves to reduce biases and smooth out uncertainties, likely resulting in a more reliable representation of basal melting and its ocean-drivers. We note, however, that the uncertainties in the boundary conditions or in the numerical methods and parameterisations shared by models, such as the use of common parameterisations of ice-shelf basal melting or common biases in the geometry, will still contribute to the uncertainty in the MMM.”

We have also removed the following sentence from the manuscript: “The Multi-Model Mean (MMM) estimate of Antarctic ice shelf basal melting therefore likely surpasses the performance of any individual model in our ensemble.”

3- In Tab.1, add a footnote near the “150 years” of E302 to indicate “pre-industrial conditions” (currently, it is hidden in the supplementary material, and this appears to me as an important piece of information).

Added.

Regards, Ben Galton-Fenzi on behalf of co-authors.