

Comments on “Investigating the internal structure of the Antarctic Ice Sheet: the utility of isochrones for spatiotemporal ice-sheet model calibration” by Sutter et al.

Thank you for submitting a revised version of your article. A number of the comments raised by one of the reviewers and the editor have not been fully addressed. These are listed below. Line numbers refer to the most recent non-track-changed version of the article. In cases where an example is given, please check for other instances throughout the manuscript. All points are minor but should be addressed prior to publication.

Pippa Whitehouse (Editor)

RC = reviewer comment

EC = editor comment

non-bold – editor’s comment explaining why the points has not been sufficiently addressed

RC: P1L9 (and throughout manuscript). Remove the comma before “that”

Commas have not been removed on lines 9, 259, 273, 288, 302, and 322

RC: P9L222-224. ... it’s hard to see why this happens here, but not later in the transect where there are significant gradients in topography [comment relates to figure 3]

Please address the reviewer’s query about why there is no divergence in modelled isochrones in the region of steep topography between 400 and 500 km on the transect

RC: P12L276. Remove wayward parenthesis “)”

RC: Figure 5. Topography color scale could be moved to left panel.

Please do not locate the colour scale for one plot within a different plot, this is confusing

RC: Figure 6. I didn’t understand where the $7\%K^{-1}$ scaling came from? Perhaps add a reason why in the caption, or add it to the list of experiments in section 2.2

You note that this point is confusing and provide an explanation in your response to the reviewer. Please also include relevant information in the revised article to explain this point to the reader

RC: comment on spin-up approach: you mention this article is not the place for a detailed discussion of the best approach to ice-sheet model spin-up. However, it would be useful if you could mention in the conclusions why this point is important, i.e. re-iterate your point on line 335 that ice sheet initial state can significantly affect its future behaviour over centennial and decadal timescales.

RC: P19L412-414. Given your conclusions about the issues with basal friction, can you recommend a more appropriate friction law to use?

You mention that this is a proposed area of future research. It would be useful for the reader if you could briefly outline the alternative approaches that could be adopted

RC: Figure 10. Add y-axis labels to the panels in C)

EC: Ensure that acronyms are defined at their first usage, and that they are used consistently throughout the remainder of the text

For example, ‘AIS’ is not defined on line 6

EC: Check the format of in-text citations

For example, see line 160

EC: When using the term ‘topography’, clarify whether you are referring to the surface or the bed of the ice sheet

For example, see caption to figure 1

EC: It is a little unclear whether some of your results are derived from the 2 Ma experiment, or whether this experiment is simply used to initiate the 220 ka experiments and all results shown are derived from the 220 ka experiments. It would be useful to clarify this in section 2.2

No edits were made to clarify this point. In particular, it is unclear whether the ‘pal’ results are derived from models run over a mixture of 2 Ma and 220 ka, and whether the ‘pd-pal’ results are based on present-day snapshots of models run over a mixture of 2 Ma and 220 ka

EC: Your methodology provides an estimate of the normalised elevation of each isochrone above the bed. However, radar systems provide an estimate of the depth of an isochrone below the ice surface. Any uncertainty on total ice thickness/bed elevation will impact on your ability to compare modelled and observed isochrone positions. Please briefly comment on this issue.

No response to this query, consider whether it warrants a comment within the manuscript

EC: logic of your argument could be clearer in a few places (e.g. lines 491-, 495-)

The logic behind the final sentence of the third bullet point in the conclusions is unclear. There is a jump in logic between the first and second sentences in the fourth bullet point in the conclusions.

EC: Figures: please check the following points in relation to all figures:

a) Colour scales are included where relevant

for example, figure 1, figure 2, figure 9

b) The caption describes all features shown in the figures

please check the accuracy of all captions. In some cases, captions do not agree with information in the figure, e.g. figure 8 refers to Purucker (2013) data which is not shown in the figure, it also refers to ‘thin dashed lines’ in panel B, which are not visible.

c) Somewhere, state the projection used to define the northing/easting values

d) Ensure that all place names mentioned in the text are indicated on a figure

for example, the reader is referred to figure 1 to locate Dronning Maud Land and George V coast (line 108) but these locations are not labelled on figure 1

e) Check the location of all transect plots is clear (e.g. this is not the case for figure 3)

in particular, it is not always clear which end of the transect is defined as 0 km

f) Define all lines in the legend/caption, including the lines representing the ice sheet surface

in several plots multiple lines are plotted at ~3000 m elevation. I think these represent the surface of the ice sheet, but it is not clear what the difference is between the lines

g) Ensure that all sub-plots are labelled

for example, figure 7

h) Ensure that all axes are labelled and that labels are legible

for example, figure 7 (x-axis, right-hand plot), figure 10C (both axes)

Additional editor comment: it is unclear what some of the numbers refer to in the edits to line 323, e.g. “pal 4.8 and pd 20”