

## Editor's comments

I would like to thank the authors for submitting a revised version of their manuscript and for responding to all reviewer and editor comments. Several sections of the manuscript have been significantly re-structured, and this has greatly improved the clarity of the paper – thank you for responding to this suggestion from one of the reviewers and for seamlessly implementing the edits.

I am grateful to two of the reviewers who provided feedback on the resubmitted manuscript. One reviewer has requested a couple of minor edits, and both are happy that the article is now suitable for publication.

I have read through the revised version of the article and list below a number of points that require clarification prior to publication – please get in touch if anything is unclear. The points are all minor and therefore I recommend this article can now be ‘published subject to technical corrections’ (i.e. it does not need to undergo any further review by the editor or reviewers).

Thank you for choosing to publish your work in The Cryosphere.

Kind regards,

Pippa Whitehouse (editor)

## Minor line-by-line comments

Line 20: “use of six different GHFs” – not clear if this refers to six different GHF models, or simply six different GHF values, please clarify and review use of this phrase throughout the manuscript

Line 32: does “subglacial rifts” refer to a geological feature or a glaciological feature? If the former, it is not clear how this is relevant when discussing the stability of the Lambert-Amery system on a decadal timescale – please clarify what type of feature you are referring to and how it is relevant

Line 79: “...the basal thermal conditions inferred from the new high-resolution topography dataset” – include a reference to clarify which study you are referring to

Line 105: suggest “The margins of the inland sub-basins...”

Figure 1: it would be useful to depict the coastline/grounding line of Antarctica in plots (a)-(c). Also, I suggest adding text labels to plot (b) to clarify which domain uses data from Cui et al. (2020) and which domain uses data from MEaSUREs – one reviewer comments that this is still unclear

Line 165: clarify what you mean by a ‘proper’ initial temperature

Line 170: clarify which models you are referring to, e.g. “coupling the forward and inverse models”

Line 179: “downhill in the ice surface” – unusual phrasing, perhaps ‘along flowlines’?

Line 185: ‘step’ -> ‘component’ (using the terminology from line 178)

Equation 1: define ‘m’ and  $k(T)$ , perhaps also stating whether they take positive or negative values

Fig. 3 caption: specify (here and elsewhere) whether this is surface velocity or the full velocity field

Line 227: in what way is the basal slip ratio ‘added’ to the method? If the method already uses a basal slip ratio perhaps the novel feature here is that you use a spatially variable basal slip ratio?

Equations 3 and 4: suggest using the del/nabla symbol when representing div, grad etc.

Line 287: on line 275 you state that beta is the basal friction coefficient, check use of terminology

Line 299: here and elsewhere, you could replace 'do', 'done', 'did' with 'carry out' or 'carried out' when referring to the methods used, e.g. "An L-curve analysis has been carried out to find..."

Line 312: "...from by..." – typo

Line 312: is  $T_M$  the same as  $T_m$  (defined on line 202)?

Figure 5: state that this figure shows results for the Martos et al. (2017) model

Lines 331-332: could relate these statements about heat to the impact of each term on the basal melt rate – this would help to clarify the sign of the final term in the numerator of eq. 10

Line 335: similar as -> similar to

Line 336: refer to figure 3 when referring to the 'mixture' of information used to determine the input surface velocity (also on line 345 when discussing merging three different pieces of information)

Line 347: by -> from

Line 438: figure 9?

Line 442-443: suggest "Regions with positive basal melt rates..."

Line 454-455: suggest "...the second greatest number of observed subglacial lakes..."

Line 477: suggest "the ...accumulation rate field used in our modelling will be..." (similar on line 181)

Line 478: "because of lower accumulation rates during glacial periods" – reference needed

Line 507: suggest "...that does not predict basal melt at the location of the observed lakes..."

Line 509: a third possibility is that lakes are present, but we do not have the data to detect them

Line 515: "direct measurements... are rare" – the important point here is that lakes can exist where basal temperatures are below the pressure melting point, suggest revising the text to reflect this

Line 517: the paper suggested by the reviewer 1 is by Tulaczyk et al. (2020) not Talalay et al. (2020) – see <https://tc.copernicus.org/articles/14/4495/2020/>

Line 530: Antarctica -> Antarctic

Line 533: "...to the our..." – typo

Line 557: include full references for the Martos and Li GHF models (also lines 592-594)

line 600: "...has smaller modelled basal friction coefficients..." – is this information quantified anywhere in the manuscript?

Please carry out a careful check for grammatical issues, particularly in relation to the use of singular and plural and the definite article ('the'), which is occasionally missing