

Statistically parameterizing and evaluating a positive degree-day model to estimate surface melt in Antarctica from 1979 to 2022

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submitted to The Cryosphere (<https://doi.org/10.5194/tc-2022-192>)

We are grateful to the Editor for the time they spent reading and reviewing our manuscript. We have carefully considered each of their comments, which are presented below. The comments from the Editor are shown in **bold text**, our replies are shown in normal text, text from the original manuscript is shown in **blue**, and proposed changes to the manuscript are shown
5 in **red**.

Editor decision by Brice Noël:

Dear Yaowen Zheng and co-authors,

10 **Thank you for submitting your revised manuscript and response letter. Your clarifications and corrections have addressed all remaining comments. Therefore, I am happy to accept your manuscript for publication in The Cryosphere. Before publication, you should consider the technical corrections listed below.**

Congratulations on the acceptance of your manuscript, and on your thorough revisions!

Thank you again for publishing your research with TC,

Thank you very much for your comments. We will take into account your technical corrections to improve our manuscript.

Editor technical corrections:

L382: “estimates are not significantly correlated” statistically is not necessary as you provide the statistics in brackets.

Thank you for this suggestion. We agree. We will replace in Line 382 from: "**estimates are not statistically significantly correlated...**" with "**estimates are not significantly correlated...**".

20 **L406-409: “is less sensitive to the low melt scenario than the satellite estimates, as the dist-PDD ... while the satellite ...”**
and **“is less sensitive to the high melt scenario than the satellite estimates, ...”**.

Thank you for this suggestion. We agree. We will replace at Lines 406–409 from: "Figure 8e shows that the dist-PDD model is less sensitive than the satellite estimates to the low melt scenario, where the dist-PDD estimates only decrease by 9.78% for the integrated 38-year CMS, while the satellite estimates decrease by 10%. Although the dist-PDD model is more sensitive
25 than the satellite estimates to the high melt scenario, where we show that that dist-PDD increases by 10.84% on the 38-year integrated CMS with the 10% increase of the satellite estimates, this increase" with "Figure 8e shows that the dist-PDD model is less sensitive to the low melt scenario than the satellite estimates, as the dist-PDD estimates only decrease by 9.78% for the integrated 38-year CMS while the satellite estimates decrease by 10%. Although the dist-PDD model is more sensitive to the high melt scenario than the satellite estimates, where we show that dist-PDD increases by 10.84% on the 38-year integrated
30 CMS with the 10% increase of the satellite estimates, this increase"

L420: “that is reported by other studies”.

Thank you for this suggestion. We agree. We will replace in Line 420 from: "...relationship that reported by other studies..." with "...relationship that is reported by other studies...".

L440-441: “We have constructed a PDD model with spatially varying parameters (dist-PDD) and with spatially
35 **uniform parameters (uni-PDD) based on the temperature-melt relationship”.**

Thank you for this suggestion. We agree. We will replace at Lines 440–441 from: "We have constructed a PDD model with spatially varying PDD parameters (dist-PDD) and a PDD model with spatially uniform PDD parameters (uni-PDD) based on the temperature-melt relationship..." with "We have constructed a PDD model with spatially varying parameters (dist-PDD) and with spatially uniform parameters (uni-PDD) based on the temperature-melt relationship...".

40 **L449: “We found that our dist-PDD model improves the accuracy of Antarctic surface melt estimates compared to the uni-PDD setting, and has ...”.**

Thank you for this suggestion. We agree. We will replace at Lines 448–449 from: "...We found that our dist-PDD model improves accuracy on Antarctic surface melt estimates from using uni-PDD, and has the ability to capture the..." with "...We found that our dist-PDD model improves the accuracy of Antarctic surface melt estimates compared to the uni-PDD setting,
45 and has the ability to capture the...".

L511: “Our dist-PDD model shows significant negative bias in both surface melt days and amounts compared to ...”.

Thank you for this suggestion. We agree. We will replace at Lines 511-512 from: "...Our dist-PDD model is significantly negatively biased towards both surface melt days and surface melt amounts compared to satellite estimates and RACMO2.3p2 simulations..." with "...Our dist-PDD model shows significant negative bias in both surface melt days and amounts compared

50 to satellite estimates and RACMO2.3p2 simulations..."

Additional changes by authors:

We acknowledge the acceptance of this manuscript. We are publishing the annual dist-PDD and uni-PDD models data alongside this manuscript. However, before the final publication of this manuscript, we do not know its DOI. We have reserved

55 a Zenodo DOI for the publication of the annual dist-PDD and uni-PDD models data. Once this manuscript is published and we know the DOI, we will publish the data on Zenodo with the reserved DOI: <https://doi.org/10.5281/zenodo.7131459>.

We will replace at Lines 480-482 from: "...The annually PDD model data (this study) is available in this study. Higher temporal resolution (monthly, daily and hourly) PDD model data (this study) is available by contacting yaowen.zheng@vuw.ac.nz." with "...The annual dist-PDD and uni-PDD models data from this study are available at

60 <https://doi.org/10.5281/zenodo.7131459>. Data with higher temporal resolution (monthly, daily, and hourly) for dist-PDD and uni-PDD models from this study can be obtained by contacting yaowen.zheng@vuw.ac.nz."