Review of Estimating surface melt in Antarctica from 1979 to 2022, using a statistically parameterized positive degree-day model by Zheng et al., 2022

Zengh et al., 2022 estimate the melt over the Antarctic Ice Sheet using a PDD model. They also carefully parametrize their model to produce similar results than satellite and RACMO estimations. The calibration of the model is particularly complete and nothing seems to be omitted for a reproducibility of the results. Obtaining a correct PDD model is interesting and important because, as the authors mention, the efficiency of the PDD in terms of computation time allows long simulations where other more complex models do not enable it. However, most of the manuscript focuses on the calibration and the evaluation of the PDD, and only a limited part is dedicated to the new information about melt. From this point of view, the scientific issue of the manuscript could be more emphasized in the title and might have deserved a submission to another journal like GMD (this does not, however, question the quality and robustness of the study. I would add that while being comprehensive is a quality, some passages are difficult to read because too much information is given when that information is sometimes obvious. I also have some more comments listed hereafter. In general, I don't have much to say except to advise to simplify/summarize some passages (introduction, result) and to add some nuances (see major comments).

Major comments:

One major limitation of the PDD is that all the calibration is done over present climate where melt is only limited to margins and weak. One could question the validity of the calibration in warmer climates, i.e. for projections. For instance, how could the melt computed by PDD take into account the snow albedo feedback (which is a process often not represented by PDD due to their simplicity)? Or could the PDD correctly represent areas where no melt currently occurs and will likely occur in warmer climates as it was calibrated to reproduce current surface melt? Maybe you could compare the results of a PDD calibrated over only low melt years but evaluated over high melt years (even high present-day melt years will be considered as low melt years in the future).

Furthermore, the calibration of the quantity of melt is solely based on the RCM RACMO, what is the impact of RACMO biases on the PDD? Although Mottram et al, 2021 showed that RACMO is one of the best models to represent the Antarctic climate, they also suggested that RACMO underestimates near-surface air temperature which could also influence melt computed by RACMO. Note that the calibration and evaluation is also not independent as you use the same values.

Minor comments:

P1L4: Consider to nuance since this will only be the case if the firn cannot absorb the additional water

P1L13: Satellite observation, I suggest to replace observation by estimates as melt is not directly observed by satellite but derived from brightness temperatures or absorptivity of the

surface under the assumption that the presence of water at the surface is newly-produced melt. (also for P3L81)

P1 L26-27: Is this 100% valid? Surface melt is projected to remain limited to ice shelves (Kittel et al., 2021) beyond 2100 where basal melt should have a much higher influence (Seroussi et al., 2020). Consider nuance.

P1 L29-L46: I would shorten these two paragraphs which, although interesting in historical terms for the evolution of ice shelves, do not bring much information directly related to your topic. This is only a suggestion, feel free to keep as it is.

P4L105: observation => values/estimates

P8L179-181: Is the ERA5 mean also computed between 6am and 6pm in local time for each grid point?

P8 L186-192: These sentences can be considered as an example of too much provided details that can make the manuscript hard to read. I'd say that the only necessary information is that the RMSE from each pixel is averaged to produce a RMSE per region. All the other information seems obvious and may be non necessary.
Also Figure 7 for instance, not necessary how the surface elevation is obtained.

P10 L229: Could this melt associated with relative apparent cold conditions be related to katabatic winds in that area, maybe not correctly represented by ERA5? (ie, could ERA5 actually underestimate temperature in that region leading to suspicious values).

P14 L283: Instead of surface temperature, use air temperature as it is the input variable of the PDD.

P16 L320-321: How do you obtain the quantity of melt from the satellite? Should it be melt area * melt days (instead of melt quantity?). Could you also compute the CMS from RACMO to add a comparison?