Review of "Estimating Antarctic surface melt rates using passive microwave data calibrated with weather station observations", by Di Biase *et al*. (egusphere-2025-2900).

General

This paper presents a new dataset of annual Antarctic surface melt occurrence and meltwater flux, derived from satellite passive microwave radiometry. The presence of surface melt is detected using a newly-developed algorithm that uses an optimised set of indices derived from the 19 GHz channel of the SSMIS sounder. The algorithm is calibrated using surface energy balance measurements from several automatic weather stations (AWS) in coastal Antarctica. The AWS measurements are also used to tune a parametrisation that estimates annual meltwater flux from the annual sum of melt days. The authors present maps of annual melt frequency and meltwater flux for the period 2012-2021 and compare these with maps derived from an existing melt product and with regional climate model output.

The paper is clearly written and the methodology appears to be sound. I was particularly impressed by the rigorous error analysis that the authors have carried out, which has enabled them to quantify the uncertainties in their product. Their dataset will undoubtedly find application in Antarctic cryospheric and climate science, particularly as a source of independent validation data for regional and global models. While the extent and occurrence of surface melt in Antarctica is currently limited, both spatially and temporally, it is likely to become more widespread in a warming climate. It is thus of vital importance to validate the representation of current surface melt in models that are used to make projections of future melt. In my opinion, the paper is highly suitable for publication in *The Cryosphere* following minor revision as detailed below.

Main Points

1. SSMIS data cover the whole of Antarctica, making it possible to generate an Antarctic-wide melt product. However, calibration data are only available for the six AWSs and Neumayer Station. Furthermore, four of the AWSs are located on the Larsen Ice Shelf. The calibration data are thus quite geographically restricted, which begs the question of whether parametrisations derived using these data will be valid across all of the Antarctic melt zone. I think that there are indications that this may be true (e.g., figure S3(c), which, I think, provides model-based evidence that just using these sits for calibration does not introduce major biases) but I'd like to see a bit more discussion of the possible uncertainties resulting from limited calibration data.

2. In section 4.2 you discuss the spatial structure of the melt field in the Antarctic Peninsula but it is very difficult to see at the scale of the pan-Antarctic maps presented in figure 3. Given that most melt occurs in the Peninsula region (and that the majority of your calibration data come from this region) I'd consider presenting separate larger-scale maps covering just the Peninsula region.

3. Not all readers will be familiar with the locations of the AWSs. I think that a location map would be useful.

Minor Points

1. Line 14: I'd say "…the only practical way…"

2. Lines 50-51: Make it clear that your "year" label corresponds to the END of the hydrological year.

3. Line 52: For clarity, replace “the period” with “hydrological years”.

4. Lines 53-55: Using overpasses at local times 06:00 and 18:00 may miss some melt days if melt is only occurring during the warmest part of the day. You do discuss this (with reference to Neumayer) in lines 237-239.

5. Line 59: replace “it” with “this”.

6. Line 71: “similarity theory”.

7. Line 234: “supports”.