Review of Dattler et al. 'A physics-based Antarctic melt detection technique: Combining AMSR-2, radiative transfer modeling, and firn modeling'
By Sophie de Roda Husman (S.deRodaHusman@tudelft.nl)

The authors have made significant efforts to enhance the manuscript, resulting in a noticeable improvement in readability. Congratulations on this achievement! At this stage, I have only a few comments remaining, primarily related to some textual changes and the figures.

Here's a brief list of suggestions for the authors to consider:

Abstract

- **L11:** Replace "*Snow Radiative Transfer model*" by "*Snow Microwave Radiative Transfer model (SMRT)*"
- **L11:** Replace "*Community Firn Model*" by "*Community Firn Model (CFM)*"
- **L12:** I am not sure what this sentence means (specifically, I don't understand the word "hybridize" in this context), but this could also be because I am a non-native English speaker.
  *"In the process, we also **hybridize** our method to statistical techniques …"*
- **L14:** In the rest of the manuscript, you use a hyphen in "statically based", add here as well.
- **L19:** Add comma: *"… Antarctic snow, and (b) …"*

Introduction

- **L36-37:** Consider adding a reference (e.g.: Hofer & Mätzler (1980); Mote & Anderson, 1995)
- **L57:** For people not familiar with microwave sensors, it might be good to introduce AMSR-2. For example by adding some information to this sentence: "…*microwave radiometer Advanced Microwave Scanning Radiometer 2 (AMSR-2)*…"
- **L58:** I think it is "*Automatic Weather Station (AWS)"* instead of "Antarctic Weather Station (AWS)".
- **L59:** Suggestion to replace "*Antarctic sites*" by "*AWS*"
- **L60:** "*Other techniques*" sounds a bit vague. What do you mean by this?

Data & Models

- **L63:** Could you replace this by "*thirteen AWS*". Or are the three "dry sites" not automatic weather stations?
- **L64:** analyses (instead of analysis)
- **L83-85:** Please double-check the abbreviations. Once you have introduced abbreviations (e.g., CFM, AIS), for consistency, continue using these instead of the full names.

Methodology

- **L58:** Physically-based

Results

- **L340:** What do you mean with this sentence: "*This likeness is not the case for the pattern of melt end dates*"?

Discussion

- **L402:** "*19H*" instead of "*18H*"
- **L419-429:** Very interesting paragraph. I had some similar findings in a paper where I compared different statistically-based methods for melt detection (de Roda Husman, et al., 2022).
- Really nice and well structures discussion!

Conclusion

- **L533:** I thought *thirteen* sites?

Figures

- **Figure 1:** Replace "*AIS*" by "*AWS*" in figure caption
- **Figure 2:** Consider rewriting the figure caption, with a first sentence that describes main idea figure, and summarize the rest of the text. Same holds for **figure 4, figure 7, figure 8, figure 10, figure 11, figure 12.**
- **Figure 3:** Shouldn't "*Calculate correlation length*" be replaced by "*Calculate microwave grain size*"?
- **Figure 4:** I don't see the red area in (c), is this missing?
- **Figure 7:** I would use a sequential color palette for the melt duration instead of a diverging one. The white color (around 65 days) seems to have no melt now (if you quickly look at the figure), which is a bit confusing. Same holds for **figure 12**.
- **Figure 8:** In (b) and (d), you cannot see the Picard et al. melt days if the Hybrid Method shows melt. I would suggest to use a symbol for days where both method show melt, or make Picard et al.'s symbol a bit larger, because now it seems that on days where the Hybrid Method shows melt, Picard et al's method does not.
- **Figure 9:** Consider adding the Pearson Correlation Coefficient to (b). Same holds for **figures 10-12.**
- **Figure 10:** The variation in color bar limits is somewhat confusing. Would you consider standardizing the limits to enhance clarity?

Used references

- T. L. Mote and M. R. Anderson (1995), "Variations in snowpack melt on the Greenland ice sheet based on passive-microwave measurements," Journal of Glaciology, vol. 41, no. 137, pp. 51–60.

- Hofer, R., & Mätzler, C. (1980). Investigations on snow parameters by radiometry in the 3-to 60-mm wavelength region. Journal of Geophysical Research: Oceans, 85(C1), 453-460.
- de Roda Husman, S., Hu, Z., Wouters, B., Munneke, P. K., Veldhuijsen, S., & Lhermitte, S. (2022). Remote Sensing of Surface Melt on Antarctica: Opportunities and Challenges. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing.