Review comments for *A Frontal Ablation Dataset for 49 Tidewater Glaciers in Greenland*

General comments

To date, most frontal ablation estimates of the Greenland Ice Sheet have not considered mass change due to calving front variations. The studies that have, however, are either limited in spatial coverage or temporal resolution. Therefore, the new frontal ablation dataset produced in this study represents a significant step forward in achieving the Greenland-wide high-resolution frontal ablation assessment and improving the mass balance quantification, especially the processing framework presented in this study has the potential to be directly applied to other tidewater glaciers. This study is timely and useful and will be beneficial to different cryosphere communities including remote sensing and ice sheet modelling. However, several major issues need to be addressed before I can recommend it for publication in ESSD.

Specific comments

1. **Dataset**:

    a. The currently published dataset contains too many separate folders - one geopackage for one data type of one glacier, this makes it difficult to visualize/use this dataset. The advantage of geopackage over shapefiles is that it can have multiple layers with each layer having a different data type. Please consider merging different layers of different glaciers in one geopackage.

    b. I see that frontal ablation plots for all the studied glaciers are presented in the supplementary file, will it be possible for the authors to provide these figures in the data product as well?

2. **Product Description**: this section is not a description of the data product generated in this study, it is purely about the frontal ablation calculation methods, therefore it should be better placed in the Methods section. Here please give an overview of all the relevant information that we need to know about the dataset itself. What kind of data product you have produced? What is the spatial coverage and temporal resolution of this data product? What data files are included in the data product?

3. **Data Sources and Methods:**

    a. In the Data Sources section, many places mention “see Methods”, this is not helpful. Please label each subsection in Methods, so you can easily cross-reference different data sources and the corresponding processing steps.

    b. Please move Table S1 to the main text, this table is important for readers to know about the spatiotemporal resolution and quality of each input data source. Also in this table, note that temporal resolution is different from temporal coverage and please clarify accordingly. Please include the Khan (2017) data, which is an important data source for adjusting ice thickness according to the manuscript. The data type of ArcticDEM used in the study, and the time periods of both ArcticDEM and AeroDEM, should also be provided in this table.

    c. Methodology needs to be restructured. First, please provide a flowchart to give an overview of all the major processing steps outlined in this section. This can help readers understand the general processing workflow. Second, there are many nice sketch figures presented in the method section, while they are helpful for readers to visualize each processing step, most of them can be easily merged into one single integrated figure, such as Figures 2/3/5/7. For Figure 5 and Figures 7B-E, I

am not even sure whether they are necessary in the main text as these details are trivial concepts that are easy to understand from the text description alone, perhaps it's better to put them in the supplementary material.

4. **Surface elevation change and ice thickness:**

    a. Khan (2017) dataset: in line 128 it says the time period of Khan dataset is 1995-2015. However, from the data link you provided in the manuscript (https://dataverse.geus.dk/dataset.xhtml?persistentId=doi:10.22008/FK2/GQJJEA), the Khan data covers the period from 2011 to 2020, which is correct? The more urgent issue is why not use the latest Khan (2023) dhdt dataset? Won't this latest dhdt improve the ice thickness calculation in this study? Again, there is no introduction of Khan dhdt dataset in the Data Sources section. Why did you choose to use Khan dhdt instead of other dhdt products? What is the advantage of this data product and how it was generated? Please also cite the associated publication for the Khan dataset.

    b. In Figure 6, if Khan dhdt is already available for the date of the terminus change, doesn't this mean that TOD has already been included in the K-SCR time range? Why there is still an additional step of checking whether TOD is in K-SCR time range?

    c. ArcticDEM and AeroDEM: what type of ArcticDEM is used in the methods? Are they mosaics or strips? If using the strip and it covers the selected terminus trace, is it still necessary to adjust elevation based on dhdt?

5. **Results section:**

    a. Figure 9 gives an overview of the frontal ablation rates produced in this study. The choices of different number scales of the annual mean frontal ablation look a bit random, why not use integers here or a colorbar that can clearly show the value variations? Can you also compare the frontal ablation rates with the Mankoff ice discharge data statistically, ideally in a histogram? This can show the impact and necessity of including terminus changes in the frontal ablation calculation.

    b. Figure 10 and Line 380-383. Authors claimed that "agreement is reduced for the period 2010-2020", this is not obvious from Figure 10, although Table S3 provides a comparison. I recommend calculating the difference in frontal ablation for each glacier between this study and Kochtitzky et al. (2023) dataset, then plotting these differences in a map similar to Figure 9, or in a histogram.

    c. Line 398-400, it briefly touched on the issue of ice discharge but only gave one example. Can you compare the discharge data used in Kochtitzky et al. (2023) and the Mankoff ice discharge data for all the studied glaciers? This should help clarify if the discrepancy in frontal ablation rates is from terminus change or ice discharge.

    d. Line 346: This sharp increase in frontal ablation (Figure 8A) started in 2005/2006, not 2004/2005. There is significant interannual variability in frontal ablation and given there is no errorbar provided in the plot, it is difficult to claim that this increase in frontal ablation is from changes in velocity and terminus, especially since there is also a sharp change in 2010/2011 according to Figure 8A.

    e. Line 348-351: can you fit linear regression before and after 2004/2005 to see if there is actually an increase in frontal ablation before and after the velocity/terminus changes?

f. In Figure 8 and Figures S2-S48, the temporal intervals in the x-axis are not regular – it contains both two-year and three-year intervals but they have the same width, is this a plotting error?

Technical comments

1. Abstract needs rewrite. For example, BedMachine has been mentioned twice and please be clear in Line 34 this is consecutive *calving front* observations.

2. Line 38-39: “any tidewater glacier”. Is it only for the Greenland Ice Sheet? Or globally?

3. Line 69-73: this paragraph reads like a separate statement and feels very sudden here. Since this is a dataset paper for a dataset journal, the focus be the data product itself instead of the methodology, please recheck the journal submission guideline.

4. Line 105-106: could you please provide a figure on the spatial coverage of the Bedmachine v4 bathymetry data sources in the supplementary file?

5. Line 127: as mentioned in the major comments, please provide detailed information about the Khan dhdt dataset here.

6. Line 142: “5 km upstream of the terminus” is this the most retreated terminus location?

7. Line 173: please be clear that the individual terminus positions are compared to each other to get area changes.

8. Line 182 **Terminus Positions**: I suggest introducing terminus positions first before talking about fjord boundary, because in fjord boundary section there are lots of descriptions on how to change the terminus direction without knowing what terminus data were used.

9. Line 188-191: this sentence is difficult to understand, please rephrase. Can you give a number on the maximum level of uncertainty involved?

10. Line 191: what is the threshold for time difference?

11. Line 212: where is this centerline from?

12. Line 217: change “mean value velocity” to mean velocity.

13. Line 229-232: please move this information to Line 103-110 when first mentioning how these 49 glaciers were selected.

14. Line 269: please be clear about “the SCR”, is this “AA-SCR”?

15. Line 357-359: please be more explicit about the importance of having this higher variability in frontal ablation. Or why does it matter to have this variability compared to ice discharge that doesn’t have it?

16. Figure 2: please label the upper and lower fjord walls in the figure.

17. Figure 3 and Line 204-205: Can you explain a bit about how these delineations can skew the mass changes? It is not clear from Figure 3 at all.

18. Figure 8: In Line 351-355, the figure labels are all wrong here, and there is no Figure 8E, please carefully check the figure labels throughout the manuscript. It is hard to distinguish

between TMC and F in Figure 8A given the current choices of linewidth and line color. In Figure 8C, which direction is terminus retreat or advance?