

Review of ESSD-2025-415

General comments

The study by Lutzenburg et al. presents a new dataset with vector outlines for the entire Greenland Ice Sheet that mostly refer to August 2022. To be clear from the start, this is a tremendous achievement and regarding quality a fantastic new dataset that is urgently needed. I only had a quick look at datasets number 6 and 7 in the list and can only hardly imagine how much effort the authors have spent to get it to this point. Indeed, such a dataset is never final and I have also seen a few regions that could be improved (e.g. some debris-covered glacier tongues are incomplete), but as the authors have encouraged feedback to the dataset and provided a link for it, I will not list such issues here. However, I have a few smaller points to the text (see Specific comments) and three larger ones to the dataset:

(1) The authors provide 12 different dataset versions that might all find their users, but I struggle a bit with the selection for further use and analysis, i.e. which dataset should be used by the community under which conditions? Or, in other words, the product user guide is missing. Section 6.1 is rather general and does not refer to specific datasets. I would like to see a (maybe tabular) list of recommended applications for each dataset so that the users know which one is relevant for them. Which one should be the master dataset?

(2) My other major point is a missing discussion about the consequences of the temporal development and resulting overlaps and gaps when combining the 2022 ice sheet outlines with other datasets. In Section 5.3 there is a bit of discussion for GL50, but nothing on the RGI. I think this would be important to discuss, as there are now several overlaps with the peripheral glaciers of the RGI and some former CL=2 glaciers (that are not in the RGI) have now disconnected from the ice sheet (changed to CL=1) and are thus also not in this dataset. Hence, a combination with the RGI would result in several missing as well as double counted glaciers. I acknowledge that dataset nr. 7 might have the intention to solve this, but I am not fully sure how to use it in this regard. Should everything with ice divides be removed to avoid overlap? What is with the glaciers that changed from CL=2 to CL=1? Please discuss this.

(3) My third point is a bit related to points (1) and (2). I support the decision to not change the connectivity levels, but I also see the deviating assignments, often due to a violation of the rules in the RGI dataset (i.e. it includes more peripheral glaciers as CL=1 than it possibly should). However, many of these peripheral ice caps in the RGI are dynamically separated from the ice sheets' outlet glaciers (e.g. do not contribute to their mass flux) and include very small glaciers in steep terrain. These are more the target of glacier models and likely difficult to model with ice sheet models. I do not expect that this issue will be solved here, but I would expect some words about the problem and maybe encourage the related communities to look closer at these topics (e.g. change of CL through time, spatial overlap and resolution, ice divides, modelling limits). This would be very valuable to initiate related activities.

Specific comments

L31: glacial retreat: please use glacier retreat when referring to contemporary glaciers.

L108: A 1 km resolution DEM to orthorectify 10 m satellite images? This might be ok for the interior of the ice sheet but for its steep margins? Please explain what the impacts on geolocation are. Please also explain why neither the ArcticDEM nor the GLO-DEM (from Copernicus) has been used.

L126: Assuming that manual editing is mostly required for debris-covered glacier parts, how does Douglas-Peucker decrease the amount of work for correcting debris?

- L148: I think 1:25,000 is more the Landsat scale, editing Sentinel-2 data can use 1:10,000.
- L158: I think this study is much more consistent in applying the CL1 definition than the one by Rastner et al. (2012). However, in part also due to shrinking glaciers, this leaves us now with CL2 glaciers in Rastner et al. that have changed to CL1 and are no longer included. On the other hand, many glaciers and icecaps that are now counted as a part of the ice sheet although they were CL1 before. In other words, there is now considerable spatial overlap of the new ice-sheet inventory with the previous local glaciers inventory. As mentioned in the general comments, please discuss this in more detail.
- L170: For a few larger outlet glaciers debris-covered part were partly missed.
- L174: The late in August scenes might suffer from extended regions in shadow which are also very difficult to classify.
- L216: Is the mosaic also available as false colour infrared? This usually provides better contrast for glacier mapping.
- L244: This is the mean error of what? The geolocation? How could there be a systematic shift? Or is it an uncertainty? And what is the impact of the area (e.g. for nunataks)?
- L258/261: Why is the area uncertainty for the entire ice sheet so much smaller than for the nunatak area?
- L246: With so many files being provided, the question arises which one should now be used by the community? Please explain and provide a (maybe purpose dependent) recommendation (see point (1) above).
- L291: I think the uncertainty visualization is fine, but I suggest getting the two figures a bit smaller and side-by-side.
- L310: I think for the northern half of Greenland, snow conditions were much better in August 2019. However, the mapped outlines seem not to be impacted too much by seasonal snow. Is it possible to shortly describe how this has been achieved?
- L320: Has the shadow problem been improved by checking other (high-resolution) images such as provided by Web Map Services (e.g. Google Earth or ESRI World Imagery)?
- L335: Hmmm, as far as I can see, the Rastner et al. study has much more local glaciers/ice caps assigned to CL=1 than this study. I suggest commenting on this.
- L340: In my view, this section should also discuss the differences between the RGI outlines and the new datasets, in particular the regions of overlap and the consequences of now missing glaciers. Are there any solutions to overcome the double counting problem?
- L379: I think the problem of the new dataset is not so much the quality of the delineation but the overlap with existing datasets, changes through time changing the connectivity level (e.g. glaciers might disconnect) and the missing discussion of including peripheral ice caps (and their outlet glaciers) to the ice sheet although they have dynamically little to nothing to do with it and can be much better modelled with glacier models (see above). I acknowledge that this is difficult, subjective and might be inconsistent with the CL1 definition, but many of these now attached ice bodies are difficult to consider in ice sheet models. I acknowledge that the datasets might not be changed now, but at least I would like to see a discussion about these issues in the text (see general comments).