

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2021-384

Anonymous Referee #2

Referee comment on "A new Level 4 multi-sensor ice surface temperature product for the Greenland Ice Sheet" by Ioanna Karagali et al., The Cryosphere Discuss.,
<https://doi.org/10.5194/tc-2021-384-RC2>, 2022

Review of Karagali et al., The Cryosphere;

A New L4 multi-sensor ice surface temperature product forGIS.

The paper is fundamentally a comparison of several ice surface temperature products over Greenland for the calendar year 2012, assessing their relative performance against ground-based AWS (PROMICE stations) and airborne radiometers (IceBridge KT-19 profiles) for that year. The study emphasizes a new Level-4 (optimally interpolated, gap-filled, gridded) data set, describing how it is produced, compares it with several other products and validation data sets, and then uses the L4 data as an input for an SMB model to determine its effect on SMB estimates for 2012, a year with record surface melt and run-off.

The paper is a bit confusing to read. The title needs to be changed because it gives the reader the impression that it will be a data-set focused paper, on the new product specifically, over an extended period. A better title might be: "Multi-sensor assessment of Ice Surface Temperature products for Greenland's 2012 melt season". And then introduce the new merged product within the Introduction. But I think that a better approach would be to convert this paper into an ESSD paper, and then write a shorter paper focused on the application of the data set to the 2012 melt season.

This paper seems to be trying to do several things at once: describe a new data product, validate it, discuss its benefits / limitations, investigate the annual cycle for the Greenland ice sheet in 2012, and finally the potential advantage of an L4 IST for SMB analysis. It would be far easier to follow the research if *first* there were a paper on the L4 data set for the full time-period it can cover, with multi-year validation and something like a climatology for the ice sheet – and *then* a study of the 2012 melt season and SMB models using it.

I think the paper could be close to publishable, but as an ESSD paper. The revised title suggested above would lead to a shorter, application-focussed, tighter paper that would not do justice to introducing the new data set and its usefulness. The major revisions required are a re-write, fairly comprehensive, to make it more focused on this 'data product' target, and to describe the full multi-year time-series that can be derived for the L4 product. A separate paper could then be developed, if desired, on the unusual climate aspects of 2012 as revealed in the IST all-sky result in Greenland, with a comparison in more detail with the existing literature on the 2012 summer there. As it stands, the manuscript seems to wander between describing a small piece of a potentially important data product (the L4 IST) and some kind of analysis of the geographic distribution of unusual temperatures in 2012.

The ESSD paper would re-focus on introducing the study more clearly, and perhaps revising some of the graphics, and reducing the number of graphics (finding other ways to show the validation/ comparison information).

I leave it to the editor to decide, of course, but I think the clearest path is to use most of this work for an ESSD paper, and then submit a shorter paper on analysis of 2012 to The Cryosphere. Sorry, it probably shows in this writing that my thinking on the text evolved over the couple of afternoons I reviewed it.

Detailed comments:

Many comments are embedded in the annotated .pdf of the paper, submitted with this review.

L132 – what is the error on the comparison with PROMICE stations? The simple bias correction, adding the regional long-term offset to derive all-sky IST is concerning.... different elevations are likely to have different clear-sky / all-sky biases.

Figure 2 – why is this a wintertime assessment when this study is about a melt season excerpt of the product? Would not an April 2012 comparison be more appropriate?

Figure 7-- -- would it not be better to simply describe the overall bias for each IST data type relative to the 2012 IceBridge flights? Another graphical, map-based way to do this would be 4 outline maps of Greenland, one for each IST data type, with the flight tracks shown, colored along the track by offset (difference between IST and KT-19) smoothed to, e.g. 10km, on each track. Really clever addition would be to show the s.d. for the 10km as a grey width to the colored line. That, and a table summarizing the whole-season 28-flight average bias and offset.

Figure 11 – the left graphic might be better as an addition to a re-shaped fig9; the center and right graphics here are a nice outcome of the L4 product, but are more appropriate for an analysis of the 2012 melt season in comparison with other melt-day product. On this point, the color bar for the right graphic should be revised to a different palette, and adjusted to show the 0 to 50 day range more clearly. It would appear that the total number of melt days is low relative to other measures of 2012's melt season – something to evaluate in your 2012 analysis paper.

In general, too many figures of low value in the information and 'story' they convey.

Please also note the supplement to this comment:

<https://tc.copernicus.org/preprints/tc-2021-384/tc-2021-384-RC2-supplement.pdf>