

The Cryosphere Discuss., referee comment RC1 https://doi.org/10.5194/tc-2022-176-RC1, 2022 © Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.

Comment on tc-2022-176

Anonymous Referee #1

Referee comment on "Weekly to monthly terminus variability of Greenland's marineterminating outlet glaciers" by Taryn E. Black and Ian Joughin, The Cryosphere Discuss., https://doi.org/10.5194/tc-2022-176-RC1, 2022

Summary:

This paper presents a Greenland-wide dataset of marine-terminating outlet glacier terminus positions. Front position timeseries for almost 200 glaciers are presented at monthly resolution between 2015 and 2021, with an additional twenty glaciers recorded at 6-day resolution. The paper focuses on simply characterising the timing and magnitude of seasonal terminus position change. The authors find that about 75% of their studied glaciers display significant seasonal variability in front position. Such seasonality had already been observed at roughly monthly frequency at many of Greenland's glaciers, but existing studies generally treated smaller samples of glaciers. The 6-day resolution data represent a more substantial advance, with similar temporal frequency observations existing only for a few of the largest glaciers.

The paper is very clearly and succinctly written and the dataset seems robust, is on the whole explained thoroughly, and represents an enormous amount of painstaking work which will prove useful to the glaciological community. The data analysis and comparison with other existing datasets, however, misses several opportunities for more thorough investigation, especially for the 6-day data, resulting in somewhat insubstantial conclusions.

Main points:

1. Identification of glaciers with prominent annual front position variability: How precise was the requirement for an annual frequency in the periodogram? Would a frequency of 380 days count, or 400 days? It might be worth bracketing around a precise annual frequency (e.g. by one month either side for the monthly data, in smaller increments for the 6-day data) to account for the effect of shorter-term variability superimposed on the annual signal. Perhaps this is already done, but if so, the process is not fully explained in

the manuscript.

2. Unambitious analysis and incomplete comparison with existing datasets: The data analysis and comparison with other existing datasets, however, misses several opportunities for more thorough investigation. For example, the authors could compare the timing and magnitude of seasonal front position variability in their 6-day data with glaciological and climatological factors (rather than simply referring to agreement or otherwise with glacier groups from other datasets). In addition, the comparison with existing terminus position datasets conflates differences in terminus position change that could be due to either varying methodologies and source data, different study periods or a real change in seasonality through time. As the authors admit, they can't differentiate these potential causes. It would be much more useful to find an existing dataset which overlaps with their own but also extends further back in time (e.g. PROMICE, ESA CCI?). Then they could try to quantify any real longer term temporal changes.

Line by line points:

L7: This does not seem like the most effective way to start the abstract (talking about earlier studies). Perhaps it would be better to say something like: 'Seasonal terminus-position variability of Greenland's marine-terminating outlet glaciers is superimposed on multi-decadal trends of...'

L57-60: It is somewhat disappointing that the paper does not pursue potential causal factors of the observed seasonal variability, especially for the 6-day data, which represent a good opportunity for such exploration at a broader range of outlet glaciers than previous studies.

L76: When did version 3 come online? What proportion of the images used had a resolution of 50 m and what proportion 25 m? Did the authors undertake a comparison on a date with both image resolutions to quantify any potential impacts of the change in image resolution on the consistency of their front position timeseries?

L120: How strict was the adherence to a 'one year' frequency? (see Main point 1).

L124-125: Could the seasonality not also have changed during your 6-year study period? Perhaps also employing a Lomb-Scargle wavelet scalogram might be able to detect temporal changes in the dominant frequency?

L129-132: I wonder if it might be better to initially smooth the data before picking out the peaks and troughs? Otherwise you risk biasing the underlying frequency by incorporation transient changes in front position (e.g. Daugard-Jensen Glacier 2017 & 2018, Figure S3). This may also change the number of glaciers with significant 'annual' periodicity in their front position records.

L136: It might be worth reiterating here that the timing (for this part of your dataset) can only be determined to monthly resolution.

L225-226: This would seem like a relatively straightforward and worthwhile thing to do (you have the data, especially for the 6-day glaciers). Could the authors justify their reasoning for omitting this avenue of further investigation?

L318: Given the different periods covered by the previous studies and the data generated by the present study, I wonder about the value of these comparisons as presented. I think a more detailed comparison would be valuable, however. (see Main point 2).