

The Cryosphere Discuss., referee comment RC1
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Review of "Extensive and anomalous grounding line retreat at Vanderford Glacier, Vincennes Bay, Wilkes Land, East Antarctica" by Picton et al. 2022

Wei Ji Leong (Referee)

Referee comment on "Extensive and anomalous grounding line retreat at Vanderford Glacier, Vincennes Bay, Wilkes Land, East Antarctica" by Hannah J. Picton et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-217-RC1>, 2023

General comments

This manuscript presents an observational study of six outlet glaciers draining into Vincennes Bay in East Antarctica using products derived from optical satellite imagery, Synthetic Aperture Radar, and laser/radar altimetry sensors. It is an impressive piece of work that uses over half a century of remote sensing data from 1963 to 2022, relying on methods like grounding line delineation using manual digitisation and DInSAR, automated feature tracking for measuring ice velocity, correcting ice surface elevation trends over different time periods, and integrating all of that to investigate decadal scale trends. Overall, the manuscript is well written, with clear references to datasets and other relevant studies, and an interesting discussion about potential forcing mechanisms for the grounding line retreat while highlighting the continued need for DInSAR based grounding line mapping into the future.

That said, I do want to offer some suggestions on ways to improve the manuscript for publication. One of the major things that stood out was the emphasis on how basal melt from warm modified Circumpolar Deep Water (mCDW) is linked to the grounding line retreat at Vanderford Glacier, with a lower emphasis on other factors like changing atmospheric forcings (surface air temperature) and/or sea ice mélange conditions. The authors have been fairly careful in their wording in the Discussion section on this, and offer a convincing line of reasoning on how increased basal melt could result in the observed rapid rate of grounding line retreat, but it does feel like there is a sudden jump between the methods used and that part of the discussion, which could be resolved with a few more sentences on how basal melt rate could be estimated to confirm this line of reasoning. Other than that, there are only some minor points of clarification that could help to reduce some ambiguity, which I will highlight in the specific and technical comments section below.

Specific comments

- On data availability. For reproducibility purposes, please upload a copy of your digitised central flowlines, sampling boxes and terminus positions (shown in Figure 1a and described in Section 2.2 and 2.3) in a standard OGR format to a suitable data repository, so that others can benefit from this work too. Ideally, the surface elevation anomaly data (shown in Figure 6 and Supplementary Figure 2) should also be uploaded. See the Cryosphere's data policy at https://www.the-cryosphere.net/policies/data_policy.html. If the data are not publicly accessible, a detailed explanation of why this is the case is required. I acknowledge the hard work and time spent manually digitising the lines, and would really appreciate this data to be shared with the Cryosphere community to save time on doing duplicate work.

Section 2: Methods

- pg9, L229-230: Just to clarify, it states here that grounding line position changes was measured along the central flowline. However, on pg10, L257-258 Figure 2 caption, it says width-averaged terminus position changes, and at pg12, L273 Table 3, it just says terminus position change without mentioning if the change is measured just along the central flowline or width-averaged. For each of these instances, could you be explicit and mention what method was used to avoid any ambiguity?

- pg15, L318: Figure 6. This is a nice time-series plot. Two minor comments though. 1) This figure appears to be duplicated in Supplementary Figure 2, albeit with a different colour scheme? 2) Is there a reason for leaving out the Smith et al. (2020) ice surface elevation trends from the plot? At pg 7, L180-183, you mentioned doing some work to allow cross-comparison of the Schröder et al. (2019), Smith et al. (2020) and Nilsson et al. (2022) datasets, but aside from a brief comment on pg 15, L322 that the trends are similar, the Smith et al. (2020) ice surface elevation anomaly trend is not included in the plot? Would the plot look too confusing with a third dataset added in?

Section 3: Results

- pg12, L265: Just need some clarification on how the median rate of terminus position change over 1973-1991 for the 6 glaciers is calculated. Are you 1) taking the median rate from 1973-1991 for each glacier, and then taking the median of those values over 6 glaciers; or 2) taking the median rate per year over 6 glaciers, and then taking the median over the 1973-1991. In other words, are you taking the median time-wise then glacier-wise, or glacier-wise then time-wise?

- pg12, L273: Table 3. Could you please provide the raw time-series data for each of the 6 glaciers' terminus position for every year, either as a CSV table or in the supplementary file? This would help with the ambiguity mentioned above, and also it would be good too for future scientists to compare rates of change for individual glaciers over different time

periods.

Section 4: Discussion

- pg 19-22: One concern on the disconnect between the Methods section (which has not explicitly measured or modeled basal melt directly) and this Discussion section 4.1 (which details how mCDW enhances ice shelf thinning and leads to grounding line retreat). At the very least, there would be some mention of how such basal melt rates could be measured directly using radio-echo sounding, or estimated using changes in ice volume (using changes in ice surface elevation over an area and making some assumptions like hydrostatic equilibrium). This could be mentioned as 'Future Work'.

Technical corrections

Section 0: Abstract

- pg1, L13: "satellite aperture radar" -> "synthetic aperture radar"

Section 1: Introduction

- pg2, L33: "Recent mass loss". Please state a general time period. E.g. 2010s to 2020s, to be clearer about when this mass loss is happening.

- pg2, L36-40: "The ice flow acceleration ... has been attributed to ice-shelf thinning and reduced buttressing, a process forced by the wind-driven intrusion of warm mCDW ...". This is a nice information-rich sentence, it might be good to mention 'basal ice-shelf melting' somewhere to be explicit that the forcing is from the bottom-up and not top-down.

- pg2, L52: "-57.0 ± 2 m" -> "-57.0 ± 2 Gt/y".

- pg2, L56-58: "..., Miles et al. (2016) have observed ... 74% of Wilkes Land outlet glaciers measured to retreat between 2000 and 2012". Table 1 from Miles et al 2016 actually mentioned that the results from Wilkes Land (DB13) were obtained from a previous study, see Supplementary Table 6 by Miles et al 2013 (<https://doi.org/10.1038/nature12382>). In the 2013 paper, the date range is 2000-2010, while the 2016 uses 2000-2012, my interpretation is that the former (2000-2010) is the correct date range. It is recommended to cite the earlier 2013 paper instead of the 2016 paper as the canonical data source for this statistic. Also, 74% of XXX glaciers can be somewhat ambiguous (though it is used like so by Miles et al. 2016), I'd recommend stating the absolute number of glaciers that have retreated (n=39) in addition to the

relative percentage. Overall, this sentence could be modified into something like "..., Miles et al. (2013) have observed widespread terminus retreat across the region, with 74% (n=39) outlet glaciers measured to retreat at a median rate of -63.6m/a^{-1} between 2000 and 2010".

- pg3, L71: Figure 1. Missing Longitude/Latitude gridlines or Polar Stereographic coordinate tick marks. Need to have some spatial coordinate reference system to set the geographical context of this area.

Section 2: Methods

- pg9, L242: Could you be a bit more specific about the REMA product used and version? Assuming that you are using REMA v1, and the mosaic instead of the strip DEMs? If using the mosaic, what spatial resolution, 10m, 100m, etc?

Section 3: Results

- pg11, L258: Figure 3. If possible, provide longitude/latitude or polar stereographic coordinate tick marks.
- pg11, L263: Figure 3 caption. Please clarify source of background optical satellite imagery, is it Sentinel-2, Landsat, or other?
- pg13, L282: Figure 4. Maybe better to replace 'Distance from VA (km)' with something like 'Distance from top of flowline (km)' or something like that?
- pg16, L329: Figure 7 colorbar. The colour bins have only one label placed at the middle of the bins, e.g. the white box for +0.00. So does white represent -0.025 to +0.025, or +0.00 to +0.05? Could the numbers be shifted to make it less ambiguous?
- pg18, L347: Figure 9. Maybe better to replace 'Distance from VA (km)' with something like 'Distance from top of flowline (km)' or something like that?

Section 4: Discussion

- pg22, L428: Figure 11. If possible, provide longitude/latitude or polar stereographic coordinate tick marks.

Supplementary

- pg4, L17: Supplementary Figure 1. Missing Longitude/Latitude gridlines or Polar Stereographic coordinate tick marks. Need to have some spatial coordinate reference system to set the geographical context of this area.