Response to Dr. Helmut Rott
We thank the reviewer sincerely for a very careful and thorough review. We appreciate these insightful comments and for the constructive and helpful review of our manuscript. The notes on the text caused us to review our analysis carefully, and we have adopted or addressed nearly all of the comments.

Below, you will find our responses in blue.
Naomi Ochwat, on the behalf of the coauthors

Comments on “Triggers of the 2022 Larsen B multi-year landfast sea ice break-out and initial glacier response”
by N.E. Ochwat et al.

This paper reports on the break-up of land-fast sea ice in the Larsen B embayment and the initial response of glaciers after the buttressing sea ice had drifted away. Furthermore, the authors studied various potential triggers leading to this process, including changes in atmospheric and circulation and sea ice cover during preceding and concurrent periods, checking numerical meteorological re-analysis data and changes in satellite-based sea ice concentration over an extended area. Patterns of fast ice break-up and the retreat of glacier fronts are documented, using optical satellite imagery. The analysis of glacier response is based on satellite observations, focusing on several Antarctic Peninsula outlet glaciers draining into the Larsen B embayment. Repeat observations of surface elevation on specific points and flow velocities along central flowlines are shown for a period spanning the break-up event.

By and large, this is a well written article, presenting interesting material on the land-fast sea ice break-up event, its potential causes and the response of glaciers. The work confirms the influence of land-fast sea ice on glacier flow dynamics, reflecting - with opposite sign - the slowdown, reduced downwasting and frontal advance of Larsen B glaciers during the previous period when fast ice was built-up. Still, there is need for major checks and improvement, as there are various issues lacking traceability or being inconsistent with previously published data.

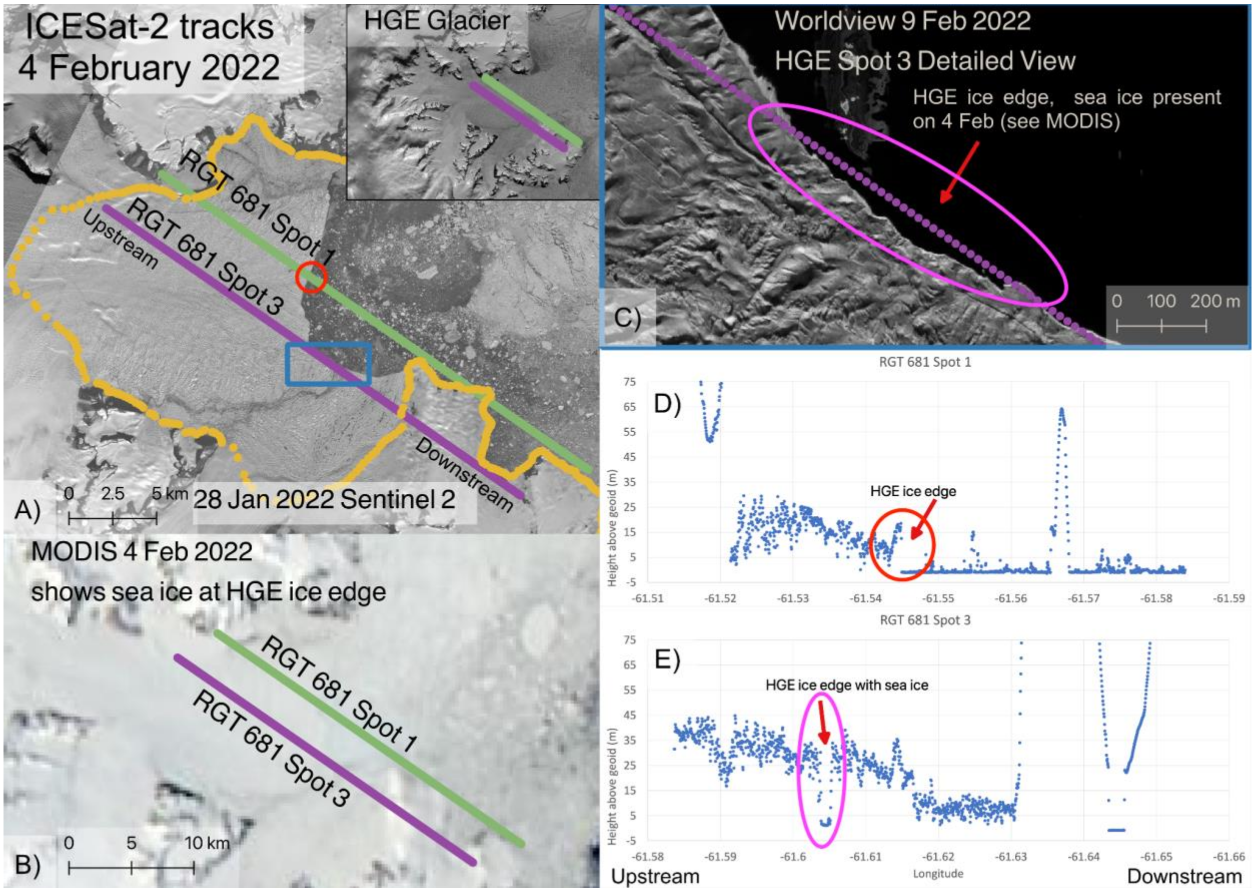
Main issues:
This section includes a short summary on main issues to be clarified and improved. Details on the concerns and suggestions for improvements are put forth in the next section.

1) **Location of grounding zone: The grounding zone positions are outdated. The 2016 grounding zone position of Hektoria Glacier was 12 km inland of the position shown in Fig. 9, and of Crane Glacier 5 km inland. This mismatch has major implications on various issues such as the interpretation of glacier flow dynamics, the estimation of the thickness of floating ice and the assessment of driving mechanisms for frontal retreat.**

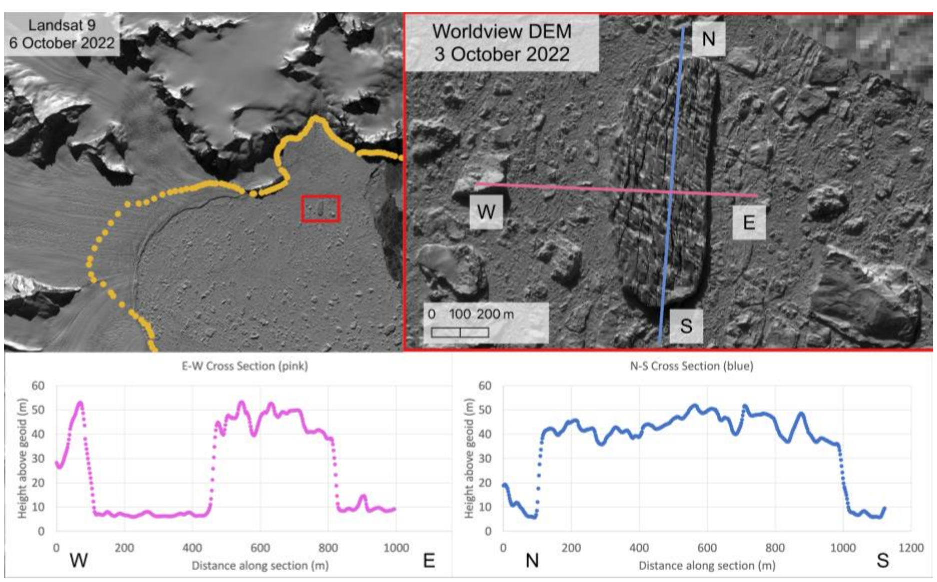
We agree that the mismatch in grounding zone location has widespread implications on various glacier dynamics. In our analysis, we have found that there is a distinct break in slope and transition in calving style at the location of our estimated grounding zone, as well as the absence of surface depressions that are usually indicative of basal crevasses. Though we have reason to suggest the grounding zone is further downstream than the 2016 estimates, we agree that in this paper we do not present enough conclusive evidence to establish the 2022 location of the grounding zone. Our focus of the paper here is to show that the glaciers underwent rapid retreat and speed-up after the removal of the fast ice. Further details on the dynamics and details of Hektoria's retreat are outside the scope of this paper (but are planned for later work). Therefore, we have added the Rott et al. 2016 grounding zone to the figure and the text.

2) **Extent and thickness of floating sections of glacier tongues: The floating section of the HGE terminus, extending between the glacier fronts of 2011 and of 21 November 2021 (shown in Fig. 8), covers more than 200 km2 in area. In the manuscript ice thicknesses of the floating terminus up to some hundred metres are mentioned. This is not an agreement with mass continuity, as it would exceed the ice volume delivered across the flux gate close the 2011 ice front.**

Below, we present ICESat-2 data that shows that the freeboard elevation of the outer edge of the HGE floating tongue on 4 February 2022 was ~10-15m above sea level (new supplemental figure 1). This is approximately 16km down flow of the 2011 grounding line (yellow outline, panel A). Panel A in the figure below shows the 28 January 2022 ice edge during a period of open water at the front. Panel B shows a MODIS image from 4 February 2022, the same day that the ICESat-2 data was acquired, showing that sea ice was in the embayment during the time the elevation data was collected. Panel C is a Worldview image from 9 February 2022 showing a detailed view (blue box on Panel A) of the ICESat 2 Spot 3 track. Panel D shows the elevation data collected on 4 February of one of the ICESat-2 tracks (Spot 1 track, in green), showing the ice edge near the center of the HGE floating front (red circle, red arrow). The Hektoria ice tongue freeboard was ~10-15 m, consistent with an ice thickness of 80-120 m; but within 3-4 km upstream it thickens to an elevation of 25-30 m that is consistent with floating ice of 200-240 m thickness. Panel E shows a plot of ICESat-2 Spot 3 track (purple track), where an ice edge is present for a small portion of the track (Panel C, pink circles). This portion of the floating tongue has a freeboard of 30-35 m, consistent with an ice thickness of ~240-280m; again, within 2-3 km upstream the ice thickens to 40-45 m freeboard, i.e. ice thickness of 320-360 m.



In addition to the ICESat-2 data, Worldview DEMs from later in 2022 show a similar freeboard for tabular icebergs near the Hektoria front, over 40 m at its center, see below (note North is grid north in ESPG: 3031; new supplemental figure 2). This is consistent with a thickness of >300 m.



In combination, these data show that the ~250 km^2 HGE floating tongue had ice thicknesses of at least a few hundred meters, even along the outer edges. This suggests our estimates are closer to the 70-100 km^3 volume range from 2011-2021. It is unclear how to reconcile the mass continuity question at hand given the multiple observations of the HGE floating tongue ice thicknesses.

3) **Processes of fast ice break-up and drift: The discussion on these processes refers to changes in the backstress of the fast sea ice as main factor, but estimates on the stress magnitude are not provided. It is questionable if changes in the backstress due to depletion of fast ice in a widening bay (as in front of HGE glacier) can be the main trigger or if other factors play an important role as well.**

In reconsidering our evidence, the comments of Reviewer 2, and the recent publications (Sun et al., 2023 and the preprint by Surawy-Stepney et al., 2023), we have modified our text (and our thinking) somewhat. The majority of the backstress on the glaciers may have come from the ice tongues' interaction with the fjord walls; loss of the fast ice re-activated calving and rifting of the ice tongues, which in turn reduced backstress on the glaciers, leading to their acceleration. When examining Figure 4 in Sun et al. (see below) there are areas of melange and fast ice compression that indicate that the downstream fast ice was indeed providing resistive stress. Moreover, the GPS results from the Scar Inlet station cannot be easily reconciled without some fast ice buttressing (that apparently varies seasonally), which will be discussed by Erin Pettit et al., (in prep). When looking at ITS_Live data (see below) it is apparent that there was a significant slow down during the fast ice occupation of the embayment as well (explored more in our follow-up paper). The rapid disaggregation of the multiple several hundred meter thick floating glacier tongues that occurred immediately after the loss of the fast ice, indicates that the fast ice provided enough backstress to keep them stable prior to the fast ice break-out. The sequence of events before and after fast ice loss, and the response of the ice tongues and glaciers in the days and months following the loss, seems hard to reconcile with a system in which the fast ice played no resistive role.

As an aside, the fast ice also eliminated wind traction on the sea surface in the area just in front of the glacier tongues. The loss of fast ice in the Larsen B embayment could have led to a significant sea surface slope in the embayment in late January 2022 and beyond. This has been shown to be capable of gravitationally 'pulling away' chunks of the floating ice (Francis et al., 2021, TCryo). This would be an interesting feature to examine in a different paper but is currently out of the scope of our study, though we now mention it in the discussion.

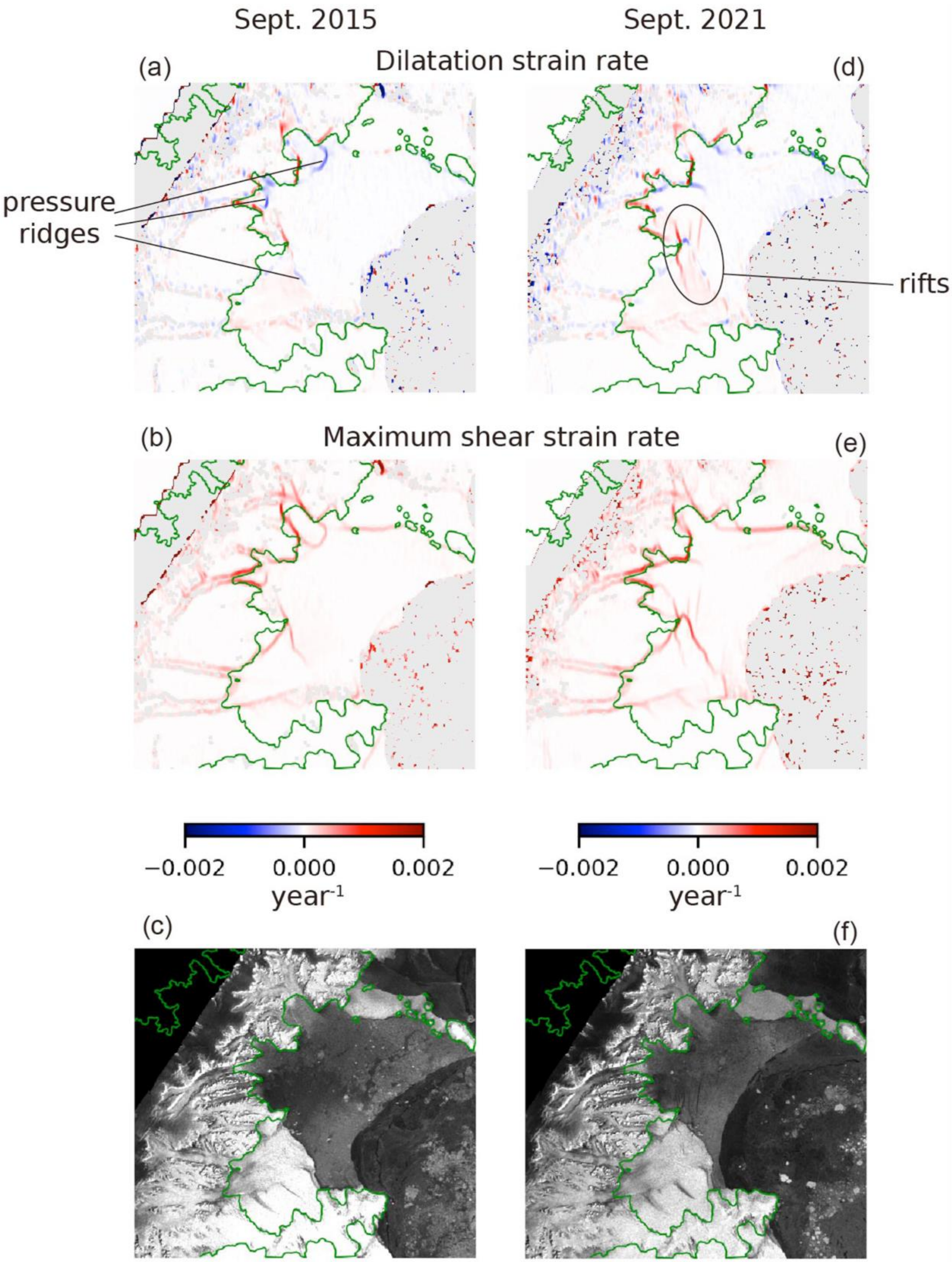
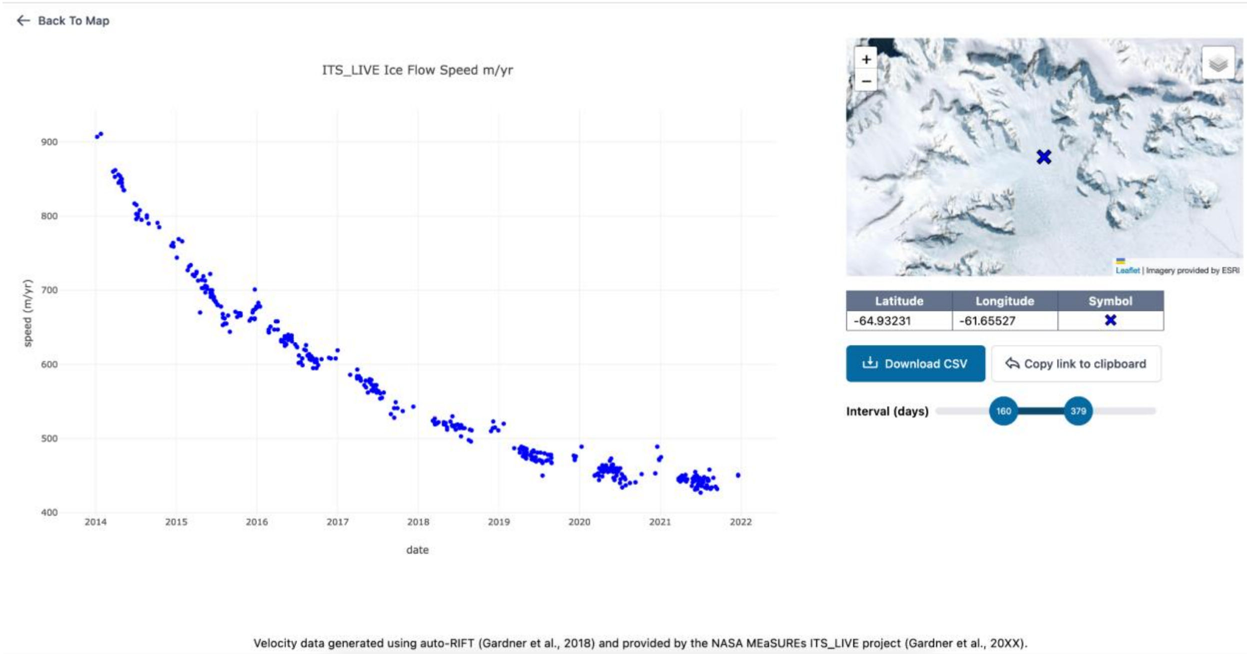


Figure 4 from Sun et al., 2023.

Hektoria Glacier slowed down during the period of fast ice occupation. (https://mappin.itsliveiceflow.science/chart?lat=-64.93231&lon=-61.65527&c=b)



4) **Processes of glacier flow acceleration and frontal retreat: Similarity of the glacier response in the wake of fast ice removal to the response after the 2002 ice shelf disintegration is claimed. However, the prerequisites and course of the events are quite different. The 2022/2023 case refers to recently formed, thin floating glacier tongues of structural weakness, in contrast to the compact, grounded ice bodies of the pre-2002 period. The patterns of frontal retreat and the ice fracture processes are also rather different.**

We agree that the two main break-up events that have affected the Larsen B tributary glaciers are different. The Larsen B Ice Shelf was much thicker and longer-lived, and provided significant backstress to the glaciers. However, despite being thinner, as we have shown the fast ice must also have provided backstress, enough such that when removed the glaciers tongues immediately broke apart and drifted away, and within months the outlet glaciers retreated and accelerated. The central portion of the fast ice was thin, 5-15 m thick, yet the floating glacier tongues were several hundred meters thick. When they were removed, Crane and Hektoria clearly reversed their decade-long trend of deceleration after the fast ice broke-up. Naturally, as the glaciers were several hundred meters thicker prior to 2002, the magnitude of their response to the two events differs, yet the critical importance is that sea ice and fast ice can affect glacier dynamics. As the climate continues to change, there will be continued losses of sea ice and fast ice that will likely cause glacier acceleration, as we see here. We have added more clarification in the discussion on the differences of these two events and emphasize that the importance of the fast ice is not proportional to its thickness (See section 5.3).

Details:

L53-L56: It would be of interest mentioning in this context also the 10-fold ice speed increase in 2009 at the Hektoria Glacier front compared to the years before 2002 (Wuite et al., 2015) and the declining mass losses during the period when fast ice was present. The total HGE losses of grounded ice amounted to 4.26 Gt/yr in 2011 to 2013 and 1.75 Gt/yr in 2013 to 2016 (Rott et al., 2018).

We have added more to this paragraph describing the changes in HGE, as you suggest.

L59-L60: Taking into account the ice volume discharged from grounded ice to floating sections of the glacier termini and assuming mass continuity, an ice thickness of hundreds of metres can refer only to a very small portion of the floating glacier tongue at its full extent. Rott et al. (2018) derived the mass fluxes across gates close to the 2011 glacier fronts of Larsen B glaciers for the period 2011 to 2016. Based on this number and accounting for further slowdown after 2016, the estimate of the total ice volume supplied to the newly formed section of the HGE tongue amounts to 39 km3 between 2011 and 2021.

Please see our explanation at the beginning of the response (#2).

L93-L98; Fig 1: The scale of the figures is too small for providing clear information on features of interest in the glacier bays and Larsen B embayment (e.g. structural properties, deformation patterns, rifts, glacier fronts). The displayed ICESat freeboard map shows blocks and streaks, with discontinuities along straight lines. Furthermore, the grounding zone positions (though not well traceable at that scale) seem to be outdated (see comment on L343ff).

We have edited this figure to show greater detail of the glacier fronts. We adjusted the area of the interpolation, and re-interpolated with additional data, to emphasize the glacier fronts and fast ice thickness. Some of the structural properties, deformation patterns, rifts, and glacier fronts are not the primary focus of this figure and are shown in Figures 8, 10, and 11. The thicknesses of various points along the floating glacier tongues and (potentially) grounded ice are shown in Figures 10 and 11. We have also added the 2016 grounding zone from Rott et al. (2018) to nearly all of the figures.

L108-109: Relative humidity less than 79% is not a suitable criterion for determining surface melt conditions. If the vapor pressure on the snow surface is higher than in the atmosphere sublimation may take place also at air temperatures above 0°C, depending on the net incoming energy.

We follow the method that Laffin et al. (2022) uses that requires a combination of parameters to determine foehn conditions - not only humidity of the descending air. We agree that surface melt can occur at various humidity levels, but in our case we are interested in the presence foehn wind conditions. According to Cape et al. (2015), the criteria for foehn wind conditions include an increase in temperature of 1°C per hour, an increase in wind speed above 5 m s^{-1} from a westerly direction, and a decrease in relative humidity of at least 5% per hour. Using the criteria in both Laffin et al. (2022) and Cape et al. (2015), the events that we have shaded in S2 (Now S4) refer to foehn conditions. The first event in S2 (16 January) is the only one that does not match both methods here we refer to Laffin et al. (2022) methods to include it because it is the most recent analysis of foehn conditions in this area. We include more information on this in the manuscript.

L167-L171: Please provide information on the procedure for deriving flow velocities (matching window size, sampling steps, cross-correlation threshold) and on the uncertainty of the velocity products for the different sensors and time spans.

We derived the flow velocities using two different methods. Using the Alaska Satellite Facility Vertex Tool we were able to derive velocities with Sentinel 1 Synthetic Aperture Radar imagery. The Vertex Tool utilizes autoRIFT, an automatic image feature tracking tool. autoRIFT includes an iterative process for determining the flow velocity. At first, with a given chip and source size, a sparse search is performed to determine areas of low coherence, then a dense search is performed, where each source and chip is matched by identifying the peak normalized cross-correlation (NCC) value. Next, whenever a specific chip size does not estimate displacements, then the program increases the size of the search chip, resulting in nested grid design with various chip sizes. The larger chip size correlation is performed on a resampled coarser grid. In other words, in areas of high flow speeds, a larger window and chip size will be needed and the software accounts for that. The final displacements are posted on the smallest chip size grid. Therefore, the final downloaded raster product has varying window size, chip size, and correlation threshold. Subsequently, the errors vary, however on average Sentinel-1 has a relative error of 4% for both X and Y-direction velocity (Lei et al., 2021). This is likely to be an underestimate because the only way to get the absolute error is by using in-situ measurements, like GPS/GNSS instruments deployed on the ground and comparing it to the satellite data.

To derive velocities using Landsat optical imagery we used PyCorr. PyCorr measures ice displacement between two images by finding the peaks in normalized cross-correlation surfaces between image chips extracted in a grid pattern over both images. Each image pair had several window and chip sizes tested and the optimal combination was chosen for the analysis. Ice flow speed errors are a combination of geolocation errors for the image pair (typically ~5m) and measurement errors on the individual correlations (0.1 pixel or 1.5 m; Fahnestock et al., 2016). PyCorr returns a limited set of metrics that help document the uniqueness and strength of a peak that can be used to filter the output, but it does provide an error estimate for each match. With that said, for images separated by one year, error is ~±7.5m/yr, however shorter time intervals result in higher errors (Fahnestock et al., 2016). The PyCorr results we have agree with the available Sentinel 1 autoRIFT results.

Given the complexity of both of the algorithms and how they process image pairs we have not added information on the window and chip sizes. However, we have added information elaborating on how these processes work and errors associated with the different methods. Please see the revised methods section.

L215- L216: Considering the ice export across the 2011 glacier front, ice with thickness on the order of 300 m can stretch out only over rather small areas. Please provide details on the ice thickness information (dates, extent of area with freeboard > 40 m). Due to the coarse resolution the Fig.1 is not a suitable source for this information.

Please refer back to response #2 at the beginning of the response.

L217-L218: The maps of surface elevation change (SEC) 2013 to 2016 by Rott et al. (2018) show increase in surface elevation on the lower 10 km of Crane Glacier and frontal advance, coinciding with major surface lowering in the upper reaches of the main glacier trunk. This contradicts the statement on dominating ice input from tributary glaciers in the paper of Needell and Holschuh (2022) who do not cite the observations of Rott et al.

Both Rott et al., (2018) and Needell and Holschuh (2022) describe the main trunk of Crane glacier as increasing in surface elevation during the period of fast ice occupation. Needell and Holschuh (2023) refer to the tributary glaciers as thinning, which are actually the upper reaches of the main glacier (see screenshot of their Supplemental Figure 7 below). Given this we see the statements as not contradictory but in agreement. We have added the Rott et al., (2018) citation to this sentence in the manuscript.

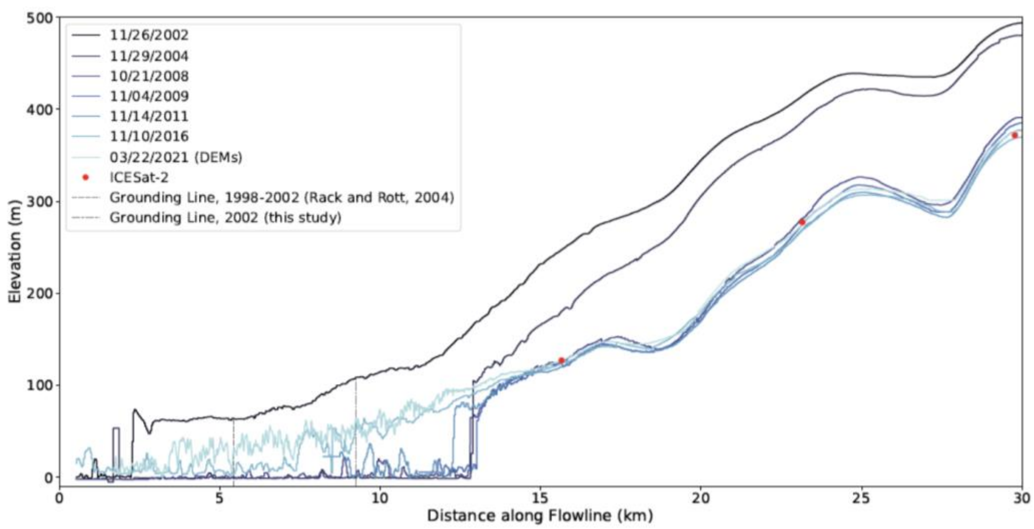


Figure S7. Extended surface elevation profile, capturing evidence of upstream elevation change. Local thickening upstream of the 2021 glacier terminus occurred ~12 km along the flowline from 2008-2021, and a period of thinning 12-30 km along the flowline occurred from 2002-2008. Data represent a combination of NASA airborne altimetry data (Airborne Topographic Mapper data and Land, Vegetation, and Ice Sensor data), and ICESat-2 calibrated stereophotogrammetric DEMs.

L218-L219: Referring to the glacier fronts on 25 June 2011 (TanDEM-X image, shown in Fig. 2 in Supplement of Rott et al., 2020) and on 21 November 2021 (shown in Fig. 8 of

Ochwat et al.) the Hektoria Glacier front advanced during this period by about 20 km and the new floating area covered more than 200 km2.

We edited the text accordingly. Calculating the area from the 2011 coastlines in Rott et al.., 2020, the area covers approximately 250 km^2.

L232: Fig. 1b and 1c show MODIS images of 16 and 21 January 2002, not 18, 19 and 20 January.

We have fixed this mismatch and added the correct dates.

L261-L264: Please explain the decision rule for identifying and for shutting on and off foehn events. According to Fig. S1 a threshold of 3 m/sec is used for Foehn detection. This number corresponds to a light breeze, not suitable for facilitating the breakthrough of the flow at the leeside of a mountain range.

As noted earlier, we use the empirically derived thresholds from Laffin et al., 2022 in section 2.2. The wind and humidity thresholds are only used in concert with other parameters. We also refer to Cape et al. (2015) that uses slightly different criteria, yet it agrees with our identification of foehn events for all but one event, in which we include because it matches Laffin et al. (2022). In Cape et al. (2015) the criterion for the wind is 5 m/s, which is the case for all but one of our identified events. Additionally, in Cape et al. (2015), the foehn conditions are split into “foehn days” where the conditions are met for longer than 6 hrs, when those conditions are no longer met then the foehn day ends. We have adjusted the text to include Cape et al. (2015)’s criterion of the “foehn day”. We note foehn events only to describe weather conditions that might have induced melt or could move the fast ice.

L274, Fig. 4: The label of Fig 4a abscissa is date (not time).

Good catch, thank you. We have fixed it.

L295: The surfaces may have been frozen on the date of the Landsat image (16 January 2022), but the temperature record (Fig. S2) shows several days of high temperature in January 2022, an indication for with surface melt that is also apparent in SAR images.

We say with “reduced melt pond coverage” not that there is not any melt at all. There very well may have been some melt, but not to the extent that was evident in the November and December satellite images.

L343ff, Section 4.3.1: In the context of various issues addressed in this section, an outdated version of the grounding zone positions is used. Estimates for grounding line locations of Larsen A and Larsen B glaciers in 2013 and 2016 were obtained by Rott et al. (2018), based on changes in surface elevation of TanDEM-X data. The transition from grounded to floating ice is associated with a strong drop in surface elevation change

(dh/dt). The 2016 grounding lines of Hektoria Glacier and Crane Glacier (see zoom images in Rott et al., 2020) are about 12 km (Hektoria) and 5 km (Crane) inland of the position shown in Fig. 9 of Ochwat et al. The 2016 Crane location refers to the centre of the canyon. Further retreat during recent years has to be expected.

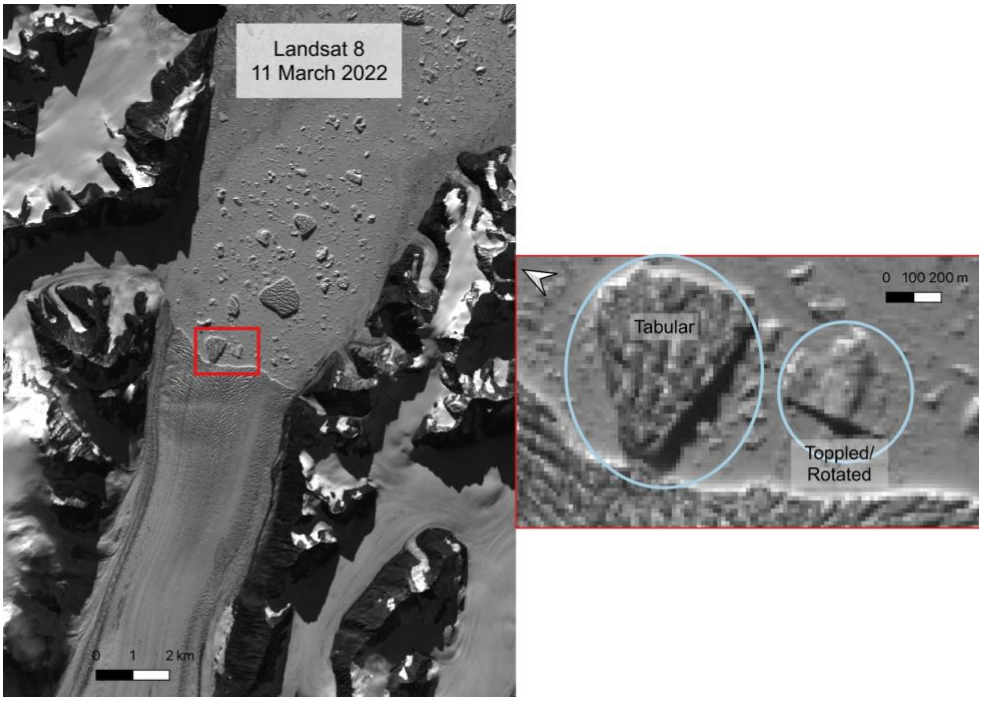
We have added the 2016 grounding zone that was referenced in Rott et al. (2018) to various figures, and in the text. (Thank you for having that data accessible and easy to add!). We have kept the grounding zone as we inferred as well, which were determined using the change in slope from the 2020-2022 Worldview DEMs, the onset location of surface depressions indicative of basal crevasses, and the location of a transition in calving style.

Due to the buttressing effect of the landfast sea ice (evident in the ITS_LIVE velocity data of Hektoria above, as well as the GPS data from Scar Inlet, Fig. 2), the grounding line may have not continued to retreat during these years. Due to the complexity of our assessed grounding zone migration, we are saving a deeper analysis of these dynamics and rapid retreat of Hektoria Glacier for a future study (now in prep).

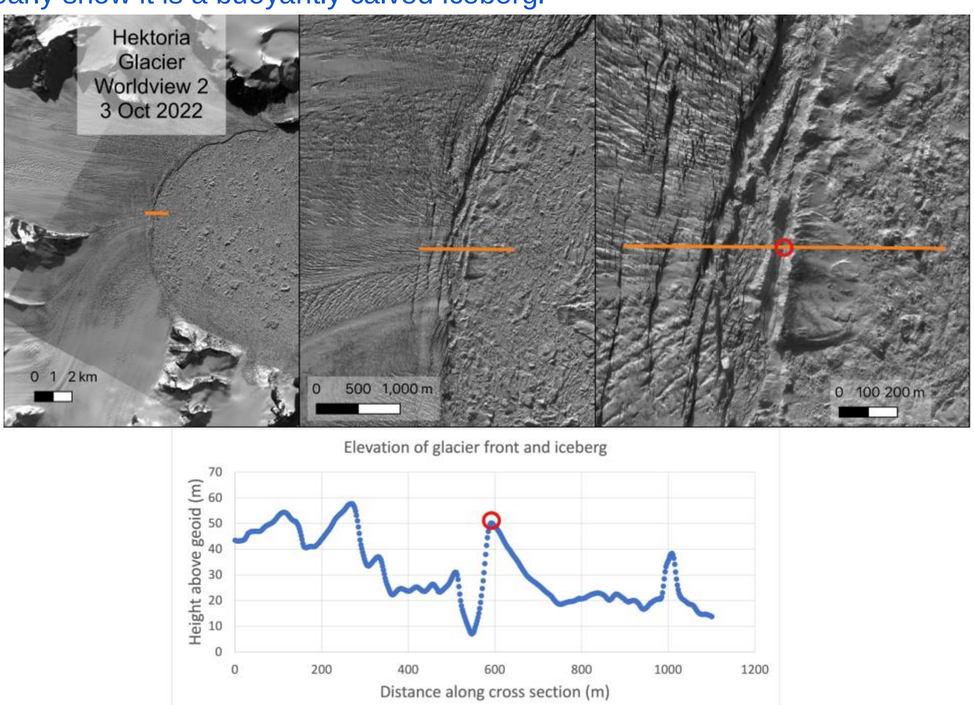
L346-L350: Please provide evidence on the iceberg properties and calving features described, as well as on the dates of the images to which the described features refer. Checking the pre-frontal embayment area in the Sentinel-1 time series of 2022 and 2023, there are no features that can be uniquely allocated to a toppled iceberg. In the SAR images of January and February 2022 and December 2023 to February 2023 icebergs in the pre-frontal areas show low reflectivity, evidence for the presence of melting firn. In subsequent colder periods the firn freezes, causing a transition to high backscatter intensity.

Several characteristics indicate the type of calving style that occurred. Tabular icebergs are evident in optical imagery by the coherent structure that resembles the surface of the glacier and has simply detached from it, usually significantly crevassed and darker due to shadowing. Rotated or toppled icebergs, a product of buoyancy-driven calving (or in some cases, forward tipping due to high basal stress at a tidewater ice front), are usually lower to the ocean/sea ice surface, smooth with minimal crevasses, and have a gently undulating upper surface. In some instances, we used SAR backscatter intensity in conjunction with the optical imagery. We agree that the refreezing of firn can cause a transition to high backscatter intensity, which is why we did not only use SAR for identifying toppled bergs.

Below you can see an example of the tabular berg next to a toppled berg in front of Crane Glacier in March 2022. At this time, Crane was still calving from its floating tongue and not yet at the grounding zone, hence having both types of icebergs.



In the figure below you can see the toppled berg at the front of Hektoria Glacier. The elevation profile (from Worldview DEM from the same image, orange line) shows the backward rotation of the berg. The red dot shows the crest of the iceberg in both the image and the profile. The features of this iceberg, including the elevation profile, morphology of the iceberg, and surface texture, clearly show it is a buoyantly calved iceberg.



L373: An extended thick (>300 m) floating tongue in front of HGE glaciers does not match the mass continuity for input across the 2011 glacier front (see related comments above).

Please refer back to response #2 at the beginning of the response.

L389-L428, Section 4.3.2: Also for this section an update on the grounding zone positions is needed (see comment L343ff). The main parts of the velocity profiles shown in Fig. 9 are located either on floating ice and or on pre-frontal ice mélange. This questions the argumentation of issues referring to the grounding zone and to velocities on grounded ice.

Please refer to response #1. We have added the location of the 2016 GL's to the figure.

L420, Figure 9: Please mark the updated location of the grounding line and the location of the ice front on different dates. The profiles of Hektoria and Green glacier deviate from the course of the central flowline. The Landsat-based Hektoria Glacier velocities of Nov. 2022 to Jan. 2023 deviate significantly from the Sentinel-1 based velocities of June to Oct. 2022. How reliable are the Landsat velocities?

We follow the central lines of the Icebridge ATM track. The velocities deviate because there is a significant speedup that begins in the autumn, this is evident in the Sentinel 1 velocity data on Crane, as well as the Sentinel and Landsat velocity data on Green and Hektoria. You can see that the January 2023 and December 2022 velocities of Sentinel and Landsat are in agreement on the Green Glacier profile. The Landsat velocities have been used in numerous publications and have frequently been compared to and merged with GPS and SAR-derived ice flow measurements.

L446: The statement "Hektoria Glacier lacks long-term elevation change data points" is not valid, at least for TanDEM-X data 2011 to 2016 (Rott et al., 2018), but also regarding further data from this mission and from other satellite sensors (e.g. CryoSat).

We have altered the sentence, because in this context we were referring to elevation changes beginning with the collapse, not "long-term": in the sense of many years or decades. We see how this was confusing. We will explore longer-term changes with more satellite data when we investigate Hektoria's grounding line migration and unusual retreat in a follow-on paper.

L523-L525: Quantitative estimates on the fast ice backstress magnitude and its spatial pattern are needed for affirming this conclusion, as well as considerations regarding possible changes of other driving factors, such as winds and ocean currents.

Please see the response to General Comment #3 and the revised discussion.

L531-L554: The argumentation, referring to proposed governing processes for glacier response and claiming similarity to the 2002 break-up event, are not well founded. There are various clues indicating major differences regarding the calving regimes and dynamic response of the Larsen B tributary glaciers in 2002 versus 2022/2023. Up to the 2002 event the glaciers were close to a balanced state, the tongues were several hundred

metres thick and grounded. In 2022 the newly formed sections of the glacier tongues were composed of comparatively thin floating ice. Furthermore, there is evidence of structural weakness. On the floating sections high resolution elevation data show rugged surface structure and wave-like surface features of different wavelengths. There are also indications for major strain-rate weakening, as velocity data show. For example, on the central flowline of Hektoria Glacier a threefold increase of velocity between the grounding line and the glacier front is evident in 2017 data, and on Crane Glacier a twofold increase (Rott et al., 2020).

We have added details about the state of the glaciers and ice shelf/fast ice prior to the two events into this section (5.3).

L537-L538: On Crane Glacier close to the calving front a velocity of 9.6 m/day was observed in June 2007 data (Wuite et al., 2015), 2.3 times the 2003 value cited in L538.

Good suggestion, we have now elaborated on the velocity history of Crane Glacier.

L542: Based on the updated grounding line position, the number for retreat of grounded ice should be corrected.

We have added retreat estimates that reference the 2016 grounding line.

L543-L544: The floating ice of 15 km length in front of Hektoria Glacier was in fact a remnant section of the Larsen B ice shelf that remained in the pro-glacial bay for several month after disintegration of the main ice shelf. The boundary of the ice shelf is clearly evident in the tidal deformation pattern of ERS-tandem (1-day repeat) interferometric data. The retreat of grounded ice started in March 2003. The changes between February 2002 and April 2003 are documented by Rack et al. (2004) by means of several SAR images.

We see your point that what we called the Hektoria Glacier Tongue was still the ice shelf, we suppose here it is a point of semantics, as this part of the ice shelf was located in the Hektoria Fjord and therefore originated from HGE and not a combination of many outlet glaciers in the main Larsen B Embayment. For clarity and to distinguish it from the rest of the shelf, we retained the term, but we note our informal designation. We corrected the date at which Hektoria began calving at its grounded front and referenced Rack and Rott (2004).

L555ff, Conclusions: Major revisions are needed, taking into account the comments above.

We have changed the conclusion to incorporate some of the suggestions that were described above.

References cited in the manuscript, but not included in the list:

Crawford et al., 2022 (cited in L159)
Hersbach et al., 2020 (cited in L104)
Kwon et al., 2020; (cited in L473)
Ochwat et al., 2022 (cited in L159)
Robel et al., 2017 (cited in L527)
Smith et al., 2020 (cited in L38 and L 501)

We have added these, thank you.

References
Needell, C., and Holschuh, N.: Evaluating the retreat, arrest, and regrowth of Crane Glacier against marine ice cliff process models. Geophys. Res. Lett., 50, e2022GL102400. https://doi.org/10.1029/2022GL102400, 2023.

Rack, W., and Rott, H.: Pattern of retreat and disintegration of Larsen B ice shelf, Antarctic Peninsula, Ann. Glaciol., 39, 505-510, 2004.

Rott, H. Abdel Jaber, W., Wuite, J., Scheiblauer, S., Floricioiu, D., van Wessem, J.M., Nagler, T., Miranda, N., and van den Broeke, M.R.: Changing pattern of ice flow and mass balance for glaciers discharging into the Larsen A and B embayments, Antarctic Peninsula, 2011 to 2016, Cryosphere, 12, 1273–1291, https://doi.org/10.5194/tc-12-1273-2018, 2018.

Rott, H., Waite, J., De Rydt, J., Gudmundsson, G.H., Floricioiu, D., and Rack, W.; Impact of marine processes on flow dynamics of northern Antarctic Peninsula outlet glaciers, Nature Communications, 11:2969,| https://doi.org/10.1038/s41467-020-16658-y, 2020.

Wuite, J., Rott, H., Hetzenecker, M., Floricioiu, D., De Rydt, J., Gudmundsson, G. H., Nagler, T., and Kern, M.: Evolution of surface velocities and ice discharge of Larsen B outlet glaciers from 1995 to 2013, Cryosphere, 9, 957–969, https://doi.org/10.5194/tc-9-957-2015, 2015.

References in our response:
Cape, M. R., Vernet, M., Skvarca, P., Marinsek, S., Scambos, T., and Domack, E. (2015), Foehn winds link climate-driven warming to ice shelf evolution in Antarctica, *J. Geophys. Res. Atmos.*, 120, 11,037–11,057, doi:10.1002/2015JD023465.

Francis, D., Mattingly, K. S., Lhermitte, S., Temimi, M., and Heil, P.: Atmospheric extremes caused high oceanward sea surface slope triggering the biggest calving event in more than 50 years at the Amery Ice Shelf, The Cryosphere, 15, 2147–2165, https://doi.org/10.5194/tc-15-2147-2021, 2021

Laffin, M. K., Zender, C. S., van Wessem, M., and Marinsek, S.: The role of föhn winds in eastern Antarctic Peninsula rapid ice shelf collapse, The Cryosphere, 16, 1369–1381, https://doi.org/10.5194/tc-16-1369-2022, 2022.

Needell, C., & Holschuh, N. (2023). Evaluating the retreat, arrest, and regrowth of Crane Glacier against marine ice cliff process models. *Geophysical Research Letters*, 50, e2022GL102400. https://doi.org/10.1029/2022GL102400

Sun, Y., Riel, B., & Minchew, B. (2023). Disintegration and buttressing effect of the landfast sea ice in the Larsen B embayment, Antarctic Peninsula. *Geophysical Research Letters*, 50, e2023GL104066. https://doi.org/10.1029/2023GL104066

Surawy-Stepney, T., Hogg, A. E., Cornford, S. L., Wallis, B. J., Davison, B. J., Selley, H. L., Slater, R. A. W., Lie, E. K., Jakob, L., Ridout, A. L., Gourmelen, N., Freer, B. I. D., Wilson, S. F., and Shepherd, A.: The impact of landfast sea ice buttressing on ice dynamic speedup in the Larsen-B Embayment, Antarctica, The Cryosphere Discuss. [preprint], https://doi.org/10.5194/tc-2023-128, in review, 2023.