We appreciate the constructive comments from two reviewers (Dr. Ann-Sofie Priergaard Zinck, and Dr. Mattia Poinelli). Our manuscript will be much improved by their input. As informed in the letter of requesting responses, this file contains author comments (ACs). The revised manuscript should not be prepared and submitted at this stage. In the following responses, we use "**bold**" text for comments, "non-bold" text for our responses, and "italic" for changed text in the later improved manuscript.

Referee #2

Dear Menglian Xia and co-authors,

The manuscript "Building multi-satellite DEM time series for insight into mélange inside large rifts in Antarctica" by Xia et al. presents a novel approach to monitor rifts' infill on the Filchner-Ronne ice shelf using observations from different satellites at high resolution Understanding variations in rift infill is crucial for assessing rift dynamics, which ultimately influence calving events. I commend the authors for their creative approach, thorough analysis, and well-designed, highly informative figures. Overall, I strongly believe this paper would be a valuable addition to the literature, and its scope and format make it well-suited for publication in The Cryosphere. Below, I provide a general comment along with more specific, line-by-line suggestions that I hope will further strengthen the manuscript.

GENERAL COMMENT:

I admit that DEM processing is not my direct area of expertise, but the logic of the technical part seems sound and appropriate for a reader, like me, who is not necessarily familiar with technicalities of DEM analysis. However, I believe this manuscript would benefit from a few improvements to enhance readability and impact. In some sections, the text becomes somewhat difficult to follow, partly due to the frequent use of acronyms and the listing of numbers with excessive significant figures. At times, this made it challenging to stay engaged with the flow of the manuscript. I recommend streamlining certain parts, as indicated in my line-by-line comments, to improve clarity and coherence.

Response:

Thanks for the suggestions. The manuscript is revised accordingly (see following responses).

More importantly, I find that this manuscript lacks a thorough discussion, a comparison with existing literature, and a clear background motivation. I was surprised to see that it does not include a dedicated discussion section, where I had expected to find these elements. To strengthen the manuscript's impact, I recommend contextualizing the observational results within the broader framework of rift monitoring and their

implications for ice shelf and glacier dynamics, while also drawing comparisons with existing studies.

Response:

We addressed the issues in two parts.

1) We added substantial text in Introduction to give a clear background motivation, comparison with existing studies, and context to this study … (also see following responses)
2) We added a Discussion section to address the remaining points:

*"**4 Discussion***

The developed multi-temporal DEM adjustment model MDAM has shown its effectiveness in removing biases between adjacent multi-satellite sub-DEMs and establishing a unified and integrated DEM time series with an average elevation uncertainty of better than 0.24 m. We demonstrate the full 3D mapping capability for characterizing rift structure (rift lips, pre-mélange cavities, mélange seracs, etc.) and estimating dynamic mélange volume changes from the ICESat-2 controlled DEM time series, extending from rift topography and mélange thickness estimated along ground tracks from ICESat and ICESat-2 measurements in previous studies (Fricker et al., 2005; Walker et al., 2021). Such high-resolution mélange dynamic observations allow us to understand the mélange movement inside a closed environment of large Antarctic rifts, and to further study its role in rapid rift propagation and iceberg calving. To make this model working in a more dynamic open ocean environment, such as Pine Island and Thwaites ice shelves, modifications need to be carried out to address the rapid calving process with incoherent mélange changes in ice shelf front.

A thick mélange layer can effectively "freeze" a rift, enabling mechanical stress transmission between its flanks and ultimately suppressing rift propagation (Rignot, 1998; Larour, 2021). In this study, we show that seracs appearing on the mélange surface are a part of the infill inside rifts. They are formed from partial collapsing of rift flanks. We propose that the surface part of the bottom rift wall is first excavated through interactions by tides (Padman et al., 2002 and 2008), melting caused by intrusion of warmer sea water into the rift (Poinelli 2023a), and other factors. This, in turn, causes the collapse of the upper part of the rift flank due to the removal of the bottom support. This process, like coastal bluff erosion, repeats itself and becomes one of the mechanisms that widen the rift and increase the mélange volume. We find that the increased mélange volume in a rift promotes its widening rate, and may further increase ice front calving and effect the ice shelf stability.

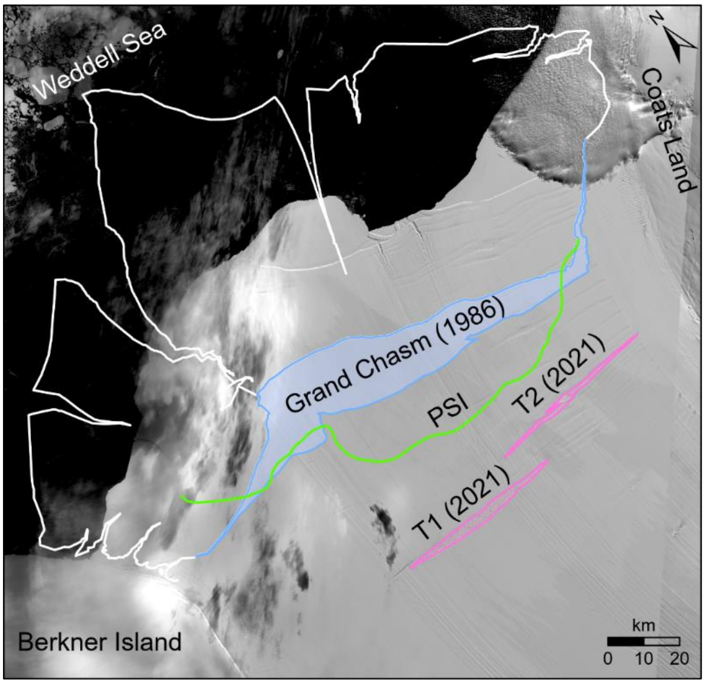
Future calving triggered by T1 and T2 and the resulting ice front retreat may expose the ice shelf to increased warm water intrusion, a process simulated for the Larsen C ice shelf and supported by modelling results (Poinelli, 2023a and 2023b). Although the iceberg calved from the shelf front in 1986 is located inside the Passive Shelf Ice (PSI) area, meaning no actual buttress reduction for support from the ice shelf to the ice sheet (Doake, 1998; Fürst et al., 2016), the combined rifts of T1 and T2 propagated rapidly recently to cover ~58% the ice shelf laterally. In the context of global warming, this is particularly relevant for the Filchner Ice Shelf, as warm water has recently been observed near Berkner Island (e.g., Davis, 2022). Therefore, T1 and T2 have the potential to trigger a larger calving beyond the PSI boundary *and could ultimately lead to destabilization mechanisms like those proposed for the Larsen C Ice Shelf."*

While rifts and calving are natural processes in the life cycle of ice shelves, the calving of their seaward-most extensions does not necessarily lead to significant upstream glacier acceleration. I have not performed the calculations myself, but rifts T1 and T2 on the Filchner-Ronne Ice Shelf (FRIS) appear to lie beyond the 'compressive arch' (Doake, 1998), suggesting they may not directly precondition the ice shelf for collapse—similar to the 'passive portion' described by Fürst et al. (2016). This raises a key question: if these rifts are not an immediate destabilizing factor for FRIS, why is their study important?

Response:

We added the following text in the Discussion: "…… *Although the iceberg calved from the shelf front in 1986 is located inside the Passive Shelf Ice (PSI) area, meaning no actual buttress reduction for support from the ice shelf to the ice sheet (Doake, 1998; Fürst et al., 2016), the combined rifts of T1 and T2 propagated rapidly recently to cover ~58% the ice shelf laterally. In the context of global warming, this is particularly relevant for the Filchner Ice Shelf, as warm water has recently been observed near Berkner Island (e.g., Davis, 2022). Therefore, T1 and T2 have the potential to trigger a larger calving beyond the PSI boundary and could ultimately lead to destabilization mechanisms like those proposed for the Larsen C Ice Shelf.*"

Also see the following figure.



This is, of course, a provocative question, and I fully agree with the authors that rifts play a critical role. Future calving triggered by T1 and T2 and the resulting ice front retreat may expose the ice shelf to increased warm water intrusion, a process simulated for

Larsen C and supported by theoretical work (Poinelli, 2023a,b). In the context of global warming, this is particularly relevant for FRIS, as warm water has recently been observed near Berkner Island (e.g., Davis, 2022). Such changes could ultimately lead to destabilization mechanisms like those proposed for Larsen C. I encourage the authors to incorporate these considerations to provide a stronger and more comprehensive discussion of their findings.

Response:

Thanks for suggestion. They are added into Discussion (see the response above).

In the introduction, there is a strong focus on technical studies related to altimetric and stereo mapping of rifts, but the broader scientific goal and the significance of this region of Antarctica seem underdeveloped. For a paper in The Cryosphere, I would expect a more robust scientific background that clearly establishes the relevance and utility of this work.

Response:

We added the following text in Introduction to address it.

"…… Furthermore, mélange (a mixture of shelf ice, snow, sea ice and water) changes related to ice shelf fracturing in Antarctica and glacier calving in Greenland are studied (Rignot and Macayeal, 1998; Larour et al., 2004; Cassotto et al., 2021). Specifically, mélange thickness reduction is observed during rift widening on Amery Ice shelf, Ronne Ice Shelf and Larsen C Ice Shelf (Fricker et al., 2005; Walker et al., 2021; Larour et al., 2021). Modelling results indicate that mélange may have the capability for transmitting stresses across rift flanks and thus, influences rift propagation and shelf front calving (Larour et al., 2004 and 2021). However, there has been a lack of large-scale high-resolution observations of 3D rift structural changes and mélange dynamics in a sustained long period to support such a conclusion. This, in turn, hinders our understanding of the role of mélange in ice shelf retreating and the mechanism of ice shelf stability weakening."

"…… The proposed MDAM model is validated and applied in the Filchner Ice Shelf, one of the dual ice shelves of Filchner-Ronne Ice Shelf that is the second largest in Antarctica (Fig. 3). Berkner Island and Coats Land are located at western and eastern margins of the ice shelf, respectively. The largest calving event recorded for this ice shelf, with an area loss of 11500 km2, occurred in 1986 due to a rapid propagation of a prominent rift known as "Grand Chasm" (Ferrigno and Gould, 1987), producing three giant icebergs that greatly impacted the circulation and hydrography in the nearby ice shelf-ocean system (Grosfeld et al., 2001). Recently, two large rifts, T1 and T2 (Fig. 3), are detected in a Landsat satellite image in 1996 and an ARGON satellite image in 1963, respectively (Li et al., 2017; Walker and Gardner, 2019; Lv et al., 2022). These rifts have a combined length of ~100 km and exhibit a similar propagation pattern as Grand Chasm……"

One crucial aspect that appears to be missing is the role of ice mélange variation in modulating rift dynamics. A thick mélange layer can effectively "freeze" a rift, enabling mechanical stress transmission between its flanks and ultimately suppressing rift propagation (Rignot, 1998; Larour, 2021). This process is fundamental to understanding rift evolution and should be better integrated into the manuscript's scientific framing. I may have overlooked this point, and I apologize if it was addressed, but I encourage the authors to clarify and emphasize its importance.

Response:

We added this sentence in Introduction: "*Modelling results indicate that mélange may have the capability for transmitting stresses across rift flanks and thus, influences rift propagation and shelf front calving (Larour et al., 2004 and 2021).*"

We further added the following text specifically in Discussion, but also make a link to the "volume" change results from this study:

"*A thick mélange layer can effectively "freeze" a rift, enabling mechanical stress transmission between its flanks and ultimately suppressing rift propagation (Rignot, 1998; Larour, 2021). In this study, we show that seracs appearing on the mélange surface are a part of the infill inside rifts. They are formed from partial collapsing of rift flanks. We propose that the surface part of the bottom rift wall is first excavated through interactions by tides (Padman et al., 2002 and 2008), melting caused by intrusion of warmer sea water into the rift (Poinelli 2023a), and other factors. This, in turn, causes the collapse of the upper part of the rift flank due to the removal of the bottom support. This process, like coastal bluff erosion, repeats itself and becomes one of the mechanisms that widen the rift and increase the mélange volume. We find that the increased mélange volume in a rift promotes its widening rate, and may further increase ice front calving and effect the ice shelf stability.*"

SPECIFIC COMMENTS

Line 13: The connection between calving and ice mélange is not clearly established in the manuscript. Why is the observed "significant gap" in mélange dynamics particularly relevant to calving processes? Ice mélange, when sufficiently thick, can bond rift flanks together, suppressing rift widening and propagation. Clarifying this link would strengthen the manuscript's argument and better highlight the importance of studying mélange dynamics in the context of ice shelf stability.

Response:

We added the following text in Introduction to clarify the link between mélange and calving:

"*…… Furthermore, mélange (a mixture of shelf ice, snow, sea ice and water) changes related to ice shelf fracturing in Antarctica and glacier calving in Greenland are studied (Rignot and Macayeal, 1998; Larour et al., 2004; Cassotto et al., 2021). Specifically, mélange thickness reduction is observed during rift widening on Amery Ice shelf, Ronne Ice Shelf and Larsen C*

Ice Shelf (Fricker et al., 2005; Walker et al., 2021; Larour et al., 2021). Modelling results indicate that mélange may have the capability for transmitting stresses across rift flanks and thus, influences rift propagation and shelf front calving (Larour et al., 2004 and 2021). However, there has been a lack of large-scale high-resolution observations of 3D rift structural changes and mélange dynamics in a sustained long period to support such a conclusion. This, in turn, hinders our understanding of the role of mélange in ice shelf retreating and the mechanism of ice shelf stability weakening."

Line 20: Mélange volume expansion is directly correlated with rift widening, but its relevance in the context of ice sheet modeling is unclear. Can we speculate on causality—does mélange volume drive rift widening, or is it simply a byproduct? Since mélange volume necessarily increases as the rift widens due to greater exposure of open ocean to surface heat loss, a more informative parameter to monitor might be mélange thickness relative to ice shelf thickness. This ratio is crucial in determining how stress is transmitted between rift flanks (Larour, 2021).

Response:

Mélange thickness change is an important indicator. It is now reviewed in Introduction (see above response). We believe that volume is another important indicator that is related to both rift widening and supply of shelf ice to adjust the infill into the rift. We added how this process might occur in Discussion: "*A thick mélange layer can effectively "freeze" a rift, enabling mechanical stress transmission between its flanks and ultimately suppressing rift propagation (Rignot, 1998; Larour, 2021). In this study, we show that seracs appearing on the mélange surface are a part of the infill inside rifts. They are formed from partial collapsing of rift flanks. We propose that the surface part of the bottom rift wall is first excavated through interactions by tides (Padman et al., 2002 and 2008), melting caused by intrusion of warmer sea water into the rift (Poinelli 2023a), and other factors. This, in turn, causes the collapse of the upper part of the rift flank due to the removal of the bottom support. This process, like coastal bluff erosion, repeats itself and becomes one of the mechanisms that widen the rift and increase the mélange volume. We find that the increased mélange volume in a rift promotes its widening rate, and may further increase ice front calving and effect the ice shelf stability.*"

Line 29: This line is a bit confusing, mass discharge across the GL is the cause of sea level rise, but what does 'lost ice mass enters' mean?

Response:

We deleted the first half of the sentence. It is changed to: "…… *The lost ice mass enters the Southern Ocean from ice shelves mainly through two processes, namely shelf front calving and basal melting, each accounting for ~50% (Depoorter et al., 2013; Liu et al., 2015; Smith et al., 2020; Greene et al., 2022).*"

Line 39: Like my comment in the abstract, I don't fully see the link between calving and ice mélange? What does 'the importance … on studying mélange … are fully recognized' mean?

Response:

We changed this part of the section to strengthen the link: "*…… Furthermore, mélange (a mixture of shelf ice, snow, sea ice and water) changes related to ice shelf fracturing in Antarctica and glacier calving in Greenland are studied (Rignot and Macayeal, 1998; Larour et al., 2004; Cassotto et al., 2021). Specifically, mélange thickness reduction is observed during rift widening on Amery Ice shelf, Ronne Ice Shelf and Larsen C Ice Shelf (Fricker et al., 2005; Walker et al., 2021; Larour et al., 2021). Modelling results indicate that mélange may have the capability for transmitting stresses across rift flanks and thus, influences rift propagation and shelf front calving (Larour et al., 2004 and 2021). However, there has been a lack of large-scale high-resolution observations of 3D rift structural changes and mélange dynamics in a sustained long period to support such a conclusion. This, in turn, hinders our understanding of the role of mélange in ice shelf retreating and the mechanism of ice shelf stability weakening.*"

Figure 1: Really nice figure.

Line 67: What do you mean with 'tie point'?

Response:

We added the text to refer it to the detailed TP description in Section 2.2.2: "*We introduce tie points (TPs, see detailed description in Section 2.2.2) ……*"

Line 76: This sentence is a bit confusing.

Response:

We revised the sentence to clarify the point: *"Finally, we demonstrate the observed mélange changes and estimated volumetric changes in relation to rift widening as the rifts advect toward the ice shelf front during the study period."*

Line 124: This is good example of the scientific motivation of this study. Perhaps this should be included in the introduction and not in methodology.

Response:

Yes, this part is now moved to Introduction.

Line 157,176: Acronyms in the title are hard to follow ad makes the reading experience confusing.

Response:

They are now spelled out in the titles.

Figure 8-9: Great figures! Congrats!

Line 264: I appreciate the precision in these values but is it necessary? This may be a question of personal preference, but I find it a bit confusing to follow these numbers. These details are also reported in Table A3 no? So why don't discuss the orders of magnitude of these changes?

Response:

We now keep the digits to meter for all numbers throughout the manuscript. We also give the orders of magnitude of these changes: "…… *we found that the rift T1 propagated consistently during the period, resulting in an accelerated widening by 647 m during 2014-2017 (44 %, 227 m y^{-1}) and 1,109 m during 2016-2021 (53 %, 268 m y^{-1}). Correspondingly, the rift has lengthened by 2,393 m during 2014-2017 (5%, 840 m y^{-1}), but only 1,082 m during 2016-2021 (2%, 262 m y^{-1}).*"

Here are data for both T1 and T2 (will update the manuscript for T2):

	Time	Rift T1	Rift T2
Length (m)	2014	47131.86	48324.04
	2017	49525.03	50025.03
	2021	50607.86	51692.19
Lengthening (m & m/y)	2014-2017	2393.17 m (5%, 839.68 m/y)	1701.00 m (%4, 597.39 m/y)
	2017-2021	1082.83 m (2%, 262.10 m/y)	1667.15 m (%3, 405.95 m/y)
Width (m)	2014	1456.65	1532.33
	2017	2103.48	1944.04
	2021	3212.20	2777.66
Widening (m & m/y)	2014-2017	646.83 m (44%, 226.95 m/y)	411.71 m (27%, 144.59 m/y)
	2017-2021	1108.71 m (53%, 268.36 m/y)	833.62 m (43%, 202.99 m/y)

Line 282: What is a 'cavity' in this context? Please specify.

Response:

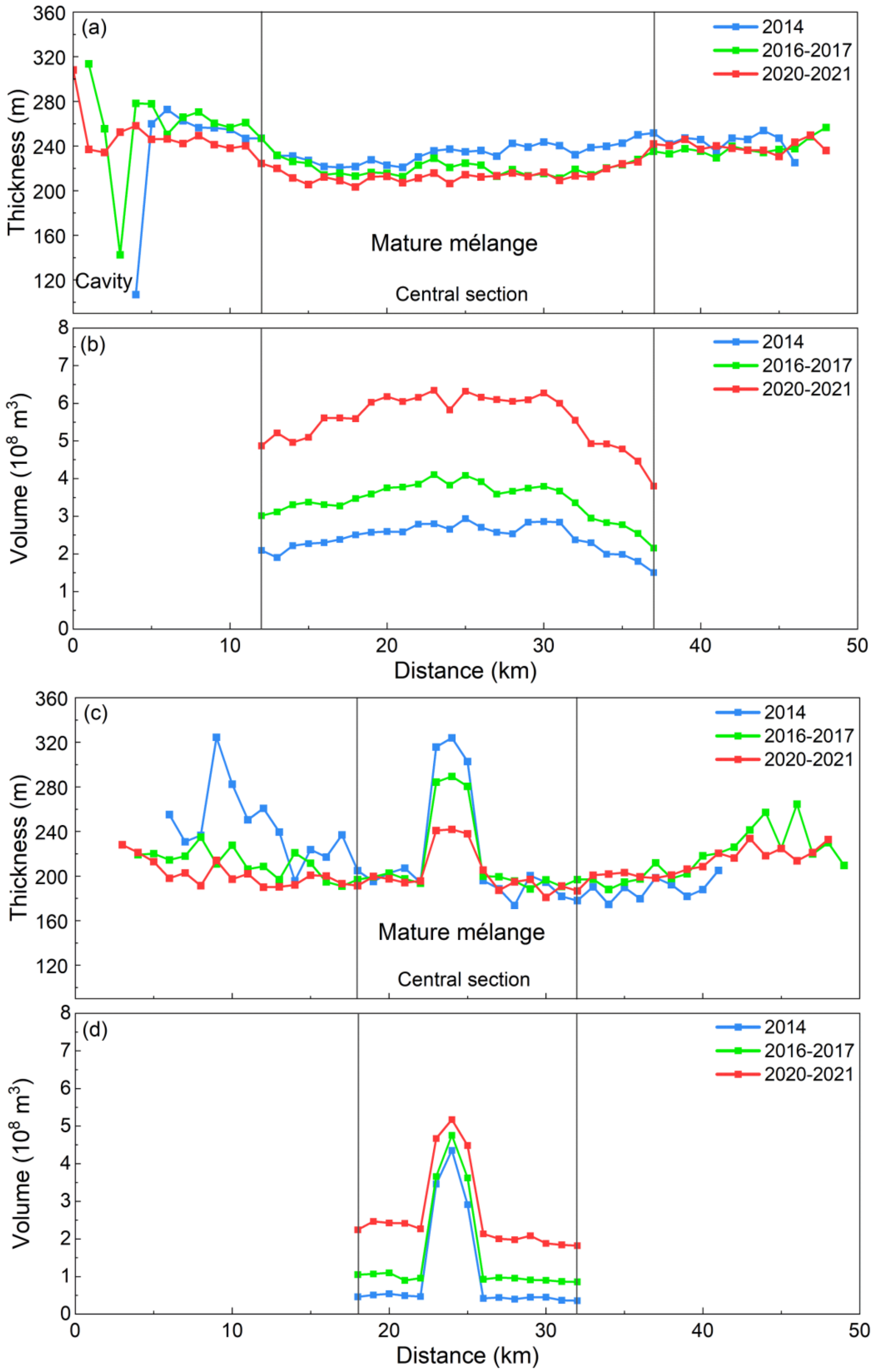
We changed it to: "*…… More specifically, we found cavities that are freshly opened during the fracturing process in the unmatured mélange section close to the west tip (Fig. 11a). These pre-mélange cavities are verified in ZY-3 stereo images (Fig. A1) ……*"

Line 290: Volumetric change is a good parameter to monitor, but it would also be interesting to see an estimation of mélange thinning, which is relevant to ice sheet modeling. The observed decreased in ice mélange elevation most likely means that this layer has thinned. This is extremely important as the stress propagation between flanks may be compromised (Larour 2004).

Response:

Here we added: "*The estimated change in mélange thickness H is relevant to ice sheet modeling. The observed mélange thinning may indicate that the stress propagation between flanks may be compromised (Larour 2004).*"

In Fig. 11 we changed the elevation profile to thickness profile, also added figures for T2.



Line 300: What do you mean with 'newly calved'? I may have missed this, but I thought the ice shelf has not calved during this period. Do you perhaps mean that the rift has widened due to partial collapse of its flanks? If so, can you speculate about what may have caused it? Mélange thinning may be the answer itself, and I agree that it is hard to point at a cause. Setting up a discussion on this would be very important.

Response:

We changed it to "…… *newly vacated space due to partial collapse of rift flank*".

We added a paragraph in Discussion to speculate its cause: "*A thick mélange layer can effectively "freeze" a rift, enabling mechanical stress transmission between its flanks and ultimately suppressing rift propagation (Rignot, 1998; Larour, 2021). In this study, we show that seracs appearing on the mélange surface are a part of the infill inside rifts. They are formed from partial collapsing of rift flanks. We propose that the surface part of the bottom rift wall is first excavated through interactions by tides (Padman et al., 2002 and 2008), melting caused by intrusion of warmer sea water into the rift (Poinelli 2023a), and other factors. This, in turn, causes the collapse of the upper part of the rift flank due to the removal of the bottom support. This process, like coastal bluff erosion, repeats itself and becomes one of the mechanisms that widen the rift and increase the mélange volume. We find that the increased mélange volume in a rift promotes its widening rate, and may further increase ice front calving and effect the ice shelf stability.*"

Line 302: I was surprised to see that the manuscript does not include a discussion section. What are the strengths of this novel approach? How does this compare to previous studies that employed ICESat2? for example Walker 2021, Fricker 2005, …? Why is monitoring of these rifts important? Can you extend this novel processing techniques to other highly fractured areas of Antarctica (Larsen C, Totten, Brunt, Amery?)

Response:

We added a Discussion section to address these points:

*"**4 Discussion***

The developed multi-temporal DEM adjustment model MDAM has shown its effectiveness in removing biases between adjacent multi-satellite sub-DEMs and establishing a unified and integrated DEM time series with an average elevation uncertainty of better than 0.24 m. We demonstrate the full 3D mapping capability for characterizing rift structure (rift lips, pre-mélange cavities, mélange seracs, etc.) and estimating dynamic mélange volume changes from the ICESat-2 controlled DEM time series, extending from rift topography and mélange thickness estimated along ground tracks from ICESat and ICESat-2 measurements in previous studies (Fricker et al., 2005; Walker et al., 2021). Such high-resolution mélange dynamic observations allow us to understand the mélange movement inside a closed environment of large Antarctic rifts, and to further study its role in rapid rift propagation and iceberg calving. To make this model working in a more dynamic open ocean environment, such as Pine Island and Thwaites ice shelves, modifications need to be carried out to address the rapid calving process with incoherent mélange changes in ice shelf front.

A thick mélange layer can effectively "freeze" a rift, enabling mechanical stress transmission between its flanks and ultimately suppressing rift propagation (Rignot, 1998; Larour, 2021). In this study, we show that seracs appearing on the mélange surface are a part of the infill inside rifts. They are formed from partial collapsing of rift flanks. We propose that the surface *part of the bottom rift wall is first excavated through interactions by tides (Padman et al., 2002 and 2008), melting caused by intrusion of warmer sea water into the rift (Poinelli 2023a), and other factors. This, in turn, causes the collapse of the upper part of the rift flank due to the removal of the bottom support. This process, like coastal bluff erosion, repeats itself and becomes one of the mechanisms that widen the rift and increase the mélange volume. We find that the increased mélange volume in a rift promotes its widening rate, and may further increase ice front calving and effect the ice shelf stability.*

Future calving triggered by T1 and T2 and the resulting ice front retreat may expose the ice shelf to increased warm water intrusion, a process simulated for the Larsen C ice shelf and supported by modelling results (Poinelli, 2023a and 2023b). Although the iceberg calved from the shelf front in 1986 is located inside the Passive Shelf Ice (PSI) area, meaning no actual buttress reduction for support from the ice shelf to the ice sheet (Doake, 1998; Fürst et al., 2016), the combined rifts of T1 and T2 propagated rapidly recently to cover ~58% the ice shelf laterally. In the context of global warming, this is particularly relevant for the Filchner Ice Shelf, as warm water has recently been observed near Berkner Island (e.g., Davis, 2022). Therefore, T1 and T2 have the potential to trigger a larger calving beyond the PSI boundary and could ultimately lead to destabilization mechanisms like those proposed for the Larsen C Ice Shelf."

Line 307: I may have missed it, but is there a similar analysis applicable to T2? The manuscript presents these rifts as a pair, yet the analysis appears to be restricted to T1, which seems inconsistent. To be clear, I am not suggesting additional analysis, but the rationale for focusing solely on T1 should be explicitly stated, even if it is due to data limitations.

Response:

As suggested also by Reviewer 1, we added corresponding analysis for T2 throughout the manuscript. The following are the revised figures and tables. The details will be in the revised manuscript.

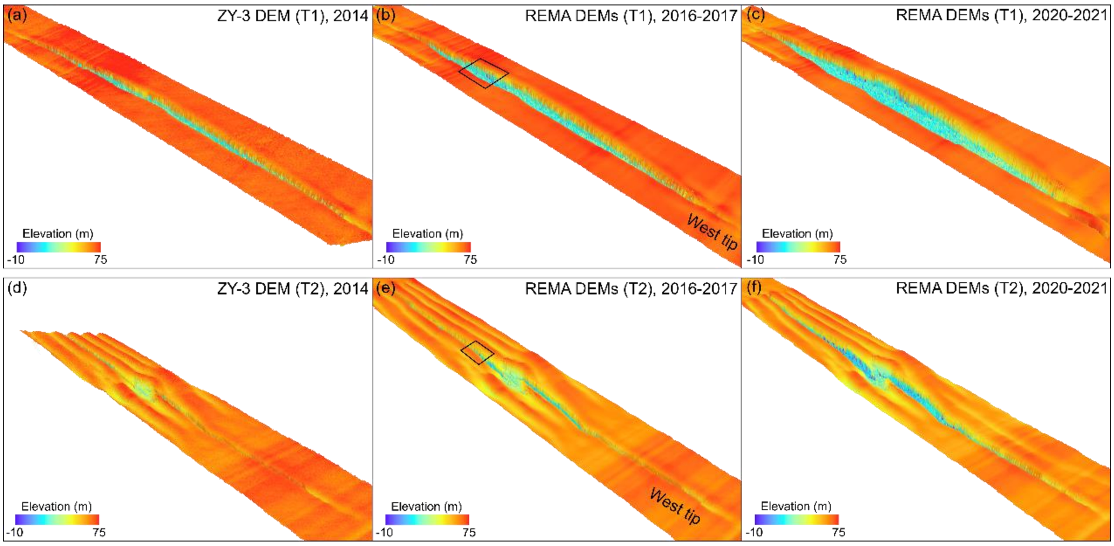


Figure 9. Multi-satellite DEM time series of the large rifts of T1 and T2 on Filchner Ice Shelf from 2014 to 2021: (a) and (d) reconstructed ZY-3 DEM of 2014, (b) and (e) bias-corrected REMA DEMs of 2016-2017, and (c) and (f) bias-corrected REMA DEMs of 2020-2021. The boxes in (b) and (e) indicate the corresponding sections of T1 and T2 where details of 3D structures and mélange are presented in Fig. 10.

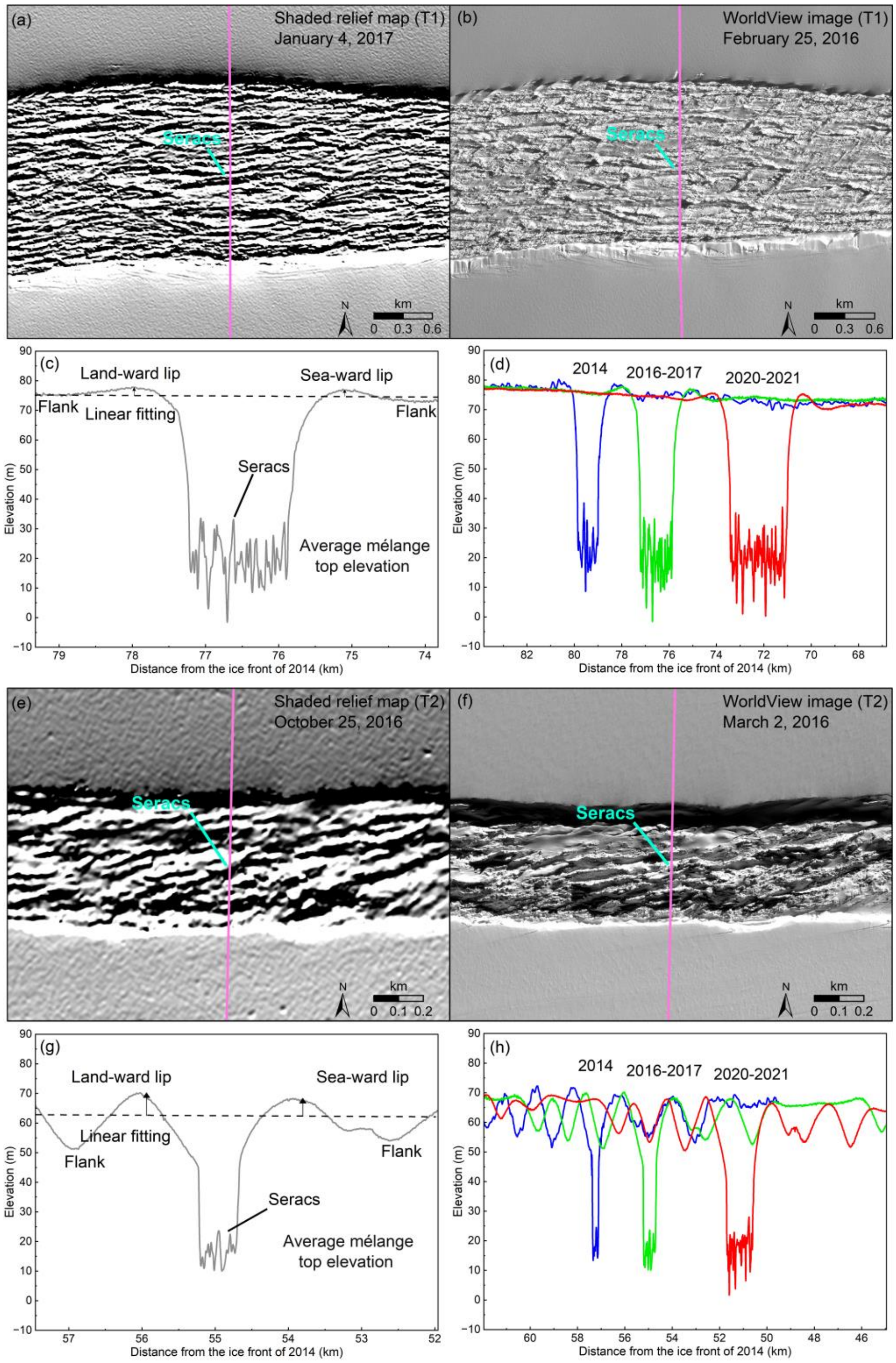


Figure 10. 3D sectional structure and mélange in T1 (a – d) and T2 (e – h): (a) shaded relief map of a section of T1 REMA DEMs of 2016-2017 (January 4, 2017) indicated by the box in Fig. 9b; (b) WorldView image (0.5 m resolution) of February 25, 2016; (c) elevation profile along the pink line in (a) and (b), and 3D rift and

mélange structure parameters; and (d) rift and mélange changes along the profile from 2014 to 2021 (February 28, 2014 in blue, January 4, 2017 in green, and February 2, 2021 in red). (e) shaded relief map of a section of T2 REMA DEMs of 2016-2017 (October 25, 2016) indicated by the box in Fig. 9e; (f) WorldView image (0.5 m resolution) of March 2, 2016; (g) elevation profile along the pink line in (e) and (f), and 3D rift and mélange structure parameters; and (h) rift and mélange changes along the profile from 2014 to 2021 (February 28, 2014 in blue, October 25, 2016 in green, and February 3, 2021 in red). Elevation displayed in (a) and (e) is exaggerated by 10 times.

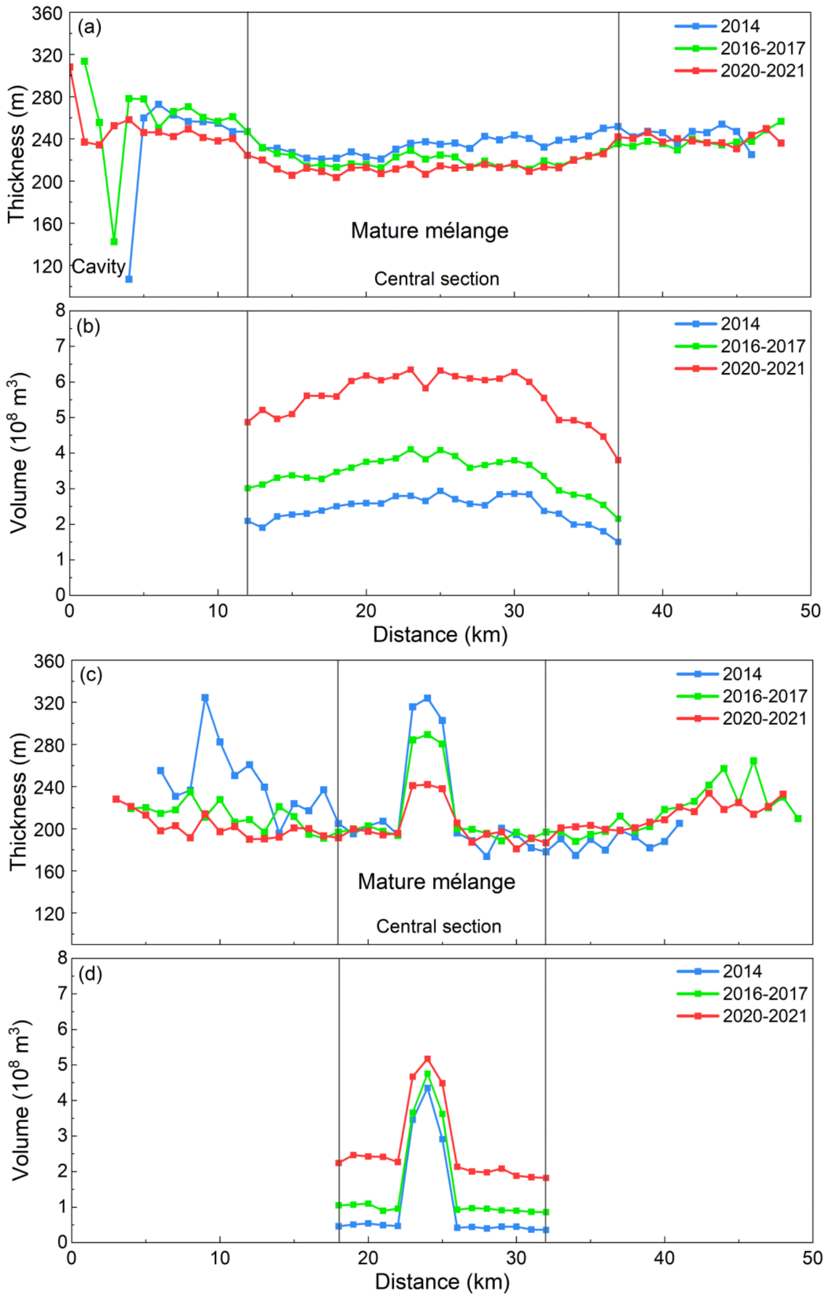


Figure 11. Thickness (a and c) and volume (b and d) of ice mélange inside the rift T1 and T2, respectively, from the multi-satellite DEM series from 2014 to 2021. Average thickness and volume of each transect that are separated every 1 km along the rift centerlines are illustrated from west tip to east tip

Table A4. Rift lip heights and differences measured for T1 and T2

T1

Transect ID from west tip to east tip (1 km separation)	Land-ward lip height (L) (m)	Sea-ward lip height (S) (m)	Difference (S-L) (m)
1	-1.67	0.54	2.21
2	3.58	4.53	0.95
3	2.68	4.65	1.97
4	0.84	1.72	0.88
5	4.39	1.49	-2.91
6	0.72	1.74	1.02
7	1.85	2.01	0.16
8	2.28	2.59	0.32
9	1.25	1.43	0.17
10	0.07	1.74	1.67
11	-1.57	1.84	3.40
12	-0.68	1.06	1.75
13	1.63	3.40	1.77
14	2.81	2.98	0.17
15	1.58	2.55	0.97
16	1.56	2.29	0.74
17	1.84	2.13	0.29
18	1.46	1.91	0.46
19	2.48	2.18	-0.30
20	1.65	1.89	0.24
21	1.91	1.82	-0.09
22	2.52	1.81	-0.71
23	1.99	1.37	-0.61
24	1.65	0.95	-0.70
25	1.70	1.03	-0.67
26	0.89	0.99	0.09
27	1.90	0.19	-1.71
28	0.98	0.05	-0.93
29	0.68	1.47	0.79
30	2.42	3.43	1.00
31	1.37	2.08	0.71
32	3.26	3.74	0.47
33	3.32	3.90	0.58
34	3.69	2.08	-1.61
35	3.71	4.80	1.09
36	1.95	1.90	-0.05
37	0.42	1.21	0.79

38	-0.27	-2.25	-1.98
39	2.77	3.48	0.71
40	2.52	1.35	-1.18
41	2.39	1.64	-0.74
42	2.02	1.10	-0.92
43	0.81	1.48	0.67
44	2.64	2.60	-0.05
45	4.62	4.19	-0.43
46	3.14	2.66	-0.48
47	-0.84	0.13	0.97
48	1.79	1.86	0.07
49	-1.40	-1.75	-0.35

Average rift lip height difference (seaward - landward) within the section of the T1 mature mélange: Mean: 0.03 m; Max: 1.77 m (13 km from the west tip)

T2:

Transect ID from west tip to east tip (1 km separation)	Land-ward lip height (L) (m)	Sea-ward lip height (S) (m)	Difference (S-L) (m)
1	0.43	2.98	2.55
2	0.56	0.67	0.11
3	-0.06	1.64	1.70
4	2.14	3.01	0.87
5	4.49	4.87	0.38
6	2.25	2.91	0.66
7	1.96	0.77	-1.19
8	2.04	2.69	0.65
9	-2.21	-1.81	0.40
10	-2.63	-0.92	1.71
11	0.06	0.54	0.48
12	-0.70	0.14	0.84
13	0.95	1.25	0.30
14	0.32	-0.94	-1.26
15	-0.33	-3.21	-2.88
16	-0.26	-2.41	-2.15
17	0.33	-0.94	-1.27
18	0.23	1.18	0.94
19	0.14	3.16	3.03
20	-1.55	4.58	6.13
21	-11.54	1.37	12.91
22	-7.76	-11.51	-3.75
23	-2.83	3.04	5.87
24	0.57	2.72	2.15

25	1.16	3.65	2.49
26	0.73	-16.66	-17.39
27	-18.62	-5.24	13.38
28	-0.31	-1.95	-1.64
29	2.49	-0.03	-2.52
30	1.75	1.64	-0.11
31	1.06	1.14	0.08
32	1.18	1.07	-0.11
33	0.62	-0.07	-0.69
34	1.89	1.45	-0.44
35	3.25	2.06	-1.19
36	2.86	2.84	-0.01
37	3.65	3.54	-0.11
38	4.66	4.38	-0.28
39	3.90	3.34	-0.56
40	4.34	3.54	-0.81
41	3.22	2.65	-0.56
42	3.01	2.05	-0.96
43	3.36	1.38	-1.98
44	3.58	1.67	-1.91
45	3.52	2.00	-1.53
46	3.53	1.65	-1.88
47	4.33	1.63	-2.70
48	5.32	1.68	-3.64
49	6.09	4.68	-1.42

Average rift lip height difference (seaward - landward) within the section of the T2 mature mélange: Mean: 0.6 m; Max: 13.38 m (27 km from the west tip)

Yours sincerely,

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Response:

The above references are all cited in places, as suggested, in the manuscript.