We would like to thank the two referees for their evaluation of our revised manuscript. We are happy to see that they found that our manuscript has improved from our revisions. Below are our replies to their comments. The referees' comments are in black text *and our replies are in blue italic.*

Referee #1

Second review of TC-2022-263

This is reviewer 1 again.

The revisions to the manuscript have improved the figures, and shifted the focus of the study in towards a description of the methods and processing strategies.

I'd like to reiterate one major point that I brought up in my first review that the authors dismissed in their response: the supposedly linked drainage of lakes 2 and 3.
The possible linked drainage is between lakes 2 and 5.
In my first review, I suggested that the evidence for a causal connection between the drainage of the two lakes was lacking, and suggested that the authors consider the amounts of water available from supraglacial hydrology. What I meant by this is that the amount of water coming from lake 2 is very small compared to the amount of water generated by supraglacial melt in this part of the ice sheet. If there is a connection between the drainages of lakes 2 and 3, it is much more likely to be because both drainages were triggered by an input of meltwater from the surface.
We agree that the amount of water at the surface is much larger than what is available from the drainage of Lake 2, but this applies each summer and we only see drainages in 2012.
The authors rejected my suggestion to use surface climatology to estimate the amount of meltwater available, but I would suggest that it is very unlikely that such a consideration would show that the water available from the lake 2 is at all significant compared to the amount of water produced at the surface. In Antarctica, when two adjacent lakes experience some change close in time to one another, the hypothesis of a causal connection is easier to argue, because there is no other source of water apart from the lakes; in Greenland, the ice is melting rapidly at the surface (especially in July and August) and water is running all over the place. The authors' conclusion that their study provides "indication of hydrologically connected subglacial lakes in Greenland" seems at best an overstatement of the evidence available. If they wish to make this statement, they should mention the likely possibility that both lake drainages were triggered by surface melt.
We agree and have revised the last paragraph in the abstract to emphasize this. We have also changed title of section 6.5 to "New Subglacial Lake", and added the following sentence to this section: "It is also possible that the coincident drainage of the two lakes was independently triggered by the large amount of surface meltwater available in the summer of 2012."
In the same vein, the authors' suggestion that lake drainage intervals provide information about water production at the bed (~line 35) does not seem to make a lot of sense in Greenland (though it is possibly true in parts of Antarctica).
We do see over e.g. Lake 4 (Flade Isblink) that the lake recharges during winter as well as summer, and this is an indication of subglacial melt. We agree that it can also be an indication of transfer from the surface to the bed and we have revised this sentence accordingly.
The new material describing Cryosat-2 processing is interesting, but not everything about the new section is clear to me. In figure 5, the swath processing has produced multiple elevation estimates at the same longitude, with xes , diamonds, and circles at the same longitude. I think this is most likely a result of an unwrapping error in the phase processing, and the 'x' measurements should be located far off to the left relative to the other measurements. The figure would be easier to interpret if the authors indicated the look direction of the waveform, plotted the x axis in meters rather than in longitude, and provided a value for the horizontal separation corresponding to a wrapped phase ambiguity.
We agree that it is easier to read the figure with m instead of longitude on the x-axis but it does not change the figure much. We have revised the figure accordingly. We are not sure what is meant by the look angle of the waveform.
The reason that some swath points are geolocated to the same longitude (waveform distance) is indeed because of noise and errors (e.g. unwrapping), because we have lowered the thresholds to get as much output data as possible. This is also why a filtering is applied afterwards.

They might also comment on the fact that the brightest part of the return is located at the bottom of the deepest surface depression, which must indicate something about how this reflection was produced.
We have added this sentence to section 4.1: "The large peak in the waveform might be caused by the reflection from surface water at the bottom of the collapse basin."

Referee #2

Thank you for carefully considering the comments from myself and the other reviewer. I think you have done a good job of addressing these, including changing the focus away from lake volumes and expanding on the methods. I have just a few, v. minor final comments, below:

Note line numbers refers to the track-changed document.
L15 – rather than "shows signs" could you be more specific here, e.g. both drained within 1 month with the upstream lake draining first, suggesting that …
We have revised the last paragraphs of the abstract to "We also present evidence of a new active subglacial lake in Southwest Greenland, which is located close to an already-known lake. Both lakes probably drained within one month in the summer of 2012, which suggests that they are either hydrologically connected or that the drainages were independently triggered by extensive surface melt. This is to our knowledge the first indication of hydrologically connected subglacial lakes in Greenland."
L30 – "characterized by a steeper ice surface slope"
Revised accordingly
L37 – overcome rather than resist (sorry, I missed this initially)
Revised accordingly
L50 – not strictly true as large lakes can be identified from flat ice-surfaces (e.g., Vostok). You note this below so I would end this sentence at " …sounding."
Revised accordingly
L86 – I would recommend removing this sentence, putting "(Fig. 1)" at the end of the previous sentence and adding the background context to the figure caption.
Revised accordingly
L88 – This doesn't quite make sense as the lakes under Isunguata Sermia are of a similar size to three of the four lakes you investigate (~1 km). I would add to the figure of active subglacial lakes identified from collapse basins at L60, and remove this sentence here, or shorten to focus on the fact they are close to the margin. It is fine to concentrate on a subset of lakes.
We have revised the sentence to:
"We do not include the three known subglacial lakes located beneath the Isunnguata Sermia glacier in this study, due to their location in the highly dynamic region very close to the ice sheet margin (Livingstone et al., 2019)".
L176 – "Depending on, for example, the …"
Revised accordingly
L232 – "when" rather than "if"
Revised accordingly
L221-239 – there is a lot of description of the figure here that you could consider moving to the caption, with the third paragraph of the three being the relevant text that should remain in the main text.
The following text was moved to the caption of Fig. 5(a): "The dark green sections of the waveform are those accepted at a coherence threshold of 0.8, light blue sections are those additionally accepted from lowering the threshold to 0.7. Likewise, the yellow and pink are those for coherence thresholds of 0.6 and 0.5, respectively." and "The round points are from the early bin range at ~300, the diamond shapes are from the range at ~500, the triangles are from the large peak at ~600, and the crossed points are from the low power section after the large peak."
L431 – I understand what you mean, but can you be more explicit in linking your new elevation observations to surface melt rates in the second half of 2011 vs summer 2012.
We have revised this paragraph to: "Notably, the addition of CS2 observations during 2011/2012 allows us to conclude that no substantial recharge of the subglacial lake occurred between August 2011 and May 2012 (see Fig. 7(b)), while recharge is observed between May and November 2012. The fact that the rate of recharge was insignificant during a period outside the melt season supports the hypothesis proposed by Palmer et al. (2015)

and Howat et al., (2015) that the subglacial lake is primarily driven by surface meltwater drained to the bed through moulins during the melt season."

L432 – doesn't ice flow encompass ice deformation?

Revised accordingly

L488 – "Lakes 1 and 4"

Revised accordingly

L507-515 – It is odd to have 2 x 1 sentence paragraphs. Could these be combined or included elsewhere.

We have moved this sentence to the end of the introduction:
"We do not include ICESat-2 data satellite laser altimetry in this study as the main goal has been to densify the time series covered by the CS2 mission, but we acknowledge that this sensor provides an obvious dataset for future monitoring of subglacial lake activity (Fan et al., 2023)".
We have deleted the sentence: "The steep and deep basins could lead to phase unwrapping errors in side-looking InSAR. In this study, we checked the InSAR elevations individually to avoid the use of phase unwrapping error distortioned DEMs."

L530 – Can you quantify the scale of this elevation change?

We have revised the sentence to: " Between July 18, 2012, and August 12, 2012, a rapid ~15 m surface elevation lowering occurs and a feature resembling a collapse basin is formed."

L539-544 – This sentence is very long and not easy to read. Please consider rephrasing.

We have revised the sentence to: " For Lake 2 we know from a TanDEM-X DEM that the collapse hasn't occurred in January 2011 (Fig. 8(b)), and Landsat-7 imagery further does not show a collapse basin either in early June, 2012 (Fig. A3). Although the image is not very clear, possibly due to snow cover, we see a body of surface water that partially intersects with the outline of the collapse basin as observed in an August ArcticDEM from 2012, indicating that a local depression had not yet formed in June 2012."

L547 – This should be Lake 5 not Lake 2.

Revised accordingly

L566 – could you give an example of how much additional data these are?

We have included the sentence:
"For example, the number of measurement epochs increased from five from ArcticDEM alone to 22 when including Tandem-X and CS2 over Lake 1, for the time period 2011-2018."

L569 – Here and above, could you give a constraint (i.e. drained between X and Y) rather than single date.

We have revised this sentence to: "Previous literature did not conclude on the timing of the drainage event over Lake 2, but the inclusion of TanDEM-X scenes shows that the drainage happened in the period between 20 January 2011 and 18 July 2012."

Figure 1 – would be improved from having an ice sheet margin outline to show where the ice is.

We would like to keep the figure as it is, because we think that it is interesting to see the underlying bedrock topography and adding an ice sheet margin would conflict with this. Also, the ice extent is shown Figures 7(a)-11(a) and in Fig. A2(b)

Figure 5 – label subpanels – a, b

We have revised the figure.