Response to Editor and Reviewer Comments

Editor Comments:

[1] *Thank you for revising your manuscript thoroughly. The reviewers think your paper is much improved after revision. The third reviewer has a few minor comments which I think should be simple to address. I encourage you to take into account these comments in the revised paper.*

Thank you! We have revised the manuscript following the suggestions from Reviewer #3. In particular, we have clarified the minimum and maximum ice slab extent and the regions where the backscatter mosaics meet the minimum thresholds for number of observations and angular diversity per pixel.

Reviewer #1 Comments:

[1] *Authors have done a good job responding to the review comments.*
Thank you!

Reviewer #2 Comments:

[1] *The Authors replied exhaustively to all of my comments and suggestions. To me the paper is ready to be published.*
Thank you!

Reviewer #3 Comments:

[1] *I appreciate all the work that the authors put into the new version of the manuscript and find the new additions to the work helpful and interesting! I only have a few minor comments to consider.*
Thank you!

[2] *The new addition of regional 10-fold cross-validation is very helpful. However, I am still left wondering what impact this has on ice slab extent? In L323, the authors list the most likely ice slab extent but I don't believe they ever mention the minimum or maximum extents. I think a few sentences addressing this range should be added to the results or discussion.*
Thanks for catching this omission! We have added the total area from the minimum and maximum ice slab extents to the same sentence where we give the most likely ice slab extent. We have also added a short discussion about the differences. We particularly note that most of the large differences between the most likely and minimum ice slab total area are drive by large uncertainties in the lower elevation limit of the ice slabs, while the upper elevation limit agrees quite well across all estimates. See lines 330-340 in the revised manuscript for the full discussion.

[3] *L68 – EESA to ESA*
Corrected in the text.

[4] *L114 - σ_{xpol} is mentioned before it is defined (L121)*
We have reworked the flow of these two paragraphs to introduce the definition of σ_{xpol} when it is first mentioned at L114. See lines 114-217 in the revised manuscript.

[5] *L162 – A word Is needed between "fit" and "the" in this sentence.*
Corrected in the text.

[6] *L167-169: "The final ice slab classification results are insensitive to angular diversity or number of observations as long as there are a median of at least ~117 observations per pixel spanning at least 10 unique incidence angles, a criterion which is met for our study area." This is not exactly true since in L147, the authors say that the minimum pixel observations was 29. What proportion of the study area has >117 observations?*
Yes, we were imprecise in our wording here. What we intended to convey is that these thresholds are met in our regions of interest, e.g. in the areas where ice slabs are found, since the low observation regions are in the interior of the ice sheet and are filtered out by the dry snow zone mask before threshold optimization. It is also worth noting that the 117 observations can be relaxed to 77 observations if the median incidence angle exceeds 30 degrees, which is the case for our dataset in 2016-2017. In the supplementary information at lines 53-61, we now describe this relaxed threshold and have added a new Figure S5 that shows the region of the ice sheet where the observation and angular diversity criteria are met relative to where ice slabs are found. In the main text, we are now careful to say that these criteria are met in areas with ice slabs and provide pointers to the supplementary discussion and figure show the exact regions (see lines 169-175).

[7] *L268 – 'teh' typo*
Corrected in the text.