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# *Interactive comment on* "Improved processing and calibration of the interferometric mode of the CryoSat radar altimeter allows height measurements of supraglacial lakes in west Greenland" *by* Laurence Gray et al.

**Anonymous Referee #1**

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This paper gives details of improved processing techniques for CryoSat-2 data, using swath-processed data to illuminate some apparent errors in the released data, and demonstrating the use of swath-mode data to monitor supraglacial lake heights in Greenland. The paper will be primarily of interest to radar altimetry specialists, but provides useful information about how to handle the CryoSat dataset and should improve the glaciological community' ability to make sense out of these data. The authors provide good evidence for their conclusions about the dataset, and show interesting examples for how the data can use used to measure lake-level changes.



The writing is generally clear, although I would recommend a careful reading and the addition of commas to some of the longer sentences. The figures, for the most part, make good use of space, and provide a good illustration of the physical principals at work. I make some editorial comments below, which should be relatively easy to correct.

Throughout: "skidoo" should be "Ski-Doo" or "snowmobile"

Section 3: Give a citation for the discussion of look angle and roll angle, either to the CS2 documentation or to a paper.

6:27 Define the look angle (relative to nadir?)

7.25: It would be helpful to say "in this section" rather than "here"

8.10: should be "change was small"

8.15-30: Experiments should be described in the past tense, results can be described either in past or present tense.

8.21: add comma after "further"

Section 3.3: This section needs some introductory material about the difference between the retrackers available from ESA and the retracker used here. Without this discussion, readers not familiar with the details of CS2 tracking are likely to be confused by the comment at 10:3-4 about retrackers that use all of the waveform.

10:5-10: Could phase ambiguity play a role in the location differences between the two products? If not, should explain why.

10: 11-12: Why not edit the L2 data based on coherence and return power? Both are available through comparison with the L1B data.

10:24: Add a hyphen: "roll-angle"

10:24: Should point out that there is a minimum error at about 0.007 degrees

10:24-26: These sentences are hard to read: I would break this into shorter sentences, to say that the POCA points are often local high points on the surface; if the beam is shifted a small distance in the across-track direction, the height error is small, while if the beam is shifted a larger distance, the assumed location is no longer on the flat part of the local high, and the error increases.

10:20-30: Are these ascending or descending passes? Both? Do the results in Fig.10 depend on what type of pass is used?

11:4 “are giving” should be “give”

11:2-15: For each of these numbers, specify which of the heights is on top: e.g. “. . .the average ATM-POCA height difference is -0.16 m, with POCA higher than ATM.

12:3-12, and figure 12. I found 12 hard to interpret, in large part because the location map is too small to distinguish the colored lines. I recommend that the April 21 and July 14 plots be combined on the same axes, and the May 20 and August 12 plots, and that the size of the axes be increased to use the additional space.

12:6-7: Need to describe how elevations for the lakes were extracted from the swath data. Why was no retracker needed (see comment on 14:30).

12:15 should be “at higher elevations”

12:28: “could” should be “can”

13: 6: should be “relative strengths” 13:9-10- the dates can be given on the plot, and are not especially helpful in the text.

13: 11-15: Doesn’t the decrease in elevation imply a slow drainage rate? See the literature on the “firn aquifer” for evidence that a lake can slowly drain through pathways that are invisible at the surface

13:16-25: This paragraph needs an introduction : explain that you are now talking about another set of lakes giving another demonstration of the mapping technique.



14:9: “would” should be “may”

14:13 : I don’t understand this sentence: What does “realistic” mean in this context?

14:22- “can be” should be “was”

14:30: Why is a retracker not required? If you plotted power vs. range for the lake returns you would see the same kind of pattern you see for a POCA return, so why not pick the first slope for the lake return?

15:4âĂŤit’s worth noting that sun-synchronous orbits are limited to +- 81 degress, so central Antarctica and the arctic sea ice would be missed.

Figure 7: To me, this looks like increasing longitude and increasing range are in opposite directions. It would be helpful to reverse the range panel so that the two are easier to compare. It would also be helpful to plot the ESA L2 range on the radargram.

Figure 9: It would be helpful to note the differences in x scale between the two rows of histograms.

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