

Reply to 3rd anonymous reviewer

We would thank the reviewer for raising the question about the reference height in Figure 7. We agree with the reviewer that the track point should be within the snow cover. We have changed the reference height to be more in line with the way ice thickness is derived from satellite altimetry and now the track point is within the snow cover (see argumentation below).

The authors addressed the suggestions and comments by the reviewers in a adequate way and I feel this improved the manuscript a lot compared to its earlier version. The authors did a good job in providing answers to the open questions and also did some additional changes to the manuscript as visible from the ATC document that improve the overall readability (such as using SI units like m instead of cm) and clarifying Figures. Aside from a question/remark and a technical thing I recommend publication.

Comments:

A remark to Reviewer 1's question/remark on Figure 5 (now 6) and the attached new version by the authors showing the penetration depth:

I found it a bit surprising that the simulated trackpoints using your 50% retracker threshold are more or less always(?) already inside the sea ice (i.e. below the snow/ice interface) instead of what we would commonly assume, i.e. inside the snow pack.

Reply: Thanks for pointing this out. The reason for the track point to be located “inside the sea ice” is that we are using the real water surface height as a reference and not the re-tracked water surface height. We have used the model and the re-tracker to simulate the lead surface height (re-tracked water surface). The difference between the real and the re-tracked lead surface height is 0.187 m. We agree that using the real water surface height as a reference is inconsistent with the way ice thickness is derived using radar altimeters and we have therefore added the offset to the re-tracked ice surfaces in Figure 7, with associated text description. It does not change the conclusions, but only an upward shift in the re-tracked surface height by 0.187 m.

Also the difference between Ka/Ku track points is almost for all measurements very small or non-existent which reduces hopes for CRISTAL kind of. Could the authors comment on this?

Reply: The snow depth in itself does not have a large impact on the Ka- and Ku-band track point difference and other variables which are to some extent related to snow depth are playing a role as well in creating the observed difference (the observations reported in the literature). In order to use the Ka- and Ku-band track point difference for deriving the snow depth, we think that we need to understand the underlying processes in more detail. Lines 316-324 are describing this.

Does this impact or result from the overall model performance? In other comparison studies, AWI measurements (who use this kind of retracker threshold in production) tend to overestimate freeboard

rather than underestimate it compared to other producers (who use a higher threshold in the 80-95% range).

Reply: The reason for this offset was the difference between the real and the retracked water surface height reference (see comment above).

Furthermore, I found there to be several instances of inconsistencies in capitalization, e.g. between Figure 7 and figure 7 on P7 L 360 and several other occurrences. I feel this is work that could be changed by the authors and not solely by the copy-editing.

Reply: Thanks for pointing this out. In addition to L360 we found two cases where a reference to an equation was not capitalized and a couple of minor typos (see MS with track changes).