

# ***Interactive comment on “Refining the sea surface identification approach for determining freeboards in the ICESat-2 sea ice products” by Ron Kwok et al.***

## **Anonymous Referee #2**

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### Summary

This manuscript describes a change in processing of the ICESat-2 sea ice freeboard product. It finds that returns from dark leads can be affected by clouds, giving erroneous higher surface heights, and reducing the accuracy of the freeboards. Revision 003 of the product removes dark leads as a source for the sea surface height calculation. This results in a decrease in the sea surface height and thus an increase in freeboard.

### General Comment

This is nice paper that documents an important revision to the ICESat-2 sea ice free-

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board product that corrects an error due to clouds in Revision 001/002 and describes the change for Revision 003 that corrects this error. The paper is well written and the analysis is complete. I have only a few minor suggestions below, the primary one being to consider moving the material in Section 4.3 to a more logical (in my view) place in the manuscript. Other comments are minor suggestions to provide more clarity in a few places.

Specific Comments (by page and line number):

P2, L33: Perhaps a bit more explanation on the 10-km freeboard determination length scale. I know this is detailed in earlier papers and the ATBD, but for a reader who is less familiar, a brief description of the method that gives rise to the 10-km length scale would be helpful. I see this noted below in Section 2.1. But still this sentence seems to presume an understanding of the products (e.g., what are “ice segment height errors”?) that hasn’t yet been explicitly introduced in the manuscript. Perhaps simplify to say “Misidentified sea surface segments can have observable impacts on freeboard determine, as described below.”?

P3, L2: CAMBOT is essentially a digital camera, right? I suggest adding this as a descriptor along spelling out the full name. “Optical translator” may not be clear to all readers. I see it noted in Section 2.2, but it still may be useful here. E.g., say “and digital imagery from the Continuous... (CAMBOT) obtained by...”

P3, L12: I would provide the title of the product initially and not just the product code, e.g., “The Sea Ice Height (ATL07) product...”

P3, L25-28: Should provide recommended citation for the CAMBOT product, as noted on NSIDC’s page: Studinger, M. and J. Harbeck. 2019. IceBridge CAMBOT L1B Geolocated Images, Version 2. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. doi: <https://doi.org/10.5067/B0HL940D452L>. [Date Accessed].

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P3, L34: “RGT” is introduced here and used in several other places in the manuscript, but not defined or explained. It should be spelled out the first time – Reference Ground Track – with a brief definition.

P8, L8-19: Section 4.3 seems a bit out of place here. You discuss a potential new filter and then note that you’re not using that for R003, which is described in Section 5. It seems like Section 4.3 should be moved to the end as a “potential improvement for a future Revision” – i.e., as a short Section 6 (with conclusions moving to Section 7), or as a Section 5.3.

P6, L23: Last sentence of Section 3: this is/was for R001/R002, right?

Table 1: I would expect that since the dark leads are being removed in R003, the number of samples would decrease over R002. But N is larger in R003 for the Arctic Jun-19 and Antarctic Jan-19. What is the reason for this? Or am I misunderstanding what N means? (And this suggests that N should be described in the Table 1 caption.)

Figure 5: It would be useful to have a difference map for R003 minus R002. Maybe that could be the third column with the distribution plots moved to the fourth column, or if that’s too crowded, maybe move the distributions to a separate figure.

Minor Comments (by page and line number):

P2, L30: typo, should be “of our” instead of “of or”

P3, L15: repetitive “from”. Could say “. . . are derived from the ATL07 surface heights.”

P7, L26: no hyphen in “to date”

P8, L19: spelling - “misclassification”

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-174>, 2020.

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