

Response to Referee #1 (Alek Petty)

In this document, we outline our responses to comments from the referee, including modifications that we intend to make to the manuscript where necessary.

Referee comments are shown in black and our responses in blue with intended changes to the revised version of the manuscript given in italics.

Overall, I'm glad there are a lot more details provided regarding the algorithm/methodology employed, that was really needed. Thanks for the extra clarification on the height precision, I agree I was confusing a few things here and appreciate things are more in-line (and potentially much more improved) than my comment suggested.

We thank the reviewer for the positive acknowledgment of our methodological clarifications. We are glad that the additional details on the algorithm and the height precision discussion have addressed the previous concerns.

I'm please you extended the ATM analysis and provided more examples, I do have some more thoughts about this though. Overall I think this still needs a clearer summary across all available flights and a fuller discussion of how observational conditions and the impact on photon rate affect the relative performance of HRFM and ATL07. In several of the flight comparisons, the differences between the products appear negligible or relatively modest. HRFM does, however, does appear to perform substantially better in the lowest-photon-rate conditions, especially in the 22 April case selected for the main figure. This all seems consistent with the different algorithm designs. Under low-return conditions, ATL07 produces longer segments, producing increasingly smooth fine-scale surface-height variability and may span mixed surface types, whereas HRFM retains a fixed 5 m sampling scale. The stronger HRFM performance in these cases may therefore reflect a genuine and useful advantage, but perhaps it should be characterized specifically as improved performance under low-photon-rate conditions rather than as a general improvement of similar magnitude across all conditions. Considering the importance of this assessment, I suggest adding a table summarizing the results from all four underflights, including the photon-rate range, usable overlap, temporal separation, number of segments, and performance statistics for each beam and product.

We fully agree with the reviewer's insightful assessment and greatly appreciate this constructive suggestion. Following the reviewer's recommendation, we have added a new summary table (*new Table 1 in the revised manuscript*) covering all ATM underflights.

We have also revised the discussion to clarify that the relative advantage of HRFM is not uniform across all observational conditions, but becomes most evident under low-photon-rate conditions. In particular, we added the following text in Section 4.1: *This is consistent with the different algorithm designs. Under low-photon-rate conditions, ATL07 tends to use longer segments, which can smooth fine-scale surface-height variability and increase the likelihood*

of spanning mixed surface types, whereas HRFM retains a fixed 5 m sampling scale.

Data availability: I thank the authors for providing the along-track data too, I would still encourage providing all along-track data processed in this study considering the focus, but just the key tracks is an ok compromise. I would like to see the data in a better format than a .mat file though to better facilitate exploration and assessment.

We thank the reviewer for acknowledging our effort to make the along-track data available. Regarding data completeness, we agree in principle that making all processed along-track data publicly available would be ideal. However, we would like to clarify that the total volume of the full along-track dataset for the one-year period (October 2021 – September 2022) is approximately 2 TB, which far exceeds the practical capacity for standard web-based data repositories. Given this constraint, we believe that releasing the key tracks represents a reasonable and practical compromise.

Nevertheless, we are actively planning to process and release additional years of data in future work. For the current dataset, we are also exploring the option of transferring the full dataset via physical hard drives to a publicly accessible Chinese data center, which would allow interested users to access the complete archive upon request.

Response to Referee #3

The authors have adequately addressed the comments raised in the previous round of review. I have no further suggestions for revision and consider the manuscript suitable for publication.

We greatly appreciate the reviewer's time and constructive input throughout the review process, which has helped us improve the quality of this manuscript. We are grateful for the recommendation of acceptance.