We sincerely thank the Reviewer for the constructive comments on the manuscript. The reviewer's insights and suggestions have been extremely helpful in improving the quality of our work. We have thoroughly considered each comment and have made the following responses and revisions. The amendments are marked in red in the revision.

Next, we respond point by point to the comments.

General comments:

1. It is currently difficult to identify how this dataset improves upon previous SIT datasets. The authors need to articulate these improvements more clearly.

Response: Thanks for your suggestion. In this study, we developed a novel Arctic SIT product by combining multiple radar altimetry data from ERS-2, Envisat, and CryoSat-2. The SIT is presented on a monthly 5 km grid, which is highest in satellite altimetry-based SIT products. The time series of our products covers from 1995 to 2023, ranking second only to that of CTOH.

In addition, we have also proposed an innovative data processing method including leads detection, freeboard conversion to thickness, and inter-mission bias correction. We first improved the lead detection method by combining the utilization of waveform parameter thresholds and lowest elevation. The improved method can eliminate the effects of grease ice, nilas, and newly frozen leads. The freeboard was then converted to thickness using a quadratic model based on hydrostatic equilibrium and least squares adjustment. We also generated a monthly thickness correction grid using the common period observations of Envisat and CryoSat-2 to correct the inter-mission bias. The thickness difference between Envisat and CryoSat-2 was reduced from 0.67 m to 0.37 m after applying the correction grid.

We have elaborated on these improvements in the conclusion section.

2. The language and structure of the paper require refinement to enhance overall readability.

Response: We have engaged a professional scientific editor who is proficient in

English to review the language of the paper. The editor has checked for grammar errors, improved sentence structures, and ensured the clarity of the writing. Additionally, we have re-organized the paper to enhance its logical flow.

3. The figures require better visual design to improve clarity and aesthetics.

Response: The figures have been polished according to your specific comments below. And we have offered high-resolution figures in the WORD file.

Specific comments:

4. Line 22: “Finally, the monthly SIT estimates for the Arctic Ocean from October 1995 to December 2023 are generated.” This statement is unclear. You only obtained SIT results from October to April of the following year. I understand that it is challenging to extract sea ice thickness during the summer, but this statement is misleading.

Response: This statement is revised as: Finally, the monthly SIT estimates datasets for the Arctic Ocean are derived for the freezing period spanning from October 1995 to December 2023.

5. Lines 85-100: What is the purpose of describing the progress in snow depth research?

Response: Snow depth is an important factor limiting the accuracy of SIT estimates, as uncertainty in snow depth can account for up to 70% of the total uncertainty in the SIT estimate. In previous researches, snow depth from W99 or PMW sensors were used in SIT calculation. However, these datasets have large uncertainties in snow depth estimation. Therefore, we here described the limitations in snow depth research to introduce why we utilized the LSA method to convert freeboard to thickness.

6. Line 111: "They have limited temporal coverage", what is the temporal coverage?

Response: The ICESat satellite covered from 2003 to 2009 and the ICESat-2 operated from 2018.

7. The authors produced a SIT product with a temporal resolution of one month and a spatial resolution of 5 km. Lines 101-116: The authors should explain the issues with current products in terms of spatiotemporal resolution and coverage.

Response: Thanks for your suggestion. The temporal coverage of SIT product is determined by the coverage of satellites. Most of the current SIT products provide data during the CryoSat-2 period because the ERS-2 and Envisat satellite are pulse-limited and have a larger footprint. The larger footprint is more susceptible to specular returns and hence increased mixing of different surface types. Consequently, these larger footprints pose significant challenges to leads identification and freeboard retrieval, and also affects the spatial resolution of SIT products.

Therefore, in this study, we improved the lead detection method by combining the utilization of waveform parameter thresholds and lowest elevation. The improved method can eliminate the effects of grease ice, nilas, and newly frozen leads.

We have added explanations regarding this issue.

8. Line 138: A reference is required here.

Response: We have added the following reference:

Legresy, B., Papa, F., Remy, F., Vinay, G., Van Den Bosch, M., and Zanife, O. Z.: ENVISAT radar altimeter measurements over continental surfaces and ice caps using the ICE-2 retracking algorithm, Remote Sens Environ, 95, 150–163, https://doi.org/10.1016/J.RSE.2004.11.018, 2005.

9. There is no textual reference to Table 1 in the manuscript. It should be moved to the appendix.

Response: Thanks for your suggestion, Table 1 has been moved to the appendix.

10. Table 2 should be moved to Line 164.

Response: Table 2 has been moved to the suggested place.

11. Figure 2 is unclear: Figures (c)-(g) should be placed below (b) according to the sequence; The connections between the boxes in (a) and (b) and figures (c)-(g) are unclear. I suggest adding color-coded borders for each subfigure, corresponding to the colored boxes and arrows in (a) and (b); The font size of the coordinates in (a) and (b) is too small, and the y-axis label in (b) is reversed.

Response: Thanks for your suggestion. Figure 2 has been updated. To prevent the y-axis labels of (a) and (b) from overlapping, the y-axis of (b) is placed on the right-hand side.

12. Figure 4 appears to be a screenshot rather than an original figure. The titles for figures (a)-(c) seem incomplete.

Response: In the PDF version, the resolution of the figure is damaged. We have provided the high-resolution figures in the WORD file. We have added explanations for (a)-(c) in the caption.

13. I understand that the primary focus of this paper is to publish a new SIT product. However, I hope you can provide explanations for sea ice variation phenomena in the results section. For instance, in Line 530, why was the average SIT in 2012/2013 the historical minimum? This could be explained by citing relevant literature.

Response: Thanks for your suggestion. We have added the following explanations:

Correspondingly, the Arctic sea ice cover reached a record minimum in 2012 for the satellite era. Cui et al. (2015) demonstrated that in 2007 and 2012, there was a higher surface air temperature and sea level pressure, which was accompanied by increased surface specific humidity and a higher sea surface temperature. As a result, the strengthened poleward wind was conducive to the melting of summer Arctic sea ice in various regions during those two years.

14. Figures 11-15: All these figures are line plots of SIT. Why do some include grids while others do not? Additionally, the x-axis title is “Year” in all cases, but some

display "22/23," while others use "2023." My suggestion is to either unify the format or explain the differences.

Response: Grids are included in Figure 14. For Figure 11, 12 and 14, we calculated the mean SIT during the frozen season, namely from October to April of the next year. So we displayed the x-axis as "22/23". In Figure 13, we show the monthly average thickness from 1995 to 2023. Therefore, the x-axis refers to the certain year.

15. Logically, validation should precede sea ice thickness analysis.

Response: The validation section has been moved forward.

16. Figure 14: The primary focus is the WHU dataset (red line), but it is currently unclear. I suggest: (1) Increasing the color contrast for the red line. (2) Using dashed lines for other datasets to make WHU stand out.

Response: Thanks for your suggestion, Figure 14 has been updated.

17. I cannot understand the statistical evaluation in Table 6: (1) MAE measures the average magnitude of absolute errors. (2) STD measures the variability or dispersion of the data, but what does it aim to express here? (3) ME (Mean Error) is crucial for assessing the direction of errors. (4) R (correlation coefficient) is also important for assessing the linear relationship. Therefore, both ME and R should be added to provide a more comprehensive assessment.

Response: Thanks for your suggestion. We have added the statistics of ME and R for the comparison. Our product has the highest correlation with CPOM, reaching 0.937. Its correlation with the products of AWI-CS2, GSFC-CS2 and AWI-CS2+SMOS also exceeds 0.9, while the correlation with CCI is the lowest.

18. Line 601: Why is October 2010 used as the dividing line for comparing two periods? Please provide justification for this choice.

Response: Before October 2010, the SIT was calculated with pulse-limited altimetry data from ERS-2 and Envisat. The pulse-limited altimeters have larger footprint than

CryoSat-2 and lower accuracy. Therefore, October 2010 was used as the dividing line for comparing two periods.

19. Figure 15: The x-axis labels are unclear. It is unnecessary to label every tick; you can increase the spacing between tick marks. The most important consideration is to clearly convey the information.

Response: Figure 15 has been updated.

20. I understand your intention with A-D in Table 7 and Table 8, but you need to explain this explicitly in the table caption to ensure clarity.

Response: Thanks for your suggestion. We have updated the Table 7 and 8 and the captions.