Response:

Dear Editor,

We sincerely thank the editor and reviewers for their thorough evaluation and constructive comments. Their feedback is highly valuable for improving the quality and clarity of our manuscript and dataset. We have carefully considered all suggestions, and in the revised version we provide detailed clarifications, additional quantification of uncertainties, and expanded discussions to better address the concerns raised. For further details, please refer to our point-by-point responses to your comments.

Best,

Teng

In particular, both reviewers ask for clarification on the iceberg detection/segregation, on the way thickness is estimated and used, and how double detections are avoided/iceberg movement is handled. Note that a careful description and discussion of errors and limitations of your dataset is essential for it to be useful for the community.

The reviewers also request further details on the comparison with the BYU/NIC dataset. A discussion of differences in the detection abilities of the approaches behind the validation datasets will be useful for the readers. The suggestions of referee #2 for the zenodo dataset metadata/description greatly improves user-friendliness of the data.

We sincerely thank you and the two reviewers for your valuable comments, which have greatly improved the quality of our manuscript.

In the revised manuscript, we have made the following improvements: (i) conducted a detailed quantification and discussion of the uncertainties caused by duplicate iceberg detections (L244-253 and L292-297); (ii) added further discussion of the comparison with the BYU/NIC dataset and analyzed differences in the detection abilities of the respective approaches (L322-331); (iii) revised the description of the ensemble incremental random forest parameter settings to make the procedure clearer and easier to follow (L153-172); and (iv) included six supplementary figures (Figs. S1-S6), which are now explicitly referred to in the manuscript text.

Lastly, is this a manually made track changes document? E.g., lines 165ff (not crossed out) suggest so, and in many places, entire paragraphs/sentences are crossed out and added back below with seemingly only slight text changes. It is a lot of work for the reviewers and the editorial team to find and identify the actual text changes made in reply to their comments. The review process is based on voluntary work entirely, and spending this extra effort is too much to ask from the reviewers and editorial team. Therefore, we expect a track changes document that allows to track text changes in a targeted way.
When resubmitting, please provide a track changes document where only changed text is highlighted, using e.g. latexdiff or the track changes/record changes option available in numerous office suite software. A resubmission with some other form of track change documents will not be accepted.

In this resubmission, the track changes document was generated automatically using latexdiff, and we sincerely apologize for the earlier submission of an improper track changes document. We truly appreciate

your patience and guidance, and we are committed to following the proper procedures in all subsequent submissions.

Additional editor comments:

- In your reply to the reviewers, you use descriptions such as likelihoods/uncertainties are "very small", or "very low", with "insignificant effect", these are vague terms. Can you quantify these uncertainties/likelihoods?

This being a data documentation publication, information about uncertainties in your dataset and comparisons to other datasets are crucial for the reader and data user. Any uncertainties (also as a result of method choices/limitations) need to be stated, if possible quantified, and discussed in the validation and uncertainty or discussion section. This needs to be improved before resubmitting.

We sincerely thank the editor for highlighting this important point. Below, after adding new experiments, we provide a revised response to the reviewers' question. The specific questions are as follows:

Anonymous Referee #1 : L339-349: I wonder if the total number of icebergs here and in Table 5 is the "true" number of icebergs. That is, if an iceberg is detected in two different Sentinel-1 scenes, how is this iceberg counted? This iceberg could be counted in duplicate, as the methods proposed in this study can only "detect" icebergs but cannot "track" identical icebergs. This could not be so significant because the authors used mosaiced data, but there is a possibility that the same icebergs are detected in duplicate (or some icebergs are missed) due to their drift even over a short period. It would be worthwhile to mention this issue and include any relevant discussion about it.

Referee #2: Braakmann-Folgmann, Anne: L93: I assume most places are covered by several Sentinel 1 scenes within 1 month. How do you select which scenes to use and how do you ensure that icebergs are not missed or counted twice when they drift between scenes that are up to 30 days apart?

Response: First, regarding image selection, we did not manually choose or filter scenes. During the image acquisition stage, all Sentinel-1 HH-polarized images within each tile were sorted in ascending order of acquisition time and mosaicked sequentially in Google Earth Engine using the mosaic function. Later-acquired images overwrite valid pixels from earlier ones, thereby filling gaps at the beginning of the month and producing a spatially continuous composite that represents the most recent observations. Statistics show that most tiles contain 2-4 images from different dates: in each year, more than 50% of tiles have a maximum time span of less than 5 days, and more than 90% have a maximum span of less than 10 days (Fig. R1).

We fully agree with the reviewer's concern that our method cannot track individual icebergs. Even after manual corrections, only large icebergs with distinct shape or texture features can be reliably checked, while smaller ones may still be subject to duplicate counting. To quantify this effect, we used the 2021 Antarctic mosaic on the Google Earth Engine platform and extracted acquisition dates (YYYYMMDD) for each pixel (Fig. R2). For every iceberg smaller than 10 km² (we consider larger ones to be fully resolved through manual correction), we assigned the centroid pixel's acquisition date and computed the distance to the nearest pixel acquired later in time. If this distance was smaller than the product of the date difference and the mean drift speed, the iceberg was flagged as a potential duplicate. Previous regional studies report mean drift speeds of

about 3-7 km d^{-1} (Hamley and Budd, 1986; Collares et al., 2018; Barbat et al., 2021; Orheim et al., 2023), and we adopted 5 km d^{-1} as a representative value. In 2021, a total of 1,757 icebergs were identified as potential duplicates, representing 3.36% of the total count and 655 km^2 (1.25%) of the total area. We therefore assign 2% as the uncertainty contribution from duplicate counting, representing a conservative cross-year upper limit. This quantification procedure has been added to the revised manuscript (L245-253).

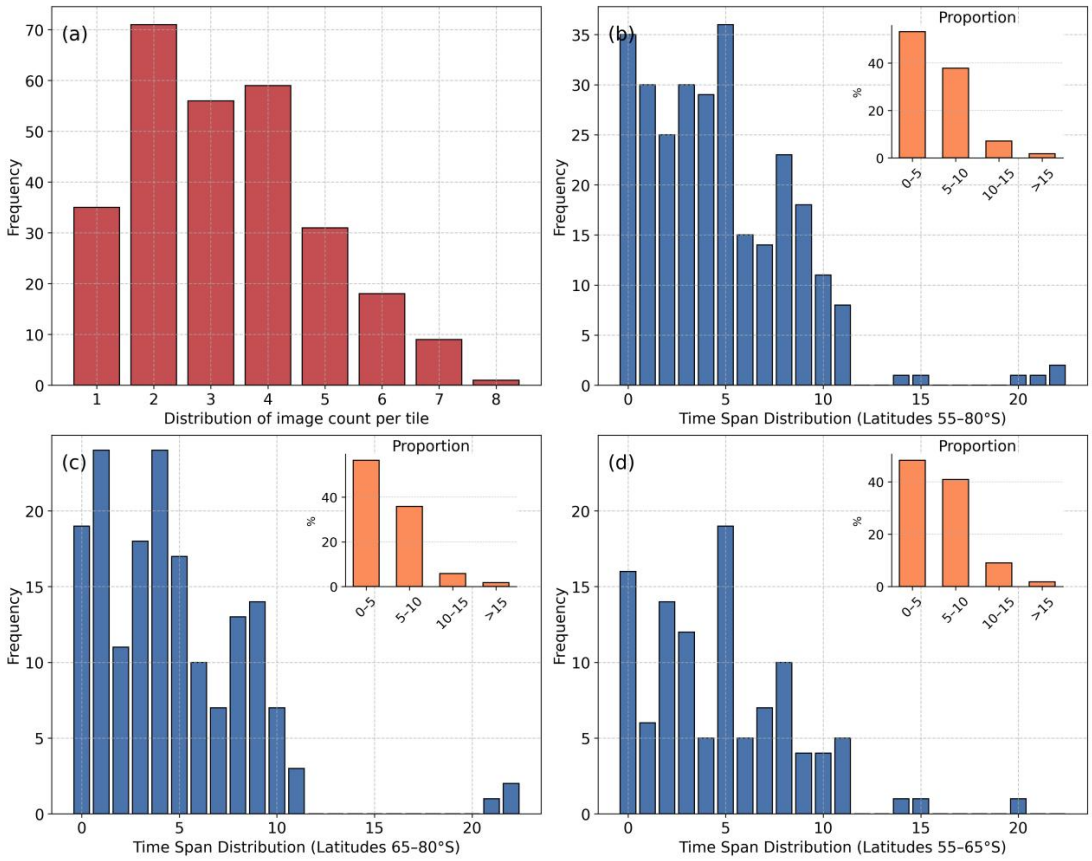

Figure R1. Panel (a) distribution of the number of Sentinel-1 images per tile. Panels (b-d) histograms of the time span between acquisition dates for tiles in different latitude bands (55°S-80°S, 55°S-65°S and 65°S-80°S).

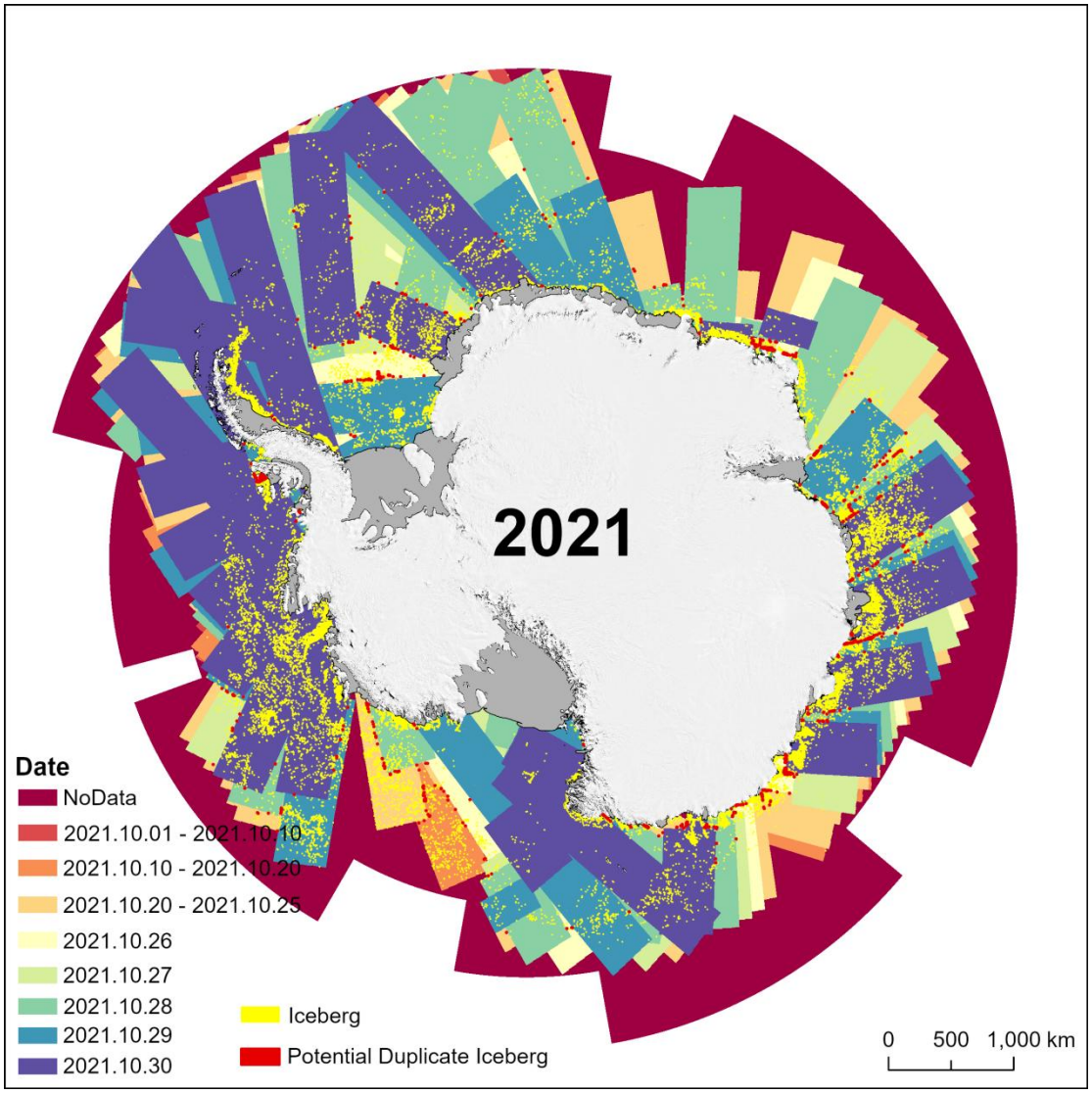

Figure R2. Spatial distribution of detected icebergs and potential duplicates around Antarctica in October 2021. Colors indicate the acquisition dates of Sentinel-1 EW scenes used to construct the monthly mosaic, while yellow and red points mark iceberg detections and potential duplicate icebergs, respectively.

- In the replying (some of) these to a manuscript supplement? If so, please refer to these in the manuscript text.

We thank the editor for this reminder. In the revised submission, we have added the relevant figures as supplementary material (a total of six figures) and have explicitly referred to them in the manuscript text where

appropriate (e.g., Figs. S1-S6 in the Supplement).

Minor comments:

- Construction of Incremental random forest classifiers (added after a request from reviewer 1): Please pay extra attention to this section, and ensure the process is transparent and understandable for the reader.

We thank the editor for this valuable suggestion. In the revised manuscript, we have simplified and clarified the description of the construction and parameterization of the incremental random forest classifiers. The revised text avoids redundant phrasing and provides a clearer step-by-step explanation of the procedures for classifier weighting and threshold setting.

- Some comments seem not considered, e.g. reviewer 2 for Fig. 10.

We thank the editor for the reminder. In the revised manuscript, we have added the note "Note that the y-axis in (c) is truncated at 80% for clarity" to the caption of Fig. 10.

References

Hamley, T. C. and Budd, W. F.: Antarctic Iceberg Distribution and Dissolution, J. Glaciol., 32, 242–251, https://doi.org/10.3189/S0022143000015574, 1986.

Collares, L. L., Mata, M. M., Kerr, R., Arigony-Neto, J., and Barbat, M. M.: Iceberg drift and ocean circulation in the northwestern Weddell Sea, Antarctica, Deep Sea Research Part II: Topical Studies in Oceanography, 149, 10–24, https://doi.org/10.1016/j.dsr2.2018.02.014, 2018.

Barbat, M. M., Rackow, T., Wesche, C., Hellmer, H. H., and Mata, M. M.: Automated iceberg tracking with a machine learning approach applied to SAR imagery: A Weddell sea case study, ISPRS Journal of Photogrammetry and Remote Sensing, 172, 189–206, https://doi.org/10.1016/j.isprsjprs.2020.12.006, 2021.

Orheim, O., Giles, A. B., Moholdt, G., (Jo) Jacka, T. H., and Bjørdal, A.: Antarctic iceberg distribution revealed through three decades of systematic ship-based observations in the SCAR International Iceberg Database, J. Glaciol., 69, 551–565, https://doi.org/10.1017/jog.2022.84, 2023.