Response to Editor

Thank you for the substantial additional revision and for the detailed point-by-point response. I also note that both reviewers had already indicated that they were satisfied with the previous revision and had no further requests. The new perturbation experiments provide a more quantitative assessment of the sensitivity of the retrieved effective grain-size parameter. The added methodological explanations and supporting information, including the explicit site-selection criteria also improve the clarity and reproducibility of the study.

We thank the editor for the positive assessment of the revised manuscript and for identifying these remaining technical points. We have addressed both comments by clarifying and justifying the dB-space temporal averaging procedure and by reviewing the manuscript for numerical precision. Please find below our point-by-point responses. All line numbers cited below refer to the clean revised manuscript, not to the track-changes version.

1. Some methodological concerns nevertheless remain. One example is the averaging of simulated backscatter in dB space before conversion to linear units (page 9, lines 267-268). This procedure corresponds to a geometric rather than arithmetic mean in linear backscatter and should therefore be clearly justified.

   We have clarified the temporal aggregation procedure for both the ASCAT observations and the FDM–SMRT simulations. The revised manuscript now states explicitly that the annual JJA ASCAT means are calculated from the original observations in dB space **(page 4, lines 90–95)** and that the simulated annual JJA means are calculated in the same manner **(page 4, lines 110–115)**.

   We have also expanded **Sect. 3.3** to explain the consequence of this operation. Because the temporal averaging is performed in logarithmic space before conversion to linear units, the converted annual values correspond to geometric, rather than arithmetic, means of the individual linear backscatter values. We retain this formulation because it ensures that ASCAT observations and FDM–SMRT simulations undergo the same temporal aggregation before comparison in the inversion **(page 8, lines 236–242).** This revision clarifies and justifies the implemented procedure; no change to the underlying analysis or results was required.

2. The authors should also review the manuscript for excessive numerical precision. Several reported values imply a level of physical accuracy that is not supported by the spatial resolution, model assumptions, or uncertainty of the retrieval.

   We reviewed the manuscript and reduced numerical precision where the previously reported values could imply greater physical accuracy than is supported by the 27 km

spatial resolution, the prescribed firn-model state, and the uncertainty of the retrieval framework. Specifically, we:

- rounded the minimum Larsen-B cell-edge distance from 1.59 to 1.6 km **(page 7, line 210)**;
- reduced the representative-site coordinates in Table 1 from four to two decimal places and rounded the corresponding FAC values to one decimal place **(page 8, Table 1)**;
- applied the same FAC rounding in the Results discussion of the Larsen-B and Amery examples **(page 14, lines 407–409)**;
- rounded the profile temperatures from 242.08 and 243.47 K to 242.1 and 243.5 K **(page 11, lines 313–315)**;
- rounded the baseline optimized correlation length and effective grain-size parameter to 0.39 and 0.48 mm, respectively **(page 19, lines 465–467)**; and
- reviewed the presentation of the perturbation results in Sect. 4.4, Table 2, and Appendix Table C1 to ensure that the text and tables are mutually consistent **(page 19, lines 473–480 and Table 2; page 34, Appendix Table C1)**.

Additional digits have been retained only where needed to document small perturbation-induced differences or numerical optimization residuals in **Appendix Table C1**. These values are presented as computational diagnostics and are not intended to imply equivalent physical accuracy in the retrieved grain-size parameter. These revisions improve the consistency of the numerical presentation and do not alter the analysis, interpretation, or conclusions.