We thank Referee 1 for the constructive and thoughtful comments, which have helped us improve the manuscript. We have responded to the comments by presenting the original comments in black, our responses in blue, and the revisions in red.

Referee #1

This article conducts a thorough evaluation of the multi-scale performance of the Sentinel-1 SAR snow depth product, offering notable value in data validation and environmental impact analysis, with clear figures and fluent expression. However, its focus on validating existing algorithms rather than achieving a breakthrough limits its innovation, and certain language expressions lack smoothness. It is recommended that the manuscript be revised prior to submission for publication.

#Major

1. Although the article systematically evaluates the C-snow product across multiple scales, its core methodology—such as the C-band SAR-based snow depth retrieval algorithm—is not original to this study but builds upon prior work by Lievens et al. (2019). The innovation here lies primarily in data validation and scale analysis, yet these aspects do not represent a novel breakthrough in the field of remote sensing. It is recommended that the study explicitly highlight its unique contributions, such as whether it proposes a new scale-effect model or an improved retrieval method.

Response: The C-snow product used in this study is based on previous work by Lievens et al. (2019). However, our primary focus is on the multi-scale validation and analysis of the C-snow product, with a particular emphasis on understanding the impact of scale effects on SD retrieval accuracy. While we do not introduce entirely new algorithms or models, we believe the study offers valuable insights into the performance of the C-snow product across different scales. We revised the manuscript to highlight our contributions more explicitly.

（1） The C-snow dataset has only been evaluated from the point to regional scales until now, not at the global scale. Our study comparatively assessed it globally by using station-based measurements and airborne LiDAR observations.

（2） Multi-scale C-snow datasets at 1-, 10-, and 25 km have been used to provide reference data to train machine learning models, improve passive microwave-based retrieval, and calibrate many hydrological models. However, existing validation articles only focus on the1km C-snow dataset, never assessing the upscaled 10 and 25 km C-snow retrievals. We conducted a systematic assessment of C-snow products at three scales (1, 10 and 25 km).

（3） We also provided the multi-scale analysis to C-snow products, and it shows that the scale patterns vary across resolutions, which can enhance our

understanding to C-snow retrieving algorithm and validation work.

2. The introduction provides a detailed review of the development of SAR and microwave remote sensing in snow depth monitoring but fails to adequately justify the selection of the 1, 10, and 25 km scales for analysis or clarify their relevance to practical applications, such as hydrological modeling.

Response: The applications of SD data vary significantly depending on spatial resolution. High-resolution SD data at 1 km are suitable for hydrological modeling and snow disaster monitoring (Wan et al., 2022). SD data at 10 km resolution are appropriate for regional water resource management (Alonso-González et al., 2018), while 25 km resolution data are widely used for SD monitoring, climate change analysis, and model evaluation at global and regional scales (Tanniru et al., 2023). We mentioned that the C-snow product at 10 km and 25 km resolutions has already been used as a reference dataset, such as for training machine learning models to improve passive microwave SWE estimates. However, the accuracy of the 1 km C-snow product at these resolutions is still unknown. Moreover, the performance of the 1 km C-snow product at 10 km and 25 km resolutions is crucial for demonstrating whether active microwave remote sensing can provide a reliable reference SD dataset for passive microwave remote sensing.

#minor

1. Lines 20-21: Sentence is too long. “The results indicate that the scale patterns of the C-snow products across various resolutions differ from those of station- and airborne-based reference data.” → “The scale patterns of C-snow products vary across resolutions. They differ from patterns observed in station and airborne reference data.”

Response: The sentence has been revised as recommended.

Revision: The scale patterns of C-snow products vary across resolutions. They differ from patterns observed in station and airborne reference data.

2. Lines 366-367: The text contains redundant expressions, and optimization is recommended. “bias values ranging from -91.31 to -52.73 cm and ubRMSE values ranging from 104.3 to 83.29 cm”→“bias values decrease from -91.31 cm to -52.73 cm, while ubRMSE decreases from 104.3 cm to 83.29 cm”.

Response: The text has been revised as recommended.

Revision: Bias values decrease from -91.31 cm to -52.73 cm, while ubRMSE decreases from 104.3 cm to 83.29 cm

3. Line 379: analized → analyzed.

Response: Corrected.

4. Suggestions for unified terminology. “ground-based measurements”, “station observations”

Response: It has been revised to use “station observation” consistently.