Response to Reviewer

Line 64: “we extend deep-learning neural network frameworks to satellite synthetic aperture radar (SAR) imagery collected by the Sentinel-1 constellation from 2015–2022”. Some of the studies you cite in this line use Sentinel-1 imagery, so I’m not sure the statement is quite accurate - maybe it’s best to say you provide an alternative.

None of the papers that we cite in line 64 use SAR data, and in the next line we have already written: “Our results provide an alternative model framework to other published deep learning approaches (surawy-stepney et al., 2023a and surawy-stepney et. al., 2023b).”

2. In my original review, I suggested removing the section on the firn model as it didn’t add much to the paper, and was a slightly confusing presentation of a simple idea. The authors have responded that they’d like to keep it, which is fair enough. However, I think there are a few statements left in the that article that suggest something beyond a straightforward application of an existing model. I recommend tidying up these last bits, e.g. line 72: “We then develop a simple geometric model for the tensile strength of polar firn to aid the interpretation of our observations.”. (I still think that the article would benefit from boiling a lot of the content around the firn model to a statement of the form “we apply the porous material model of Jelitto and Schnewider (2018) to firn.”)

We have adapted the model by Jeliitto and Schneider (2018), which is part of why we’ve described it in detail in the text. We assume different relationships between the volume of pore space in the firn and the firn structure. We can make this more clear though. We also think it strengthens the presentation of this work when we recognize that tensile weakening of porous materials is not a new idea and is well developed in literature on ceramics.

3. In general, I think the figures need a bit of tidying up. In particular, making sure text is large enough to read

We will work on this with the editorial team as part of sizing of the figures for the final layout of the manuscript. We appreciate this comment though.

References

Jelitto, H. and Schneider, G.: A geometric model for the fracture toughness of porous materials, Acta Materialia, 151, 443–453, https://doi.org/10.1016/j.actamat.2018.03.018, 2018.

Surawy-Stepney, T., Hogg, A. E., Cornford, S. L., and Davison, B. J.: Episodic dynamic change linked to damage on the Thwaites Glacier Ice Tongue, Nature Geoscience, 16, 37–43, https://doi.org/10.1038/s41561-022-01097-9, 2023a.

Surawy-Stepney, T., Hogg, A. E., Cornford, S. L., and Hogg, D. C.: Mapping Antarctic Crevasses and their Evolution with Deep Learning Applied to Satellite Radar Imagery, The Cryosphere Discussions, 2023, 1–32, https://doi.org/10.5194/tc-2023-42, 2023b.