

The Cryosphere Discuss., referee comment RC1
<https://doi.org/10.5194/tc-2022-127-RC1>, 2022
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Comment on tc-2022-127

Isis Brangers (Referee)

Referee comment on "Sentinel-1 detection of seasonal and perennial firn aquifers in the Antarctic Peninsula" by Lena G. Buth et al., The Cryosphere Discuss.,
<https://doi.org/10.5194/tc-2022-127-RC1>, 2022

The paper uses Sentinel-1 (S1) data to map perennial firn aquifers in the Antarctic Peninsula. I think it is the first study that uses Sentinel-1 for aquifers outside of Greenland. Other novelties of this work are the comparison of S1 backscatter with a firn model and SMRT radiative transfer modelling. Overall it is nice work. The paper is well written and the limitations are clearly stated. The proposed methodology is only slightly different from previous methods and has similar limitations.

Some comments:

What are the advantages of the presented method compared to the work of Brangers et al and Miller et al.? The latter could be more robust.

How was the threshold of 105 days chosen?

The dry snow zone was justly masked, however, in the bare ice zone there also can be no firn aquifers since there is no firn. It might improve the performance if this zone was also excluded. I believe slowly draining/freezing supraglacial lakes on bare ice could give similar backscatter responses as aquifers.

Part of the inter annual variability could potentially be explained by differences in weather. E.g. at an aquifer location the backscatter might increase faster in case of a colder fall than a relatively warm fall (especially at sites with deep water table). I agree part of the differences are seasonal aquifers, but this could also be part of the explanation.

The validation of the methodology is a bit limited. There is only a visual comparison with the model and a comparison of the total aquifer area. The authors could consider adding a more qualitative analysis.