Response to RC1 comments on **Airborne SnowSAR data at X- and Ku- bands over boreal forest, alpine and tundra snow cover**

RC1:
This paper well describes historical deployments of SnowSAR at X- and Ku- band for airborne active microwave observations for SWE retrieval from remote sensing.

Response:
We thank the reviewer for his constructive comments and observations. We have done our best to comply to the suggested edits and additions. Where this was not done, we have provided justified answers below.

RC1:
1. While worthwhile to archive the past applications of the airborne SnowSAR deployments, it would be desirable to point out lessons learned from expensive airborne campaign along with in-situ snow and weather observations on the ground. Please refer to point-by-point conclusions in the past literature similar to:
Mätzler, Christian, and Erwin Schanda. "Snow mapping with active microwave sensors." Remote Sensing 5.2 (1984): 409-422.
Matzler, Christian, Erwin Schanda, and Walter Good. "Towards the definition of optimum sensor specifications for microwave remote sensing of snow." IEEE Transactions on Geoscience and Remote Sensing 1 (1982): 57-66.
Foster, J. L., et al. "Derivation of snow water equivalent in boreal forests using microwave radiometry." Arctic (1991): 147-152.

Response:
Thank you, this is a good point. We have included a new "lessons learnt" section which summarizes our experiences in collecting airborne radar data for snow cover. However, as this paper is meant as a presentation of the data, we refrain of making any conclusions as to e.g. the potential merits of the collected radar data and the volume scattering approach for SWE retrieval. The "lessons learnt" are thus meant as a technical reference of experiences (and mistakes!) when organizing possible future campaigns.

RC1:
2. Another limitation is in a lack of contributions from snow hydrology models such as SNOWPACK and CROCUS. Please include how applications of the snow hydrology model can support SWE retrieval algorithm of using SnowSAR, i.e. microwave volume scattering approach.

Response:
Thank you, good point, we have included a mention of this in the Conclusions section, also referencing recent work.

RC1:
3. Another note could be made with in-situ observations not limited to snowpit measurements but including ground-based remote sensing measurements. Recently, stateof-art ground technologies have been proposed including Specific Surface Area, Tomography Scanning of snow microstructure, and ground-based remote sensing measurements. I think an inclusion of the recent development of field and laboratory technologies would make synergy with airborne SnowSAR observations toward SWE retrieval algorithms.

Response:
Thank you. We have added a mention of the more advanced techniques for snow microstructure quantification and their potential benefit in the "lessons learnt" -section with references. Indeed, many of these techniques were applied during the campaigns, e.g. SSA measurements are available from most sites, and are available on separate request.

Coincident ground-based remote sensing was available for the Finnish dataset. A mention of these is now included with referencing.

RC1:
4. While this paper is aimed at summarizing SnowSAR airborne observations, it would be useful to indicate a brief future planning how to use SnowSAR to retrieve SWE at the end. For example, 'background scattering' is quite well known, and the paper also summarizes the lower boundary scattering. A paragraph or a diagram would benefit the audience to understand how.

Response:
This is a good point; a new paragraph is added to section "6 Considerations for use of the data" regarding the use of the data for SWE retrieval. Here, we also reference recent work.

RC1:
Minor issue
1. ***In abstract and line 55:*** *'dual polarized (VV/VH)* ➔ *dual polarized (VV, VH, HV, and HH). Is there any physical reason only using VV, VH, and HV, not HH? If so, please provide this in the beginning.*

Response:
The SnowSAR instrument, while technically capable of all four orthogonal transmit/receive modes, was only operate in VV and VH pol modes during the campaigns in Finland, Austria and Canada. Therefore, we would prefer to keep the original notation of VV/VH.

RC1:
2. 'operable from a small aircraft' ➔ *'operated by various sizes of aircrafts'. It was deployed by P3 back in 2017 at NASA SnowEx*

Response:
Agreed, corrected.

RC1:
3. Any reference for 'In Canada, the TVCEx campaign took place in March and April 2013, with two flight campaigns over sites in the Trail Valley Creek (TVC) watershed, Northwest Territories, representative of the tundra snow regime.'? I found
Di Leo, D., et al. "Radiometric calibration of the SnowSAR images of sub-artic open tundra watershed in Canada." (2015): 7-7.

Response:
Agreed, reference added.

RC1:
4. Figure 1 Caption: 'Location of weather station' ➔ *'Location of weather station, groundbased remote sensing, and in-situ snowpit observations' to be complete*

Response:
We would prefer to keep the original legend for the following reasons: 1) ground-based remote sensing are not a part of the dataset 2) regular snow pit observations were made at two locations, neither of which correspond to the weather station. The coordinates of the snow pit observations are included in the dataset.

RC1:

5. Figure 1 north and south: the left panel may be 90 degree counter clockwise rotation to satisfy the right panel. Try to be physically correct the aerial photo along with vegetation map. It will help the retrieval algorithm to account for vegetation effect on microwave volume scattering.

Response:
The left panel in the figure is an aerial photograph meant to give a general idea of the typical scenery, and is not intended to cover the entire test site. Similar photos are included for all sites. This has been clarified in all the figure captions. The essential data for volume scattering analysis is included in the dataset itself on e.g. forest characteristics.

RC1:
6. Figure 4: It is excellent to see flight occurrences such as M00 to M10. It may be helpful to move y-axis of air temperature up not to avoid to see SWE evolution.

Response:
Agreed. We adjusted the axis for all figures to avoid overlap of SD and temperature data.

RC1:
7. Line 235: '17 March 2011 (M00)' ➔ *It is helpful to have local time to interpret a diurnal status of snowpack during a daytime.*

Response:
Agreed. Added local time of the flights in the text in the context where possibility of melt is discussed.

RC1:
8. 'SnowSAR mission T1, T2' also needs local time, not the UTC.

Response:
Ok, added mention of local time in the text.

RC1:
9. Specify which frequency and polarization in Figure 3 and 10.

Response:
Thank you for noting this. All examples are KuVV. Added mention in caption of Figure 3, which was missing.

RC1:
10. Figure 1, 2, etc: Please consider 'google mapTM' embedded format.

Response:
Here, we were unsure what the reviewer meant. However, all the data fields, including the land cover maps depicted in Figures 1 and 2, are available in the database with embedded geocoding, enabling the user to easily apply them in e.g. google maps and other GIS software.

RC1:
11. Spatial distribution of snowpit observations: For a microwave forward modeling perspective, locations of snowpits are essential to be compared with SnowSAR. I think a map of spatial distribution of snowpits is prerequisite at least for one or two campaigns.

Response:
We agree the location of Snowpit data is essential for colocation with SnowSAR data; therefore, coordinates of the snowpits are always included in the dataset. However, in particular for the AlpSAR and TVC sites the number and location of snowpits was large and the location of the pits varied

during campaign; therefore the addition of the location e.g. over land cover maps would be cumbersome due to the large number of individual locations, and we feel this would not provide any added value. Nevertheless, as an example, we have added the location of the regular Snowpits in Sodankylä, Finland, on Figure 20, which exemplifies the difficulty of finding collocated snow and radar information for some of the campaigns.