



EGUsphere, author comment AC4
<https://doi.org/10.5194/egusphere-2022-899-AC4>, 2022
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Reply on RC1 - addressing 'specific comments'

Annett Bartsch et al.

Author comment on "Towards long-term records of rain-on-snow events across the Arctic from satellite data" by Annett Bartsch et al., EGUsphere,
<https://doi.org/10.5194/egusphere-2022-899-AC4>, 2022

Please find our further responses to the 'specific comments' below.

L35. I would not use the term "*aging of snow*" _since it is not accurate. Please refer to the vapour flux from temperature gradient.

- Reply: We agree to modify this accordingly in the revised version.

L38. "The mapping of snow changes afterwards instead of wet snow circumvents", I'm not sure what is meant in the sentence. Please consider modification for improved clarity.

- Reply: we suggest the following rephrasing
- Old: The mapping of snow changes afterwards instead of wet snow circumvents this issue but requires the use of wavelengths which are sensitive to changes in snow properties, this means comparably short wavelengths with respect to the typical grain size of snow
- New: The mapping of snow structure changes as a result of events instead of wet snow during an event circumvents this issue but requires the use of wavelengths which are sensitive to changes in snow properties, this means comparably short wavelengths with respect to the typical grain size of snow

L40. Include citation on wavelength and snow grain size.

- Reply: We agree to modify this accordingly in the revised version.

I65. Do you mean "*With ROS, associated*" _

- Reply: yes

L77-80. Perhaps the objective should be modify or addressed more clearly in the conclusion. Were you able to correctly answer (1) with this method? How was (3) evaluated?

- Reply: "(1) gain insight into recent occurrence of rain on snow events across the Arctic" – this refers to the ROS cases with known impact which are detailed in the paper. We suggest to add 'specific' before 'rain'. Regarding (3), the impact of ROS on snow properties was investigated using hardness from snow pit records. This is briefly

referred to on line 522 in the conclusions, but we agree that it could be extended.

L150. Consider adding a statement on how these data can be subjective and what was done to avoid this.

- Reply: e.g. "Hardness measurements can be subjective. Specific schemes have been developed to judge hardness (see table 1). For long-term measurement sites such as Varanger, Saariselkä and Sodankylä people doing the measurements undergo training in using these schemes. "

L207. Please clarify this sentence "ROS using wet snow from C-band". Do you mean wet snow detection?

- Reply: yes. Rephrasing suggestion: "ROS identification based on wet snow detection from C-band ..."

L246. Please reword the beginning of the sentence.

- Reply: please find our suggestion below
- Old: Passive microwave observations as available from SMOS provide two polarizations ..
- New: Passive microwave observations commonly provide two polarizations ...

L248. Algorithms for ROS detection using 37 and 19 GHz are also sensitive to dry snow surface change into ice crust and ice layer. Consider using does to improve the algorithm since L band is useless when no liquid water is present.

- Reply: In this section we list published wet snow detection schemes. But we agree, that this should be mentioned in the outlook when referring to potential use of other passive microwave data .

L521-523 Can you provide a quantitative validation of the method to detect ROS events?

- Reply: The LRI record for Sodankylä can be summarized.

L527. the phrasing with the comma is confusing, do you mean ... "*play a role on what should be considered*"

- Reply: We mean that the role of frequency and polarization should be studied in more detail.

L526. Maybe consider using a passive observation with 19 and 37 GHz to improve sensitivity to ice crust and dry snow surface change. Once the liquid water is frozen and the temporal timing of the ROS event could not be detected with SMOS, those frequencies could help to detect surface change while C-band can provide info at high resolution.

- Reply: see response to 'L248'

L529. "*The magnitude of specific extreme events can be documented by the use of ASCAT alone, without fusion with SMOS.*" I thought you showed you need wet snow detection and ASCAT alone cannot detect ROS.

- Reply: what we mean is that if it is known from other observations that it was a ROS situation, then the cross-check that it was not a 'temperature-drop' misclassification is not needed. It refers to the Alaska example, where the ROS occurred rather south, where there was a gap in SMOS.

Figure 6. This figure is hard to understand. what are H4 1, H4 2 and H4 3? Why not add all layers so we have a better understanding of the whole snowpack?

- Reply: In case of use of 1, 2, and 3, there have been 3 separate layers with type H4 in the snowpack. Other layers could be added, but would be less relevant.