EGUsphere, author comment AC2
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Reply on RC2

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-AC2, 2022

Many thanks for your valuable comments!

Please find responses to your questions below:

RC2: Area of study: it is apparent from the figures that the authors have applied the approach to not only the entire Arctic but also to land areas extending much further south (eg., Figure 5). However, it is stated in the conclusion that the approach is only recommended for regions north of 66 deg due to coverage issues with SMOS. Perhaps the authors should revise the boundaries of the areas for which ROS detections are presented, or comment on how representative the ROS data are for the lower latitude areas shown in Fig.5?

Reply: The analyses extent was chosen based on the boundaries of the existing database from QuikScat. We describe the differences between sensors in forested/southern regions on lines 377ff and discuss it on lines 452-469. In the latter case, a wrong figure is referred to in the submitted manuscript (#2 instead of #5). However, we agree, an extended discussion on how representative the results are south of the treeline/in the SMOS gap zone would be beneficial.

RC2: The authors have described and presented a wide range of different types of observations, but I think that some of the datasets used do not really add much to the overall goals and conclusions of the study. While I see the need for observations to validate/support the remote sensing data, I think the use of too many different observations, each with their own considerations for ROS detection, makes it at times difficult to follow the main objectives of the study. I would for example recommend reconsidering whether the use of the caribou data are really necessary.

Reply: Our reasons for including the Caribou/Serward peinsula study were to (1) demonstrate that there is stronger variability from year to year regionally than what can be observed for the entire Arctic (Figure 5) and (2) to point to the potential use of the backscatter change magnitude in addition to just event detection. The Caribou herds used some areas where an event was detected, but not areas which exceeded a certain back scatter change value (figure 12c). This could be moved to the discussion part of the paper.

RC2: Line 175: why were different terms/hardness scales used at Yamal compared to the

Scandinavian sites? Why not just use a standard scale for all sites?

Reply: : The surveys come from different (partially long-term) monitoring programs, carried out by different institutions which follow different schemes. It would be indeed very beneficial if future surveys would follow the same scheme.

RC2: Line 296: “location specific threshold” - does this mean that a threshold is determined for individual pixels, or for regions?

Reply: Yes, the threshold is defined individually for each grid point.

RC2: Table 2: Events represent November 2021 to February 2022; why are values from only 1 year/winter of observations used?

Reply: Thanks for spotting! It should read November – February, years 2011-2022 (note that figure 1 is also positioned in the main text, similar to table 1)

RC2: Figure 4: Could the authors comment on the event confirmed by SMOS occurring in the start of December 2016? Here the AWS data show very low temperature (approx. -15 deg.C), no precipitation and increasing snow depth in the following days. What could be the reason for detection of wet snow?

Reply: The SMOS detection actually refers to a smaller event (LRI < 1mm) two days before the ASCAT detection. The ASCAT detection does however represent a period of temperature drop (following the rain event). The impact of liquid precipitation several days before is not captured. This case shows the disadvantage of using a 3 day window for the SMOS masking, but it is necessary to account for data gaps and nature of the radar retrieval scheme, as discussed on lines 304 in the methods part. We agree that the discussion on the choice of the detection window could be more extensive and included in the discussion.