Comment on tc-2022-116
Nathan Kurtz (Referee)

Referee comment on "Wind Transport of Snow Impacts Ka- and Ku-band Radar Signatures on Arctic Sea Ice" by Vishnu Nandan et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2022-116-RC1, 2022

This is a very interesting and useful study on the impacts of wind-driven changes to Ku and Ka radar returns from ground-based observations during MOSAiC. The study is quite thorough and rigorous, I just had a few minor comments and suggestions for the text as noted below. I would suggest publication subject to some minor revisions.

Overall, I find the results to be quite interesting to ponder as they show a very detailed look at wind and roughness induced changes in Ku and Ka radar returns. The authors make clear this is a step towards interpreting what factors influence the often-times complex radar returns found in airborne and satellite radar altimeter data, there is not necessarily definitive conclusions to be determined for going from these results to altimeter data but the results are certainly intriguing and worthwhile to publish. I do wonder what this might mean for next steps in terms of future experiments with radar systems on field sites such as this, perhaps this could be added to the end discussion to further highlight what the significance of the data and results may be.

Minor comments

L38: "snow redistribution events increased the dominance of the air/snow interface at nadir as the dominant radar scattering surface" Is the use of the term “dominant” here redundant, or purposeful?

L73-74: I’m not sure the term "originate" is applicable here, perhaps stating they are assumed to be the dominant scattering surface is more appropriate.
Figure 1(a) and (b): What is “foot” in the figures? I think the caption may be describing this, but it would be good if consistent terminology is used.

Also L130-131: Is the pedestal here just the platform the radar sits on? Not the phase center of the radar or some determined zero range point?

L128: Isn’t the center frequency a bit off from the CryoSat-2 frequency? Or do you mean the frequency ranges overlap?

L137-138: Given the small range of incidence angles of radar altimeters like CryoSat-2 and AltiKa (mentioned previously in the text), I’m curious what motivated the reasoning for the 5 degree incidence angle steps? Do you not expect there to be much variation at smaller incidence angles or was this an instrument limitation?

L189-191: What approximate time interval did this integration over the amplitude thresholds typically occur? I think including that could give further evidence to support the fact that you expect the returns to capture the entire snow interval.

L193: A similar statement about the time interval could apply here too. So long as there weren’t sea ice ridges or very high surface features in the footprint I think a smaller interval as stated here is appropriate.

Figure 8: Are these plots from data averaged between -5 to 45 degrees? It seems so from the caption. Is there much difference in plots showing only data from the nadir direction? I think to some degree this is shown in Figure 9, but I do like the waveform plots in the bottom panel of Figure 8 as a way to show the waveform structure in similar manner to altimetry data.