Northern winter roads built on sea ice, lake ice, and tundra are essential transportation corridors and lifelines for northern Canadian communities. Changes in snow conditions can affect ice growth, road availability, and road stability. This study utilizes KuKa dual-frequency polarimetric radar and employs the polarimetric method to detect snow depth on winter roads under different surface types. Comparison with the dual-frequency method shows that the polarimetric method performs better in snow depth detection. It also suggests that the upcoming CRISTAL snow depth product which based on the Ku-Ka dual-frequency method may have non-negligible uncertainties under some snow and surface conditions. Overall, the manuscript is well written, but some details of the results require further clarification.

Please find my specific comments below:

1. Figure A7 is titled "20211206_new tundra". Please further confirm whether "new" was intentionally added or a typo.

2. Line 202: The manuscript states that Table 1 uses the first detected peak as the reference for the air/snow interface. This statement may mislead readers into believing that the first peak is a more reliable representation of the air/snow interface. However, the snow depth retrieval follows previous approaches and uses the maximum-amplitude peak or centroid, rather than the first detected peak. Please clarify why the first detected peak is not used to calculate snow depth, and whether introducing it could provide an improved snow depth estimate.

3. Line 257: The weaker alignment between the VH peak and the snow/ice interface in Resolute Bay compared to Churchill is difficult to evaluate by visual inspection alone. Please add quantitative metrics, such as the percentage of waveforms where the VH peak matches the snow/ice interface.

4. Line 283: Should “air/ground interface” be “snow/ground interface” here?

5. Figure 1: The figure may be clearer if the same surface type is shown with the same color at both sites.