

This paper aims to provide a Delay Doppler Map simulation tool chain for the cryosphere, especially for the radar altimeter observations over the ice sheets. The simulator not only wishes to include the effects of the layering ice sheet structures, but also the elevation changes in the resolution cells. Wave statistics are also considered such that the coherent and incoherent waves are included in the model. This is indeed an ambitious work, as the effects from those many factors are very hard to be evaluated correctly. The simulation majorly relies on the incoherent model simulations. Coherent effects are included but do not seem to be evaluated in a rigorous way. This is however acceptable given the limited ability to perform full wave simulations to Ku band density media. Overall, the paper provides a valuable tool for high frequency microwave altimeter DDM simulations. There are several details that need to be clarified.

1. The authors reviewed several models that calculate the altimeter wave forms. It will be great if the authors can provide some math equations in the main body or in the appendix. This would help understanding the simulation algorithm.
2. In the implementation of volume scattering in the DDM, how is the delay for the snow to be calculated? Or alternatively speaking, what is the speed of light in the ice sheet when calculating the delay?
3. Coherent effects between boundaries. No doubt there will be multiple scattering effects between the internal boundaries. Please clarify in the main body whether this effect is considered in the waveform and DDM simulations and also tell why.
4. Rough surface effect. Maybe I missed it, but could the authors tell which kind of topography is used? The random modelled one or the deterministic one form DEM? For the DEM, what is the size of the DEM “patch”?
5. This question is an open discussion; I just want to know your opinion. In the paper, the rough surface is decomposed into microwave roughness and DEM roughness. Based on what could this partition be made? Partitioning the scales is a rather difficult problem which now is determined empirically just like the two-scale ocean surface scattering models.
6. Figure 6 applied slant range corrections to the DDM. Could the authors elaborate more on how the correction is performed? Also please provide a color bar to the map, it helps with the evaluation of the relative strength of each DDM bin
7. I would like to recommend the authors provide a DDM area map, maybe in the appendix that shows the area each DDM bin corresponding to. Since the simulation is at Ku band, I would expect the difference in intensity is majorly due to the difference in the area that each DDM bin covers. Also, providing the delay and doppler weighting map on the ground surface would also help interpret the results.

8. Also on figure 6, could the authors explain why the simulated wave form using SAR mode is sharper than the LRM simulation?
9. Section 5.3 delay window widening. Could you elaborate more on why extending the gates from 128 to 256 makes the DDM wider in the doppler domain? My understanding is that using longer gates only allows longer delay signals to enter the DDM but it should not provide energy to small delay bins