

Interactive comment on “Can C-Band SAR be used to estimate soil organic carbon storage in tundra?” by Annett Bartsch et al.

Anonymous Referee #1

Received and published: 31 May 2016

Authors evaluated the use of microwave backscattering Radar data to predict the SOC stocks of Tundra regions. Authors report that the C-band of SAR data can be used to predict the SOC stocks. Validation results show that their approach under predicts the SOC stocks as it does not capture the dynamics of peatlands and cryoturbated soils. The prediction accuracy was reported to decrease with depth. The results of this study are suitable for publication in Biogeosciences. However, at present form, the manuscript uses many undefined acronyms and the language structure is not reader friendly sometimes. The manuscript will benefit from the proper English editing.

Arctic soils are covered by thick mass of scrub vegetation (herbaceous vegetation less than 5 m tall) or thick O horizon, therefore its unlikely that the microwave spectra can reach to the mineral soil surface. As the Radar microwaves do not penetrate deeper into the soil profile (P6L3-4), the predictions might be a result of pure correlations. It will

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be helpful to see more descriptions of the process/mechanisms by which the backscattered spectral data is related to the soil properties such as SOC stocks. How the surface vegetation of Tundra region impacts (helps or complicates) SOC predictions?

This study used backscatter data of December month. What about the surface snow accumulation impacts on backscattering? I think in December, the spectra won't even reach to the soil surface. So basically it can't distinguish between dry and wet areas, which is the basis to estimate SOC stock (as authors describe) in this approach. What about using the spectra of summer months where may be you can find dry and wet areas at surface?

Authors used a variety of data averaging approaches for the evaluation purpose. While generating prediction accuracy or validation errors of maps, I prefer comparison of modeled results with pedon data as done in Figure 12. Please provide R2 values in figure 12.

Authors calculated RMSE values to demonstrate the prediction accuracy of generated maps (P9L10-12). Please compare the RMSE values with the standard deviation of SOC pedon data at both depths (see Mishra and Riley, 2012). This will provide the predictive ability of the adopted approach.

Mishra U., and W.J. Riley. 2012. Alaskan soil carbon stocks: spatial variability and dependence on environmental factors. *Biogeosciences*, 9:3637-3645, doi:10.5194/bg-9-3637-2012.

What about using L band? Many studies have shown good correlations of L band with vegetation biomass. If the C band better discerns wet and dry surface, than peatland SOC stocks should be predicted better? See P5L18-21.

Methods: Move the “background” section to Introduction