

# ***Interactive comment on “High-resolution digital mapping of soil organic carbon in permafrost terrain using machine-learning: A case study in a sub-Arctic peatland environment” by Matthias B. Siewert***

## **Anonymous Referee #3**

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### General comments:

The study involves the evaluation of different methods for detailed mapping of SOC in permafrost regions. It targets a relevant topic and the methodological approach is sound. The manuscript is well written and thoroughly deals with all sections. Some improvements could be made though. The different machine learning methods were utilized a diverse set of input parameters, including individual parameters (e.g. spectral bands), derived parameters from single data sources (e.g. NDVI, TWI) and integrated parameters (landcover/LCC). The single best predictor was LCC which is not surprising

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since the LCC integrates several remote sensing sources and also involves manual processing. These diverse types of parameters make it difficult to conclude which raw data sources are most important for SOC mapping. A brief discussion about the importance of different sources could be added to the discussion. Further it would be very interesting to see the performance of LCC alone for mapping as a single predictor. This could be achieved by providing the performance of LCC alone in Table 1. The study focusses on high-resolution mapping (e.g. 2x2 meters) which is good, but in addition it would be of interest to see how the different methods perform at coarser scales. Unbiased estimate at the 100x100 meter scale or 1x1 km scale is of great importance for global SOC mapping initiatives. A summary of landscape estimates for all the different methods (including LCC) could be added to the results. The SOC distribution in the Abisko area is strongly dependent on the occurrence of peatland areas. In Fig. 4 it can be seen clearly that the modelling mainly separates peatland areas from minerogenic soils. This is not discussed in relation to method performance and implications of the findings.

Detailed comments:

P1 L21: Abisko is misspelled. P2 L15: Describe more specifically which “dramatic changes is peat mires...” that you refer to. P5 L6: I believe it should be “>2mm” instead of “<2 mm”. P5 L6: How was the coarse fraction volume determined? P7 L29: Change “visual” to “visually”. P9 L24 (also P12 L17): Explain why the external validation was so much superior for RF compared to the other methods. What is the implication of this? P13 L24: Change “let” to “led”. P13 L35: Clarify that LCC is an integrated parameter combining many other data sources. P13 L35-: In this section please discuss the inference of your results based on the fact that the distribution of SOC in the Abisko landscape is so strongly dependent on the distribution peatland.

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