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Geoscientific Model Development Discussions

Interactive comment on "Soil carbon stock estimates in a nationwide inventory: evaluating performance of the ROMUL and Yasso07 models" *by* Aleksi Lehtonen et al.

Anonymous Referee #1

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This is an interesting study that tested the performance of two forest soil carbon models for their ability to predict SOC stocks across Finland. Specifically, the authors investigated the explanatory power of the parameters litter quality and quantity as well as understorey vegetation and water holding capacity. The strength of the paper is the detailed description of model parameters, particularly the estimation of litter input and understorey vegetation biomass, which are difficult to detect. Although some of the these estimations might be afflicted with uncertainty (for example, a spatial extrapolation of understorey vegetation by kriging for total Finland based on only 18 plots is hardly meaningful), I think that a rough estimation of an important but difficult parameter is better than not account for it at all. This is particularly true when the main

objective is to compare model performance rather than a precise SOC prediction.

There is only one important point which is not clear so far, the depth of the SOC estimates. I did not find any information about the depth for which SOC was predicted. From the biosoil data that was extrapolated to 1 m depth it seems that this was the depth also the models predicted SOC. However, due to the fact that C dynamics in subsoils are fundamentally different from topsoil dynamics, I can hardly imagine that such simple soil models are able to predict also subsoil SOC stocks sufficiently. From my point of view the structure of those models only allows a prediction for topsoils (0-20 cm), for deeper parts stabilization mechanisms of mineral-associated SOC must be taken into account. At least, model performance should be tested not for the total depth but for different depth increments (e.g. 0-20, 20-40 cm etc.).

After a revision in terms of this issue and following minor points the paper is acceptable for publication.

Title: I would include "Forest soil carbon" and "Finland"

P1, L11: generally, the manuscript is well-written, but the first sentence of the abstract is not very good ("We test...weather data are enough..."), please rephrase.

P2, L3: References for Sweden and Germany?

P2, L11: to reproduce

P2, L17: here is becomes clear for the first time that the paper is about forest SOC, however, this could be clarified from the beginning with a clear focus on forest SOC models and references to similar studies.

P2, L20: CENTURY model

P5, L31: the kriging approach was only shortly mentioned. Due to its importance the overall performance of this important step should be described in more detail, e.g. by showing variograms.