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# *Interactive comment on* "Hot regions of labile and stable soil organic carbon in Germany – Spatial variability and driving factors" *by* Cora Vos et al.

**Cora Vos et al.**

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Dear anonymous referee, We thank you for reviewing our manuscript and for giving instructive feedback on how to improve it. We very much appreciate your work as reviewer. Please find our answers to your comments below:

L62: There is ample evidence that no-till does not lead to net increase of SOC compared to conventional tillage as indicated here, but only to a change of the depth distribution of SOC

Answer: We agree with the reviewer that this should be mentioned more clearly and, thus, we will include references to studies that report this depth distribution of SOC as a result of no-till (Baker et al. 2007, AGEE, review from Luo et al. 2010, AGEE).

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Discussion paper

Section 2.3: The fractionation approach is not really clear: to separate the fPOM, normally SPT is used as done in this study, but without any dispersion (as indicated by "free"). Here, ultrasonic dispersion at 65 J/mL was applied that probably destroyed macroaggregates, so the extracted POM is rather fPOM+oPOM (derived from macroaggregates). Of course you can do that, but this fraction should not be called fPOM. Furthermore, 450 J/mL was used to destroy "aggregates" (I guess microaggregates), please explain why this energy level was used (reference). I further miss information on recovery rates of the fractionation and further basic data such as fraction mass and C content in order to evaluate the approach. Particularly the measured C content of the POM is important to evaluate the fractionation approach.

Answer: We see now that more details are needed in the manuscript concerning the fractionation procedure. We used a very low dispersion energy of 65 J/mL to obtain the FPOM fraction. We did this as in Don et al. 2009, JPNSS and other publications. Such a light ultrasonic treatments helps to standardize the shaking of the samples that has been proposed in the original method by Golchin. The energy level of 450 J/mL to obtain the OPOM fraction was chosen as Schmidt, Rumpel and Kögel-Knabner (1999, European Journal of Soil Science, 50, 87-94) found that 450-500 J/mL is enough to disperse all aggregates (including microaggregates) in a wide range of soil types. We will include this reference to the revised version of the paper, as well as information on recovery rates, mean fraction masses and C-contents of the fractions, which are indeed valuable criteria to evaluate the fractionation approach. We know that there is ample discussion on fractionation methods and how to obtain which fractions, but we do not want to go into detail in this paper, as it is not the main focus and the FPOM and OPOM fraction are merged for the NIRS prediction anyway.

L182+L194: More information is needed in this regard, Jaconi et al. is not accessible (see also the comment of Lauric Cécillon). Please include relevant information also in this paper, even if Jaconi et al. is published during revision.

Answer: As already stated in the reply to the comment of Lauric Cécillon we will include more details on the NIRS calibration and validation approach into the supplement of the revised version.

L188-198: I would rather see that as results

Answer: We propose not to put this paragraph in the results section, as it is the justification for using the methodology and not the result and topic of this paper. But we changed this paragraph in the revised version as follows: “We used the methodology as stated above, as Jaconi et al (submitted) found out that NIRS is a fast, low-cost and accurate method to predict the carbon fractions. The authors found the following calibration results: For prediction of carbon content in the fractions (g kg-1), the coefficient of determination ($R^2$) between predicted and measured carbon content in the fractions was found to be 0.87-0.90 and RMSECV was 4.37 g kg-1. The RPD was 2.9 for the prediction of carbon content in the light fraction and 3.2 for the prediction in the heavy fraction. For prediction of carbon proportions in the fractions (%), $R^2$ was 0.83, RMSECV 11.45% and RPD 2.4 (Fig. S1 and S2; for more details see Jaconi et al., submitted). The accuracy of prediction of both SOC content and proportions of the light and heavy SOC fractions was very good and was comparable with that in other studies that have used NIRS to predict SOC fractions (Cozzolino and Moro, 2006; Reeves et al., 2006).”

L197-198: NIRS is certainly a promising way to predict fractions, but of course this approach is specific to the fractionation. As there are numerous other fractionation approaches (probably even better ones to derive “active” and “passive” SOC), this study should avoid giving the impression that the presented approach is the only way to estimate active and passive SOC at the regional scale.

Answer: In l. 197-198 we merely aim to say that NIRS is a good way to predict the fractions, not that it is the only way to do so. We will change the sentence accordingly.

L203-205: More information is needed on the calculation of C and N inputs as well as on the regional yield estimates.

Answer: We will include more information on the calculation of C and N inputs in a revised manuscript.

L229: In order to avoid interaction effects between the variables, one could perform PCAs prior to the analysis and reduce the number of predictors to independent ones (e.g. dependent climate variables MAT, MAP and elevation can be reduced to one factor climate). For example, $CaCO_3$ was identified as important, but this is probably only due to a correlation with texture (clay is the most important factor).

Answer: The reviewer is right suggesting that using PCAs prior to the cforest analysis would reduce the number of predictors to independent ones. We refrained from doing so however, as the cforest algorithm did not find very many variables of a high importance in our case. With our approach we receive a nonbiased assessment which is not influenced by a preselection of certain variables. We therefore do not see the need to conduct the PCAs beforehand and decided to discuss all the single variables, keeping in mind, of course, that a high variable importance can also be due to interactions with other predictors. We did however eliminate predictor variables with correlations above 0.8 from the dataset as to avoid multicollinearity. We will therefore add the following sentence to the revised version of the manuscript: "As multicollinearity between the predictors may result in a biased variable importance measure in cforest algorithms, (Nicodemus et al., 2010) the correlations between the predictor variables were controlled. When the correlation between two possible predictors was >0.8, only the one with the broader range of variation was kept in the dataset.“

L316: remove “and”

Answer: the "and” will be removed in the revised version. Thank you for noticing.

Section 4.4: In principal, I agree that the fractionation approach based on a separation of POM from MOM is suitable to derive “labile” and “stable” carbon, as POM is the major constituent of “active” carbon (assuming that the contribution of pyrogenic carbon is negligible, which is the case in most regions of Germany). However, the authors could mention that there are other ways to derive labile and stable SOC.

Answer: We agree that there are very different methods/fractionation schemes to separate labile from stable SOC. Therefore, we will add the following sentence: “The applied fractionation method is only one out of several methods and options to separate labile from stabilised SOC.”

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