SOIL
Discussions

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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.

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Vos et al. present a region-wide investigation of SOC content among fractions and analyses into potential drivers of SOC content. They used a novel approach by using NIRS to predict C fractions and were able to describe POM and MOM contents and drivers across multiple sites in Germany. This work warrants publication in SOIL, but is not publishable in its current state. There are many points to be addressed and I recommend some substantial rewriting and reorganization of the paper. Please see below comments as well as comments in text (uploaded as an attachment).

Introduction

Overall, I think that the introduction needs some restructuring and needs more "meat"

to it. Many statements are vague, blanket statement and don't provide much insight or examples (e.g. "The effects of land use and management are not the same for all soil organic matter compounds..." How? Why? Give me more details). I think that the manuscript would benefit from a closer look at the flow and organization of the introduction. I suggest taking a close look at each paragraph; map out the main point, make sure this main point is reflected in the topic sentence, and verify that the preceding and following paragraphs fit/flow. There are a few paragraphs that just don't fit (seem out of place) and it detracts from the main points of the introduction (which is essentially to build up to, i.e. provide background and rationale, the objectives and hypotheses of the study). As such, please align the introduction specific to the goals and objectives of the study.

I strongly encourage the authors to reframe the objectives of the study as hypotheses in lieu of the somewhat vague research questions that are currently reported in the introduction. What do the authors expect the distribution of POM vs. MOM to be across Germany (and why)? Which factors (land-use, climate, soil type, clay content, etc.) do the authors expect to be more important in driving these distributional patterns? And the final question "can regions of high vulnerability..." needs to be clarified. First, I don't know how you define "vulnerable" and second, I am unaware how you plan on verifying that your predictive approach (i.e. machine learning)

Many of the statements or research addressed here are specific to European agro-ecosystems and yet the authors often make broad statements about land use and management effects on SOC as fact. However, land use and management effects on SOC differ greatly depending on cropping system, location (climate, topography, parent material, etc.) and there is often an equal amount of work that supports different results than what you present in this paper. As such, please be more specific and make sure to constrain postulations with "in temperate cropping systems..." or something to that example. I would be satisfied with a sentence early on stating that you are limiting the state of art (or body of knowledge) to your specific system (i.e. western European

cropping systems).

As mentioned earlier, many sentences are vague. Please try to be more specific and detailed when building up the background and rationale in the introduction. There is more "telling" than "showing". Please see the attached line-by-line review.

Methods

Overall, I suggest reorganizing the methods section to be more aligned with your objectives. This is especially true when it comes to the use of calibration versus all samples. Sections often jump from calibration to all and it makes it a bit confusing. There also needs to be more technical details into how soils were collected and processed (e.g. collected with a corer, composite samples, one sample per depth, homogenized, dried, etc. ?). Replication need to be explicitly stated (how many samples did you use for each classification combination – i.e. land use, or depth, etc.). Including a supplemental table that lists all the samples/sites or something may help clear this up. There are also several areas where the methods need to be more explicitly stated and many instances were citations are needed. Please see attachment for line by line comments.

Calibration samples versus all: The experimental design (use of calibration sites versus all sites) needs to be clearer. It was confusing with the way the methods section was organized for the reader to understand why/what/how calibration samples were used as compared to all sites. Perhaps have a separate calibration section in the methods where all of this is addressed would be clearer.

A major issue I have with the methods is combining the oPOM and fPOM fractions together as a "light fraction." As much as I hate to ask authors to redo their analyses, I think that the best way to deal with the oPOM is to either ignore it or analyze it separately.

Results

Please review my comments in the attachment and address them. Most importantly, I

do not agree with using total SOC to explain fraction SOC. Of course, C would explain C. Total SOC is NOT a driver – it is a response variable for this study.

You are also missing any reference to Fig. 6 and Fig. 8 in the results! If you don't use them – don't put them in the manuscript (or put them in supplemental).

Discussion

I would almost reorganize the discussion to be more explicitly aligned with the study objectives – first discuss the how SOC is distributed among fractions at a national scale, then discuss which drivers are relevant and finally end with whether or not you can predict "vulnerable" (but please define) areas using your approach. Section 4.1 is entirely too brief, especially since it supposedly addresses your first objective. Again – don't just tell me what other results support or do not support your results, show me!

You have a great discussion on the "black sands" section. I would love to see that reflected in the entire discussion section. Some of the details I was looking for in section 4.1 are included in 4.2. I think it would be good to combine section 4.1 and 4.2 (and address your first objective) and discuss black sands in the context of objective 1.

In section 4.4, it would be great to discuss why/why not you think your approach worked to identify vulnerable areas. It is one of your objectives and you do not directly discuss it in the discussion. It needs to be addressed. I think concluding section 4.4 with a paragraph answering "Can regions of high vulnerability to carbon losses be identified by this predictive approach?" is warranted.

Conclusion

See notes regarding final sentence.

I believe that with a few revisions (as per my and other reviewers' suggestions) this manuscript is publishable and I look forward to the revisions!

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Please also note the supplement to this comment:
https://www.soil-discuss.net/soil-2017-30/soil-2017-30-SC2-supplement.zip

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Interactive comment on SOIL Discuss., https://doi.org/10.5194/soil-2017-30, 2017.

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Discussion paper