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Comment on egusphere-2022-273

Anonymous Referee #2

Referee comment on "On-the-go VisNIR spectroscopy to predict SOC at field scale" by Javier Reyes and Mareike Ließ, EGUsphere,
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The manuscript "Can soil spectroscopy contribute to soil organic carbon monitoring on agricultural soils?" deals with an interesting topic and aims at evaluating the capability of soil spectroscopy in predicting SOC contents under laboratory and field conditions. Two instruments and different pre-processing methods were tested. The script is well-written, the figures are well displayed and the results are clear. The analysis about predictive bands under Lab and field conditions are comprehensive and informative.

However, there are some concerns related to:

Regarding the objective of this study, the title seems to contain two aspects of research questions: (1) the capability of soil spectroscopy (in SOC prediction), and (2) how to deal with disturbing factors that come from field conditions (for on-the-go measurements). To me, the first aspect is not new because the soil spectroscopy has been widely proved its capability for SOC estimation, especially under laboratory condition. The interesting point here might be whether it is capable for dealing with the relatively small variation of SOC content in this study (14-25 g kg^{-1}), otherwise I do not consider there is novelty in this regard. As for the second aspect, for agricultural fields, the results might be influenced by:

- the presence of some residues

- soil roughness left by plough, harrowing or other tillage operations

- moisture (depending e.g. on the rain events or wet air)

- curst

The manuscript did not provide soil information from these aspects, thus the readers are not aware of how different the soils are between field conditions and laboratory 'standard' soil samples, e.g., by providing some photos of field condition or providing some descriptive indices of soil roughness or moisture. It may help readers understand how much it is effective of these pre-processing methods when mitigating noisy signals coming from field conditions.

The effects of field disturbing factors should be better discussed if we want to know whether such on-the-go measurements are consistent if days/months past and the field conditions changed. Specifically, for such small variation of SOC range, whether the disturbing factors result in error that beyond the limitation of detection, i.e., whether the change of spectral signals caused by disturbing factors results in wrong estimation of SOC contents. Here it involves spatial and temporal variations of the heterogeneity of disturbing factors, and in my opinion these issues are interesting to address for the on-the-go spectral measurements. More specifically, the different pre-processing methods were well compared to derive the best prediction models, however, the readers do not get the information about to what extent these methods can deal with different types/levels of disturbing factors, and to what extent the solutions are transferable, e.g., if we switch a dataset derived from another field, is the best processing method in this study still the best one? Which processing method is sensitive to SOC-variation induced spectrum feature and immune to disturbing factors induced spectrum noise?

In my opinion, to answer the question of the title, the authors might need to focus more on field conditions and (quantifying) their effects on soil spectrum in-situ, and whether/what/to what extent pre-processing methods can mitigate such perturbing effects.

In summary, the manuscript may have not sufficiently or comprehensively answered the question of the title, and accordingly may need to improve: 1. The clarity of objectives; 2. The structure of the results: paying less attention to Lab-based results, paying more attention to Field-based results and quantifying the disturbing factors of field conditions, and even, quantifying the variation range of such conditions. However, I understand it might be hard to achieve this goal based on current experimental design, and I look forward to follow-up studies if possible.

If the main content and structure are going to be remained, I suggest the title should be modified into a more specific one to focus on the pre-processing methods.

Some minor suggestions: (1) Adding RPD or RPIQ as additional indicators apart from R^2 (see Bellon-Maurel et al., (2010). https://doi.org/10.1016/j.trac.2010.05.006) (2) Giving more context about perturbing factors and relevant pre-processing approaches in introduction. (3) These studies may be relevant:

https://doi.org/10.1016/j.geoderma.2021.115432

https://doi.org/10.1016/j.catena.2012.01.007

https://doi.org/10.1016/j.geoderma.2009.06.002

etc.