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Interactive comment on "Oblique geographic coordinates as covariates for digital soil mapping" *by* Anders Bjørn Møller et al.

Anonymous Referee #1

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The present paper is well written and structured. Moreover, the study aims to make a contribution to the field of DSM by providing a novel methodological framework based on the usage of coordinates. This is something that can be considered as rather 'out of the box thinking', because most attention in the international literature goes either to the use of advanced geostatistical methods (e.g. capturing the spatial autocorrelation through kriging) or external drift fitting based on '(environmental) co-variates' or a combination of both. Hence, the work certainly merit respect for its originality and the methodological framework seems to provide useful thoughts to be considered in future DSM-studies. However, I also see some shortcomings which should be addressed/considered in order to maximize its potential to be applied widely, and as such, I am looking forward receiving the authors replies on the associated comments

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Discussion paper

and suggestions presented below.

Major Comments: I believe that the main issue with this research is that it considers only one rather small field characterized by 1 remarkable / specific spatial structure as regards the variation of SOM (i.e. one spot/area with clearly higher values) in order to test the validity of the present new methodology, whereas the authors claim that the method will be highly useful for mapping soil properties in larger areas. Hence, I believe that the present methodology requires further testing by considering larger areas (e.g. catchment-regional scale) with more complex spatial patterns in SOM in order to prove the validity of the statements that have been made in this respect. Moreover, it would also be interesting to consider other key soil variables (besides SOM) to check whether the usages of oblique geographic coordinates as covariates could be seen as a universal DSM approach. In this context, I believe that using a national soil inventory database could be a good way forward. I may understand that this might not be possible in this study, but I still believe that this should be mentioned clearly (as a critical note) in the discussions (and maybe be picked up by the authors in future research).

When I have a look at the performance of the different mapping methods (as presented in the Violin plots in figure 7), it seems to me that your new OGC (+AUX) method only results in (very) small improvements as compared to some other (more commonly used) methods such as Kriging. Hence, I was wondering whether this improvement is statistically significant? And if this might still be the case when either (i) another field (characterized by a different spatial pattern), (ii) another soil variable or (iii) larger geographical extent are considered?

Minor Comments: I'm not too sure if it is entirely appropriate to use R2 as a measure to compare the different methods, because (i) a very high R2 value may also mean an 'overfit' and (ii) each method has it own degree of (model) complexity. Hence, I guess that it could be a good idea to take (also) another statistical measure into consideration that specifically aims to evaluate the methods' performance taking into account its complexity (in order to avoid overfitting)?

Figure 1 - Subpanel C: Showing hill shade is not enough to give the reader an insight into the topographical configuration of the field. Hence, I suggest adding contour lines.

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