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Interactive comment on "Mapping homogeneous spectral response zones in a soil profile" *by* Edward J. Jones and Alex B. McBratney

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General comments

This paper reports results about the application of visible near-infrared reflectance spectroscopy(Vis–NIR) imaging to assess horizon boundaries from a single soil profile dug in Australia. A contact probe is used on a resonably fine grid on the face of the pit. Two techniques (EPO and DS) are tested to remove soil moisture signal from the Vis–NIR spectra, then principal component analysis (PCA), along with k-means clustering, is used to try and identify horizon boundaries.

The paper is well written, but would need some improvements before publication:

1. I found some references to existing work lacking in the introduction section. Various

authors have published about using Vis–NIR on soil profile, and on the horizonation detection, in or ex situ.

Disclaimer: I'm first author in one of the references I'm about to suggest:

- Roudier, P., Manderson, A. and Hedley, C., 2016. Advances towards quantitative assessments of soil profile properties. In Digital Soil Morphometrics (pp. 113-132). Springer. - Steffens M, Kohlpaintner M, Buddenbaum H (2014) Fine spatial resolution mapping of soil organic matter quality in a Histosol profile. EJSS. - To some extent, also relevant: Grauer-Gray, J. and Hartemink, A.E., 2018. Raster sampling of soil profiles. Geoderma, 318, pp.99-108.

2. The data analysis is well done and explained, but some details are lacking, as advised below, about soil moisture recording/what happened to bulk density measurements.

3. There is at this stage a distinct lack of discussion. I would suggest authors could reflect in particular about horizontal variations: an obvious plus of this technique is that is can account for horizontal variations, so it is a bit puzzling to see so much focus on classic horizonation being used as an absolute reference. In Roudier et al. (2015) a pedologist drew horizons as a curve (as opposed to horizontal lines) to take this into account. The conclusions about EPO and DS are fine, but I think the overall study needs to be put into context a bit more: what have you solved, and what are the next challenges you need/want to tackle.

4. The conclusion is very short, and in my view it will be improved once more discussion is being added to the last sections of the paper.

Overall, a great study that will benefit hugely from more discussions in both Introduction (better literature review in particular), at the end of the Results section, and Conclusion.

Cheers,

Pierre

Specific comments

l20: The abstract is well-written, and could only be improved by specifying what is the reference taken when computing performance metrics such as CCC and RMSE. l25: Define OM (Organic matter I suppose) l72: Sorry to toot my own horn again, but I feel a paper we published last year, and that compares EPO and DS in great detail, should be referred to here : Roudier, P.et al 2017, in Geoderma. Evaluation of two methods to eliminate the effect of water from soil vis–NIR spectra for predictions of organic carbon. l74-86: I would put these two paragraphs *before* your comparisons between the different soil moisture correction methods. l90: For the sake of clarity, you could split your objectives in (i) the EPO vs DS comparison, and (ii) the identification of homogeneous regions as an overarching objective. l104: Add reference for the WRB l110-112: I think this would be best put in the next subsection l123: Please add detail about the scanning done back in the lab l125-128: It's fine to refer to those papers, but please consider using (or at least adding) the Roger et al., 2003 reference which has more details about the EPO theory itself. Also, I would suggest adding a couple of sentences detailing how EPO and DS differ (without getting into any equations, just to make it easier for the reader). l123: I believe the correct spelling of that package is 'prospectr'. l123: The spliceCorrection method implemented by prospectr differs by the correction recommended by ASD, which is a parabolic correction, as implementedin their software suite (more info: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7819458). You can access this correction in R using the 'spectacles' package: https://github.com/pierreroudier/spectacles/blob/master/R/splice.R l155: I don't think you need the equation, k-means is very common l163: k-means clustering don't identify *zones*, they identify *classes*. K-means don't take into account spatial arrangement, therefore, you can't ensure results will be spatially contiguous (and in basically all real world applications, they won't). This is a major difference between segmentation/object-based classification. l165-166: Unless you have used methods to autonmatically pick cluster numbers, I would not put this here, but rather in discussion, or even conclusion. But there are many many other references available to feed this

disucssion, with many newer techniques (I would mention it to avoid opening a whole can of worms). l193: You need to go back to your Methods section and add details abaout how soil moisture was recorded l193-198: You need units (is that %?) l212: Use percents. l221-223: I don't really like "intrinsic information" – "information" is a loaded term, that needs to be measured properly (Shannon's approach, etc). l2220: Surely the CCC results for PC4 and EPO aren't as good as the rest? Actually, maybe a table with RMSE and CCC per PC would be a good addition here. l225: If you are going to look at horizonation, you could make aggregated metrics of classes per depth slice to provide quantitative results. l274: Same warnings about using "information" in this context l273-276: The conclusion is a bit too short

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