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Discussions

Interactive comment on "Coupling X-ray microtomography and macroscopic soil measurements: a method to enhance near saturation functions?" *by* E. Beckers et al.

Anonymous Referee #2

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Review of the manuscript entitled "Coupling X-ray microtomography and macroscopic soil measurements: a method to enhance near saturation functions?".

General comments The present paper addresses relevant scientific questions within the scope of HESS. The idea of coupling X-ray CT parameters to more classical lab measurements is not new, but still in progress. I suggest not publishing the paper in its actual form, as many of the conclusions are based on interpretations that cannot be supported by the data. Moreover, there is a number of sentences that are not clear and difficult to grasp. There are ambiguities when the authors mention or discuss macroscopic and microscopic processes and measurements. As an example, according to

the authors, "microfauna produces large pores". There is no statistical analysis of the differences between the two treatments for the parameters, measured or calculated, which induces strange statements from the authors: "outliers seem to be a rule in RT2 populations". Soil strength, Ksat, k(h) are highly variable in the field and this variability should be assessed. Comparing parameters measured at different scales as in the present study needs to assess the variability of each parameter! The part dealing with soil strength does not fit with the objectives dealing with hydraulic functioning and should be removed. Finally, all the work concerning the hydraulic curves for RT1 and RT2 (Fig 3) should be removed from the paper, as k(h) measurements (near-saturated hydraulic conductivity) were influenced by both layers and represent an average hydraulic behaviour for the RT treatment, the "coupling" with microCT (specific for each layer) is then invalid.

Specific comments

Title The second part of the title doesn't make sense to me: what do you mean by "a method to enhance near saturation functions"?

Abstract

P4802 L4: you claim improving the soil water characteristic and near-saturated hydraulic conductivity by scanning soil samples? I don't understand what you mean.

Introduction

P4802 L4: I don't agree, you can describe in a mechanistic way (using mechanistic models) soil hydraulic functions at the plot scale, and also at the catchment scale, it has been done a lot the last many decades!!

P4803 L22: what do you mean by "enhance near saturation characterisation"? Same wording problem as in the title. Are you referring to macroporosity, i.e. the functional pore space close to saturation ? Please explain.

P4803 L29: "concurring mastered and redundant macroscopic observations" what do

you mean? Please explain.

P4804 L2: "fundamental processes highlighted by macroscopic measurements" what do you mean by macroscopic measurements? SWC, Ksat and k(h) are not macroscopic!!

Material and methods

P4804 L5: see my previous comment about macroscopic measurements.

P4804 L14: How many replicated plots? Where are the statistical calculations to test the effect of treatment on the different parameters???

P4805 L4: only one area per treatment?

P4807 L16: at which soil water potential were the samples scanned?

P4809 L21: could you define what you mean by "supplementary pore system"?

P4811 L1: which parameters are included?

Results and discussion

Penetrometry: if you don't discuss these results later against the other parameters you should remove this part.

Retention functions: There is a need of comparison between the two treatments (three horizons), I suggest presenting the three SWC on the same graph as a new figure. Then, you should discuss the discrepancies between Richard and microCT very close to the saturation, as the two methods are based on two completely different approaches. For example, there is not hysteresis effect for microCT measurements... At which soil water potential were the samples for scanning? This is very important here!! There is no description of how you used the microCT to get the point on the curves, this should be included. Where are the statistics of the fit by the different models (R2, p value, etc.)?

P4812 L1: how do you calculate the RRMSE? I know the RMSE and the Normalized RMSE but not the Relative RMSE. Relative to what?

P4812 L6: "significant" but never tested!!!

Figure 2: how can pF be negative? how can you estimate a microCT porosity for pF<0???? The text on this figure is too small and impossible to read.

Table 1 and table 3: both have the same caption but address something different? No statistics here again!! You need to test that you really have CT>RT2>RT1

P4813 L18: no statistics again to compare the models!!!

P4814 L21: "And the algorithm....enhancement" I don't understand this sentence...

PCA: I suggest including hydraulic parameters (from table 2) in the PCA or remove this part, according to the objective, it is useless to analyse only the microCT parameters.

P4815 L10: you cannot see that from your measurements.

P4815 L13: you mention tortuosity but you did not quantify this parameter, why?

P4816 L1: see my general comment.

P4816 L3: see my general comment.

Conclusions

P4816 L9-10: which data support this conclusion?

P4816 L10-11: please define globally and locally.

P4816 L16: isn't this secondary pore system due to the fact that two different methods (Richard and microCT) were combined to get the SWC? It might only be an artefact!! P4816 L17: what do you mean by "near saturation pore distribution"? Consider rewording. P4816 L25 to P4817 L2: not supported by the data. P4817 L3 to end: what do you mean?? Tables There are many units missing for the parameters presented in

the three tables!!

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