

Interactive comment on “Macropore flow at the field scale: predictive performance of empirical models and X-ray CT analyzed macropore characteristics” by M. Naveed et al.

Anonymous Referee #4

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The manuscript presents a study in which X-ray CT-based image information and existing prediction functions are used to deduce/predict macropore flow “at the field scale”, based on topsoil samples from a 15x15m area. I find the study interesting and justified, and reasonably well presented, although I don't see much novelty in checking some exotic PTFs that are not designed to estimate macropore flow, especially not to the foreign locality. I have relatively minor and technical suggestions towards finalizing the manuscript, other than I would really encourage the authors to make the relevant data available to others if possible through some data repository (which would hopefully find followers).

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1. I wonder if sample storage at -2C (P120955 L21) introduces freeze-thaw effects? Was the actual moisture content controlled – which could introduce differences in the behavior of samples when frozen and thawed?
2. I suggest introducing – early in the manuscript – the corresponding pore diameters that are expected to drain at the examined pressures, and relate that to the resolution of the images.
3. It would be great to introduce each of the CT-derived metrics, or refer to a source if one exists for all of the used metrics.
4. On fitting power functions to the data in Fig 7: Were power functions better than simple linear regression? After describing that they were fitted on an either-or basis, there was no discussion of how they performed relative to each other, but only power functions were mentioned. If there is a physical basis why power relationship can be expected, explain it briefly.
5. Define how the samples with biopore flow were separated from those with only matrix flow.
6. P12101 L13-19: It is understood that those PTFs were developed based on small core samples (mainly from horizons), so the scale difference is not really real. (To this end, I wonder if this is really a “field scale” study – hence the quotes in my intro sentence. Second, I think the situation in terms of over and under prediction is not that simple, given the huge range difference between predicted and measured data (Figure 3). First, find out and discuss why there is a large range of measured kw but a much smaller range of PTF predicted ones - I guess this comes from the limitations of the PTFs. To my understanding existing PTFs are not really expected to perform well to predict macropore flow. And third, as I deduct, the study evaluates its own prediction (fitting?) on exactly the same data (i.e. no independent evaluation), while the data set is an independent set to any of the PTFs involved. That is not exactly good methodology. Is the PTF part really needed?

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Minor editorials:

P12091 L8: of its inherently

L19: 'relatively failed' – I can't make sense of this. Did it fail or not? Needs to be stated based on objective criteria.

L19: potential, particularly (comma use)

P12020 L1: I suggest replacing 'need of' with 'opportunity for'

L2: for a digital

P12093 L3: replace 'large presence' with 'abundance'

L6: first by

L21: along with the prediction

L28: However, none of the studies have tested their application in the field scale before.

P12094 L20-26: These are not specific objectives, but research questions. Introduce them differently, or reformulate the 3 points to present objectives.

P12095 L14: in the summer of 2012

L16: move the word 'stepwise' to after 'cylinders'

L18: move 'step by step' to the end of the sentence

L20: from the field

L27: using the method of Kulkarni et al

P12097 L17: calculated as the ratio

L20: and was defined as

P12098 L13: for laminar flow

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P12099 L21, 'mainly': Preferably state all the texture classes

P12100 L13: north side of the field

L24, 'marked samples': marked for what? It should be here, or even earlier that some of the samples are highlighted – why those, etc.

P12101 L8: At least some of the referred studies predict Ksat, not Kw

L14-15: over-predicted under-predicted

L24: comparatively fails? Does it fail or not?

P12102 L9: methods, whether global or locally adaptive, resulted (comma use)

L27: between the two measures

P12103 L1: if the image

L2: i.e. there is a lot of noise

P12104 L4-5: 'two-branch system data trend' and 'single' needs to be introduced. I know what is meant, but this is vague. Also cite the unfilled symbols.

L10, 18 and elsewhere later: explain 'moderate and significant power regressions', modify terminology as necessary.

L28: the performance of the regression function significantly improved. . . (Btw, use significantly if tested, else use the term substantially. Significantly is a reserved term.)

P12106 L3: despite this

L7: for the prediction of

L8-9: particularly for the samples that contained top-to-bottom connected biopores.

P12107 L5: of a digital

Figure 2: Better relate to Figure 1, and especially to the text on P12100. At the moment

they are introduced quite late in the ms.

Figure 6: Define what is weak, moderate, etc. and how decided.

Caption of Figure 7: if found significant.

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