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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Use of field and laboratory methods for estimating unsaturated hydraulic properties under different land-use" *by* S. Siltecho et al.

Anonymous Referee #2

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This paper assesses the use of several methods to determine unsaturated hydraulic properties in a watershed in Northeast Thailand with rubber tree plantation, pasture and natural forest. The objective of the paper is twofold: i) verify whether different land management corresponds with different soil properties, and ii) compare different measurement techniques for estimating soil hydraulic properties of top soil. Five measurement techniques are discussed: Beerkan with BEST algorithm for analysis, disc infiltrometer with Wooding's method, evaporation method, inverse evaporation method with Hydrus 1D, and pedo-transfer functions. Evaluation between methods and between land use is done with Kruskal-Wallis. All methods are also compared with ten-

siometer measurements, and evaluated in Hydrus 1D on the basis of four modelling performance criteria. The approach followed in the paper is useful, a comparison between laboratory and field techniques, in situ data and the application of the resulting data in a soil water flow model such as Hydrus 1D is interesting to readers of HESS.

The current manuscript is concise, but difficult to assess at times. To fully appreciate the comparison, the reader currently needs to be an expert on the various approaches already, or needs to be willing to look up all of the references made to various methods and techniques. The conciseness also hampers the conclusion in my opinion; the comparison is done on a strictly statistical basis, on which the authors conclude no method outcompetes another, and therefore the low-cost Beerkan method is probably the best. Nonetheless, every measurement techniques has its pros and cons. The manuscript would benefit from mentioning such pros and cons in the technique description, and assessing these together with the statistical analysis. The scale dependency of the (unsaturated) hydraulic conductivity may justify discussion on the area/volume being assessed by each technique.

Abstract and page 6115 line 9-11: Perhaps it can be expected that measurement method variability is higher than location variability if a statistical test designed to indicate independence between samples is used. For example Ks is highly variable as a result of soil variability, and scale-dependent. The limited amount of samples in all of the measurement techniques, and the different area/volume these techniques cover are compared with location variability of which not much more is written than the textural composition of the sites, and the land use. These issues need to be discussed to make the current concluding statements more convincing.

Another difficulty in assessing the paper is the consistency of naming methods in the text and in the tables (including structure). Especially i) Wind's method/evaporation method/inverse method/associated inverse method and ii) pedo-transfer function(PTF)/Arya and Paris method/Arya method. With careful reading this can be overcome, but could perhaps be prevented.

Some vagueness surrounds the hypothesis on page 6103 lines 19 to 23. If different land managements would change soil properties, are these changes for example a result of structural changes due to (mechanical) cultivation? Or the transgression from natural vegetation to pasture or plantation, leading to changes in root mass, and thus in soil structural changes? Can it be assumed such changes can be assessed by measuring the hydraulic properties of top soil? Or is the rationale for this study from the perspective of infiltration capacity and erosion risks? Please clarify.

On page 6105 and 6106 two models for estimating soil unsaturated hydraulic properties are described. What was the motivation for using these models, instead of others?

Page 6107 For the disc infiltrometer: How many repetitions at each of the sites?

For the evaporation method an inconsistency seems to occur between the M&M and result section: Page 6108 line 4 “Two undisturbed soil samples were collected at each location” versus Table 3 evaporation/inverse n=3 (or 2 for some of the sites).

Which samples were used for the PTF method described in section 2.2.5?

Section 3.6: Since infiltration was strictly 1D in one of the distinctive groups, I would expect a discussion here if the results of some of the measurements techniques suffered from lateral flow. This is not mentioned in the text discussing the measurement results, it could be that by applying the algorithms to analyse the data such possible errors are assessed, but since none are described very extensively it is hard to assess.

The conclusions focus on differences between techniques only, and do not justify the first line in the conclusions, nor the first objective of the paper.

Table 3 and 4 only show Ks while equation 3 and 4 seem to facilitate K(theta) as well. For unsaturated flow modelling the shape of K(theta) is important. Why did the authors only plot the scaled retention curve (Fig 3), but not K(theta)?

Fig 4 only displays a small amount of the in situ data without justification. Also, while soil moisture measurements were mentioned in the M&M section, none are shown.

Technical comments

Page 6107 line 20: Simuneket is not correct. Occurs at multiple places in the text. Please check.

Page 6114 line 26: Kurskal should be Kruskal

Fig 3 evporation should be evaporation

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 6099, 2014.