**Hydrology and
Earth System
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Discussions**

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Comment

Interactive comment on "In-situ evaluation of internal drainage in layered soils (Tukulu, Sepane and Swartland)" *by* S. S. W. Mavimbela and L. D. van Rensburg

Anonymous Referee #1

Received and published: 30 December 2011

General comments

The authors present a study in which they determined the soil hydraulic properties of three different layered soil profiles by in situ double-ring infiltration experiments and in situ drainage experiments. The latter used water content measurements with the neutron probe technique and were evaluated by the instantaneous profile method to yield $K(\theta)$. These field measurements were replenished by laboratory measurements of the soil water retention curves using the hanging water column method. The overall goal was to assess the suitability of the soils for the application of infield rainwater

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harvesting techniques (IRWH). The amount and quality of experimental data presented is impressive and the topic is clearly within the scope of the journal. However, the manuscript cannot be published because of its great number of shortcomings. The major points are:

- The analysis is restricted to the pressure head range from saturation to -1000 mm. It appears questionable whether this range is representative for a site where IRWH is planned to be applied and the climate is semiarid. The study focuses on drainage but the water loss by evaporation is not addressed.

- The functions fitted to the retention data $\theta(h)$ is a linear function which is unphysical. I recommend the use of more popular approaches like the van Genuchten or the Brooks and Corey model. This could also lead to more representative extrapolations beyond the range of pressure heads covered by the experimental conditions.

- The applied model for the hydraulic conductivity function is not given explicitly and the coefficients resulting from linear regression which are summarized in Table 4 are hard to interpret. It does not become clear whether and how the saturated conductivities obtained from the infiltration experiments were used in the analysis.

- The suitability of the different soils for IRWH should be analyzed by numerical simulations with the Richards equation using site-specific atmospheric boundary conditions.

- Scientific language and soil physics terminology is insatisactory for a scientific journal.

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Specific comments

- The use of abreviations is confusing. In the abstract, the term SWC stands first for soil water release (L1), then for soil water content (L7). In the introduction, soil water release is abbreviated as SWR (P2L1) while SWC stands mostly for soil water content.

- [P9798 L8] "The water hanging column" – this should read the hanging-column method.

- [P9799 L2-6] Here the authors mix different things: permeability, conductivity and the K-coefficient (whatever this shall be). The authors claim that the SWR could be described by the SWR curve (this is tautological) or the soil water characteristic curve (what is finally the difference between SWR and SWCC?). Then they state that the SWR is expressed as SWC. Such incorrect terminology and repeated lack of clear definitions is absolutely inacceptable.

- The terms DUL and DLL are not properly defined [P9799 L9-10]. While the DLL is equated with the permament wilting point (P9799 L11), the DUL could be seen as field capacity from [P9799 L14] but the authors fail to provide an exact definition. What is more confusing is that "the DUL has been realized at about 0.1 to 0.2% per day".

- [P9799 L12] what is meant by "vertical soils"?

- Why is the DUL achieved after 2-12 days? What is the time of reference here?

- P9799 L22] "Difficulties in measurement of K-coefficient..." – this sentence is neither understandable nor gramatically correct.

- P9799 L28] The inversion of the Richards equation is a powerful tool to derive soil hydraulic properties. However, what the authors describe in this sentence

is the inversion of the Buckingham-Darcy law and not an inverse solution of the Richards equation.

- [P9800] Here the authors discuss a variety of methods to determine the soil hydraulic properties. The way this is done is confusing because field and lab methods are mixed in a rather arbitrary order.

- [P9802 L 12] "until a steady time was clocked by the falling water head" – what do the authors mean?

- [P9802 L19] "that the soil matrix suction was negligible and did not affect macropore domain" – again, it does not become evident what the assumptions are. Is the assumption that gravity is the only driving force for infiltration? Were macropores actually activated?

- [P9803 L17] "the measured soil water content that resulted in a drainage flux of ... was assumed to have reached the DUL" – what is the justification for this?

- [P9804 L15] "water that dripped from the samples was attributed to the porosity of the samples" – this is wrong.

- P9804 L23] Information is missing which function was used for the regression to derive the $\theta(h)$-relationship.

- [P9805 L13] "The classical exponential function was used" – although straightforward, the function should be given here. Otherwise the coefficients in Table 4 are hard to interpret. Were the K_s-values included in the analysis?

- [P9808 L27] The units for the slopes of the $\theta(h)$ functions are wrong, they should be % per mm.

- [P9809 L13] "a goodness of fit of not less than" – a coefficient of determination of not less than.

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- [P9809 L15] "indicated a high permissable soil water release" – please rephrase.

- [P9811] I think it is crucial that the measured data $\theta(t)$ are presented before the presentation of the $K(\theta)$ data because the latter are computed from the former.

- [P9811 L13] "the power regression functions" - did you finally use the measured data directly to compute $K(\theta)$ or did you use the fitted functions? If you applied the first strategy, why did you fit a power function to the data?

- [P9813 L1] "total water loss was equivalent to 0.09% of the 550 mm rainfall" – the time period is missing to come to this conclusion.

- P9813 L19] "Given that internal drainage is accountable to gravitational flow boundary conditions, the hydraulic characteristics of the underlying soil profile layers are key this process" – I don't get the message here and don't even understand the sentence.

- [P9813 L27] "the saprolite layer was ill-posed" – this does not make any sense.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 9797, 2011.

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