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Hydrology and Earth System Sciences Discussions

Interactive comment on "Evaluating models for predicting hydraulic characteristics of layered soils" *by* S. S. W. Mavimbela and L. D. van Rensburg

Anonymous Referee #1

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Review of the manuscript hess-2011-269 entitled "Evaluating models for predicting hydraulic characteristics of layered soils" by S.S.W Mavimbela and L.D van Rensburg.

The manuscript presents an analysis of the experimental dataset involving measured soil water retention curves, saturated hydraulic conductivities, and instantaneous profile experiments on three different soil profiles, each having three soil layers. The measured soil water retention curves are analyzed using the RETC model and utilizing multiple analytical models describing soil hydraulic properties (Brooks-Corey, van Genuchten, modified van Genuchten, and Kosugi's models are used). Instantaneous profile experimental data are then analyzed using the HYDRUS-1D software package.

Soil hydraulic conductivity functions obtained using different methods (i.e., predicted from soil water retention curves using theoretical pore-size distribution models, or evaluated from the instantaneous profile dataset using Darcy's equation or the HYDRUS-1D model) were compared. Extensive discussion of obtained parameters is presented.

Main problems:

a) I have been surprised how many wrong terms, spelling errors or misspelled names occurred throughout the manuscript. The authors have to pay much more attention to details. Examples are "Kasugi" instead of "Kosugi", "HYDRUS 1-D" instead of "HYDRUS-1D, "root sum of squares error" rather than "root mean squared error", "Gardener" instead of "Gardner", "van Genutchen" rather than "van Genuchten", "segmoidal" instead of "sigmoidal", "Wildnchild" versus "Wildenchild", etc. I do find this quite troubling.

b) I think that the paper is rather unbalanced. There are long discussions of obtained parameters (which are rather uninteresting), while the methods (e.g., how HYDRUS-1D is used in the inverse analysis) are described rather briefly.

c) I'm actually not even sure if I understood the approach correctly. It is logical to use the RETC program to analyze measured soil water retention data. It would also be logical to use HYDRUS-1D to analyze transient flow data obtained during the instantaneous profile flow experiment. However, in such case the objective function would need to be defined using variables measured at different times, such as pressure heads versus time, water contents versus time, etc. It is illogical to use HYDRUS-1D for analyzing the instantaneous profile data when the objective function is defined using (quote) "pressure head from horizons centre block and K-coefficient determined by IPM as a function of soil water content", i.e., using no transient data. Such data (hydraulic conductivity and retention data) could be actually analyzed directly using RETC. I actually find it unfortunate to use the derived data (i.e., hydraulic conductivities calculated using the Darcy's equation) rather than the original data (measured water contents and pres-

sure heads at different times) in the optimization. One could actually use (in HYDRUS) at the same time the original data from the instantaneous profile experiment (water content and pressure heads versus time), as well as retention data measured in the laboratory to constrain the solution.

d) I also find rather unfortunate the term "K-coefficient", which is used multiple times (tens of occurrences) instead of "unsaturated hydraulic conductivity" of "hydraulic conductivity function".

e) It is important to realize that when you optimize alpha and n parameters using HYDRUS-1D, you are optimizing these parameters not only for the hydraulic conductivity function, but also for the retention curve. Thus while you may get better description of calculated hydraulic conductivities, you may be getting worse description of the retention curves. Have you compared those?

f) The entire manuscript needs to be edited for English. There are many grammatically incorrect or awkward statements.

Minor problems:

1. I do not know what equation (1) is, but it does not seems to be correct.

2. P307L10: What do you mean by "the square root relationship of theta(h)"?

3. P308L5: Kosugi model assumes "lognormal distribution" of what?

4. P310: What is DFM? I would not use acronyms if not needed.

5. P310, eq. 10: What do you get using this equation, if each pressure head measurement is obtained from a different soil horizon? To which horizon do you assign calculated hydraulic conductivities?

6. P310: What is the size of undisturbed samples used to measure retention curves?

7. P311L7: Rosetta can be used "to provide initial estimates of optimized parameters",

but not for the "initial fit".

8. P312L25: Why giving here the saturated hydraulic conductivities, when discussing "Soil water characteristic curve"?

9. P313: When giving parameter values, which have units, you need to give units. Such as for parameter alpha.

10. P313-314: This description of results is really long and should be shorten.

11. P313: What is D-Index? Define.

12. Table 1: The asterisk should be with the value, to which it refers (not with Ks).

13. Table 2: Whenever giving parameters, which have units, units have to be provided.

14. Table 2: Use the same acronyms for parameters as in the text (e.g., theta_r, rather than Q_r).

15. Table 2: Is there an "m" parameter in the Brooks and Corey model? Is there such parameter in the Kosugi model? Where does it come from?

16. Figure 1: What (a), (b), (c), (i), etc represent what? Describe.

17. Figures 2, 3, and 4: ditto. Do not use "K-coefficient"!

While the manuscript can eventually be an interesting contribution to HESS, very major revisions (considering my comments above) are required before the paper can be accepted.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 301, 2012.