**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

H. Cloke (Editor)

hannah.cloke@kcl.ac.uk

Please see the detailed comments from the two referees. Your manuscript should only be resubmitted after all of the substantial revisions requested have been undertaken. A much clearer and more comprehensive description of your experimental rationale and approach is needed to make your manuscript stronger and some more evidence and analysis is needed. Please note that referee 2 submitted their review in good time in relation to when they were asked to review. It was in fact a difficulty in finding a second reviewer to agree to the review which took the time. Please be careful in criticising in

this way.

Referee 1 notes in particular that you need to pay much more attention to details in the manuscript and correct the many mistakes, that you must make the manuscript more balanced and discuss the methodology in more detail and put the method in a better context so that it is clear what you are doing. Referee 2 notes that the "background and purpose of this Study" is not clear. Please describe your objectives very specifically and make sure the following experimental design and analysis meet these objectives sufficiently. Referee 2 notes that parts of the manuscript are confusing or are incomplete, and they do not feel they can assess the results and discussion at this stage because the method is not clear.

Importantly please add some further analysis to the paper as these sections need fortifying. As referee 1 notes "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." This would be a useful exercise. Also please look at a comparison of the retention curves, as referee 1 notes "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?".

You note in your response to referee 1 that "I would also admit that my understanding of HYDRUS 1D is still at infant stage.", and I would encourage you to consider resubmitting your manuscript only when you feel you thoroughly understand the model and modelling process of HYDRUS.

Please make sure you address all of the referee comments. I have not listed them all again.

Additional review comments from the Editor:

1. As is usual convention, please remove references from the abstract and just leave the names. These can be fully referenced in the main text.

2. I agree with the referees that the English needs checking carefully before a manuscript is resubmitted. Some initial examples: The first sentence of the abstract would better read "The Soil Water Characteristic Curve (SWCC) and the unsaturated hydraulic conductivity ....". In the abstract, the phrase "carried much prospects" would be better rephrased to "showed promise". Line 29. Change to "model predictions"

3. In the introduction line 7 please change to "availability of computer based models" and then specify what type of computer model you're talking about. Models for what purpose? Line 11/12. Explain what traditional methods are and why they aren't efficient.

4. Please include some clear discussion (in your introduction and discussion section) about how uncertainties are introduced to modelled results by parameterisation of soil hydraulic equations in models through use of field/lab data and pedotransfer functions. For example, a single optimal value for K might be better replaced by a distribution of suitable parameter values within an uncertainty framework (for example see discussion in Cloke HL, Pappenberger, F. and Renaud, J-P (2008). Multi-Method Global Sensitivity Analysis (MMGSA) for Modelling Floodplain Hydrological Processes. Hydrological Processes. 22 1660-1674. Also see the many works of Keith Beven on this subject, such as Towards a coherent philosophy for modelling the environment. Please relate these concepts to your own application.). You already mention briefly the problems of parameter uniqueness, but this is a large body of work and the issues surrounding the representativeness of parameters needs some further discussion.

5. What does this all mean when applied in practice for prediction? What are the implications of what you have found for general modelling studies. (See discussion of representation of the saturation uncertainty zone in Cloke HL, Anderson, M.G. and Renaud, J-P (2006) Development of a modelling methodology for the investigation or

C1662

riparian hydrological processes. Hydrological Processes. 20(1) 85-107, Can you provide some similar examples?).