

Interactive comment on “Hydraulic and transport parameter assessment using column infiltration experiments” by A. Younes et al.

Anonymous Referee #2

Received and published: 29 August 2016

The paper deals with an inverse modelling method determining simultaneously hydraulic and transport parameters from a packed soil column. Some of the questions posed are very useful for experimental work on flow and transport and will help future work to choose efficient experimental designs to obtain parameters. Overall the paper focusses on the methodological aspects without posing a clear hypothesis. With no clear hypothesis formulated, I would expect to have a stronger statement on the benefits of the methods employed and what we should be learning from this (not just stating that the methods used in the paper are superior over the methods other researchers have used). Even if we come up with better parameter estimation, do we have a better understanding of the physics of fluid flow in porous media? The authors should be stating what novel insights they expect from this type of numerical experiments. Furthermore, some of the findings are to be expected, for example the inclusion of both

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water content or out flow along with matric potential data should always provide better parameter estimation. In fact, the use of only one of those variables makes parameter estimation non-unique. An interesting aspect of their work is the impact of the length of the injection of the solute pulse. Can the authors provide some kind of explanation why this occurs?

Considering how fractional derivatives and continues time random walk have been used to describe solute transport in unsaturated soil, will the parameter estimation method give hints on systematic model errors (which require real world experiments). Certainly one short coming of the approach - it is assumed that the model is indeed correct.

To make this paper a value contribution I suggest the following:

(i) Include a clearer summary of what has been done on inverse modelling in the context of transient water flow and solute transport. Perhaps state the methods more explicitly that were used by other researchers.

(ii) The methods sections need more precise description of numerical methods used and experimental set up. I doubt this paper is reproducible with the information provided. The language is used in such a way, that true experiments were actually done. When the authors talk about experiments they mean virtual numerical experiments. This needs to be clearly stated earlier in the paper.

(iii) The discussion section needs a thorough revision to address the above points – clearly relate your findings to the work of others on parameter estimation. Currently the discussion focusses only own findings without setting a broader context.

Further comments:

Lines 74-75: When stating column length, column diameter should also be mentioned if real world experiments were used.

Lines 83-92: The research questions are not logical derived from previous research -

they were certainly retrospectively formulated based on the findings of study.

Line 113: There is an issue with the van Genuchten - Mualem model near saturation (hydraulic conductivity will decrease before air entry point as been reached)- will this affect parameter estimation.

Lines132-139: Be precise on what was exactly implemented. The numerical scheme should be exactly described (appendix or supplemental materials are sufficient for this purpose).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-295, 2016.

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