

HESS-2016-295 Reviewer Report

Younes et al., 2016, Hydraulic and transport parameter assessment using column infiltration experiments

General comments:

This research article introduces an inverse modeling study of the soil parameters of column infiltration experiments using MCMC sampler. General speaking, this study is novel, and provides important scientific contribution for understanding the soil parameters. I would suggest to be published in HESS after the following minor revisions and technical comments are addressed.

- 1) Ln 30-34: This sentence may be too long to read.
- 2) Ln 93-94: The benefits of the Levenberg-Marquardt algorithm should be briefly addressed here. Please refer to previous literatures.
- 3) Ln 117,120, 124: The number bullets should be 1), 2) and 3).
- 4) Ln 118-119: The authors only addressed a limited range of water content under moderately dry conditions. It is okay, but what about other conditions? Is there any specific reason that the author didn't analyze the water content in a wider range? Please provide more information.
- 5) Ln 151: How does the transport equation coupled with the Richard equation? Please provide more details
- 6) Ln 178-180: I'm confused about the reference solutions. If the reference solutions are from previous literature, please add citations. If the authors calculated the parameter values or measured from experiments, please provide more details.
- 7) Ln 185-187: How to determine the standard deviations? Are MCMC output and conclusion sensitive to the standard deviation values?
- 8) Ln 223-224: How did the authors determine the seven scenarios of measurements sets and periods of injection? Please provide more detailed information. If the design is based on previous studies, please add citation and be specified. In my understanding, the authors would like to claim that the soil parameters can be better estimated by C instead of θ , and non-intrusive measurements are good enough for parameter estimations. I hope to see a clear and specific explanation of the reasons for each scenario, highlighted before discussing the result of each scenario. For example, scenarios 2 and 4 compared the effect of C and θ to parameter estimation.
- 9) I would suggest to re-organize Fig. 1-7 as one panel figure, since they all present the match of simulation and observed data, and the individual plot may stand too much space in publication.
- 10) Ln 286-291: The authors explain that $(\theta_r, \theta_s) = 0.96$ is only observed and cannot be identified accurately in scenario 1, when water contents are not evaluated. I would suggest to highlight it in Table 3 as well in case if readers miss the text.
- 11) How did you make conclusion 4) (the estimation of the dispersivity is sensitive to the injection duration)? I didn't see discussion about this point before conclusion. Please specified the scenarios you based to draw this conclusion.

- 12) The readers can understand the conclusion more straightforward, if the sources of each conclusion are highlighted. For example, conclusion 5) is from a comparison between scenarios 2 and 4.
- 13) I agree with the comment ii) from reviewer 2. The authors should clearly state that the experiments are numerical experiment in the paper to avoid misleading. The revised manuscript still does not have a clear statement and description about the experiment and the observed data used in this study. This must be done before the paper can be published.