

Interactive comment on “Sensitivity and identifiability of hydraulic and geophysical parameters from streaming potential signals in unsaturated porous media” by Anis Younes et al.

Anonymous Referee #2

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The paper addresses the important topic of assessing the influence of hydraulic and geophysical parameters on streaming potential in the unsaturated zone. I think that the topic would be interesting to the journals audience. Furthermore the paper is generally well written and includes novel results. My main concerns and recommendation are as follows: (1) What is the notion behind replacing the numerical model with data-driven PCE in global sensitivity analysis? I mean PCE is often used when the computational cost is prohibitive, and off course, at the cost of reduced accuracy. However, the computational cost does not seem to be high in the current study. So justification is needed on this issue. (2) Why does the study use two different method for parameter estimation? Is the objective (a) comparison of the two methods, or (b) double checking

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the results (or possibly both)? I suggest that the authors clearly define the objective. Moreover, since the two methods are conceptually very different (e.g. sampling vs. optimization), if the objective includes (a), then attention must be given to other issues such as the very different and superior information content of the results in MCMC, and its ability to effectively employ prior information. (3) MCMC is not a method but a general class of strategies that may not necessarily be based on the steps described in page 17. Hence, I suggest that before describing the steps, the authors mention the specific algorithm used in the study (i.e. DREAM) and then focus their discussions on how DREAM works. Please also add reference for the MCMC steps. (4) Some other choices in the paper also require further explanations and justification. These include: (a) choice of the uniform priors (line 193), (b) choice of parameters of the Gaussian distribution for θ (lines 366-367), and (c) the logic behind the definition of scenarios in section 4.2.

Minor Comments: (1) The numbering of some sections requires correction (e.g. after section 4.2 we have section 3.1) (2) Line 83: Move “parameters” before the parenthesis. (3) Section 2.2: I also suggest adding a schematic figure and possible a photo of the laboratory setup. (4) Line 166: Data are generated “from” or “for”? (5) Line 186: Delete additional “a”. (6) Line 193: Why use the word “prior” and not simply “distribution”, since the authors are discussing GSA in section 3.1, and not a Bayesian inference method. (7) Line 230: Correct typing error for “blue”. (8) Line 289: Correct typo to “shows that:” (9) Line 357: Add reference for the DREAM software. (10) Line 378: Not all sub-plots of figure 3 are symmetric though (e.g. plot for α) and so some cannot be considered bell-shaped. (11) Fig. 2: The colors are not so distinct (e.g. blue and blue-green) and so the difference between the plots may be hard to conceive for some readers. (12) Fig 3 and 4: Purely as a suggestion, the histograms can be replaced with PDFs, as I think this would provide better visualization.