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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Quantification of the influence of preferential flow on slope stability using a numerical modeling approach" *by* W. Shao et al.

Anonymous Referee #1

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The authors numerically investigate coupled flow and deformation processes in an academic test case, a partially saturated hill slope. The flow is modeled with the Richards equation, preferential flow is accounted with a dual permeability model and the results are also compared with a single permeability model. The deformation is modeled with a linear elasticity model using Mohr-Coulomb as failure criterion. Flow and deformation are weakly coupled. The authors conclude that preferential flow has a positive effect on the slope stability for low intensity rainfall while it is vice versa for high intensity rainfall. The linkage of preferential flow with a dual permeability model to the slope stability analysis is new and the results are interesting. The paper is well written.

A few points require some further investigations and analysis: - Eq. 6: give the unit of Tau_w (m2/s) - Eq. 7: you use an arithmetric average for the interface hydraulic conductivity; why haven't you chosen a harmonic average which generally better approximates the fluxes between very heterogeneous media? - Below eq. 10: Boundary conditions may be specified for pressure head . . . - P. 13063: Why have you chosen the pore water pressure of the preferential flow do-main for the effective stress? Why haven't you chosen an averaged pressure of the matrix and preferential flow domain? - P. 13065: Can you explain why you have chosen alfa_w = 0.2 /m2. I can imagine that this exchange coefficient has a very important influence on the results. Therefore, I suggest to carry out a sensitivity analysis and to increase and decrease this parameter (or the product alfa_w k_sa) by one or two orders of magnitude. Please then check whether your conclusions are still valid. - P. 13072, last sentence: The numerical experimental results are compared with field studies and other published numerical results. You should mention that this is done in the following. I was searching for that in sec. 4. - P. 13074: check headline 5.3 for typo; 3rd line in 5.3 van der Spek -> Van der Spek - Conclusions and Abstract: Your conclusions are of course valid for the parameters you have chosen and which are typical (Tab. 2). You just have investigated the effect of different cohesion. The question is whether your conclusions are still valid when other sensitive parameters such as the exchange coefficient alfa_w have other values. A parameter study to sensitive parameters would help here. - Fig. 7: skip free line between Dual-permeability model and preferential flow domain - Fig. 8: the unit of Tau_w is m2/h not 1/m; Water distribution rate: Positive values . . . (add double point)

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