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Hydrology and Earth System Sciences Discussions

Interactive comment on "Characterization of groundwater dynamics in landslides in varved clays" *by* J. E. van der Spek et al.

Anonymous Referee #3

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The authors investigate groundwater dynamics in multi-layered fractured soils in the context of landslides. They idealize and conceptualize different parts of the subsurface system. Only few data are available. After a model calibration they obtain a reasonable agreement between simulated and measured hydraulic heads and a correlation between peaks in hydraulic heads and the occurrence of landslides. The paper is well written and organized and only needs few extensions for publication. I have read the discussion with the other 2 reviewers.

I have the following points to be discussed: Conceptual model: Instead of using 3 different models for the colluvium layer, the varved clay and the fissures and couple them, one could use one model for all. A double-continuum Richards or two-phase flow model for porous media: colluvium layer: fracture continuum enabled, recharge directly

included; varved clay: double continuum, bottom boundary: closed for clay, open for fracture / fissure domain; advantages: distance between fissures not necessary, no reservoir constant necessary; however in the calibration: fracture permeability, porosity, possibly more parameters; the authors should comment on that and should include this in section 7 if the feel it to be worth.

Model calibration: You have taken 4 parameters for the calibration and you have taken other parameters from the literature which I have not read. Do these parameters (e.g. saturated hydraulic conductivity and specific storage of silt) come from measurements or from another calibration? What would you expect if you would include these parameters in your calibration? Do you have a feeling for the sensitivity of these parameters?

Entrapped air: Comparing a two-phase instead of a Richards model for such a case would give an indication whether this aspect is important here; it might be the case; I refer the authors to the following publication where this aspect has been investigated for a similar case STADLER,L., HINKELMANN,R. & HELMIG,R. (2012): Modeling Macroporous Soils with a Two-Phase Dual-Permeability Model. Transport in Porous Media: Volume 95, Issue 3, Page 585-601, Springer Verlag, DOI: 10.1007/s11242-012-0064-3

My other minor and technical comments have already been addressed by the other reviewers.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 295, 2013.