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Hydrology and Earth System Sciences Discussions

Interactive comment on "A model of hydrological and mechanical feedbacks of preferential fissure flow in a slow-moving landslide" *by* D. M. Krzeminska et al.

Anonymous Referee #1

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Title: A model of hydrological and mechanical feedbacks of preferential fissure flow in a slow-moving landslide.

Authors: D. M. Krzeminska, T. A. Bogaard, J.-P. Malet, and L. P. H van Beek

The Authors analyze the Super-Sauze landslide (South French Alps) from an hydrological point of view taking into account the role played by fissures. They adapt the Spatially Distributed Hydrological and Slope Stability Model (STARWARS) linking the hydrological response of the landside to the evolution of the fissures network. The paper is very interesting and it can be published with minor revisions essentially regarding

geotechnical aspects. It is clearly written and most of the assumptions are sufficiently justified. In my opinion the only weak point of paper is the direct link between fissures formation and stability state which is not sufficiently justified.

In fact, the Authors consider that temporal changes in fissures volume and density are related to stability conditions through the relationship n. 2 (page 8; row 25) between safety factor and fissures volume. In this relationship:

- there are no (or limited) fissures if Fs»1; - the number and the volume of fissures increase as Fs decreases to 1.

In the case of high and medium plasticity clays, the process of formation of vertical tension cracks (see Figure 2d) assumes the maximum intensity during dry period (FS»1) while it is almost absent during wet period (FS≈1). This clearly contradicts the relationship 2 (page 8; row 25).

In the case of highly fissured-low plasticity stiff clays, approaching shear failure (FS≈1), it is possible to consider a different mechanism of formation and propagation of fissures as a result of a de-structuration process due to shear strain (induced by soil mass movements). The Authors seem to refer to this kind of mechanism; I guess.

But you'd better pay attention to the very different styles and magnitude (and hence different shear strains) that the same landslide may display along the slope and in different (dry or wet) periods. Different vertical profiles of shear strains can be induced in different portions of landslide (detach, transition, accumulation zones) in dry or in wet period. As a consequence, the process of formation of the fissures and its extension will be different and difficult to be simulated.

Hence, I would suggest to the Authors to specify that the process of formation of vertical tension cracks is to be considered as negligible. Moreover, they'd better to specify that the proposed relation is an empirical one that tries to link Fs to fissures but simplifying the true mechanism of formation and propagation of fissures.

Suggestions for the future: To better support the relation between Fs-fissures you could link the evolution of the process of fissures formation to the monitoring of displacements (see Figure 3) and, eventually, to the results of the inclinometer measures (if available).

You'd better explain the assumption on the saturated hydraulic conductivity by the results of your in situ or laboratory investigations (section 3.1).

Please add Greco et al., 2002 (Pag 3 row 14) in the references.

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