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Interactive comment on "Field investigation of preferential fissure flow paths with hydrochemical analysis of small-scale sprinkling experiments" *by* D. M. Krzeminska et al.

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We thank the Referee for the general and specific comments that constructively contribute to the improvement of our manuscript. Here we reply to these comments in detail. and will revise our manuscript accordingly.

SPECIFIC COMMENTS:

1)BROADER IMPACT: This work, and the discussion therein, adequately describe the hydrological processes occurring at these sites (..) the authors clearly demonstrate 3 different hydrological regimes. What is missing, is some discussion of what we learned from these observations: Possible questions: a. How are these three regimes related

to interesting geographic features, such as topographic position, aspect, etc...? b. How are the observed regimes influenced by the landslide, vs. a more stable hillslope? c. How do the observed regimes influence the landslide development? d. Are these regimes widespread in this location, or are they localized?

ANSWER/COMMENT: This is a very valid point of the referee. In our paper we focus on the use of relatively small scale sprinkling test for monitoring/investigation of fissure flow in the field and we test it on real landslide. The major part of the paper presents the results obtained from our field experiments and their case specific interpretation. We believe this quite detailed description of the field work results is necessary to show strength and drawbacks of proposed experimental set-up. The discussion part focused on collating our observation with existing hydrological concepts of the Super-Sauze landslide to show the 'reality-check' and the potential of the presented method to identify and quantify hydrological process distributed across the landslide. However, we do agree with the Referee that with this focus the broader perspective has been somewhat neglected whereas some additional discussion about broader impact of our observation would be beneficial. We learned for example from our experiments in the upper part of the landslide that pore pressure built up is modest as fissures and highly permeable matrix seem to drain the water easily and thus that gravity forces dominate the stability. On the contrary, the active middle part of the landslide consisting of secondary mudslide deposits retains its water quite strongly. The consequence can be a high re-activation of that part of the slope. This is also evident from terrain features. Comparing an active slope with the hydrology of a more stable slope is challenging, but clearly relates to the development of fissures and crack where material has been displaced in contrast to compression and deposition parts. The former giving rise to changed in filterability but also increased lateral transport, the latter reducing (temporarily?) precipitation infiltration for example. Our experiments and observations do not allow conclusions on the relationship between hydrological regime and landslide development. However, it is very tempting to speculate on it: as landslide displace they do change/adapt their hydraulic properties and consequently the pore pressure field.

This influences the geomechanical behavior of the moving mass can stabilize it but could also result in acceleration. Generally, the regimes we have found are widespread over the landslide. We will revise the discussion section accordingly.

2)APPLICATION RATE: When applying artificial precipitation, it is often difficult to get the precipitation rates low enough to mimic natural events. In this work, the applied rate averaged 40-60 mm/hr, which seems high. I think some discussion is warranted about whether these precipitation rates are consistent for the area. If not, discussion of the implications of such high rates is needed.

ANSWER/COMMENT:The referee is right, it is difficult to have constant "natural" rainfall intensities, especially with the use of a nozzle as too low intensities have as drawback a worse spatial homogeneous sprinkling intensity. The sprinkling was carried out in blocks of 15 min sprinkling and 15 min break with sprinkling intensity of approximately 20-30 mm.15min-1. This intensity is a trade off between the feasibility of the sprinkling equipment (pump and nozzle) and a realistic sprinkling rate (the applied intensity is comparable to the observed intensity of summer and autumn storms reaching 50 mm.h-1 in 15 minutes; Malet et al., 2003) and is high enough to ensure infiltration to both matrix and fissure compartments. The reference to the work of Malet et al. 2003 describing the character and the rates of rain patterns typical for the area of Super-Sauze landslide will be included in the text.

3)DEEP PERCOLATION: Deep percolation is brought up late in the paper (page 650), and does not appear to be included in the water balance calculation on page 642. I would include some mention of deep percolation (including your definition) when discussing the water balance. Deep percolation will have a significant impact, and cannot be ignored from a water balance perspective. More and more research has shown that systems previously thought to be underlain by "impermeable" bedrock are quite leaky (Graham et al., 2010, Tromp-van Meerveld et al., 2007, Aishlin and McNamara, 2011). It is unclear from your discussion and figures 4 and 6 how Deep Percolation is being dealt with.

ANSWER/COMMENT:We agree with the Referee that some more words about "deep percolation" is necessary. We used term "deep percolation" to refer to percolation that occurs or may occur below the depth of our analyses.. As we were not able to distinct between lateral groundwater outflow and vertical groundwater outflow, these two terms were merged. We will include this information while discussing water balance analysis (section 2.2, page 642). We will also include deep percolation in Figure 4.

TECHNICAL CORRECTIONS:

The English corrections has been double checked and implemented where necessary.

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