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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Hillslope experiment demonstrates role of convergence during two-step saturation" *by* A. I. Gevaert et al.

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This study presents a unique irrigation experiment carried out at the B2-Leo observatory to shed light on the role of convergence on formation of saturated areas during a very extreme long term precipitation event. The experimental setup and the quality of the underlying data are unique in the world. The study deserves without doubt publication in HESS. In the present form the study leaves a couple of open doors and misses to my feeling quite obvious opportunities to underpin the value of B2-Leo to benchmark theories, concepts and models.

Major points

The authors should discuss the dependence of the course of the experiments on the

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boundary conditions as natural hillslopes have no impermeable lateral boundaries. The proposed hillslope setup is thus at best representative for a very small set of natural hillslopes (bedrock topography equals surface topography and impermeable bedrock), which fit by the way very well to the TOPMODEL concept. Do you think the system would behave similar with permeable lateral boundaries? I think this issue needs to be discussed to decide whether the observed dynamics is typical for hillslopse or for small confluent catchments, where the assumption of no flow across the mantle is much more justified.

In fact it would be extremely interesting to benchmark TOPMODEL (which is still THE model for simulating variable contributing areas) with the experimental data and the observed evolution of the saturated area. Such a benchmarking would clearly improve the scientific significance of this study, by stepping beyond a pure description and interpretation of the experimental findings and fully explore the value of the experiment as well as underpin the potential of B2-Leo.

Total rainfall is 262 mm in 1 day, which is for instance 1 tenth of the annual rainfall amount in the Vorarlberg Alps (an area where induced landslides occur). In 1999 290 mm of rainfall fell in this area, however, within a couple of days. What is the return period of such an event in Tucson, what in the Alps? Landscapes where such events have a low return periods have a wet climate and are certainly characterized by strongly weathered, fine grained soils. How realistic is this setup thus to occur in reality (such an event on almost un-weathered soils)?

Technical points and suggestions - Figure 5: Might be instructive to plot cumulated storage against cumulative rainfall?

- Please specify the error margins of your measurements.

- You explain the overshoot of the soil moisture observations by the influence of the capillary fringe of the ground water table. Can you specify how this should work for a TDR or and FDR sensor with respect to the measurement principles?

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- How did you measure the retention curves?

- Please specify the hydraulic conductivity curve of the material. Do you expect ks to be anisotropic (now and in the long term future)?

- Subsurface hydrological dynamics at chicken creek (a large artificial hillslope) turned out to be pretty much contaminated by artificial structures (capillary barriers between cones when the site was filled). Do you expect B2-Leo to be free from this? If so I would expect symmetric patterns of saturation in Cross section B. This is not the case for the early stage of the experiment. Where does this come from - fingering?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 2211, 2014.