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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Analysis of an extreme rainfall-runoff event at the Landscape Evolution Observatory by means of a three-dimensional physically-based hydrologic model" *by* G.-Y. Niu et al.

Anonymous Referee #2

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This is an interesting paper that points to the enormous potential of the artificial hillslope laboratory, LEO. The results of the first experiment conducted in LEO are already interesting, however the description of the results has the effect of guiding the reader to more traditional questions. This is unfortunate, and I hope the authors can fix this problem in a resubmission at the end of this discussion.

First of all, when viewed one way, the results show that, however well-conceived, one can never achieve perfect homogeneity in the real world. However, it is clear that this

was already expected by the developers of LEO, in that the focus of the experiment on not reproducing the real world, but on exploring how heterogeneity evolves over time, indeed how hydrological variability and landscape heterogeneity co-evolve. The discussion of the results already indicate that this is already happening, in that the authors are ascribing differences between model predictions and actual observations to this emerging heterogeneity, explaining the compaction (even relative compaction) of the soils even as the experiment is happening.

Given all this, the focus on characterizing on the errors between outputs from various model configurations and actual observations, gives the impression that they are merely asking traditional questions, i.e., fitting a hydrograph, in this case for just one event. I am not against these details, as the modeler still must get the model to mimic the observations, and there is certain amount of equifinality in this fitting. However, I would have found the results more informative, for this event and for the best parameter combinations of the model, some deeper insights into the internal dynamics that led to the hydrograph that was observed. For example, the dynamics of the groundwater table during the event, the soil moisture, and the saturation area etc. would provide more insights. Note that it is here that LEO is most innovative and helpful compared to real world field experiments, the ability to observe the space-time dynamics of water partitioning. Also, any additional information on change of structure and heterogeneity will also be insightful, and will shift the focus in the appropriate direction.

Another comment on the presentation: from the beginning the authors framed the aim of the paper as hoping to explain the big difference between the observed and predicted hydrographs. This is the valid approach: however, towards the end the paper veers away somewhat from this goal. I was expecting a clear, conclusive statement on the causes of this difference, and I did not find it. They may want to make sure to go through the entire paper and ensure the main message is carried through to the end.

One final question/suggestion: the title has the word "extreme rainfall-runoff"> What is the motivation for this phrase? Do the authors think that the event studied is extreme

as to cause the erosion that happened? The 12 mm/hr intensity does not sound like too extreme to me.

Another question/suggestion about the title: it might be better for the title to reflect the main message coming out of the paper. As it is now, the title is somewhat neutral, and does not attract attention to the main question/issue that is really highlighted in the paper.

Overall, I like this paper and would like this paper to be eventually published in HESS. I would prefer if the paper undergoes some (perhaps moderate) revisions to address the concerns raised above and attract sufficient attention to some really important issues in hydrologic process understanding and distributed modeling.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 12615, 2013.