Interactive comment on "Relevance and controls of preferential flow at the landscape scale" *by* Dominic Demand et al.

Anonymous Referee #3

Received and published: 26 March 2019

This study investigated preferential flow and the underlying processes on mesoscale considering various soil textures, land covers and topographic characteristics. This is done by evaluating a rich dataset of rainfall and soil moisture observations. Furthermore capillary theory is evaluated for the occurrence of non-sequential responses of soil moisture profiles. The study appears to be appropriate for HESS audience. The main novel aspect compared to preferential flow studies on local scale is the spatial and temporal coverage and inclusion of various landscape characteristics to explain variability in soil moisture profiles.

Although this study seems to potentially fill an important knowledge gap in understanding preferential flow across scales and landscapes, the manuscript in its current state is not ready for publication. Primarily the structure and selection of results should be re-

considered, but also a more defined storyline could assist the reader to extract the main novelties of this study. In general, the manuscript could benefit from reconsidering what information is necessary to broadcast the main message. I recommend to consider a few key figures that conveniently show the reader the approach and main interesting findings, instead of a long sequence of tables and graphs. Lastly, the readability would greatly increase if the authors consider a key phrase in each paragraph that, perhaps almost trivially, highlights what should be learned from the given information.

For the structure of the paper, I would recommend to consider separation of the hypothesis and throughout the paper clearly indicate which sections address information for which hypothesis. I miss this in the paper. The hypothesis could possibly be broken up in two sections. For example: 1) PF is the dominant process during infiltration, and 2) capillary theory does not suffice to explain infiltration. These can be tested for the given explanatory factors, such as land cover, geology etc. Which also gives more structure in the result and discussion section.

The generalized linear model (GLM) provided insight in the explanatory power of a large set of variables. However, as anonymous referee #2 addressed, there are some limitations to this approach. I will not re-evaluate these points, but I instead would recommend the authors to consider the use of mixed effect models. This approach allows to include random factors that potentially explain variability but are not directly incorporated in the study design. Seen the authors use R, the packages 'lme4', 'lmerTest', and 'nlme' could relatively easily allow to explore the use of mixed effect models.

On a final note, I wonder if there is any indication that the contributing area of each site is independent of the occurrence of NSR? A correlation could guide towards rising groundwater tables and associated capillary rise, or horizontal flow. Especially with high antecedent soil moisture groundwater response could be relatively fast when contributing area is large.

Since Dr. Bogena and anonymous referee #2 have readily covered a large part of my

specific comments, and technical comments seem out of place seen the current state of this manuscript, I limit myself to only the following specific comments: âĂČ

P2L17 Seems out of context to mention hotspots or hotmoments, especially as a final statement of the section. The statement needs further elaboration and references.

P2L26 '. . . scale (∼km2) and' Is this referring to 1 km2 to be considered large scale, or is a number missing?

P3L11 This section seems out of place, considering reorganizing with earlier paragraphs covering methods.

P6L1 Appendix A: consider presenting standard errors of the K measurements

P8L15 How can observations at a single depth be considered sequential?

P11L5 I would start with the most interesting finding of this study, although it could be strictly seen as a result, I could see this information to be more suited in the methods section.

P24L10 The range of reported flow velocities both in this study and other reported studies generally seems extremely large. If the range is large to begin with, how is it remarkable that they fall in the same range? Perhaps I miss a part of the reasoning.

P25L15 Awkward sentence structure

P25L29 Although this seems like an insightful comment, are there any examples how this could be implemented, or is it readily tested on small scale? A reference would be useful here.