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Comment on hess-2022-117

Anonymous Referee #1

Referee comment on "Subsurface flow paths in a chronosequence of calcareous soils: impact of soil age and rainfall intensities on preferential flow occurrence" by Anne Hartmann et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-117-RC1, 2022

Hartmann et al. present work on infiltration experiments across a moraine chronosequence in the Swiss alps, spanning almost 14,000 years. They performed infiltration experiments on four plots of different ages, with each plot being subdivided into three subplots where different precipitation intensities were applied.

The work is a heavily revised version of a previously submitted manuscript. I was one of the original reviewers back then and suggested a rejection. This submission was deemed different enough to be considered a new submission, and I would agree with this assessment. The way the authors reworked the current manuscript makes it much more enticing and sets it apart further from Hartmann 2020a and 2020b (in my opinion).

In the introduction, the authors describe the need for identifying different flow patterns for potential integration into landscape evolution models. It would be interesting to revisit this idea in the discussion. What does the work suggest such an integration could look like, and more importantly, what would the practical differences be between the different flow types for such a model (especially considering that some of the differences between the plots appear minor, even though they were found to be significant)?

I am also wondering if the amount of rocks has an effect on the flow type. If a large fraction of the profile is taken up by rocks, percolating water will be restricted to the space between the rocks. The authors do include flow types that take into account rocks in the profile. From what I understand, though, this applies mostly to homogeneous flow that happens around the rocks. What would happen if a larger rock led to an effective partitioning of an otherwise homogeneous wetting front? (That is, if the soil below the

rock remained dry)

Further, it appears that some profiles exhibited a significant portion of rocks in the upper soil layers. Overland flow was not measured, but it could be beneficial to talk a little more about the potential impact of less water infiltrating at these sites.

In the discussion, the authors mention very briefly that the edges of the plots were not analyzed. I might have missed this earlier, but does this only apply to the outer edges of the 1x1.5 m plots or also to the borders between plots 1 and 2 and plots 2 and 3? If so, how big of a buffer was included? I could imagine that interactions around the inner boundaries could have an impact, too.

I think the revisions are a little more than just minor, but I am confident that the authors can address them.

General comments:

Page 4, Lines 9-11

What is the reasoning for having two plots of ~the same age?

7, 24+

Can you describe what the practical differences are between the flow types?

7,31

Do these indices depend on the effective width of the profile? If there is a flow restriction, for example from a rock, wouldn't that lead to a "compression" of the water flux through the narrower width? Is it possible that water from one experiment gets drawn into another subplot through matric forces?

9,13

Given the low n, there is a chance that the trend is random, even if it's statistically significant, no?

Fig 4

When there were rocks at or immediately below the surface, what happened to the water that couldn't access that space? Did it run off?

12, 16-18

Which appears to be the case for most profiles…?

13, 6-7

Is it really…?

Fig 6 and 14, 6-7

Curious to read why sometimes SAD is greater for lower intensities and sometimes greater at higher intensities.

18, flow type classification

A table with the percentages would be good here so that the reader doesn't have to piece together everything. Fig 10 is nice, but it is a little difficult to compare the length of the bar sections after "Matrix flow between rocks". Maybe something for an appendix.

20, Fig 11

I'm wondering if the percentage of rocks in a profile affects this as well. This harkens back to my earlier comment in which way rocks affect all these flow characteristics.

21, 5-8

I was thinking about this the entire time while reading the manuscript. Can you estimate infiltrated volume or surface runoff? I would imagine the rocks close at the surface play a huge role here and not just the soil properties.

23, 1-3

This makes sense to me. It could be a combination of both larger diameter and longer roots.

23, 10-16

I like that you bring this up. My initial interpretation would have been that the different external factors of the sites (which also affect landscape evolution) are more important than age.

23, 30-31

Didn’t you argue on the previous page that hydrophobicity could affect the infiltration patterns…?

25, 29-30

This is an important point that needs to be included in the methods (unless I missed it somehow). Does this only refer to the outer edges or to the inner boundaries as well? How much was excluded?