

Interactive comment on “Vectors of subsurface stormflow in a layered hillslope during runoff initiation” by M. Retter et al.

Anonymous Referee #2

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Comments to the manuscript "Vectors of subsurface stormflow in a layered hillslope during runoff initiation" by M. Retter, P. Kienzler, and P.F. Germann

The paper contributes to a better understanding of hillslope runoff processes. It uses a recently developed measurement technique to quantify the directions of the wetting front in a hillslope plot under mainly irrigated conditions. The aim of the study is well defined and the main conclusions seem to be supported by the presented results. The paper, however, needs to be worked through thoroughly in order to improve the readability and to clarify the experimental setup and analysis.

My main points are the problems with Eq.(2) and figure 5, see respective comments in the list below.

The English language should be looked over, see for example p 2533, line 6 "the tracer

time resulted 80 min, which was similar than time to concentration". There are also several misprintings, incomplete sentences and examples of inconsistent tenses and punctuation. I will not comment further upon them.

The points below should be considered before publication:

p2523 li 16 Glacial till may also be sandy with high permeability and no tendencies for preferential flow in soil pipes.

li 17 The sentence"... Beven and Germann (1982) considered infiltration, which is mainly preferential flow, as driven by gravity" is strange. Infiltration is not mainly preferential flow etc.

p2524 li 2 What is meant by "marked off"? Did you just mark it on the surface or did you enclose it by sidewalls on or below the surface?

li 17 Does the wetting front velocity refer to the bedrock? How could it be determined in lab, and how could such a small velocity (2 mm/year) be measured? The address of the reference (pers.comm.) should be given in the reference list.

p2525 li 2 The sentence "One obliquely...." is not clear. "them"?

li 13 Eq. 2 presumes that the water content represented by the initial volumetric soil moisture does not contribute to the flow, which is not true in the general case. The volume flux density is larger than (or equal to) q from Eq.2. This should be commented and the effect of this error should be quantified.

p2526 li 1 What is meant by "sensitivity"? Is it sensitivity to disturbances or to variations in the observed variable? Please express more clearly.

li 16 How could you ensure undisturbed soil between the steel rods, oriented in different directions, when installing them at depth (40 cm)?

p2527 li 18 Explain that the 1-m² plots were within the hillslope plots (i.e., subplots)

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p2528 li 10 How did you take the samples at the trench face? In the flow collectors (how were they constructed?) or directly in pipes (c.f. line 15). If in pipes, what about representativity?

li 24 There seems to have been 123 passages of wetting fronts rather than "123 wetting fronts". Each triplet gave 3 values for the same front if I understand correctly (and the different triplets measured the same wetting front, at different locations in the hillslope). Change wording.

p2529 li 3 What do you mean by "linear regressions of $\theta(t)$ between t_U and t_L "

li 7 I can find only the components of the vectors in table 1, not v_{tot} li 8 "the means" of what (not the means of the components according to the table) " $v_y = -1.1$ "? li 10 Vectors can not be "faster", and how did you measure the wetting front velocity in the bedrock?

P 2530 li 23 High velocities also occurred at depth (ID12 and 22)

P2531 li21 Were matrix and pipe flow these measured separately? (how?)

Li 27 I cannot see this conclusion, that "we always had the same initial loss". Please show analytically.

P2532 li16 It would be easier for the reader if you show the water balance data in a table, with comments in the text. Show also the data from 27 May.

P2533 li4 What is meant by "plot within the same order of scale"?

Li 5 What is "backlogging"?

Li 23 What is the evidence of macropores in the z-direction?

P2534 li4 What is meant by "The results presented state the moment of initial infiltration of the wetting front."?

Li 9 It must be considered that the wave-guides only measure unsaturated flow, the

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direction of the saturated flow it not seen.

Li 14 I don't understand the discussion in this paragraph, please explain better.

Table 1 Include Intensities and vtot. The layout of the table can be improved.

Fig 4, caption. What is meant by "A linear regression between tU and tl is assumed"

Fig 5 This could be the most interesting figure, particularly fig 5a). Together with the ID-numbers and the information in table 1 (and table 3 for irrigation intensity) it gives the main result of the study (after enlarging to make it readable and much work of the reader to combine all information). It is, however, very dangerous to use logarithmic scales here, since the dots do not represent the points of the resultants. (With linear scales the resultants would be represented by arrows from origin to the dots.) The risk for misinterpretation is particularly large since the graphs are embedded in "physical" descriptions of the hillslope (surface slope and the location of the bedrock). In fig 5a), for example, the first impression is that the directions of the resultants vary within a narrow range, not very far from 45 degrees down to the right. But the variation is much larger, with angles from nearly horizontal (ID 10) to quite vertical (ID 16). I understand the problem with the large variation of the magnitudes of the components, as commented in the text, but I strongly warn for logarithmic scales here. Use linear scales and draw the resultants (I tested such graphs on your data and they are quite readable). If you find it necessary, make special graphs for the smallest components.

An alternative, and to my opinion better way to illustrate the x-z components in table 1 is to draw a "normal" hillslope profile and put the arrows at their locations in the hillslope (with one such graph for each irrigation event).

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