

Interactive comment on “Formation of runoff at the hillslope scale during intense precipitation” by S. Scherrer et al.

Anonymous Referee #2

Received and published: 31 August 2006

General comments

The aim of the manuscript is to understand the processes of runoff formation. Using a total of 18 plot sites the authors determine a wide range of reactions to sprinkling and identify the relevant processes and attributes. The paper presents an extended wrap-up of two previous, well known studies (Scherrer, 1996; Scherrer and Naef, 2003). Especially the important latter one, that introduced a decision scheme, receives further detailed evidence by means of the recent manuscript paper.

The overall quality of the paper is good, wording is fine and the presentation of the work is clear. It is recommended for publication in HESS subject to changes according to the comments given below.

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Two major comments:

a.) The paper particularly aims to improve flood modelling as well as runoff prediction of a site. I am confident, that executive users (any modeller or person in power of flood prediction) would like to get more information on the different sites. Here, the notice "visual inspection of the plot surfaces and vegetation cover gave no hint" [p2527 line 22] makes even more curious. Further, three forested plots were also included, which surely looked different. Therefore, I suggest the authors should profit from HESS being an online journal, that easily allows to include small colour pictures at no extra charge. E.g. update Table 1 with 3x3 cm pictures of the entire 18 different plots. In my opinion, this also allows to link to a similar study on surface runoff under torrential rain, that focused on presumably similar plots as your plots 2, 12, and 16 in the alpine area (see Markart et al., 2004). They assigned surface runoff coefficients to soil and vegetation properties. Overall, I think it is useful to also discuss these findings in your section 5.1 and sharpen your manuscript towards 2006, almost 10 years after the initial report of Scherrer (1996) (as a suggestion see major comment b.); and reassess the very last paragraph of your conclusions). I also wondered why the introduction did not include Scherrer (1996) and Scherrer and Naef (2003) and therefore the manuscript does not clearly emphasises on the progress made. Connect to the conclusion of Scherrer and Naef (2003) that states "currently the scheme is under test" and present the results of your 18 (!) plots.

b.) Referring to the section on "Are reliable process predictions possible?" (p 2541). [line17]: "knowledge" [line 27/28] "evaluation is very generally difficult"; and also p 2542: [line3] " combination of observations" and [line 7] "clearly identified" ->To me, the method presented (reliable process predictions) still depends on the individual experience. The reproduction by fellow scientists (traceability of results) is not guaranteed. Please discuss this aspect and [p 2537, line 5] in your section "Are reliable process predictions possible?". Connect also to the conclusion of Scherrer and Naef (2003) where you state "by workers not involved in its development... objective assess-

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ment".

Specific comments

p2527 [line 2]: "to cover a broad range of conditions" versus [line 10]: "fairly homogeneous sites were selected". To me, this is a conflict. You may use the inserted colour pictures, as suggested, to clarify this task. [line 26 ff] The description of sprinkler need further details. First, assuming your maximum slope of 55%, a major influence results from pressure differences within the tube system. Did you use pressure reduction utilities to optimize the sprinkling distribution? Second, the kind of nozzles (e.g. Veejet or Perrot; 360°, 180° and 90°) are of further interest. Overall, please provide information on sprinkling homogeneity. How did you measure input (no rain gage is mentioned)? [line 29] "therefore the rainfall intensity varied gradually". I do not understand, please rephrase.

p 2529 [line 15]: "with 15% eventually running of". Why eventually ?

p 2531 [line 20/21]: "less than a quarter to total runoff measured" to me this already needs to be stated in section 3.1.2 experimental observations. Instead you could finish the sentence "... (3 in Fig. 4) was of minor importance". [line 24/25]: Soil characteristics need to be shifted to section 3.1.1 already. So far, there is no sufficient thread that leads from observations to interpretations. Please more clearly separate these aspects.

p 2537 [line 5]: So far, I can not see any hard criteria to distinguish between SSF1 and SSF2. Is there a specific time interval? This also applies to Fig. 9 where processes changed from SOF3 to SOF2, but no measure is provided. You also state later [line 28+next page] that the distinction is "somewhat arbitrary". If you aim for reliable simulation of runoff, the timing is essential and should be treated more carefully here.

Technical corrections

p2526 [line 9]: Bronstert (1999) and Jones and Conelly (2002) both emphasized on modelling the bypassing. Also include further field evidence of the phenomena.

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p2527 [line 22]: "Visual inspection"; add "Here, visual inspection..."

[line 25]: "study area of 60 m²" repetition, replace by "the plots"

p2528 [line 2]: "angles between 20 and" according to Table 1 angles range between 15% and 55%.

[line 8]: TDR-probes, please provide details of electrode length for horizontally and vertically installed probes.

[line 9]: Did piezometer drillings always reach the underlying rock? At plot 4 and 6 it seems that they did not.

p2530 [line 10]: delete "At site 18, where"; to shorten it as section 3.1 contains site 18

p2536 [line 7]: insert comma, "Both, the time...and ..."

[line 25]: correct "From this diagram it is obvious"

[line 26]: rearrange and speciy to "of selected hillslopes in Switzerland"

[Fig. 1]: "The sites were selected to cover ... Switzerland" rephrase to "The selection of sites aimed to cover ... Switzerland"

[Fig. 4]: legend " water level at the end of experiment" extend by "as recorded by piezometer P3"

[Fig. 9]+[Fig. 10]: Resolution of graphic is not sufficient. Particularly the width of major ticks of the axis' needs to be enlarged.

[Table 1]: insert a separate columns for number (1-18) and events correct parent Material of site 11 from "Conglo-merate" to small case letter

[Table 1]: insert horizontal space between entry 17 and 18

[Table 1]: the slope of site 1 is stated with 29%. Please confirm the number as I suppose it to be 15% referring to Faeh (1997) table A.1, page 175.

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References

Faeh A.O. (1997): Understanding the processes of discharge formation under extreme precipitation. A study based on the numerical simulation of hillslope experiments. Mitteilung VAW 150.

Markart G., Kohl B., Sotier B., Schauer T., Bunza G., Stern R. (2004): Provisorische Geländeanleitung zur Abschätzung des Oberflächenabflussbeiwertes auf alpinen Boden-/Vegetationseinheiten bei konvektiven Starkregen (Version 1.0). BFW-Dokumentation, Wien: 83 S. <http://bfw.ac.at/rz/bfwcms.web?dok=4009>

Scherrer S. (1997): Abflussbildung bei Starkniederschlägen. Identifikation von Abflussprozessen mittels künstlicher Niederschläge (Runoff generation during intense rainfall—Identification of runoff processes using sprinkling experiments). Mitteilungen der VAW 147, Zürich.

Scherrer S. and Naef F. (2003): A decision scheme to identify dominant flow processes at the plot-scale for the evaluation of contributing areas at the catchments-scale. Hydrological Processes 17(2), 391-401.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 2523, 2006.

HESSD

3, S853–S857, 2006

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