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Hydrology and Earth System Sciences Discussions

Interactive comment on "The influence of soil moisture on threshold runoff generation processes in an alpine headwater catchment" *by* D. Penna et al.

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We thank the anonymous referee for her/his comments, which helped to clarify some points and improve the revised version of the paper. The reviewer's comments are quoted above the authors responses.

General Comments: "In this paper, the authors examine the influence of soil moisture content on runoff triggering processes. Overall, the paper is interesting, and reads fluently. I have only a couple of comments that I recommend the authors to address, because I believe it would help to place the paper more in context with other, related

research, and would help to clarify some items in the paper."

Specific comments:

1."I am missing a discussion on the variable source area concept. I am sure the authors are aware of this concept, and it seems to be related to this research. I would recommend a discussion of this concept in the introduction, and a discussion of how the results in this paper relate to this concept."

The variable source area (VSA) concept is related to this research even though it only partially agrees with the observed hydrological dynamics at Bridge Creek Catchment. The expansion of the saturated areas from the riparian zone to the foot of the hillslopes with increasing wetness is similar but the threshold behaviour of hillslope activation and the subsequent abrupt increase in runoff is not explained by the VSA concept. We will add a comment on this in section 4.4 "Results and Discussion" of the revised manuscript.

2."Also, there has already been performed quite a bit of work on model reinitialization using remote sensing soil moisture data ("data assimilation"), for the improvement of modeled discharge peaks. This goes back for about a decade. Lately, more research seems to be done on this subject. Perhaps it would be a good idea to also discuss this research in the introduction, because it seems to be related to the results in this paper."

We will add a short comment on this in the introduction of the revised manuscript.

3."Section 3.2. It is stated that the average of the four probes was in good agreement with the average of the measurements at the 26 points. We really need proof of this, because it is a central result for the remainder of the paper. I would recommend a table or graph (or both), where this statement is substantiated."

We agree that we need to proof that the four soil moisture sampling points monitored continuously are representative of the soil water content conditions of the hillslopes. Therefore, we will add a Table in the revised manuscript presenting the correlation co-

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efficients between the mean values of the four TDR measurements at 0-30 cm depth and the hillslope-averaged soil moisture values at 0-6, 0-12 and 0-20 cm depth for the two study periods. Correlations ranged between 0.72 and 0.90, were always statistically significant for both hillslopes and, as expected, increased with increasing depth. We will also add a Figure that shows the good agreement and the temporal consistency between the average of the four soil moisture points and the hillslope-averaged soil moisture at the different depths.

4."Section 3.3. It is stated "baseflow was substracted from total flow to obtain the value of event stormflow. Event runoff coefficients were defined as total stormflow (in mm) divided by the rainfall. A couple of questions come up here. First, how was the baseflow estimated or measured? Please explain this, because the results and the conclusions are probably going to be very dependent on this. Further, this implies the assumption that there is no contribution from the ground water table to the runoff, because the rainfall leading to base flow is not substracted from the total rainfall. This does not seem very realistic, and is going to have a strong influence on the results further in the paper. The authors either need to justify this methodology, or to reprocess the rainfall data as stated above."

The separation between baseflow and stormflow was carried out using the constant-k method proposed by Blume et al. (2007), with the only difference being that the break in slope in the recession that identified the end of storm runoff was determined visually and not analytically. We subtracted the baseflow from the total flow in order to compute the event-based runoff coefficients, defined as the ratio between event stormflow volume and total rainfall. The computation of event runoff coefficients requires that the hydrograph is separated into the baseflow and stormflow components and therefore, by definition, it does not include baseflow. This procedure is common in the literature (e.g., Sidle et al., 2000; Bowden et al., 2001; Schellekens et al., 2004; Mertz and Blöschl, 2009; Norbiato et al., 2009; Marchi et al., 2010) since it allows the assessment of the fraction of storm precipitation that is converted in runoff during, or immediately

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after, a rainfall event. We will include the reference to the Blume et al. (2007) paper in the revised manuscript.

References:

Blume T., Zehe E., Bronstert A., 2007. Rainfall–runoff response, event-based runoff coefficients and hydrograph separation / Réponse pluie-débit, coefficients d'écoulement événementiels et séparation d'hydrogramme, Hydrological Sciences Journal, 52: 5, 843 - 862. DOI:10.1623/hysj.52.5.843

Bowden, W. B., Fahey, B. D., Ekanayake, J. & Murray, D. L. (2001) Hillslope and wetland hydrodynamics in a tussock grassland, South Island, New Zealand. Hydrol. Processes 15, 1707–1730

Norbiato D., Borga M., Merz R., Blöschl G., Carton A., 2009: Controls on event runoff coefficients in the eastern Italian Alps. Journal of Hydrology, 375, 312-325, doi:10.1016/j.jhydrol.2009.06.044.

Marchi L., Borga M., Preciso E., Gaume E., 2010. Characterisation of selected extreme ïňĆash ïňĆoods in Europe and implications for ïňĆood risk management. Journal of Hydrology 394, 118–133, doi:10.1016/j.jhydrol.2010.07.017.

Merz, R., Blöschl, G., 2009. A regional analysis of event runoff coefïňĄcients with respect to climate and catchment characteristics in Austria. Water Resources Research. doi:10.1029/2008WR007163.

Schellekens, J., Scatena, F. N., Bruijnzeel, L. A., van Dijk, A., Groen, M. M. A. & van Hogezand, R. J. P. (2004) Stormflow generation in a small rainforest catchment in the luquillo experimental forest, Puerto Rico. Hydrol. Processes 18(3), 505–530

Sidle, R. C., Tsuboyama, Y., Noguchi, S., Hosoda, I., Fujieda, M. & Shimizu, T. (2000) Stormflow generation in steep forested headwaters: a linked hydrogeomorphic paradigm. Hydrol. Processes 14(3), 369–385.

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