

Interactive comment on “Hillslope characteristics as controls of subsurface flow variability” by S. Bachmair and M. Weiler

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Received and published: 10 July 2012

General comments

The paper by Bachmair and Weiler searches for the controls of subsurface flow variability on hillslopes. They carried out an intense field study to obtain information on SSF on a grass field, and two forest sites. From the field data they derived response and predictor characteristics. In an elaborative statistical analysis they tested the partial correlation between the response variables and the predictor characteristics.

Furthermore, the authors applied the Random Forest approach to analyse the explained variance of the predictor variable. The study is very relevant and in-

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teresting for hillslope hydrology. However the study limits itself by only looking at one predictive characteristic at a time, while maybe combinations of predictive characteristics can better explain the variance in SSF. I think this point should be discussed.

The paper is well written and well structured. Sometimes the paper is difficult to follow, because of the often used acronyms. It would be very helpful if an additional list of acronyms will be added, with a short explanation of the meaning and the units.

Specific comments

P6893 L03: you may add [Gerrits, A.M.J., Pfister, L., Savenije, H.H.G. (2010): Spatial and temporal variability of canopy and forest floor interception in a beech forest, Hydrological Processes, Vol 24, 3011–3025.] as an additional reference for persistence of throughfall patterns.

P6895 L04: Opening bracket is missing near Koeppen classification.

P6895 L09: Order figures in text is order appearance of figures. Hence change order figure 2 and 3.

P6896 L05: Change sentence into: “However, many wells are shallower, due to . . .”

P6897 L01: What was the collecting area of the totalizers?

P6898 L05: None of the five selected events cover a winter period. Was there a specific reason for selected those five events? Please explain.

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P6898 L07: I do not understand the meaning of $AREA_{NORM}$. What do you mean by area below the water table time series? Is this simply the average water level over a certain time (normalized to well depth)? What is the unit of $AREA_{NORM}$?

P6898 L12: Please indicate better that 'index range is 0-1' is referring to $INDEX_{ACTI}$ and $INDEX_{150}$.

P6898 L25: Make a separate heading/section for 'missing data'. And improve layout of the subsections 'seasonal scale', 'event scale', and 'entire time series'.

P6899 S2.4: It will highly help the reader if an overview (list of acronyms) of all assessed characteristics is given with short definition and units.

P6899 S2.4: I think the predictor variable 'soil depth' is an important control for SSF that is missing in the analysis (Hopp & McDonnell, 2009). I recommend to add this, although I understand that this parameter is difficult to determine.

P6899 L17: I assume that THROUGHF is defined as percentage of rainfall?

P6901 L4-17: As correctly discussed by the authors, the STEMF index is arbitrary. Main missing characteristic in STEMF is the tree type. In general, deciduous trees have higher stemflow rates than coniferous, due to the tree architecture (upwards or downwards pointing branches). The latter prefer to drain the water along the branches to the edge of the canopy, while deciduous trees prefer to drain the water like a funnel to the bark of the tree.

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P6901 L23: Change sentence to “. . . for 82% of the wells; the rest of the wells have. . .”

P6904 L04: What is m_{try} ?

P6904 L24: To me the spatial pattern of $AREA_{NORM}$ does not differ that much between seasons and events. Only season 3 for the coniferous forest differs significantly.

P6905 L3-6: Define when a correlation is weak, moderate or high.

P6905 S3.2: Define when a correlation is considered low, moderate or high.

P6905 L12: Define AWI as Antecedent Wetness Index in the manuscript.

P6905 L11-13: I do not understand this indicative conclusion. Please elaborate.

P6906 L14-21: Add the not shown data in a supplement.

P6906 L21: What is the base case?

P6907 L18-27: How is it possible that the explained variance of all wells (n=90) is higher than the forest (n=60) and grass (n=30) separately (related to fig 4)?

P6909 L25-29: Why is THROUGHF not equal to 100% at the grass site?

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P6910 L16-19: The study reveals that the hillslope characteristics only explain the spatial variability of the water table to some extent. This is true if one considers the predictive characteristics separately. But very likely certain combinations of occurring predictive characteristics will better describe the water table. For example: a thin soil layer in combination with a throughfall hotspot can cause high SSF. But if either the soil layer is not thin or there does not exist a throughfall hotspot high SSF might not occur. I think this is the main limitation of the study. Some discussion on this topic is recommended.

P6911 L19-29: same comment as previous. I think it is too strong to conclude that vegetation is of minor importance for SSF based on this study.

P6912 L07: Replace Gerrits, 2010 by Coenders-Gerrits et al, 2012. In this study I also found that throughfall has a minor effect on SSF and that the influence on soil moisture is only for a short period of time (it's a balance between throughfall pattern and bedrock topography). Hence it is not contradictive.

P6930 F2: Keep legend in the same range to make a comparison easier.

Change Gerrits et al, 2009 into: A.M.J. Coenders-Gerrits, A.M.J, Hopp, L., Savenije, H.H.G. and Pfister, L. (2012) The effect of spatial throughfall patterns on soil moisture patterns at the hillslope scale. accepted for publication in HESSD

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 6889, 2012.

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