

Interactive comment on “Modelling dominant runoff production processes at the micro-scale – a GIS-based and a statistical approach” by C. Müller et al.

Anonymous Referee #5

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General comments

The paper aims to model dominant runoff production processes with a respect to regionalization (page 1688, lines 2-3). The methodology consists on determining the Dominating Runoff Process (DRP) on the basis of the classification given by Scherer and Naef (2003; Hydrological Processes). Two new approaches were developed and their results compared to an existing DRP reference map established by Schobel (2005; Report in German) on two sub-watersheds of the Zemmer basin: the first approach is GIS-based, and the second uses discriminant analysis of the characteristics of the watershed. Results show that the first approach is linked to the geological prop-

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erties of the watershed (i.e. permeable and impermeable zones), while the second revealed a strong dependence to topography (i.e. slope, profile curvature, flowline density and length, first and second derivative of DEM).

This objective is of international interest for understanding and modeling runoff genesis on un-gauged watersheds. However, the paper presents only technical results (GIS application, statistics interpretation) on only one case. There is no validation of the approach neither on other watersheds, neither using hydro-meteorological data. It is not obvious if the results can be generalized and applied on other study cases. My major comments concern:

1. The objective of the paper: The introduction ends (page 1680, lines 4-9) by presenting the objectives of the paper to develop two different models for regionalization of different runoff processes. The abstract starts also by presenting the methodology used and did not states why we do this work. But, why to develop different models, and how these models will be used in practice? Once the main hydrological processes identified on each zone, how to model hydrological processes? For what category of spatially distributed models the resulting maps of the study (Figures 3 and 4) will be used? And how to use these maps in practice, and for what range of application cases: is it for flood modeling at the event scale for example? Second, why two models using different approaches, and does the objective is to select one of the two approaches proposed? If yes, which one (the paper does not give any response)? If no, how to proceed in practice for regionalization, and what approach should be used?

2. The methodology used: The methodology compares the results of the two different approaches to a reference model. But, what is the accuracy of the reference model? Moreover, the discriminant analysis was done on the basis of the observations obtained on the reference map. Consequently, it is normal to find in the results of the statistic approach (the slopes as a major factor for example) the input of the reference map established on the basis of slope classification of the method of Scherer and Naef (2005). Please also give a map illustrating the results of the application of the statistic

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approach (similar to Figure 4 for the GIS-approach).

3. Domain and limit of application of the two approaches: The paper is based on only a comparison between the two approaches and a reference map on an experimental site. There was no validation on other watersheds, using new cartographic data not already used in the phase of analysis of the two approaches. Can results of Tables 5 and 6, and Figure 6 be generalized? It is not obvious that the two approaches will give good results on other basins. The two approaches needs to be validated on other basins, and by discussing the domain and limit of application of each approach: Does the domain of application of the two approaches limited only to the Rhineland Palatinate and Luxembourg regions as stated by the authors? Can the approaches be used in other hydro-meteorological conditions? What is the spatial scale of application? When to use one approach instead of another? What about comparing approach 1 to approach 2?

4. Hydrological processes: A large part of the paper concerns the interpretation of technical results, such as crossing maps in a GIS or analyzing statistical procedure results (i.e. Table 5), or comparing areas between the reference and the modeled maps (Table 6, Figures 3 and 4). However, the paper lacks of discussion on hydrologic processes: What are the main hydrologic processes on the studied watershed and how to model these processes? Do hydrological processes remain the same on a given pixel during the whole year? What about the spatio-temporal variability of these processes function of rainfall intensity, water table level, initial conditions of soil moisture? The methodology developed by Scherrer and Naef (2003) is considered as a reference, what is the accuracy of this approach and what is the domain and limits of application of this approach?

5. Modeling dominant runoff production processes: As stated above, the paper does not give a clear response to the objective announced in the title. The word modeling must de defined clearly, because the model used in the applications refers mainly to crossing maps technique and statistic analysis. There are no applications to calculate

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the runoff flow production at the local scale. The paper needs to be strengthened by showing an application case of the methodology presented to simulate runoff production at the local scale for various hydrological processes. This needs the use of hydro-meteorological data (e.g. rainfall-runoff, water table level) in order to show a concrete application case of modeling, and in order to validate the approach on measured data. A sensitivity analysis must be done and discussed in order to establish what are the main parameters in modeling runoff processes.

Specific comments

- . DEM: Please indicate the accuracy of the DEM used. How slopes were calculated on each pixel and how a mean slope was calculated on hillslopes or on a group of pixels (for example page 1682, line 1 and in the whole paper)? What is the accuracy of slope calculation on flat areas?
- . There are a lot of references in German (for example the paper of Schobel (2005) is cited 11 times). In order to help the reader, a short synthesis of the main results of the papers in German should be given in the main text.
- . Page 1678, line 4: Please indicate the range of areas for micro-scale.
- . Page 1682, line 1: The reference (PBS, 2006) is not given in the reference list. Please explain also the abbreviation PBS.
- . Page 1684, Lines 2-4. Please explain the origin of the F-values 2.71 and 3.84?
- . Page 1681, Line 16: The references of Müller (2007) and Müller (2008) do not exist in the reference list. May be Müller (2007) should be replaced by Müller et al. (2007).
- . The reader cannot easily interpret the numbers given in Table 5. The values given needs either to be further discussed or synthesized.
- . I do not understand the meaning of the different colors on Figures 2a and 2b. What represents PBS on Figure 2a? What slope is used on Figure 2a, is it the local pixel

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slope, or a mean slope on a group of pixels?

. The legends of Figures 5a and 5b are not clear. The characters on the x-axes and y-axes on Figure 5a are too small. What represents the minimum and maximum values of each Function.

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