Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-218-RC3, 2017
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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A method to employ the spatial organisation of catchments into semi-distributed rainfall–runoff models" *by* Henning Oppel and Andreas Schumann

Anonymous Referee #3

Received and published: 8 June 2017

This study presents a new method for analyzing the spatial organization of the catchment properties relevant for rainfall-runoff modelling. The method is applied for subdividing the catchment in sub-basins with minimum internal variance of the analyzed properties. This can be relevant for reducing the uncertainty in parameter identification of semi-distributed models, which discretize catchments in units to be modelled as lumped. It can be also exploited for designing stream gauge networks. The method is based on a "distance-factor function", which describes the spatial variability of a given catchment property with respect to classes of flow path length. The performance of the proposed method is evaluated on four large catchments in Germany and Czech, by evaluating the "pore volume" and the terrain slope. A significant reduction of the

variance is achieved for the pore volume. HBV model is also applied for evaluating the impact of the proposed catchment discretization on the simulated catchment response. The results show a higher Nash-Sutcliffe Efficiency of the discharge simulated with the proposed catchment discretization with respect to two other benchmark methods.

The proposed methodology appears to be promising, but the manuscript needs to be improved a lot.

The algorithm is not clear. Many equations are not formally correct. Equation (3) describes a threshold value for the variance of the catchment property. I do not understand the theoretical motivation behind the definition of this threshold value. The exponent parameter "e", described as non-linearity factor, is not mentioned in the following paragraphs. Is this a calibration parameter? What was the value applied in the examined case studies? It is not clear why it appears only in the numerator and not in the denominator. Equation (3) is not a weighted sum of the class variances if "e" is not equal to 1. Anyway, the motivation to weight the variances by their differences with respect to the maximum variance is quite unclear.

The readability of the paper is very poor. I needed to read it a few times to get a clear picture of the paper content. A revision by a native speaker can improve the paper. However, I also think that the structure of the paper should be revised. The sections dedicated to the description of the algorithm should be improved by adopting a more rigorous mathematical formulation. Many paragraphs are verbose, with comments that are not relevant for understanding the proposed methodology. The appendix does not help either.

The evaluation based on the comparison of the HBV model output performances is not convincing. The outcomes depend on the adopted calibration procedure, which is not clearly described. An analysis of the parameter uncertainty would be more valuable.

The evaluation of the proposed methodology could be limited to the analysis of the variance reduction, while the analysis of its impact on the simulated catchment response

could be discussed in a second manuscript.

Reducing the length of the paper, by focusing on the essential aspects, may improve the impact of the research.

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