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Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Spatial organisation of catchments – assessment and usage for impartial sub-basin ascertainment and classification" *by* H. Oppel and A. Schumann

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Reviewers' major comment 1: Missing validation of the proposed method by means of a hydrological model, therefore Technical note rather than research article.

- Response -

As already discussed with S. Gahari, we acknowledge the need to demonstrate the opportunities of the proposed method for hydrologic applications. These are not exclusive hydrological modelling but also regionalisation issues. By the application of the proposed methodology in the framework of one or more hydrological models, we would only gain information about the interplay of the GIS-based analyses with the particularly used model structure. The opportunities to parameterise the chosen model and other benefits from our method are closely related with its model structure.

If we interpret your request on a more practical application as a demand for a common way of comparison, with a result that is evident for readers, we propose the following additional analysis: we subdivide the used catchments by the existing gauging network. Obtained subdivisions can be compared to the outcomes of our method. Additionally we will apply a common approach for further zonal subdivision (based on land cover as proposed by (Lindström et al., 1997)). With this analysis we could compare our results on the one hand with a benchmark (nevertheless we are aware that hydrometric networks fulfil also other tasks and are not designed to capture different hydrological characteristics of landscapes only) and on the other hand we establish a further field of application. Results from the algorithm can be used to examine existing gauging networks or as suggestion for spatial resolution for models/ hydrometric networks in ungauged basins. To demonstrate this, we added a new section (4.3) for the paper. New section is placed after line 10 on page 12 in the original manuscript. Moreover results from the new section were incorporated into the conclusions.

Reviewers' major comment 2 and detailed comments 2 3: Explanation of the algorithm is detailed and hard to read.

- Response -

The methods sections intended to describe the methods and algorithm in a way other researcher were able to reproduce its functionalities. The high degree of detailing goes to the expense of intelligibility. To enhance intelligibility the method section of the revised version has been split into a description of objectives and functionality in Section 2 and a more detailed explanation of procedures in an appendix. Additionally, we changed the performance measures $\alpha 1$ and $\alpha 2$ (Eq. 7 9 in the original manuscript) to ratios of variance to make results more palpable. Discussion sections have been adjusted to new evaluation numbers and revised for better intelligibility

Since these points required major revisions we uploaded a new version of the manuscript to the supplement of this commentary.

Detailed comments (Reviewers' Comments (C), Authors Response (A))

C1: please define what the physiographic system is. And what does "more critical" mean? A1: Following passage has been inserted on page 2, line 5: "Contrary to analysis of the hydrologic system where the crucial variable (discharge) is known, the variable(s), yet the number of variables causing the characteristic hydrological behaviour are mostly unknown. This makes the analysis of the physiographic system (the interplay of topography, soil land cover, etc.) more complex than the analysis of the hydrologic system"

C2 C3: Already addressed in response to major comment 2.

C4: Page 7, line 3: Wrong references. A4: References have been updated in course of revision.

C5: "Page 9, lines 5-10: I would suggest to add here an equation that explains how the sigma after separation is calculated, instead of using just words" A5: New section including equation has been added to the new methods section.

C6: "Page 10, line 12: do you mean "...has been performed aiming..."?" A6: We assume denoted reference actually aims to line 17. Passage has been revised.

C7: "I cannot understand exactly how the resampling has been done. I would suggest to explain it better" A7: Explanation of resampling experiment has been extended as follows: "The basic concept is to examine structural identical catchments with a different range of featured values. First step is to examine the spatial organisation of pore volume in the Mulde as it is. Then we change the specific values of pore volume and repeat the analysis. If performance values are similar, the assumption about dependency of performance on the range of values has to be rejected. In order to change the characteristic values in a reasonable way, we did not change the values randomly but

exchanged data of two natural catchments. Accounted by their similar size, the Mulde and the Salzach catchment were chosen for resampling. The exchange of pore volume between these two catchments has to retain the order and arrangement of the original catchments. Therefore we assigned high pore volume values of the original basins to high pore volume values in the exchange basin and applied this scheme to all values. Then the values were exchanged. By this procedure sequences along the flow path like: first high pore volume then low pore volumes have been restored, but the actual pore volume values has changed. The same exchange of values has been applied to the DEM, as the root of slope values. Figurate, the alpine structure of the Salzach has been shifted to soil and heights of the Ore Mountains, and the middle mountainous structure of the Mulde to an alpine soil and topography. If the performance in these resampled basins is identical to the performance in their origin basin (e.g. resampled AWC Mulde and original AWC Salzach) the assumption about dependency of performance on geomorphologic structure has to be rejected."

C8: "Page 10, line 27: this sentence is confusing? What do you mean by "geomorphologic structure and the individual values"?" A8: Geomorphology addresses the interplay of spatial arrangement of topography, soil and other catchment characteristics. The actual values of the single characteristics for example the amount of pore volume are addressed in this sentence. Expanded explanation is included in the beforehand (A7) cited excerpt.

C9: "Page 11, line 21: do you mean "spatial extent"? If so, correct also the following occurrences of the wording "spatial extend"" A9: Misspellings have been corrected.

C10: Subjective choice for classification in Sec 4.3, should be discussed. A10: Following passage has been added on page 13, after line 17 in the original manuscript: "In summary the automatically ascertained sub-basins and zones have been used to categorize regions of catchments into different physiographical types. These types were designed to represent different surface and soil patterns. For the actual categorisation we used the density of defined zones and used gathered information

(Sec. 4.2) about the link of stream network patterns and zone density to derive a classification scheme. However, the absence of an impartial threshold required the (more or less) subjective choice a threshold value for classification of the sub-basins. Therefore the presented results have to be considered as a prospect to future work and possible applications of the algorithm."

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-486/hess-2016-486-AC3-supplement.pdf

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