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Hydrology and Earth System Sciences Discussions

Interactive comment on "Comparative assessment of predictions in ungauged basins – Part 1: Runoff hydrograph studies" *by* J. Parajka et al.

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Author response to review 2

We would like to thank the reviewer for her/his positive, constructive and very helpful comments on the manuscript. We have addressed the comments as follows (our response is in italics):

This paper is well-organized and clearly written. I enjoyed reading this paper, which has a number of noteworthy strengths, such as the development of synthesis methodology which allows to summarise the information from myriad of case studies. As such, this is a much-needed development in the PUB project. At the same time, a few theoretical and empirical issues need to be considered for the paper to be published. These are

reported below.

P380, L24-25: "Four catchment characteristics are analysed: aridity index, mean elevation and catchment area." These are three characteristics.

Corrected.

P381, L8-9: "Catchment area is an indicator of the amount of rainfall data that is available for runoff estimation in ungauged basins, since larger catchments tend to contain a large number of rain gauges." This sentence is worthy of a comment. The authors should be more precise concerning the relationship between mean areal rainfall accuracy (i.e., estimation variance), amount of rainfall data (in terms of raingauge number or raingauge density) and catchment area. For a constant raingauge density, the estimation variance decreases with increasing the catchment area (Lebel et al., 1987). However, even the raingauge density may increase with increasing the catchment area, given that most raingauges are located in low lying areas.

Yes, we agree with the reviewer. In response to this comment, we have added following sentence: " With increasing area also the estimation variance of areal rainfall decreases and areal rainfall might be biased by increasing number of stations locating in lower parts of the catchment (Lebel et al., 1987)."

P388, L20: "Overall, this very clear pattern of an increase of the performance with catchment scale may be due to two reasons. The first is a trend for an increasing number of raingauges within a catchment as the catchment size increases." See the above comment concerning the sentence at P381, L8-9.

In response to this comment (and comment of reviewer 1) we have added following sentence into the section 4.5: "... a trend for an increasing number of raingauges within a catchment as the catchment size increases. This trend likely reflects the relation between raingauge density relative to the correlation length scale of the rainfall (Schaake (1981)."

P390, L29: “To avoid fragmentation and duplication, it might be valuable to group the world into classes of similar behaviour, based on some kind of classification scheme and then to narrow down the number of models adopted.” This is a laudable effort. However, the authors should not miss that most of the conceptual models were developed as process-neutral tools. In the words of the HBV developer (Bergström and Graham, 1998): “Most hydrological models consist of a model structure and more or less empirical parameters which are tuned in the calibration process. Thus, the same model structure can be used for a great variety of basins as only the parameters are given different values. This means that the model structure is general but not the parameters.”. It is likely that an inverse process may be developed: the introduction of a catchment classification system in hydrology may serve (or trigger) the development of new pseudo-conceptual models which reflects the physical characteristics of a catchment class by limiting the number of model parameters.

Yes, we agree with the reviewer that there are several other options how to proceed with further research and development in the future, but we prefer not to extend this part of the manuscript.

Figure 7: for consistency with the other figures, the variable EPA/PA should be reported as aridity index.

We have revised the figure accordingly.

References

Bergström, S., Graham, L.P., 1998: On the scale problem in hydrological modeling. Journal of Hydrology, 211 (1-4), pp. 253-265.

Lebel, T., Bastin, G., Obled, C., Creutin, J.D., 1987: On the accuracy of areal rainfall estimation: a case study (Cevennes, France). Water Resources Research, 23 (11), pp. 2123-2134.