

Interactive comment on “Understanding Hydrologic Variability across Europe through Catchment Classification” by Anna Kuentz et al.

Anonymous Referee #1

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This paper uses established methods to classify regions with similar physiographic characteristics and with similar flow signatures to determine the best predictive relations at ungauged locations. For this reason, the manuscript reads more as a report rather than a novel contribution to the literature. For example, in lines 13-15, it seems the manuscript goals do not seem to be driven by scientific hypothesis but more by having a large set of data and wanting to develop/explore some relations which may (or may not) be useful at some later point. In this way, I think the motivation for the study seems weak as a scientific contribution. Despite this, I do believe that the novelty of the manuscript is in the application of these methods over such a large spatial domain. As hydrologic modeling efforts expand to cover continental scales, the ability to upscale existing approaches for model calibration across large ungauged regions becomes a limiting factor in these efforts. This point should be emphasized more in the

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manuscript to elevate the impact of the work beyond an application of existing methods to a larger region than had been tested previously.

1. The selection of flow signatures needs more details as to how they were selected. Olden and Poff (2003) do not from my remembering of the paper - as the authors indicate in line 16 - provide 9 signatures. Their paper attempts to reduce redundancy in the 200+ statistics that have been used for hydro-ecologic classification but they do not provide a definitive reduced list. More details need to be provided as to why these signatures were selected, particularly because their usefulness in applications is not part of the analysis in the paper. This reads as quite an arbitrary choice.

2. In lines 12-13, the comment is made that this type of analysis has not been applied at the continental scale “including large rivers with human alteration...” Do the catchments examined here have human alteration? This is not noted in the methods? Does this bias your results?

3. In line 18, the statement is made that “identified gauging stations that should be further explored and filtered out...” Was this actually done?

4. In Section 2.3, how were variables determined to be significant in the regressions? What diagnostics were used? How many variables were allowed to enter in each equation? It may be useful as an explanatory tool to see which variables are significant but to make predictions (which is the goal of this work), one needs to adhere to good statistical practices. How were these practices followed?

5. I found myself questioning the value of Section 3.1. I do not think this offers any additional information beyond what can be determined from the CART and regression analyses. This section also contributes to the manuscript reading more as a report as this section seems to explain what could be characterized as exploratory data analysis that is completed before one settles on an approach and hypothesis to test. I also think that the manuscript is a bit laborious in its reading and removal of this section would help streamline the manuscript.

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6. Section 3.2 seems to be missing a reference to how the classification was applied to the data. At the very least, reference Section 2.2 to describe how the classification was completed.

7. I may have missed this but I think it is necessary to develop regression on the flow signatures using the entire dataset to compare to the regression results obtained for the classes. This analysis would determine the objective improvements provided by first classifying the data. If this analysis has been completed, please refer to this in the text when discussing the results.

8. There are two papers that I direct the authors to for potential citation.

Singh et al. (2014) used CART to classify model parameter behavior across the United States and may be helpful to motivate some of other contexts in which CART has been utilized for model parameterization at ungauged locations.

Oudin et al. (2010) ask almost the same question as this paper in how physiographic similarity is related to hydrologic similarity, although they answer this question using actual model results.

Oudin, L., A. Kay, V. Andréassian, and C. Perrin (2010), Are seemingly physically similar catchments truly hydrologically similar? *Water Resour. Res.*, 46, W11558, doi:10.1029/2009WR008887.

Singh, R., S.A. Archfield, and T. Wagener, 2014, Identifying dominant controls on hydrologic model parameter transfer from gauged to ungauged basins - a comparative hydrology approach, *Journal of Hydrology*, doi: 10.1016/j.jhydrol.2014.06.030, 2014.

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