

Interactive comment on “Clustering CAMELS using hydrological signatures with high spatial predictability” by Florian Ulrich Jehn et al.

Anonymous Referee #1

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Jehn et al. classified the CAMELS catchments based on hydrological signatures, and subsequently investigated the link between catchment attributes and the classes. The conclusion of the study is that catchment behavior can mainly be attributed to climate in regions with homogeneous topography, but that this is more difficult in regions with heterogeneous topography.

Unfortunately, my perception is that the conclusions of the study are based on a fallacy. The main problem can be found here: “If climate were the main driver, the clusters would be located along a climatic gradient. However, this is only true for the eastern half of the United States (for a climatic map of the United states see (Beck et al., 2018)). In this part of the United States, the low relief allows large regions with a uniform climate, that only changes of larger scales.” If looking at the map in Beck et al.

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(2018), but also Peel et al. (HESS, 2007), or Knoben et al. (WRR, 2018), indeed the eastern part of the US shows large regions with uniform climate. But the maps also all show the large scattering in climates in the west: there is more spatial variation in climate in the western part of the US. This therefore seems no justification to state that climate is less relevant in regions with varying topography - there, the climate is just more variable too. This is also confirmed by the results of the study, where precipitation falling as snow is found as one of the main indicators in the west. "This implies that climate is a good indicator for the discharge characteristics as long as the topography is homogenous." seems therefore a too strict and incorrect conclusion, that does not necessarily follows from the results / figures. Furthermore, I wonder to what extent 'homogeneous topography' can be found as criterion, when looking at the catchment scale, considering that most catchments in CAMELS are rather small.

Besides my disagreement with the main conclusion, I consider the insights gained from the paper low compared to already available literature, especially considering Addor et al. (2018) and Knoben et al. (WRR, 2018). What did we learn from this study about the relation between attributes and signatures, or catchment clustering, that was unknown before? Especially given that I disagree with the main conclusion. If is it the method applied (PCA combined with clustering), then further elaborate on the methods and better explain everything that is done and how it differs from other studies. This also needs explanation why this method would provide insights that cannot / haven't been obtained with other methods. I would like to encourage the authors to dive deeper into the material and expand the analysis, and have a critical look at their own conclusions.

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