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Hydrology and Earth System Sciences
Discussions

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

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General comments: This paper examines the CAMELS catchments and clusters them using hydrologic signatures that have been previously found to have high spatial predictability. Overall this study is somewhat unsatisfying. Little new physical insight is gained in understanding how we determine similarity across catchments. The results do agree with past studies, which is a good test of the previous work. However, what does this specific study bring to us? Previous results discussed here, e.g. Addor et al. (2018) (Fig. 4), and Newman et al. (2015) (Fig. 12) found the same results. Aridity is the primary driver of basin behavior given the catchment scale attributes used, followed by other climate indices (e.g. snow). Finally, one of the primary conclusions drawn from the clustering results needs to be reexamined (specific comment #2).

Specific comments:

1) Is 10 clusters necessary? Why does 10 make this study similar to others? Did those studies arbitrarily pick 10 also? I wonder if a similar cluster selection method is better, rather than the same number of clusters. A more detailed justification in the methods section is necessary.

2) Many of the attributes have high co-variability. For example, elevation and temperature/fraction of snowfall, elevation and mean slope, forest fraction and elevation (in the western US) are likely candidates. Addor et al. (2018) discusses this briefly, but much more could be done here.

It would be good to understand this co-variability and modify the discussion accordingly, particularly the conclusions on lines 173-180. Spatial proximity or the attributes defined as climate by the authors are bad predictors in areas with heterogeneous topography precisely because topography and climate are intertwined. That does not mean that climate is a poor predictor of catchment behavior in those same regions.

3) Could more explanation be given as to how the clusters contain basins from very different locations (e.g. cluster 4)? There is some discussion in the appendix, which is good, but this cluster highlights limitations in our current clustering methods or application of those methods. How could other hydrologic signatures be used to provide more discriminatory power? Is predictability in space the best metric to determine which signatures to use in a study like this?

Also, it seems like more discussion on the issues/benefits of using this method (clustering on principle components) using already aggregated data (signatures and catchment averaged attributes) would be useful. This could help the community learn more from these various clustering studies. The authors already provide a summary discussion relating these results to other studies, so I do not feel like this is out of scope.

Minor comments: 1) The sentence starting on line 55 and ending on line 59 is a very

long run-on sentence. It is hard to follow and should be reworked. I suggest checking the manuscript for other instances of run-on sentences.

Figures: 1) Please consider increasing the contrast in the cluster colors in Figures 1 and 3. Specifically clusters 1-3, and 4-6 are hard to visually separate.

Sincerely, Andrew Newman

References:

Addor, N., Nearing, G., Prieto, C., Newman, A. J., Le Vine, N., & Clark, M. P. (2018). A ranking of hydrological signatures based on their predictability in space. Water Resources Research, 54, 8792–8812. https://doi.org/10.1029/ 2018WR022606

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