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Hydrology and Earth System Sciences Discussions

Interactive comment on "Exploring the physical controls of regional patterns of flow duration curves – Part 3: A catchment classification system based on seasonality and runoff regime" *by* E. Coopersmith et al.

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Overview

The authors' stated purpose is to produce homogenous groups of catchments within the continental USA with respect to monthly climate and runoff regimes. They propose 4 indices (obtained from climate and streamflow data) as a means of classifying catchments, and discuss the rationale for their selection. The authors use an automated

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technique to produce a hierarchical grouping of catchments, based on a particular combination of the 4 indices. In Figure 14, the authors show the monthly flow regimes for each of the resulting groups.

Specific Comments:

1. It has been common practice to make classifications of seasonal climate regimes, or of seasonal flow regimes, but not of both at once. By doing both simultaneously, the authors have taken a new approach; I think it is a legitimate choice which may have some advantages, but they need to point this out more clearly, because it explains some of the choices they have made. Why did the authors choose to classify the seasonality of climate and flow regime? Why did they not just classify the flow regime?

2. In my experience, successful (in the sense of widely adopted) classifications depend on well-informed subjective decisions. In this case, the decisions include the selection of the 4 indices, the particular objective function chosen, and method for splitting catchments into groups. I think the authors should note some of the major alternatives which they did not pursue (e.g. indices which quantify the amplitude and/or phase of P-Ep or which quantify proportion of precipitation which falls as snow, an objective function which scaled the variances differently, a different splitting/grouping method), and why not.

3. The authors refer to the idea of extending the Koeppen classification so that it applies to hydrology. If the purpose of the paper is to help develop a Koeppen-like system which classifies seasonal flow regimes, why not adapt or build on the decision tree approach shown in Figure 2 of Haines et al (1988)? That paper only uses the monthly runoff data, and does not use climate data. Why do the authors consider that a classiflcation of seasonal hydrology requires any data beyond runoff data?

4. The authors do not provide any evidence to substantiate their bold claim that the four indices ". . . represent the minimum amount of information that is needed to classify regime behavior within the continental US". Where is that evidence?

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5. Another way of asking the same question is to seek clarification over the authors' choice of objective function. Why is "regime similarity" defined as being composed of similarity in seasonality, aridity, timing of precipitation and timing of runoff?

6. I find the rationale behind the 4 indices chosen is acceptable, but incomplete. If the purpose is to identify a minimal set of variables which can be used to discriminate amongst different seasonal regimes, why are there no comparisons of competing groups of variables, nor any quantitative measure of the success of this particular set of 4 indices. Indeed how is success quantified? For example, what is the within-group and between-group heterogeneity of monthly flow regimes for the groups shown in Fig 14?

7. "a key objective of this research is the classification of regime behavior using an absolute minimum quantity of data" The authors have not shown that all 4 indices are essential. Would the results have been similar if one or more of the 4 indices was omitted?

8. "several classes of catchments are distinguished, in which the connection between the catchments' regime behavior and climate and catchment properties becomes self-evident" I do not think that the connections are self-evident; indeed the description of processes in the Conclusion relies on a considerable body of knowledge (e.g. roles of snow and frozen soil) not included in the classification.

9. How similar are the flow regimes of the groups derived? [the graphs in Fig 14 are too small to gain more than a qualitative impression – I cannot read the vertical axis to see the units or scale]

Reference

Haines A T Finlayson B L and McMahon T A 1988 A global classification of river regimes. Applied Geography 8 255-272. Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 7085, 2012.

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