**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.

Anonymous Referee #4

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This manuscript addresses the important issues of catchment classification and the need to understand controls on catchment similarity.

I have several comments on this manuscript:

I have read one of the other manuscripts (Part IV) in this four-part series and I am uncertain of the innovative contributions of this manuscript, particularly in relation to the other manuscripts. The manuscript does not use the flow-duration curve in the

analysis and the context of this work in relation to the other three papers is not clear. I am also not convinced a classification on the four seasonality variables moves forward the science of catchment classification beyond previously published work. To address these concerns, the literature review needs to be strengthened to make the case for why this analysis is innovative and unique relative to other published classifications. The introduction should also include more detail about how this paper relates to the others in the series.

My other major comment relates to the use of the four similarity metrics. Two of these metrics incorporate streamflow: 1) the aridity index and 2) the timing of maximum runoff. Therefore, I would not characterize the conclusions as having power "for predicting regime behavior across the continental US." (p. 7111; line 2) In my mind, regime dynamics go beyond only timing of the maximum runoff and mean annual streamflow (which is part of the aridity index) and I do not think extrapolation is justified. This again makes me question the unique contribution of this manuscript.

The clustering algorithm description is detailed but does not mention why this particular algorithm was selected over others. Is there something more desirable about this type of clustering algorithm than other algorithms?

I am not sure this manuscript contains enough new and unique contributions to be considered a stand-alone paper. I do commend the authors for their analysis of the stability of the classes by using a smaller dataset of catchments and in how they assigned class names to the resulting classification. It is my hope that the authors' responses to these comments will serve to underscore the innovations in the paper and that the paper will ultimately be accepted.

Editorial comments:

p. 7100, 8-16: This paragraphs reads differently from the rest of the text. Should there be a reference here that is used to describe the algorithm?

There are a few places where the text is quite informal and should be edited:

p. 7100, line 3: Remove "from scratch." Section 4.4: Use of "Big 6." Can you say "the largest six" classes in place of this? p. 7112, line 9: Should be a question mark at the end of the sentence and not a period.