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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Coherence of Global Hydroclimate Classification Systems" *by* Kathryn L. McCurley Pisarello and James W. Jawitz

Kathryn L. McCurley Pisarello and James W. Jawitz

jawitz@ufl.edu

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We thank the reviewer for these helpful comments. The Reviewer comments are listed below, along with our response to each. Most comments require only minor edits. In some cases, we describe revisions to the manuscript (with line numbers), and we recognize that the revised manuscript is requested in a subsequent step.

REVIEWER 1

The submitted manuscript suggests an innovative and parsimonious climate classification system for hydrological applications. A detailed comparison of system coherence

obtained from four established and four proposed climate classification systems is provided. The proposed classification looks interesting and promising for several hydrological applications, although the paper needs some improvements before publication. In what follows, the authors may find key and minor comments.

Page 3, l. 83: How did the authors perform this? By subtracting long-term mean annual from annual values? Please add more details on this.

Response: We thank the reviewer for calling attention to this. As suggested by the reviewer, we have added clarification (line 103).

Page 3, l. 89: KPG - please define acronym at first occurrence.

Response: Corrected (line 33).

Page 4, eq. (1): is it correct to have y over-bar, or is it y_m over-bar (see "monthly mean" as reported in l. 95)?

Response: We agree with the reviewer that this was not precise, and we have clarified the meaning of y over-bar in line 116.

Page 4, l. 106: "established" rather than "veteran"?

Response: We thank the reviewer for this suggestion. "Legacy" is now used in line 136 (note that "established" was used already in the previous sentence).

Page 4, l. 107: I would suggest to add citations immediately after KPG and HDL.

Response: Corrected (line 136).

Page 5, l. 136-137: I recommend the authors to show this uniform CDF in Figure S1, or, better, add a new figure in SI showing the comparison between empirical and analytical CDF

Response: As suggested by the reviewer, we updated Figure S2 in SI to show the comparison between the empirical and analytical uniform CDF.

Page 5, l. 147: select between "means" and "k-means" and apply it consistently

Response: We have elected to retain “k-means” as this is the name of the clustering approach, while “means” refers to input variables and/or variables assessed for coherence. The respective usage of each term is consistent with those definitions.

Page 5, l. 150: "CV of mean annual ET" instead of "ET mean CV"

Response: Corrected accordingly (line 189).

Page 5, l. 151: "system" instead of "systems"

Response: Corrected accordingly (line 190).

Page 6, l. 158: Referring to zone complexity, more details on thresholds are needed. I suggest the authors to move this part from SI to the main paper and add a discussion.

Response: As suggested by the reviewer, we have updated this in the main text (section 2.6, lines 196-202) and SI (under added section “Multivariate climate classification system selection”) to enhance clarity.

Page 6, l. 159: in SI, coherence is multiplied by 1.50. Are the authors assuming that coherence in WCE system can be larger or equal than KPG plus 50% KPG? If this is the case, please clarify this in the main text and also in SI. In SI, numbers in squares are not clear. If it is a product, simply add a dot between numbers.

Response: As the reviewer suggests, this has been corrected.

Page 6, l. 162: From SI: "Hierarchically, water budget coherence and number of zones were given highest priority. Therefore, the P,PET clustering system with 22 zones (denoted Water-Energy Clustering), was chosen for comparison against the other climate classification methods." How do the authors choose this? The authors should better explain this fundamental part in the main paper and also add more details on the sensitivity analysis performed for the number of zones.

Response: As suggested by the reviewer, and similar to the previous comment, this has been updated in the main text (section 2.6, lines 205-210) and SI (under added section “Multivariate climate classification system selection”) to enhance clarity.

Page 8, ll. 197-203: only the last sentence seems to be reasonable. Other comments try to justify the definition of ETA and ETC systems and support their performances, but both ETA and ETC show similar performance as MHR and KHC. Actually, except for CV(ET), even the proposed systems show similar performance compared to established systems MHR and KHC. This was somehow expected since the authors defined ET-based systems. I would suggest to improve this discussion by highlighting that WEC is the best model from the new ones. "similar P coherence to KPG": I cannot see this from Table 1, where CV(P) for KPG=0.38, ETA=0.56, ETC=0.47.

Response: As suggested by the reviewer, the language in the text has been changed to more definitively reflect that WEC is the best system (lines 235-236). However, the statements preceding this conclusion that were questioned by the reviewer are supported by K-S tests, as noted in the Table 1 heading and as now added to line 232. The values cited by the reviewer are the means for CV(P), but as shown in table 1, the standard deviations of the distributions are relatively large for CV(P), resulting in statistically similar values for all methods except WEC, again as indicated by bold in Table 1 (corresponding to K-S test results).

page 8, l. 215: please explain what phi over-bar means

Response: This has been corrected in line 247.

Page 8, ll. 216-217: the authors are invited to show this in SI. Actually R2=0.25 is very low.

Response: This has been removed.

Page 10, l. 235: "Discussion and conclusions" instead of "Discussion"

Response: We thank the reviewer for calling attention to this. This is corrected.

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