MS Title : Use of streamflow indices to identify the catchment drivers of hydrograph
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Responses to Reviewer Comments

We sincerely thank Editor Elena Toth, Dr. Wouter Knoben, and the anonymous reviewer for offering critical reviews and constructive suggestions that helped us sharpen our thought process and enabled us to improve the presentation of the manuscript. We also appreciate their assistance and patience in examining the work. We provide here our responses to their comments.

The line numbers mentioned in "Response" correspond to the "Clean version" of the revised manuscript.

Editor's comment

Dear Authors,
I thank you for your new revision work, where you addressed the additional concerns raised by the two referees. Referee #1 has further revised your presentation and is overall satisfied by your changes, suggesting a careful revision of the text and of the clarity of some of your descriptions and phrasing in the discussion. I approve your decision to merge sections 4.1 and 4.2, as suggested by Ref#2 (in the new Section "Spatial Variability in Streamflow Indices and Relation of the Streamflow Indices with Catchment Attributes") that was necessary in order to provide the basis for the analysis and interpretation of the proposed indexes in relation to the catchment attributes spatial distribution. Section 4.2 (previously 4.3) is still a bit detached from the previous part, but, eventually, it is simply a focus on the investigation of the relation of the streamflow indexes with the two climatic attributes (fraction of snow and aridity), considered as the most influential of the set of attributes, and you added it in order to deepen the analysis that in the previous section was based on the "lumping" in clusters. Actually, I still find that the introductory part of section 4 may be improved, to clarify and explain the layout of the presentation of the results, and you may consider rephrasing it in order to better address Ref#2 comment on the connection of the section ex-4.3 with the previous subsection.
While I agree that a discussion of the next steps ("Hypothesis testing"), as suggested by Ref#2, would certainly provide additional value to the analysis, I do not think that such absence prevents the work from being publishable and maybe the Authors can address such issue in future papers.
I have appreciated the substantial work you did in the two revision rounds: the paper is certainly much improved in respect to its initial form, thanks to the constructive and patient suggestions of the two expert referees, that I thank again for their precious help.
Best wishes,
Elena Toth

Response: We are extremely thankful to you for all your critical comments and valuable suggestions that helped us improve the manuscript.

As suggested, we have now rephrased the introductory part of section 4 for better readability. Please see line numbers (lines 222-242)

We have also addressed the Ref#2 comments by clarifying the descriptions and rephrasing the corresponding discussion. Please see our responses to the comments of the anonymous referee.

Anonymous Referee#2:

I thank the authors for taking into account our comments and suggested changes. I just have a final comment on the writing of the manuscript, which I think can still be improved to some extent. Sentences throughout the manuscript are unprecise and a little unclear. I give a couple of (non-exhaustive) examples:

Lines 261: "dense vegetation cover". Not clear what of the CAMELS attributes from the table S1.

Lines 271: "the catchments of cluster 3 have the largest snow storage". Snow storage is not among the CAMELS attributes used and presented in table S1. Perhaps the authors refer to frac_snow?

Lines 274: "low precipitation seasonality". Does it mean low values of the seasonality index (i.e. winter precipitation seasonality) or uniform precipitation throughout the year?

I suggest carefully revising the manuscript in its writing to improve its clarity and precision.

Response: We sincerely thank you for all your critical comments and for allowing us to revise our manuscript. We provide here our responses to each of these comments.

1. Line 261 says that Cluster 1 is characterized by dense vegetation cover and low elevation, resulting in little annual snowfall.

   From Figure S3, which shows boxplots of the catchment attributes of the clusters (Jehn et al., 2020), we can see that Cluster 1 is mainly characterized by a high forest cover constitutes, located in the southeastern and central plains. We refer to Figure S3 for this mention, and it is now included in the revised manuscript. The sentence is now modified in the revised manuscript (line 270) as follows:
   Cluster 1 is characterized by high forest fraction and low elevation (Figure S3), resulting in little annual snowfall.

2. Line 271: The catchments of Cluster 3 have the largest snow storage in the dataset.

   Yes, thank you for pointing this out. We have now rephrased the sentence (line 279) as follows:
   The catchments of Cluster 3 have a high fraction of precipitation falling as snow (Figure S3).

3. Line 274 is not discussed regarding lower precipitation seasonality, but this term has been mentioned on line 264 of the manuscript.

The precipitation seasonality is termed as seasonality and timing of precipitation (positive (negative) values indicate that precipitation peaks in summer (winter); values close to 0 indicate uniform precipitation throughout the year). From Figure S3, Cluster 9 experiences negative values of the seasonality index (i.e., winter precipitation seasonality). So, we have now referred to Figure S3 for this and rephrased the sentence (line 272) as follows:
However, Cluster 9 encompasses all of the United States' southern states, with negative precipitation seasonality (winter) and higher forest cover and green vegetation (Figure S3).

4. We apologize for the lack of clarity in the description. Previously, we have not referred to the corresponding Figure and Table numbers in a few places. This was the reason for the lack of clarity in the discussion section, which included the Reviewer's examples. We have now rephrased Section 4.1 (Spatial Variability in Streamflow Indices and Relation of the Streamflow Indices with Catchment Attributes) and Section 4.2 (Influence of Attributes of Climate to Streamflow Indices) to improve the discussion part's readability. We have now added the mention of Figures to the revised manuscript so that the Reviewer can better clarify the statements. We also request you to see the boxplots of the attributes of the clusters (Jehn et al., 2020) in the Supplement (Figure S3) and the location of clustered CAMELS catchments in the continental United States (Figure S2) to understand the discussion section better.

Minor corrections:

- Streamflow indices related to rising limbs and falling limbs are computed for the selected catchments and displayed in spatial maps as shown in Fig. 5 and Fig. 6, respectively.

  This sentence has been updated to replace “Figure 6” with “Figure 7”. We apologize for the error in the figure numbering. The following is the revised text:

  Line 245-246: Streamflow indices related to rising limbs and falling limbs are computed for the selected catchments and displayed in spatial maps as shown in Fig. 5 and Fig. 7, respectively.

- Additionally, the findings of Jehn et al. (2020) highlighted that the climate appears to be the most critical factor influencing hydrological behavior in the CAMELS dataset as a whole, and depending on the location, either aridity, snow, or seasonality are most important.

  We have modified this sentence as follows for better clarity.

  Line 369-371: Additionally, the findings of Jehn et al. (2020) highlighted that the climate appears to be the most critical factor influencing hydrological behavior in the CAMELS dataset.

References

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