Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., author comment AC2
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# Reply on RC1

Gregor Laaha

Author comment on "A mixed distribution approach for low-flow frequency analysis – Part 1: Concept, performance, and effect of seasonality" by Gregor Laaha, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-195-AC2, 2022

I thank the reviewer for the very positive and constructive feedback. Please find my responses below.

1. The title suggests that a part 2 exists. If so, please refers to it in the manuscript. What does it deal with?
Thanks, now mentioned in the abstract and in the introduction (L 60):
*In a two-part series we aim to fill this research gap. In this first part we propose a mixed distribution approach for low-flows to perform frequency analysis in catchments with a mixed summer/winter regime. The method is based on an independence assumption which is explored in the second part of the series \citep{Laaha_copula_2022}, where we address possible seasonal dependency using a copula-based estimator.*

2. I suggest to include a figure that synthesizes the seasonal characteristics of the analyzed dataset, e.g. empirical cumulative distribution of the observed low-flow values, mean monthly series, so to appreciate the effectiveness of the mixed proposed approach.
The seasonal characteristics are characterized in Figure 5 and a detailed assessment is given in Laaha and Blöschl 2006ab. I am therefore reluctant to add "more of the same" information to this paper. However, I see your point and will add an additional Figure (attached) with regime plots (monthly mean and monthly low flow regime) of the four example gauges of Fig. 1.

3. Sometimes variables are not explicitly defined. Please, make sure of that. For example, at line 129, define clearly the utilized circular seasonality index (r) and the seasonality ratio (SR). I see the reference to Laaha and Blooschl (2006b), but I suggest to make the manuscript self-structured.
Added to the beginning of the section, which is now formulated in the following way:
*Using archetypal examples, we demonstrate how the model behaves for a range of low-flow regimes: from weakly seasonal ones where summer and winter occurrences are equally likely, to strongly seasonal ones where low-flows in one season predominate. Seasonality is characterized by two indices: the seasonality ratio (SR), where SR > 1 indicates a winter and SR < 1 a summer low flow regime, and the circular seasonality index (r), where r=0 indicates the weakest and r=1 the strongest possible seasonality for the definition of indices see {laaha_seasonality_2006}).*
*Seasonality is characterized by two indices: the seasonality ratio (SR), where SR > 1 indicates a winter and SR < 1 a summer low flow regime, and the circular seasonality index (r), where r=0 indicates the weakest and r=1 the strongest possible seasonality (for*

*the definition of indices see{laaha_seasonality_2006}).*

4. The values of the relative frequency in Figure 3 are very low; the discussion cannot be appreciated very much. Maybe I would add the cumulative relative frequency or the CDF
Will be added.

5. Comments to table 2 at lines L241-245 are a bit confusing. What does it mean 32 to 34 cases? I don't have the total number of gauges to verify the 10%. Please, refer also to the syntax used in the header of the table, i.e. 1st and 3rd
The number of catchments is mentioned in L. 178. This number is also now added to L. 241, and to the caption of Fig. 2, and reference to the syntax in the header is given.

6. Please, make clear in the text among which variables the correlations are computed (section 4.2.1)
Between the accuracy gain and three seasonality indices (see first sentence of this paragraph).

7. Please, note that Figure 4 is neither recalled nor discussed in the text. Add comments. Define the Relative error. Which return period does it refer to?
Thanks, will be included in the first sentence of the paragraph.

8. Figure 6: be consistent with the shown variables (relative error not defined, performance gain not defined)
The term error was defined as a synonym for the deviation when we place emphasis on the inferior model (L. 194). Analogously, the term gain was defined as the change in performance of the superior model compared to the inferior model (L. 192). All have been used throughout the text.

Technical corrections:
Many thanks, will be amended in the revised version of the MS.

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2022-195/hess-2022-195-AC2-supplement.pdf