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Hydrology and Earth System Sciences Discussions

Interactive comment on "Estimating the flood frequency distribution at seasonal and annual time scale" *by* E. Baratti et al.

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We are very grateful to H. Winsemius for his positive judgment about our work and also for the suggestions aimed to improve the quality of the paper. The authors' reply is structured as follows, we report all referee's comments (indicated by RC) together with our reply (denoted by AC, Authors' Comment).

RC:
The paper describes a new methodology to consistently and jointly estimate flood frequency distributions at seasonal and annual time scales. I believe that the paper is well written, to the point and provides a novel and suitable contribution to HESS. I have

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Discussion Paper

only suggestions for minor revisions. Although minor, I do think that the suggested revision would make the paper stronger. My suggestions are the following:
1) Most importantly, a discussion section is lacking. Since the paper is about a new methodology, I think that a discussion of the method is important in order to outline the applicability of the methodology to readers. In particular, the implications of application of the new method for the end users of flood frequency analyses are important to recognize. Furthermore, the implications of choices in the methodology (choice of the season separation, choice of the weights) on the results are important to discuss.

AC:
This is a good suggestion, in the new version of the manuscript there will be a discussion section.

RC:
2) The authors describe the sensitivity of the choice of the weights in the optimization process. However, the choice of the division point between one season and the next, as well as the amount of seasons may in many cases be rather subjective. The authors suggest this on page 7957, but do not demonstrate what this means. This subjectivity is not a problem, as long as the effect of this subjective choice is demonstrated. I recommend that the authors demonstrate the effect of this sensitivity on the results (i.e. what would it mean for the results if we would select a different subdivion of seasons, either by selecting different dates or different season amounts? What are the implications of choosing seasons that are slightly less statistically independent?). This is important a) because in some applications a user may select season divisions that are important for his/her decision making process rather than seasons that are mathematically statistically independent; and b) because the division of seasons may not always be so clear as in the Blue Nile case, where a clearly defined wet and dry season exists.

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AC:
Reviewer's suggestion is appropriate and sensible. We will point out the effects of the division of seasons in the new version of the manuscript.

In general, in order to answer to the Reviewer's questions, we can say that the method is based on the hypothesis of independence of seasonal peak flows (i.e. the annual distribution is computed as the product of the seasonal distributions). Therefore, strictly speaking, the method we present should be applied only if the hypothesis of independence is not rejected (for an assigned significance level). If we would apply the method when the hypothesis does not hold, then we would make an error in the annual quantile estimation.

However, we can say that for each choice of division of seasons that we make, we obtain certain seasonal distributions (depending on seasonal peak flows) and a well-fitted annual maxima distribution: indeed, through the weighs, it is possible to put more emphasis on the fitting of the annual maxima frequency distribution. In this way, we expect that, on one hand we will obtain a well-fitted annual flood frequency distribution (i.e. very close to the corresponding independent estimate), but on the other hand the seasonal distributions will be worse fitted (i.e. not close to the corresponding individual maximum likelihood estimates). This is already shown in Fig. 4, and we hope that the sensitivity analysis that we will perform on the division of seasons will clarify this point.

To show the effect of the seasonal division on the results, we are currently performing the following analyses:
- select several season divisions (for istance two, four and six intra-periods);
- for each choice, select different divisions dates in order to obtain correlated and incorrelated seasonal maxima;

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- apply the method and shows the differences.

The above considerations and the results of this sensitivity seasonal analysis will be reported in the new version of the manuscript.

RC:
Small in-line comments:
p. 7950. l. 11. Between 'occurrence' and 'We', start a new paragraph
p. 7950. l. 14. "assumption of mutual independence". Explain what this assumption means and why it is required.
p. 7950. l. 17. ", which consists in the"; ", consisting of the"
p. 7950. l. 24. "since it combines"
p. 7951 l. 19-22. Difficult reading. The sentence is somewhat unclear. Could you try to rephrase this one? L. 22. Should "analysis of peak flows" be "analysis of yearly peak flows"??
p. 7953, l. 5. "Since eq 2 depends only on seasonal parameters
p. 7953. l. 9-12. "whose frequency distribution is used twice", this is unclear to me. How and why is it used twice?
p. 7953, l. 22. "that reaches Egypt, originates from the Blue Nile.2
p. 7955 - 7956. A lot of effort is put into the derivation of the seasons. Should this part not be part of the methodology itself?
p. 7957, l. 1-7. On the correlation between seasons. There's a very suggestive statement about a higher chance of correlation when more seasons are defined. So demonstrate this (e.g. by choosing different season subdivisions and repeating the experiment) and discuss the implications!! (see my comment above).
p. 7959 before Conclusions-section. Introduce a discussion, see my previous comment.
p. 7959, l. 7. "in the entire year is higher than or equal to the probability..." Figure 2.

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Please plot the maxima and the hydrograph on the same y-axis scale. It is confusing. Figure 4. Small error in the caption. 1.15

AC:

All these suggestions will be incorporated in the revised manuscript.

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