

Interactive comment on “Bivariate return period based on copulas for hydrologic dam design: comparison of theoretical and empirical approach” by A. I. Requena et al.

Anonymous Referee #1

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Report on the manuscript: Bivariate return period based on copulas for hydrologic dam design: comparison of theoretical and empirical approach By A. I. Requena, L. Mediero, and L. Garrote

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This manuscript deals with flood frequency analysis in the bivariate framework by focusing on flood peak and volume. More precisely, it is oriented to hydrologic dam design. The manuscript is generally well written and presents some interest. However, on the basis of the following comments, I recommend major revision.

1. The main contribution of the manuscript is not clearly highlighted in the introduction
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and not enough developed in the methodology section. In the conclusion, text on top page 575 is not connected to the methodology or the results sections. How the methodology (especially the novel part if any) could be applied to other datasets?

2. Information in some places are not complete or unclear which prevent a full understanding some parts, such as: page 561, sentence in lines 3-5 is incomplete; lines 8-10 should be justified; 21-24 does not reflect what is presented at the end of section 2 (there is no “procedure”); the function $K(t)$ is not defined and what is its “generalized” version (on page 563); the justification of focusing on the upper tail is not convincing (page 565, lines 3-5); no interpretation is given for the quantity λ_U (eq 5); what is the goal of this comparison (page 565, lines 13-15)? The first paragraph on page 566 is not clear; the secondary return period is not defined and the relation in 11 is not well defined and not clear; the idea on page 567 lines 4-6 seems important and needs more explanation; page 571 line 7, zero of what? The sentence seems incomplete or unclear; lines 14-28 need to be rewritten for more justification and clarity; q_T and v_T are not defined; since the graph is not defined, the interpretation on top page 573 is not clear.

3. The structure of the manuscript, even though generally good, needs to be improved. For instance, section 3 is very short and could be included in a section like Applications; the abstract does not follow usual order (it is like a mix between the context, the aims and the results); the introduction is almost a literature review and does not contain important elements such as the motivation of the study, the novelty, the problematic and critic of other similar studies; the methodology section is mainly composed of well-known techniques and neglected the development of the new part (I guess it is part 2.3).

4. The results in Table 5 are problematic. First, the SE quantity is defined and obtained? The estimators are very different and particularly the p-values where for each case (except Frank and Plackett) it is very close to reject with MPL and the opposite with Tau (e.g. with $\alpha = 10\%$). These results are important and require a careful

checking and more justification.

5. The quantile notion is not considered here even though it is closely related to the return period. In addition, the curves in Figs 9 and 10 are very similar to those of the bivariate quantile in Chebana and Ouarda (2011, *Environmetrics*). The bivariate quantile or return period are curves whereas in Tab 7 and 9 they are presented as numbers. In these tables, what is t ? Why $K(t)$?

6. The use of the p -value as a selection criterion is not correct (page 564, lines 22-23). The correct use of the p -value is only to tell “accept” or “reject” but not to “make an order” among those accepted. However, for this purpose, one can use criteria like AIC. This has an impact on the results on page 570.

7. A general procedure to be applied to other data sets is missing. For instance, section 2.3 needs more clarity and developments (how related to other steps, to the literature, an illustration could be helpful, justify the choice of 100 000, explicit formulations, etc).

8. In section 3, the choice of Gumbel for the margins needs justification (at least with which method).

9. The generation of hydrograph seems to generate pairs of peak and volume but not hydrograph. May be I am missing something.

10. In section 4.1, why not present first the scatter plot (Q,V)? It is not clear how the conclusion is drawn from Figure 3a? And the quantities in the axes of this figure are not defined. The K-plot (in fig 3b) is not clear how obtained? If it the one mentioned in section 2, then it is not aimed for this purpose.

11. The choice of 100 000 simulations is based on what? And why it is the same for the different situations (coincidence!)?

12. Some tables could be gathered or converted to text. Tables 4 and 5 require a reference source to be indicated.

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13. Figure 8 is not clear how obtained? Fig 9a and c seem to be identical, is that correct? Why?

14. The English is generally of good quality but needs to be checked in some few places.

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