Journal: Hydrology and Earth System Sciences

Title: Modeling the spatial dependence of floods using the Fisher copula.

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Dear Prof. Guadagnini,

We thank the reviewer for acknowledging the value of our work and his/her feedback. We have taken into account his/her suggestions and we would like to answer to his/her comments. Below, we describe step by step which comments have led to which changes in the revised manuscript. Our replies to the reviewers' comments are written in blue and italic to distinct them from the reviewers' comments.

Thank you for your efforts with our manuscript. We hope that you will find the revised version suitable for publication in *Hydrology and Earth System Sciences*.

On the behalf of all co-authors,

Yours sincerely,

Manuela Brunner

Reviewer 2:

The present work analyzes the occurrence of flooding events at a regional scale. In this context it is crucial to account for the dependence among flowrates at diverse locations. The modelling of the dependence for flooding events is here tackled via the recently proposed Fisher copula. Furthermore, the Authors provide a framework to spatially interpolate flowrate (during the realization of a flooding events) at ungauged stations, leveraging on the Fisher copula embedding the dependence among gauged stations. As physical distance for the interpolation of the flowrate the Authors find that the river length is the most appropriated one. The Authors compare the proposed approach with several others type of Copula and Max-Stable processes, finding that for the Thur catchment in Switzerland the Fisher copula give the best results.
I think that the paper is worth for publication after some minor revisions.

Comment 1
The Event Definition procedure could be hard to follow, perhaps a graphical depiction of the procedure (based only on two records and up to line 12 of pp. 5) could help the reader to follow it properly.

Reply: *Thank you for this suggestion. We have added an illustration of the three-step flood event identification procedure in order to be more pedagogical.*

Comment 2
Figure 3: I would not add the interpolation line connecting the observations, I think it would make more convincing the smoothing spline and the exponential fitting.

Reply: *We have removed the interpolation line which indeed makes the plot easier to read.*

Comment 3
Figure 6: it is really hard to read the figure. I suggest to split in (a) and (b) panels, where poorly performing models and satisfactory models results are depicted respectively.

Reply: *Thank you for pointing this out. This issue was also risen by reviewer 1 who had suggested to plot each model in a separate panel. We did so which largely increased the readability of the plot.*

Comment 4
At first, inspection of Fig. 3 and Fig. 6 suggest a very erratic structure of the dependence (via correlation coefficient and/or F-madogram) in the data as a function of the river distance. This make suspicious the use of such a distance as a good explanatory variable and the reliability of the current work. Then I have realized that dependence metrics in both Fig.s 4 and 6 are evaluated just among pairs of gauged stations (e.g., the erratic behavior of the correlation between two stations with a distance of approximately 80Km is due to the fact that the two pairs of stations could be placed in the upper or lower portion of the catchment, making a marked impact on the correlation coefficient. The same for the F-madogram) : this clearly reveals the need for a multivariate assessment of the dependence to me. I think a sentence pointing out this aspect in the text would help the readers.

Reply: *This point was taken into account and added to the discussion section.*