

Interactive comment on “Multivariate hydrologic design methods under nonstationary conditions and application to engineering practice” by Cong Jiang et al.

Anonymous Referee #3

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Review of “Multivariate hydrologic design methods under nonstationary conditions and application to engineering practice”. Jiang et al. have developed a four-dimensional Vine copula for multivariate hydrologic designs under nonstationary conditions. Reading the abstract, I expected to read a throughout and well-organized study on such a hot topic. Going through the manuscript, I was a little bit disappointed, as the manuscript was not written in a coherent and clear way to reflect the concepts and methodology. There are serious concerns about the selection of different dimensions and also developing non-stationary models. Therefore, I cannot recommend the manuscript for publication in HESS journal in the current format. The manuscript needs substantial revision before considering for a potential publication. More details of my arguments

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are provided below:

1- It is not clear why the authors select regulated flow time series for their study. Since the reservoir is above the gauge station, the flow time series is manipulated and does not represent the natural regime. Another question is that how do the authors address non-stationarity arising from global warming and land use change. And how do the authors separate the natural variability in flood series from the non-stationarity in their methodology.

2- Why do the authors select three flood volume dimensions, which are considered redundant? These variables are the same in nature and it is quite clear that the dependence between them should be high. The authors should explain why they do not select different variables representing different aspects of flow (with different nature) if they are really interested in applying a four-dimensional vine copula. Apparently, the whole process could be done using a bivariate copula. But if they are interested in developing a four-dimensional nonstationary-based vine copula, they should convince the readers why they select three of the dimensions from the same variable.

3- Why do the authors assume an exponential trend for the location parameters? How they make sure that there is not any other type of trend in the time series? What criteria is used to choose such an exponential trend? And why do not they use time dependent trend or any oscillation signal as covariates.

4- The reason that the authors do not assume any time dependent dependency in roots T2 and T3 is not clear.

5- Why do not the authors select the copula in eq 6 from the extreme copula families. And why do not they use any Goodness of Fit Test to select the best fitted copula from different copula families?

6- In equation 7, it is not clear that what is the covariate? Is time is the covariate? And again, why the authors use an exponential nonlinear trend to express the non-

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stationarity in the copula parameter? What if a linear or polynomial regression model is fitted well to express the trend in the copula parameters.

7- The authors talk about robustness of their model in lines 217 and 241. What is the definition of the robustness for these two cases?

8- The authors have not done any uncertainty analysis for estimation of the marginal and copula parameters through time.

9- Section 4.1 and 4.2 should move to the methodology, as they are not related to the results section.

10- Finally, the manuscript would greatly benefit from the input of a native English speaker.

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