Dear Reviewer #2:

This paper deals with the problem of flood risk assessment in urban area, by combining a classical design approach based on rainfall IDF curves and a copula method enabling to combine different durations. By doing that, author indicates that this new method makes it possible to combine risks from multi-sources, ie : from "coastal flooding, flooding from river channels and inundation caused by insufficient drainage capacity". The subject of the paper is of great interest, and the article is well structured and presented. However I would require a major revision.

Thank you very much for your set of critical review and comments for technical improvement of this manuscript. The summary of our specific response is as follows:

1. The objective of combining different risk sources is very (too) ambitious. But the proposed method is in my opinion to simple: it only generalizes a flood design method widely used in engineering and it principal limitation lies in the choice of the different characteristic durations. This choice is very difficult and is finally made using empirical formulas. To properly deal with the multi source risk issue, I would try to use a rainfall runoff model coupled with a stochastic rainfall generator, in order to analyze all the different scenarios (see ref [1] applying this idea in another context).

We agree with you that the objective of combining different risk sources is too ambitious. In fact, it is our finally goal. This paper is the first step that estimate flood risk from rivers and inundation which caused by rainfall, therefore, we generalize the flood design method by using a copula method. In future study, we will consider flood risk from rivers and inundation which caused by rainfall as well as storm surge caused by typhoon, since copula have ability to combine different statistical laws.

We would like to show a big picture, however, it may confuse readers. We agree with your suggestion that we should make the objective simple and clear. We will make a reversion on that and put our ambitious research plan in the discussion. We are happy that you recommend a reference share similar idea of this paper ref [1]. It could be a good reference for us to clear our idea.

I would like to add an example to illustrate the problems which may be not very clear in the paper. As shown in Fig. 1, in an area there are two rivers, we want to estimate the flood risk at the blue color area which influenced by two rivers. Because the whole area is not very large. We may use area representative rainfall followed by a rainfall-runoff-inundation simulation to solve this problem.

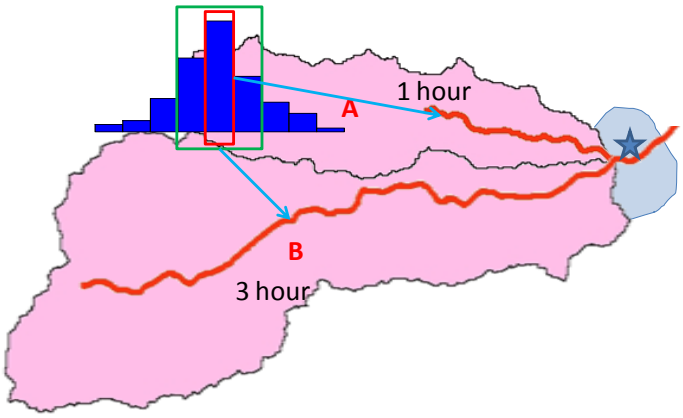

Fig. 1 Flood risk from two rivers

The first question is how to properly design area representative rainfalls. It is the focus of this paper. The response characteristic of a basin to rainfall could be represented by concentration time of flood. For example, in Fig.1, for the small basin A, the concentration time of flood is 1 hour which means flood can reach to the blue area in 1 hour from basin A. As for basin A, the maximum 1 hour rainfall could be the most dangerous part to cause a flood to the risk assessment area (shown in the red box of design rainfall). For the big basin B, the concentration time of flood is 3 hour which means flood can reach to the blue area in 3 hour from basin B. As for basin B, the maximum 3 hour rainfall could be the most dangerous part to cause a flood to the risk assessment area (shown in the green box of design rainfall).

Since the blue area is influenced by both rivers, a design rainfall for this area should carefully consider such correlations between maximum 1h rainfall and maximum 3h rainfall. The probability distribution of maximum 1h rainfall reflects the probability distribution of flood from river A. The probability distribution of maximum 3h rainfall reflects the probability distribution of flood from river B. To evaluate the flood risk from both river A and river B, the joint distribution of maximum 1h and 3h should be evaluated and such correlation should be reflected in rainfall design.

In this study, we want to develop a rainfall design method include consideration of flood risk from multiple rivers and local inundation. Concentration time is considered as important index that indicates critical duration of rainfall for different flood sources; Maximum rainfall amount in different critical durations are considered as critical rainfalls which may cause flood from different flood sources. To evaluate the flood risk from multiple sources, it is necessary to estimate the correlations and joint distributions of maximum rainfall amounts in different durations and reflect them into rainfall design.

2. The presented copula method is very interesting and copulas are more and more used in hydrology (and also for rainfall generator see ref [2]). Its interest lies in the possibility to combine different statistical laws. However, I don't see the interest in the presented case study using IDF curves. Why the statistical law should change with the duration? (by the way, page 8017 line 3 : why 3 parameters for a log-normal law?).

Yes, copula are more and more used in hydrology such as in ref [2] and other recent literatures. Its interest lies in the possibility to combine different statistical laws as well as offer a new way to measure correlation.

We are sorry for not explaining this part clearly. In fact, in this case study, we don't use IDF curves, we use copula to study the correlations between maximum rainfall amounts in different critical durations, and construct joint-probability distribution of them. The fit of margin distribution is completely data driven, therefore, different statistical laws are adopted to maximum rainfall amounts in different durations. It is possible to use same statistical law, but we found from data that the distribution of maximum rainfall amounts in the different critical durations could be different. In addition, we do not find references of "standard statistical laws" for rainfall amounts in the different critical durations. On the other hand, as you mentioned, copula's interest lies in the possibility to combine different statistical laws, we also want to show this advantage by using different statistical laws for different critical rainfalls.

As for 3 parameters for a log-normal law, we adopted the 3 parameters log-normal distribution. Compare with 2 parameters log-normal distribution, it add a shape parameter. Probability it is seldom used hydrology study, but it fit data better through comparison of Akaike information criterion (AIC). We also use statistical test such as Kolmogorov-Smirnov test, however, with one more parameter, the 3 parameters distributions may always fit data better than 2 parameters distributions under such statistical test. Therefore, when comparing 2 parameters and 3 parameters distributions, we tend to use AIC.

Furthermore, some choices are not enough discussed (ie choice of the copula) In order to improve the paper, I would recommend: - to better explain the objective (here it is too ambitious) - to compare the proposed method to another which don t use copulas, in order to show the gain of using copulas. - to study the impacts of all the underlying choices, in order to give guidelines on how to use copulas in this type of issue.

Thank you very much. We agree with your recommendation, some choices are not enough discussed and thank you very much for help us format the idea and structure. We will make a reversion considering you recommendation.

[1] Carvajal, C.; Peyras L. ans Arnaud, P.; Boissier, D. & Royet, P. Probabilistic Modeling of Floodwater Level for Dam Reservoirs Journal of Hydrologic Engineering, 2009, 14(3), 223-232
[2] Cantet, P. & Arnaud, P. Extreme rainfall analysis by a stochastic model: impact of the

copula choice on the sub-daily rainfall generation Stochastic Environmental Research and Risk Assessment, Springer Berlin Heidelberg, 2014, 28(6), 1479-1492

If the authors want to compare their approach with outputs given by a rainfall stochastic generator, some tools are available in R : Kossieris, P.; Koutsoyiannis, D.; Onof, C.; Tyralis, H. & Efstratiadis, A. HyetosR: An R package for temporal stochastic simulation of rainfall at fine time scales European Geosciences Union General Assembly, 2012 Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 8005, 2015.

Thank you very much. We am also a R user. It is great to see such a R package. To realize the method in this paper, We also made some R-programs. Thanks for this information. Probability We can make my complex R-program much simple with the help of this R package.