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Interactive comment on "Uncertainty analysis of hydrological return period estimation, taking the upper Yangtze River as an example" *by* Hemin Sun et al.

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Thank you for the review and constructive comments. We have responded item by item as below to your comments in italic.

This paper addresses the uncertainty in estimating return periods by considering different data sampling approaches, distribution assumptions and parameter estimation methods. It showed that different approaches could lead to very different results, and the optimal approach varies across gauging stations. The work is technically sound and the manuscript is clearly organized. The results are of practical importance.

Major comments:

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Discussion paper

Q1, The study somewhat lacks an in-depth discussion. The results are case-dependent and do not have a general implication. One reason is that it considered only two gauging stations, and they are in the similar climate and watershed conditions. They do differ in the flow variation trend, the uncertainty results reflect the difference. However, the author didn't go further to reveal de underlying physical or mathematical reasons for the difference. Thus, no general conclusion can be drawn from the comparison. I improve the scientific significance of this work, I suggest the authors either analyze more stations in different watershed and climate conditions, or provide a theoretical analysis of the difference between the two stations.

Answer 1: We focus mainly on the contributions of the different sources to the uncertainties of estimated return levels for the discharge series with or without significant trends. Section 3.1 shows that the data series is very sensitive to the return level estimation, especially for the series which have significant trend. Both of the variations of skewness and kurtosis between three sample series are larger for the series with significant trend than those without. That is to say, return level of three sample series have lager range for the series with significant trend than those without.

We prefer to add more theoretical analysis in conclusion and discussion parts. In revised manuscript, we conducted a sensitivity test to figure out whether the results from this study transferable to other stations under different climate conditions. By using a detrend method, we generated a new discharge series, and found that the main uncertainty to the estimation of return levels is from distribution functions.

Q2, The introduction to the sampling methods in Section 2.2 is two succinct. With the limited information, readers may not be able to understand how the extreme series are actually produced through POT and DPOT. Missing such critical information makes it hard for readers to understand the work.

Answer 2: We will add formula and references to revise the manuscript to describe all processes including the POT and the DPOT sampling methods more clear.

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Discussion paper

Minor comments:

Q3, Acronyms are not consistent in the text and figures. Some examples are: MLE vs. ML; P III vs. P3; LN vs. LN2; Gam vs. GAM; GUM vs. GUM. . .

Answer 3: Sorry for our carelessness. We corrected all abbreviations to make sure acronyms are consistent throughout the paper.

Q4, Section 3.3 was poorly written. It pours a lot of numbers here, but provides few insights. This section could be condensed into a couple of tables or figures, following by a paragraph or summary.

Answer 4: This part will be rewritten to highlight the main topic.

Q5, Please check the units, many of them do not have correct superscripts.

Answer 5: We will check and correct all of them.

Q6, The introduction should articulate the research objectives.

Answer 6: Main aim of this paper is to quantity the uncertainty sources of return level estimation by adapting the ANOVA method to two hydrological stations which have long-term observational records. Unlike previous publications on this topic, we focused on the return level variation caused not only by the choice of distribution functions, but also by the other two uncertainty sources: sampling method and parameterization method. As a result, possible way to reduce the uncertainties of return level estimation is delivered in this study. We believe our findings are meaningful for decision makers to get optimistic results. We will articulate the research objectives in the end of introduction section.

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