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Interactive Comment

Interactive comment on "Extreme precipitation and extreme streamflow in the Dongjiang River Basin in southern China" *by* W. Wang et al.

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It is very common to provide evidences for changes in extreme hydro-meteorological events due to global warming in the literature, but it is rare to see the evaluation of the robustness of those results. The present study raises the concern of the robustness of statistical change-detection methods, shows the necessity of combined use of different methods including exploratory methods, and emphasizes the need of physically sound explanation when applying statistical test methods for detecting changes. We believe that the results of the present study would be an interesting contribution to the issue of detecting changes in hydro-meteorological events.

To our knowledge, the three non-parametric methods introduced in the present study, i.e., Kolmogorov-Smirnov test, Levene's test and quantile test, are not-commonly used by the hydro-meteorology community. Although the reviewer disagrees, no indication is given about where and how these methods are used in the literature. We would be happy to see the references if possible.

Although non-parametric tests are considered not particularly powerful, it is still interesting to see how powerful non-parametric test are, as shown in the present analysis. In addition, to our knowledge, no robust parametric test is readily available for detecting changes in non-Gaussian hydro-meteorological time series as well. As mentioned in the Section 5, in detecting changes in extreme hydro-meteorological events, two approaches are commonly seen in the literature, i.e., testing trend in the extremal series for the entire period under consideration, and comparing probability distribution parameters for data observed during different periods (e.g., Tromel and Schonwiese, 2007). The former approach is typically done with the nonparametric Mann-Kendall test (e.g., Karl and Knight, 1998; Zhang et al., 2005), whereas the later one is a typical parametric one. In some cases, the two approaches are used in combination (e.g., Osborn and Hulme, 2002). However, is the parametric method particularly powerful? To examine the robustness of the parametric method, we can make a simple experiment by generating 5,000 simulations for Gamma distributed samples with a fixed value of Alpha = 0.5, and a fixed value of Beta = 20, which are commonly seen in the case of precipitation modeling, with varied length of data size L = 50, 100, 200 and 300. Then, we use the method of maximum-likelihood to estimate the shape parameter Alpha and scale parameter Beta. The results are shown in Table 1 (unfortunately, we cannot show the scatter plots of the estimates of Alpha versus the estimates of Beta in the interactive comments).

According to the results in Table 1, we see that the parametric method is not particularly powerful either. For instance, with a dataset of 100 points, the 95% confidence intervals for the estimates of Beta is (13.15, 28.59), which means that estimation uncertainty may cause a over 100% increase of Beta, whereas in the real world, the estimated change of Beta is rarely over 100% (e.g., see the analysis of Osborn and Hulme (2002)

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for the precipitation statistics in the UK).

Table 1 Estimates of Gamma distribution parameters for simulated Gamma distributed samples with various data sizes (the mean values and standard deviations are calculated based on 5,000 simulations)

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L=50; A_mean=0.5229; A_SD=0.0913; B_mean=21.8063; B_SD=5.8795

L=100; A_mean=0.5116; A_SD=0.0614; B_mean=20.8684; B_SD=3.9404

L=200; A_mean=0.5052; A_SD=0.0416; B_mean=20.4227; B_SD=2.6423

L=300; A_mean=0.5043; A_SD=0.0339; B_mean=20.3220; B_SD=2.1565

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Note: In Table 1, A denotes shape parameter Alpha; B denotes scale parameter Beta; SD denotes standard deviation.

In conclusion, we believe that the present study, including the analysis of the robustness of statistical change-detection methods, and so on, would be a helpful contribution to the study of climatic and hydrological changes.

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