

Interactive comment on “The effect of Three Gorges Dam and rainfall on summer flow risk over Yangtze River Basin” by Zhenkuan Su et al.

Zhenkuan Su et al.

zhenkuan.su@gmail.com

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We appreciate the suggestions and comments from the referee. We extract each comment from the overall comment. This document discusses, point-by-point in response to the comments. Comment 1: However, the runoff process of Yangtze river is a very complex process, should fully consider the respects of precipitation, evaporation, infiltration, underlying surface, groundwater and the control of reservoirs and lakes. Response: Yangtze River basin is the largest basin in China and subbasins within the Yangtze River Basin show a range of distinct properties and subsequently exhibit markedly different flow characteristics. Due to lacking sufficient documentation regarding data such as land cover, water levels above and below the dam, inflow and outflow of the lakes in the downstream, we simplify the problem in order to conduct

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a suitable analysis given the data available. The analysis of dam influence is conducted along with the rainfall, excluding the non-studied factors such as land cover, urbanization, while the individual factor likely exerts a limited influence on the basin. From some related literatures (Wang et al., 2017), we can know that climate variability is the main driving factor of the runoff variability and already explains the observed inter-annual tendency. The integrated impact of TGD and other human activities may result in the difference between the predictions and observations, while for summer (JJA) flows during the post-dam period (12 years, from 2003-2014), the TGD-induced Yangtze flow changes can trigger instant alterations (Wang, 2013). For the above reasons, we emphasize the impact of rainfall and TGD on the summer river flow.

Wang, J.: Lake dynamics in the Yangtze Basin downstream of Three Gorges Dam driven by natural determinants and human activities, PhD, Dep. of Geogr., Univ. of Calif., Los Angeles, 2013. Wang, J., Sheng, Y., and Wada, Y.: Little impact of the Three Gorges Dam on recent decadal lake decline across China's Yangtze Plain, *Water Resources Research*, 53, 1-24, 2017.

Comment 2: It can't be simplified as a linear relationship. Response: In this study, we apply the canonical correlation analysis to explore the relationship between runoff and rainfall. To our best knowledge, the tendency of intra-annual rainfall is strongly consistent with that of runoff. Please also see the revised figure 1 and references (Zhang et al., 2011; Jiang et al., 2008). As the predominant driving factor of runoff, the rainfall in summer provides main water source to the Yangtze river. So, in the developed model, the log-transformed runoff is linearly correlated with the rainfall over subbasins, while that does not mean that the runoff of each individual hydrological station is a linear function of the rainfall. For the runoff in one specific station, it is not only simulated under the constraint of rainfall but also the constraint of observed runoff in other hydrological stations.

Figure 1: Monthly average streamflow (barplots) for each station and rainfall amount averaged over the entire Yangtze River basin (Blue lines). (Corresponding to the figure

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2 in the original manuscript)

Jiang, T., Kundzewicz, Z. W., and Su, B.: Changes in monthly precipitation and flood hazard in the Yangtze River Basin, China, *Int. J. Climatol.*, 28, 1471-1481, 2008.
Zhang, Z. X., Chen, X., Xu, C. Y., Yuan, L. F., Yong, B., and Yan, S. F.: Evaluating the non-stationary relationship between precipitation and streamflow in nine major basins of China during the past 50 years, *J. Hydrol.*, 409, 81-93, 2011.

Comment 3: The risk analysis of the dam running is not deep enough and not quantified. It is lack of theoretical analysis. Response: Thanks for pointing out this problem. We try to analyze the impact of spatial and temporal variability of rainfall on runoff during both pre-dam and post-dam period. Through the simple comparison, the TGD-induced runoff variation was then explicitly reflected. Since the rainfall is the main component of the high flow in flood seasons in summer, the use of rainfall anomaly can help to interpret the reason that the distinct difference between predictions and observations. Theoretically, our analysis may result in a conservative estimate of the runoff but provide an original comparison of the relative influence by the TGD, and this also considered the correlations among the runoff stations and rainfall stations over the entire Yangtze Basin.

Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, <https://doi.org/10.5194/hess-2017-159>, 2017.

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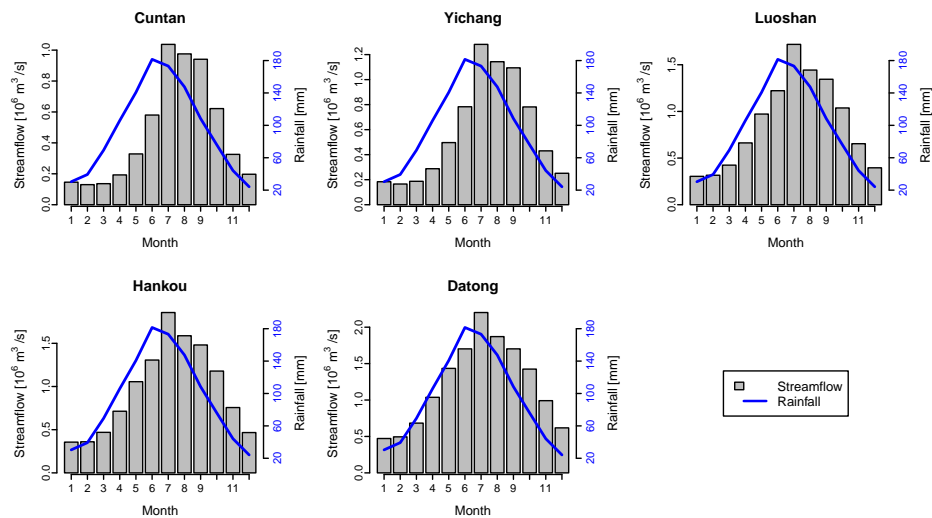


Fig. 1.

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