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MS TITLE: Comprehensive evaluation of hydrological drought and the effects of large reservoir on drought resistance in the Hun River basin, NE China

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RESPONCES TO THE REVIEWERS' COMMENTS

We do appreciate all useful comments and suggestions on our manuscript.

The MS was thoroughly revised, against all revision comments from the editors and reviewers. We have taken this opportunity also to read through and tried to perfect the analysis details, discuss the results more comprehensively and pick up any minor grammar, wording or format problem and made corrections accordingly so that it strictly follows the Journal formatting requirements. Detailed corrections and revisions are listed below point by point. And, all the revisions have been addressed in the reply and highlighted in the manuscript with yellow background.

Reviewer # 1:

1. ***The methods section is missing SRI and SPI. They are well-known drought indices, but their application is not straightforward because it requires normalization of the probability distributions. What transformations were applied and how good were the results?***

[Authors' response]: We thank you for reminding us this importing. We have already added the introduction of SRI and SPI in the Methodology section in our revised manuscript (Page 4 line 20 to 30).

2. ***The definition of drought "severity" is not clear. On line 1 of page 5, it is stated that drought severity is the "run length", but run length is related to duration, not severity.***

[Authors' response]: We gratefully appreciate for your comment. The drought severity is identified as the absolute value of the accumulated SRI during the drought duration. We have revised it in our revised manuscript (Page 6 line 8 to 9).

3. ***I have some trouble with the interpretation of the drought propagation time. It is stated that drought propagation time is the SPI time scale with the best correlation with the 1-month SRI. However, in the results section, the analyses are presented separately by months (Figure 7). I interpret these results as the correlation coefficient obtained between n-month SPI and 1-month SRI for the values of each month in successive years. However, the values of the correlation coefficients change from month to month. If we focus on relatively high correlation coefficients (over 0.5), the band is larger in some months than in other. How can it be that the drought propagation time in June is 2-6 months, in July and August increases to 3-12 months and in September it drops to 2 months? Am I missing anything? I would expect some discussion of this in terms of droughts, physical processes, and reservoir operation, not only in terms of numerical results from the statistical analysis.***

[Authors' response]: We gratefully appreciate for your comment. The T_p was indicated by the month with the strongest correlation. In some months, the SPI time scale varies widely and the correlation is high, which leads to the drought propagation time in June is 2-6 months, in July and August increases to 3-12 months. However, the correlation is high for a large variety of SPI time scales in some months, which makes the identification of T_p values highly uncertain.

Therefor, in order to overcome this issue, the uncertainty of the correlation coefficients was calculated. And the T_p was expressed on SPI time scale with strong correlation and low uncertainty. We have revised it in our revised manuscript (Page 15 line 9 to 13). Meanwhile, the conclusions related to T_p have also been revised.
[Authors' response]: As suggested, we have added the discussion in terms of droughts, physical processes, and reservoir operation to further reveal the changes of T_p (Page 16 line 5 to 18 and Page 17 line 1 to 23).

4. I am also troubled by the discussion of the propagation time. The sentence in line 5 of page 16 states: "Considering the lack of data before the construction of the DHF reservoir..." How can you make an analysis of the effect of a reservoir if there are no control data without the reservoir? The authors are attributing the differences in the results obtained in the different stations to the reservoir. How can they be sure of this if there are no data prior to the construction of the reservoir? In fact, they even state that the reservoir "weakened the drought resistance upstream the DHF reservoir". I cannot imagine a way in which a reservoir may influence the threshold of rainfall deficit required to generate a drought of certain level in an upstream basin. This should be discussed. Could it be just variability in the data?
[Authors' response]: We gratefully appreciate for your comment. After our further discussion, we decided that it would be imprecise to attribute the differences in results obtained at different sites to reservoir construction. Indeed, it would be more convincing if we get a comparative assessment on the data before and after the construction of the reservoir. However, the data before the construction of DHF reservoir are lacking. Therefore, based on the calculation of drought propagation threshold for triggering different scenarios hydrological droughts, we discussed the drought resistance capacity of the basin and the influence of factors including the operation of Dahuofang reservoir on the drought resistance of the basin in section 4.4 (Page 19 line 5 to 6, Page 20 line 1 to 30 and Page 21 line 1 to 10).

5. Finally, I was entirely lost with the presentation and discussion of the Bayesian network model to link cumulative precipitation deficit to hydrological droughts. What is the purpose of this analysis and why is a Bayesian model required? What is the utility of the conditional probability distributions shown in Figure 9? Are these distributions derived from the fitted models? What is their relationship with actual data and their usefulness? Please clarify all these questions.
[Authors' response]: We gratefully appreciate for your comment. Bayesian networks are directed acyclic graphs in which the nodes represent variables of interest and the links represent informational or causal dependencies among the variables. The strength of a dependency is represented by conditional probabilities that are attached to each cluster of parents-child nodes in the network.
Fig 3a shows the graphical model of Bayesian network. It describes the causal relationships among the cumulative precipitation deficit (CPD, mm), drought duration (D), severity (S) and hydrological drought levels (HDL) (Page 9 line 1). In this model, the drought duration and severity of each drought event are taken as the target, respectively, and the corresponding CPD is identified as the condition. The conditional probability of hydrological drought under different CPD conditions would be calculated. The conditional probability distribution in Figure 9 (present Figure 11) was obtained by fitting the conditional probability and CPD. Then, the CPD corresponding to the confidence level of 0.95 was identified to determine the drought propagation threshold for triggering hydrological drought events (Page 8 line 19 to 22).

6. Some of the figures need additional work or explanations. In Figure 1, I was not able to locate the stream gauge upstream of the reservoir (BKQ). The definition of severity is not clear in Figure 2. What are the bar charts that appear to the right of the plots in Figure 7?. Are these the PTMH?
[Authors' response]: We are very sorry for the mistakes in this manuscript and inconvenience they caused in your reading. The graphic error in the our revised manuscript has been corrected (Page 5 line 1).

[Authors' response]: We gratefully appreciate for your comment. The definition of drought intensity in Figure 2 has been more clearly defined (Page 6 line 18).

[Authors' response]: We gratefully appreciate for your comment. The bar chart that appears on the right of the chart in Figure 7 (present Figure 8) are the drought propagation time T_p for each month (Page 16 line 4).