

Nat. Hazards Earth Syst. Sci. Discuss., author comment AC3  
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## Reply on RC2

Min Li et al.

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Author comment on "Hydrological drought forecasting under a changing environment in the Luanhe River basin" by Min Li et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2022-244-AC3>, 2022

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*1) Throughout the results analysis section, the results are mostly focused on very detailed preliminary results, whereas insights and discussion of results are lacking. It is quite obvious that the transitional probability depends on SPI and the lead time, while the readers might be more interested in the new insights brought by this new methodology. The authors might need to rephrase some of the texts in the results analysis section to make them more logically connected.*

**Response:** Thanks for the expert opinion. According to the opinion of experts, we have further summarized the conclusions and added our insights and discussions based on the new methodology.

*2) Lines 4-10, page 12, the justification of 1979 as the change point (due to human activity) is not sound enough. Why the sudden change in annual runoff in 1979 is not caused by the heavy rainstorms?*

**Response:** Thanks for the expert opinion, according to historical records, local human activities (such as land use change, reservoir construction, etc.) are regarded as the main factor influencing runoff (Yan et al., 2018; Chen et al., 2021). In this paper, it is determined that 1979 is the change point of the runoff sequence in the basin and this conclusion is consistent with Li et al. (2015) and Wang et al. (2015). We have further described the reasons for the sudden change of runoff series in the manuscript.

*3) the authors determine the change point with the Nonstationarity analysis. Do you perform the prediction based on data of each period? In this case, the sample size may be short. How to tackle this problem?*

**Response:** Thanks for the expert opinion, in this paper, the study period is divided into a correction period (1961-2003) and a verification period (2004-2010) and we perform the prediction based on data of the correction period (1961-2003).

*4) The authors introduce the multivariate distribution model and the conditional model for the prediction. The motivation of this method should be highlighted. For example, there are multiple prediction models out there. Why do the authors select this model? This model is closely associated with the copula mode. What is the difference or why do you select this model instead of other models?*

**Response:** Thanks for the expert opinion, the Copula can be adopted to model the dependence structure between meteorological/hydrological drought indices, and based on the conditional probability, the transition probabilities and transition thresholds from different classes of meteorological drought to hydrological drought were calculated. (Majid et al.,2019). The traditional probability prediction models (such as the Multivariate normal distribution model, Markov Model, etc) can be used to calculate the transition probabilities from the current drought index classes to the future drought classes, but the conditional probability model can calculate the transition probabilities from the current drought index values to the future drought classes, which is more robust to forecast hydrological drought than the traditional probability prediction models. We have highlighted the motivation of the conditional distribution model in the introduction according to expert opinion.

5)Lines 9, page 15, "Transition probabilities involving HI", did you mean "Transition probabilities with involving HI as the covariate"?

**Response:** Thanks for the expert opinion, in order to express our meaning more clearly, the sentence in the text has been changed to: "Transition probabilities with involving HI as the covariate".

6)There are some language issues in this manuscript, a thorough editorial check might be needed.

**Response:** Thanks for the expert opinion, we have carefully examined and revised the language problems in the manuscript.

## References

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