

Reply to CC1' comments

Legend

Reviewers' comments

Authors' responses

Direct quotes from the revised manuscript

Cui et al. (2023) mainly proposed a CHUP-BMA method to solve the unreasonable assumption of normal distribution of the BMA framework in hydrological forecast field. This specialized theory has been applied to the Three Gorges region of China to demonstrate its feasibility. The study is interesting and meaningful to the hydrological forecast community. However, it needs some revision before it is up to the publication standard of HESS.

Response: We deeply appreciate your constructive comments and the time you spent on reviewing the paper. We have accepted all the revision comments. Point-by-point replies to the comments or suggestions made can be found below.

1. Lines 8-10, the statement is not accurate. As I know, few existing literature (with Copula tool or without it) has been devoted to avoiding the normal transformation in the HUP-BMA method.

Response: After further careful review by the authors, it is found that this paper is indeed the first article used to solve the problem of the normal distribution assumption of the HUP-BMA method. In order to be more rigorous, the corresponding content is modified to "This study introduced a copula-based HUP in the framework of BMA and proposed the CHUP-BMA method to bypass the need for normal quantile transformation of the HUP-BMA method".

2. Lines 68-70 are not clear. It is ambiguous that " When the member forecasts are the same, the ensemble forecasts produce the same conditional probability distribution and lack rationality". The parameters of the BMA method include membership weights and variances, and the posterior distribution of the ensemble forecast is not necessarily the same even if the forecast members have the same results. In order to reflect the necessity of the initial state, the article should be changed to " When the forecast results of a member are the same at different moments, the same forecast conditional probability distribution will be generated, which is not reasonable." It is important to highlight that the distribution is the same at different moments.

Response: Thank you very much for your constructive comments. It has been changed to " When the forecast results of a member are the same at different moments, the same forecast conditional probability distribution will be generated, which is not reasonable." in the paper.

3. Line 79, missing punctuation.

Response: The punctuation has been added to the article.

4. Line 120, unit superscript error.

Response: Error subscripts have been modified.

5. Line 186, the symbol $c_m()$ does not appear in Eq. (12).

Response: The c_2 in Eq. (12) denotes the 2-dimensional copula density function. c_m denotes the m -dimensional copula density function. To reduce ambiguity, it has been supplemented with " m denotes the dimension."

6. Line 279 is not clear. To improve the readability and logic of the paper, it is suggested to revise as "the forecasted flow of the upstream mainstream station".

Response: The corresponding content has been revised to "the forecasted flow of the upstream mainstream station".

7. Line 339, whether these distributions and Copula functions passed the K-S test or other assumption tests?

Response:

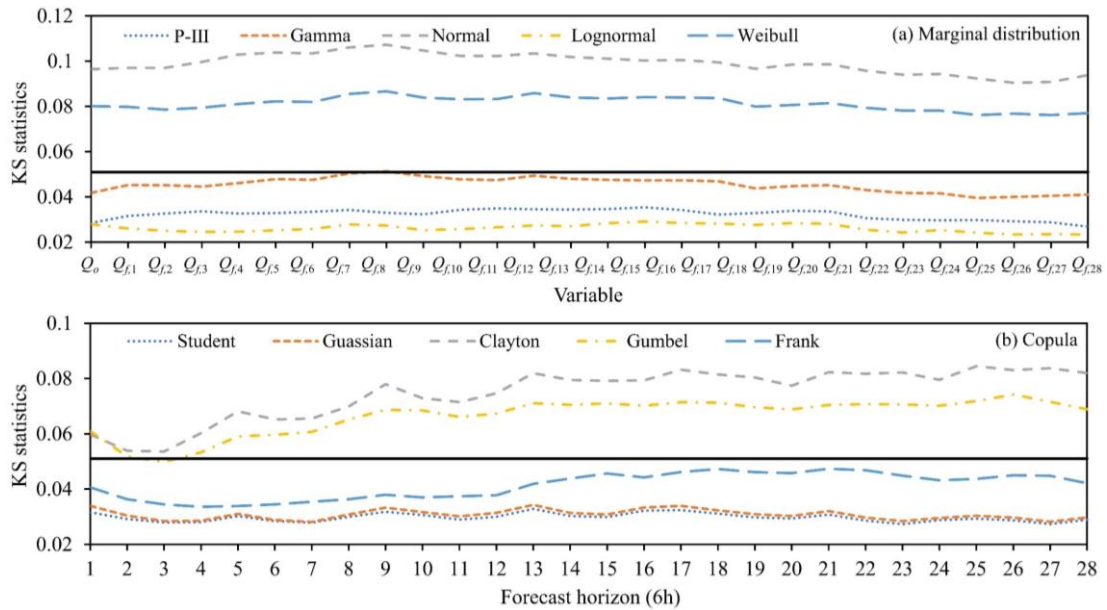


Fig.1 The KS statistics of Q_o , Q_b , and Q_f sequence marginal distributions and copula functions. 1, 2, ... ,28 denote 6h, 12h, ..., 168h forecast horizons, respectively

Fig.1 illustrates the average of the KS statistics for the eight members. The Lognormal, Gamma and P-III passed the K-S test for marginal distribution. The Student, Gaussian, and Frank copula passed the K-S test for copula function. The Lognormal and Student copula have relatively low KS statistics, which follows the same trend as the RMSE values. Therefore, it is found that both the K-S test and the RMSE criterion are effective in reflecting the fitting performance of the marginal distribution and copula function. To save space in the article, only the RMSE values are shown.

8. Line 498, although the authors do not mention it, it is necessary to mention the improvement room of the inherent mechanism of the CHUP-BMA method.

Response: Thanks for the valuable comments. The improvement room of CHUP-BMA method has been added in the article "In this study, the copula-based HUP is coupled with the BMA method, and the CHUP-BMA method is proposed, which not only can consider the influence of the initial state on the ensemble forecast, but also can avoid the assumption of normal distribution in the HUP-

BMA method and derive the posterior distribution function more accurately. An ensemble forecast scheme that consists of two forecasted precipitation, two hydrological models, and two objective functions of parameter calibration is established”.