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Comment on hess-2021-599

Anonymous Referee #2

Referee comment on "Comparison between canonical vine copulas and a meta-Gaussian model for forecasting agricultural drought over China" by Haijiang Wu et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-599-RC2>, 2022

Review of "Model Comparisons Between Canonical Vine Copulas and Meta-Gaussian for Agricultural Drought Forecasting over China" by Haijiang Wu, Xiaoling Su, Vijay P. Singh, Te Zhang, and Jixia Qi.

This paper developed an agricultural drought forecasting model based on canonical vine copulas under three-dimensions (3C-vine model). With the meta-Gaussian (MG) model as a reference model, they found that the 3C-vine model showed better performances than the meta-Gaussian model for agricultural drought forecasting over China. Any such model aimed at improving the forecasting of drought should be encouraged. The topic falls into the scope of HESS.

Overall, the paper is well written and structured, and I support the publication of this work after major revision based on the comments below. Some works are needed to improve in the methodology, results, and discussion. I have some suggestions/recommendations to improve the manuscript, which are given below:

General concern:

The major concern is about why the authors compare the vine copula model with the Meta Gaussian model. the latter one is generally based on the Gaussian distribution, and the prediction function is expected to be not superior than other competitors. More justifications or involving some other statistical models are expected through the paper.

Other concerns:

1. In comparison with the MG model, what are the superiority of the 3C-vine model or C-vine copula? The authors need a further statement about this in the Introduction section or discuss more about this in the Discussion section. Also in Line 57, the authors made a list of existing model for the drought prediction; yet those models are all statistical models, some physical-based hydrological models are also widely used in hydrological prediction, the droughts included as well. A elaborate introduction is expected herein.

2. Page 3 Line 62: I suggest the authors add the 'aforementioned' before the 'conventional statistical methods', to avoid the broad statement.

3. Page 5 Lines 90-91: "The propagation between meteorological drought and agricultural drought..." should be changes as "The propagation from meteorological drought to agricultural drought...", as the meteorological drought is a source of the agricultural drought. Be careful with the wording.

4. Page 5 Lines 95-97: Authors mentioned that the 3C-vine and MG models are employed to forecast the agricultural drought in August. It is rather confusing. I strongly suggest the authors provide some compelling reasons for choosing this month. Of course, if the authors can display the agricultural drought forecast in any interested months (e.g., the forecasted of extreme agricultural drought in June), it can further strengthen the robust of 3C-vine model.

5. Page 6 Line 126: I think the 'three' should be changed to 'top-three'. Please check it.

6. Page 8 Line 155: The $\mu_{y3|y2,y1}$ in Equation (3) should be removed. Be careful with the checking.

7. Page 9 Line 187-188: "Here, regarding the conditional distribution of z given the conditions $w...$ ", the terms ' z ' is confusing here, maybe it should be revised as ' y ' according to the Equation (5). Please check it.

8. Page 11 Line 213-220: A graphical representation or flowchart of this process would be helpful, maybe in the Methodology section. I am actually quite intrigued by it.

9. Page 11 Line 226: The numerator term in the Equation (11) may be have problematic. Be careful with the checking.

10. Figure 6: I suggest the authors should add the PDF curve for the MG model. Maybe the authors need to consider completing it via the simulations.

11 Page 17 Lines 342-344: I think the 'at time $t-1$ (t denotes target month)' should be removed. Please check it.