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Comment on hess-2022-67

Anonymous Referee #1

Referee comment on "Probabilistic subseasonal precipitation forecasts using preceding atmospheric intraseasonal signals in a Bayesian perspective" by Yuan Li et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-67-RC1, 2022

The authors established a Bayesian hierarchical model (BHM) to predict the 10-60d precipitation for 17 hydroclimatic regions over China during the boreal summer monsoon season (May to October) by using the previous atmospheric intraseasonal signals. Both deterministic and probabilistic evaluations showed that the BHM provides skillful subseasonal forecasts over southeastern and southwestern hydroclimatic regions at a lead time of 20-25 days while the skills are poor over northeastern China, owing to the underestimation of intraseasonal variability.
The authors have conducted numerous calculations and employed many different statistical analysis methods. However, the explanation for their choice of the calculation and methods are deficient. Moreover, I cannot tell whether the BHM proposed in this paper show any superior skills than other statistical models or even dynamical S2S models. From this point of view, I incline to reject the manuscript, but I give an opportunity to the authors to improve the manuscript.

Major comments:
1. The intraseasonal variability and the intraseasonal oscillation are different terms. The authors focus on the prediction of intraseasonal precipitation (10-60d) over China during summer (May to October). Although the selected predictors are atmospheric intraseasonal signals, no specific BSISO or MJO pattern can be found in the previous correlation maps. The title may be more consistent with the content after removing “oscillation”.

2. The selected intraseasonal signals and the physical processes of their influencing on precipitation over China should be provided.

3. For each region and each pentad from May to October, a BHM is built to forecast precipitation at different lead time. The detail information should be shown in caption of Fig.2, Fig.3, Fig.5. Are the results in these figures for a specific pentad or the average mean from May to October? If the latter is the case, will the skill for each pentad be similar throughout the whole summer?

4. Figure 1 shows the division of the hydroclimatic regions. However, this is not a scientific way to divide China with respect to rainfall variation. Does the precipitation in each region have the coherent intraseasonal variation? If not, the correlation map is meaningless because they are calculated based on the areal-mean precipitation. Moreover, do we really need 17 regions?

5. No evidences are provided to justify the advantage of this prediction model. Does this model have better performance than the ECMWF S2S model? Or the spatial-temporal projection models (STPM)? The authors need to make some comparison.

6. From Figure 4, I can see the prediction skills mainly came from the annual cycle (which is quite stable), rather than the pentad variation (the intraseasonal component). How about the skills if only anomaly precipitation is verified? I think the skill is very limited.

Minor comments:
1. Page 1 Line 9, ”..” is “.”.

2.Page 9 Line 208, the order of Fig. 2 is confusing for the reader to discern the evolution of intraseasonal atmospheric signals from Lead 25d to Lead 0d. The figure can be sliced to two figures with the first one showing the correlation between preceding U850, U200, OLR and 10-60d precipitation from Lead 25d to Lead 0d, and the second one showing the remaining H850, H500, and H200.

3. Page 15 Line 355, Fig. 3. The skill of Kling-Gupta Efficiency (KGE) in region 2, region 9 and region 12 increases with time, why? Could you please show r, β and γ before you show KGE? Because correlation coefficient and bias are the basic metric for forecast verification.

4. Page 15 Line 355, Fig. 3. The prediction skill (KGE) of region 1 is the best in 17 regions, but in Fig. 4, the BHM model shows no skills for extreme events. Please explain the reason.

5. Page 16 Line 365. What is the standard of efficient prediction in KGE and Continuous Ranked Probability Score (CRPS)? In the paper, the authors use “0.2” and “positive” as the standards, what is the reason?

6. Page 18 Line 385. The prediction skill over northeast China is relatively lower than that over southeastern and southwestern China. Although the number of samples will be

induced, the results of southeastern and southwestern China can better demonstrate the skill of BHM.

7. Page 18 Line 385. There is no caption of a detail description of the size of dots.

8. Line 355, during the boreal summer monsoon season.

9. Line 55-70, So far, there are many statistical models for subseasonal prediction (some of them were already used in operational subseasonal prediction). The authors may want to read or cite the following publications, and make comparisons with their model.

Zhu Z., T. Li, P.-C. Hsu, J. He, 2015: A spatial-temporal projection model for extended-range forecast in the tropics. Clim. Dyn., 45(3), 1085-1098. doi: 10.1007/s00382-014-2353-8.
Zhu Z., T. Li, 2018: Extended-range forecasting of Chinese summer surface air temperature and heat waves. Clim. Dyn., 50(5-6), 2007-2021. doi: 10.1007/s00382-017-3733-7.
Zhu Z., T. Li, 2017: The statistical extended-range (10–30-day) forecast of summer rainfall anomalies over the entire China. Clim. Dyn., 48(1), 209-224. doi: 10.1007/s00382-016-3070-2.
Zhu Z., T. Li, 2017: Empirical prediction of the onset dates of South China Sea summer monsoon. Clim. Dyn., 48(5), 1633-1645. doi: 10.1007/s00382-016-3164-x.
Zhu Z., T. Li, 2017: Statistical extended-range forecast of winter surface air temperature and extremely cold days over China. Q. J. R. Meteor. Soc., 704(143), 1528-1538. doi: 10.1002/qj.3023.
Zhu Z., S. Chen, K. Yuan, Y. Chen, S. Gao, Z. Hua, 2017: Empirical subseasonal predicting summer rainfall anomalies over the middle and lower reaches of Yangtze River basin based on the atmospheric intraseasonal oscillation. Atmos., 8(10), 185. doi:10.3390/atmos8100185.
Zhu Z., T. Li, L. Bai, J. Gao, 2017: Extended-range forecast for the temporal distribution of clustering tropical cyclogenesis over the western North Pacific. Theor. Appl. Climatol., 130(3), 865-877. doi: 10.1007/s00704-016-1925-4.
Li W., P. Hsu, J. He, Z. Zhu, W. Zhang, 2016: Extended-range forecast of spring rainfall in southern China based on the Madden–Julian Oscillation. Meteorol. Atmos. Phys., 128(3), 331-345. doi: 10.1007/s00703-015-0418-9.

10. Line 75-80, “However, we should note that the relationships between ISO signals and precipitation are of high uncertainty for different regions at different lead times”
Yes, that is why in Zhu and Li (2017), they used REOF to divided the mainland China into 10 subregions based on the coherent nature of the 10-90 variation in each subregion. They predicted 10-30day predictand at once because considering the whole process of intraseasonal variability with the time-varying and spatial varying information. The authors may want to read the paper via the following link:
http://dqkxxb.cnjournals.org/dqkxxb/article/abstract/20200120