

Editor decision:

Dear authors,

One of the referees has only two minor issues for you to address. Your revised manuscript will be sent to the referee. I look forward to receiving your revised manuscript.

Sincerely,

Yi He, HESS Editor

Thanks for your kind decision. We have carefully revised the manuscript to address the comments of the reviewers. The point-by-point responses are provided in the following.

Responses to Comments on “Probabilistic sub-seasonal precipitation forecasts using preceding atmospheric intraseasonal signals in a Bayesian perspective” (Referee #2)

Anonymous Referee #2 reported on 26 August 2022.

Our responses are in blue and revisions are in blue and italics, with the reviewer’s comments shown as normal text.

General comments:

The authors have satisfactorily taken into account the vast majority of my comments. I think this manuscript is far better than the previous version and can be published after correcting some typos and answering to the two points below.

Thanks for your recognition of the revised manuscript. Your constructive comments help us to greatly improve our manuscript after revision.

Major comments:

1) I’m glad the authors have decided to compare the scores of their statistical forecasts to those of a dynamical S2S system. However, I am dubious about the choice of NCEP which is not reputed to be the best-performing one, as they acknowledge. The authors seem to imply that except for NCEP, it is not possible “to generate pentad mean precipitation forecasts for the same period as the STP-BHM model” (l.420-421). But actually, the problem could be turned the other way round by providing STP-BHM forecasts matching the pentad mean precipitation of another S2S system, e.g ECMWF. It seems entirely feasible since STP-BHM is a purely statistical model. I would therefore suggest a comparison with ECMWF, that would give even more importance to your statistical method if you beat it, although I consider it optional for this revision. At least, I think you should modify the sentences claiming that other comparisons are not possible (in Sections 2.1 and 3.1).

Thanks for this comment. We admit that that the ECMWF model outperforms other dynamical models for S2S forecasts. It would provide stronger evidence if the STP-BHM model beats the ECMWF model. However, we also note that the forecast skill of dynamical models varies at different lead times and different regions. Figure S1 compares the forecast skill of the ECMWF model and the NCEP model from May to September over the 1999-2009 period. The ECMWF model shows higher forecast skill in **tropical regions** at all lead times. Whereas, the differences between the ECMWF model and the NCEP model are much smaller in **extratropical regions**. Both the ECMWF model and the NCEP model show little skill in predicting precipitation when the **lead time is beyond two weeks** over China. Thus, we believe that the comparison of the STP-BHM model and the NCEP model could provide useful information for sub-seasonal precipitation forecasts as well.

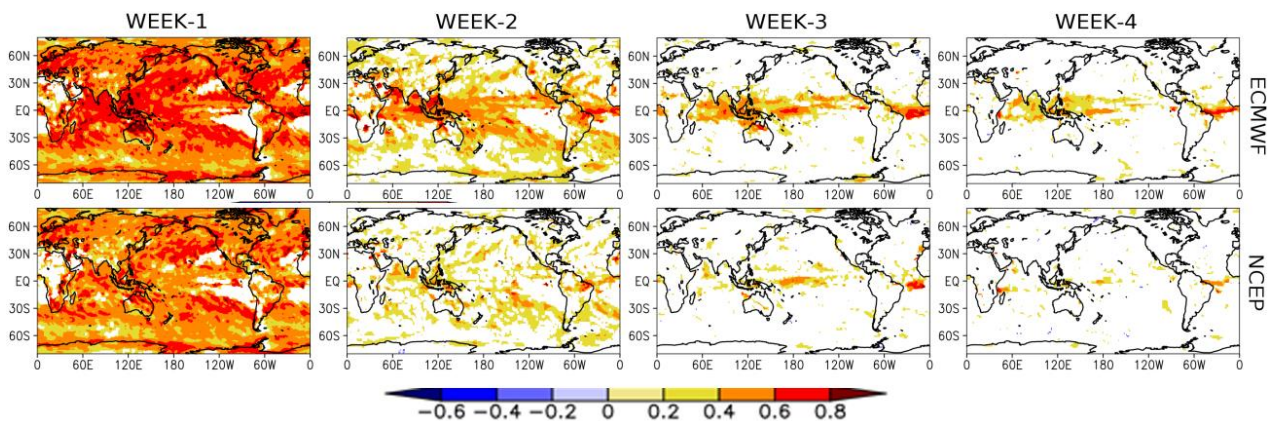


Figure S1. Correlation between the ensemble mean and observed (GPCP) accumulated precipitation anomalies for each S2S model (rows) during weeks 1-4 (columns) for hindcasts initialized from May to September over the 1999-2009 period. Correlation coefficients statistically significant at the 5% level are shaded. (Felipe et al., 2018)

To address the above comment, we have removed relevant sentences in Sections 2.1 and 3.1 as follows:

L. 165 to L. 168: The STP-BHM model we built in this study is compared to the dynamical models to provide a benchmark for sub-seasonal precipitation forecasts. In this study, we compare our results of the STP-BHM model with the NCEP model archived in the S2S Database for the same period of 1999-2010 from May to October (<http://apps.ecmwf.int/datasets/data/s2s/>).

L. 416 to L. 421: Figure 9 compares the CRPS skill scores of the STP-BHM model and the NCEP model from May to October during the period of 1999~2010. It is not surprising that the NCEP model outperforms the STP-BHM model when the lead time is within 5 days. However, we should note that the STP-BHM model shows much higher probabilistic forecast skill compared to the NCEP model at longer lead times. Positive CRPS skill scores are observed for the STP-BHM model over most hydroclimatic regions, whereas the skill scores are mostly negative for the NCEP model.

2) I am surprised to see an evaluation for both precipitation amounts and precipitation anomalies. I do not say it is irrelevant, but it is quite uncommon in the context of verification of S2S precipitation and I would have expected only one of them (presumably anomalies). I would be interested if you briefly discussed why you chose to look at both, and why the results differ. In the meantime, I think the article could be shortened by not repeating all verification charts twice (e.g the attribute diagrams and the Brier score could appear only once). Thanks for this comment. In our first submission, we built the statistical model for pentad mean precipitation amounts as it could be further used for hydrological predictions at sub-seasonal time scales. The anonymous referee #1 suggested that we should verify the prediction skill for precipitation anomalies as well. To have a broader audience, we finally chose to predict both precipitation amounts and precipitation anomalies.

We added a brief explanation of the results in the discussion section from **L. 480 to L. 485** as follows:

We also note that the forecast skill of pentad mean precipitation amounts and precipitation anomalies are different. The precipitation amounts behavior at different timescales (interannual, intraseasonal, and synoptic). The large-scale circulation anomalies (U850, U200, H850, and H500) may be dominant for the total variability of precipitation amounts. In comparison, the precipitation anomalies only represent the intraseasonal component of precipitation. The OLR plays a more important role for intraseasonal convections compared to other dynamical fields (Ventrice et al., 2013; Liu et al., 2016).

To shorten the length of the manuscript, we have moved Fig. 11 and Fig. 13 to the supplementary file.

Liu, P., Zhang, Q., Zhang, C., et al. A revised real-time multivariate MJO index. *Monthly Weather Review*, 144(2), 627-642, 2016.

Ventrice, M. J., Wheeler, M. C., Hendon, H. H., et al. A Modified Multivariate Madden–Julian Oscillation Index Using Velocity Potential, *Monthly Weather Review*, 141(12), 4197-4210, 2013.

MINOR COMMENTS

I.119: Please specify the meaning of the STP-BHM acronym here. Although it appears in the abstract, it should be detailed once in the main body of the article.

Thanks for this comment. We have incorporated this suggestion in the revised manuscript at [L. 119](#).

LANGUAGE AND TYPOS

I.58: “which the predictors were identified” → “whose predictors were identified”

The word “which” has been corrected as “whose” at [L. 58](#).

I.104: “The predictand is assumed to follow a distribution” (missing word)

The word “a” has been added at [L. 104](#).

I.124: “dataset” or “datasets”?

The word “dataset” has been corrected as “datasets” at [L. 125](#).

I.149-150: “In addition, the correlations between geopotential height at 850 hPa, 500 hPa, and 200 hPa (H850, H500, H200) are also analyzed.” There’s a missing “s” for “correlations”, and the sentence is not clear. I guess you should either write “the correlations between geopotential height (...) and precipitation” or simply “the correlations with geopotential height” (as precipitation is already mentioned in the previous sentence).

This sentence has been rewritten from [L. 150](#) to [L. 151](#) as follows:

[In addition, the correlations with geopotential height at 850 hPa, 500 hPa, and 200 hPa \(H850, H500, H200\) are also analyzed.](#)

I.184: “where the correlation **is** statistically significant” (missing word)

The word “is” has been added at [L. 182](#).

I.382 to 387, I.444 to 448: “**B**rier” (upper case B)

We have incorporated this suggestion in the revised manuscript.

I. 422: “it is not a surprise” or “it is not **surprising**”

We have incorporated this suggestion in the revised manuscript at [L. 417](#).