Response to Review

Reviewer #1:

Overall comment:

This manuscript proposed the SOM-CNN-LSTM post-processing method to correct the raw daily forecast precipitation by combining large-scale circulation patterns with local spatiotemporal information. The proposed method showed better performance than other benchmark methods (i.e., CNN, LSTM, CNN-LSTM). The paper is very interesting, well written and well structured. We highly recommend the paper for publication with moderate revision.

We thank the reviewer for this positive evaluation and the constructive feedback. In the following, we provide a point-by-point response to the reviewers' suggestions. We are confident that all points raised can be appropriately addressed and will help to significantly improve the quality of our manuscript.

Major comments:

1. I think it would be good for the readers if the authors could briefly add the meaning of four-fold cross-validation in this study.

Thank you for your suggestion. We agree that it would be beneficial to the readers. For four-fold cross-validation, the 15 years of datasets are randomly grouped into four groups, and one group of datasets is selected as validation data while the other groups of datasets are used as the training data to fit the statistical post-processing models (i.e., SOM-CNN-LSTM, CNN, LSTM, and CNN-LSTM). This step will be repeated four times until all datasets are used for validation. We will add the meaning of four-fold cross-validation in the resubmitted manuscript.

2. As for predictors, why didn't the authors consider to use reanalysis data as predictors to establish the post-processing model? Based on my experience, the reanalysis data (e.g., ERA5) is more accurate than the forecast data. Meanwhile,in addition to the predictors mentioned in the paper, the vertical velocity affecting precipitation is also worth to be noted.

Thank you for your questions! For the first question, we can use the predictors(e.g., elevation, specific humidity, and mean sea level pressure) from the reanalysis data(e.g., ERA5) to train the post-processing model and get better corrections to the historical forecast data, but when we need to use the trained model to correct the future forecast precipitation, the predictors from the reanalysis data cannot be obtained and we can only use the forecast data. The difference between the two data (the accuracy of the reanalysis data is better than that of the forecast data) may make the model unstable. Therefore, we still use the predictors from the forecast data to establish the post-processing model.

For the second question, as the reviewer mentioned, the precipitation is also influenced

by the vertical velocity and we will consider using it in future research.

3. Is the circulation pattern the same in each lead time? This point is not clear.

We are sorry for not explaining the point clearly. We use the 500 hPa geopotential height of each lead time(e.g., 1-day, 2-day, 3-day, ..., 15-day) to classify the circulation patterns, so the circulation pattern in each lead time is different. We will explain it in the resubmitted manuscript.

Minor issues:

1. Line 102. “Study area and datasets” should be “Methodology”.

Thank you for your suggestion. We will replace “Study area and datasets” by “Methodology”.

2. Line 123. “” should be “”.

Thank you for your suggestion. The other two reviewers also mentioned the same question. We will replace “$\langle Z \rangle = \frac{Z - Z_{mean}}{\sigma_Z} \cos$” by “$\langle Z \rangle = \frac{Z - Z_{mean}}{\sigma_Z} \cos\phi$”.

3. Line 188-189. “southeast” and “southeastern” should be consistent.

Thank you for your suggestion. We will correct it by using ‘southeast’ in the sentence.

4. Line 232, “each season” is more appropriate than “every season” here.

Thank you for your suggestion. We will replace “every season” by “each season”.

5. Line 305, “we compare the method” should be “We compare the method”.

Thank you for your suggestion. We will replace “we compare the method” by “We compare the method”.

We appreciate for Reviewer’s warm work earnestly, and hope that the correction will meet with approval.

Once again, thank you very much for your comments and suggestions.