

Geosci. Model Dev. Discuss., author comment AC2
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Reply on RC2

Fang Wang et al.

Author comment on "Customized deep learning for precipitation bias correction and downscaling" by Fang Wang et al., Geosci. Model Dev. Discuss.,
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In this paper, the author customized a deep learning model to bias correct and downscale hourly precipitation data over the coastal region of the Gulf of Mexico. The study considered six different scenarios with different initial parameters to assess the added value in the model performance reproducing the local features. Data from MERRA2 reanalysis was used as predictor and data from stage IV radar as predictand. The results were assessed using the statistical matrices at different time scales. The findings in this paper are very interesting. In general terms this paper falls within the scope of this journal, the figures and tables are well organized, and the results are properly discussed. However, a few minor comments must be addressed:

Specific comments:

- In the upsampling layers the author used the nearest neighbor interpolation method, this method played a fundamental role in increasing the spatial resolution of the results from the residual blocks, the author needs to justify why he chose this particular interpolation method.

Response: Thank you for your comments. The nearest neighbor interpolation method is the defaulted interpolation method in the Upsampling2D layer in Keras API and effects of other interpolaton methods were not explored in this study. We have included the following explanations in Section 3.1.1 of the revised manuscript: "The defaulted nearest neighbor interpolation was chosen in the upsampling layers to increase spatial resolution and effects of different interpolation methods were not explored in this study."

- During the training phase, some scenarios consider atmospheric covariates of precipitation from MERRA as predictors, what about the predictand? Did the author use the same variables from stage IV? Also, it's not clear how the author aggregated those covariates to generate precipitation.

Response: Thank you for your comments. Scenario4 to 6 considered atmospheric covariates from MERRA2 as predictors and the predictand is stage IV radar precipitation. We did not use any other variables from stage IV and did not aggregate any covariates. The selected covariates are physically relevent to precipitation and studies have shown those covariates are helpful for estimating precipitation. For example, Li et al. (2022) used CNN-based approach to postprocess numerical weather prediction model output and found

that the use of auxiliary predictors greatly improved model performance compared with using raw precipitation data as the only predictor. See the detailed information in Section 1 of the revised manuscript. We also explained the motivations of including covariates in Section 3.1.4 of the revised manuscript as follows: "As described in Section 1, studies have indicated that including atmospheric covariates is helpful for estimating precipitation (e.g., Baño-Medina et al., 2020; Li et al., 2022; Rasp and Lerch, 2018)." The general form that using those covariates to estimate precipitation is comparable to a classic multiple linear regression problem (multiple variables as predictors and only one predictand). We have included the following explanations in Section 3.1.4: "Comparable to a classic multiple linear regression problem, covariates are multivariable predictors and hourly precipitation is the only dependent variable."

- In the results section, the first subtitle "Overall agreement" should start from 3.1.

Response: Thank you for pointing that out. We have fixed it.

- The author could elaborate more on why the 6 scenarios resulted in a low correlation ratio at hourly time scale.

Response: Thank you for your comments. We have included the following explanation in Section 4.1 of the updated manuscript: "The reason is that the correlation component was estimated based on all the hour-to-hour P data, while the other two components (i.e., and) were calculated based on long-term climatological P statistics and were relatively easier to estimate (Beck et al., 2019b)."

- It is suggested to add the definition of r , β , and \square in the caption of Tables 3 and 4.

Response: Thank you for your comments. We have added their definition in the caption of tables 3 and 4.

- Figures 2 and 3: the unit beside the colorbar is missing, is it (mm/hour)?

Response: Thank you for pointing it out. We have added units in the caption of each figure. Yes, it is mm/h.

- Page 12: "Monthly mean from QDM_BI had a relatively higher..." something is missing in this sentence.

Response: Thank you for pointing it out. The monthly mean from QDM_BI had a relatively higher g and g is missing. We have fixed it in the revised manuscript.