

Geosci. Model Dev. Discuss., author comment AC1
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Reply on RC1

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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For local scale studies, current precipitation datasets are crucial for bias correction and downscaling. By using customized loss functions et al. to bias correct and downscale hourly precipitation data, the authors developed a customized DL model based on the SRDRN architecture. This model provides better precipitation estimates at fine spatial and temporal resolutions. However, there are still some problems need to be solved:

- Page 5, Line 130. Although the authors acknowledge that SRDRN performs better than conventional methods, they do not discuss its benefits over other types of deep learning models, and it is unclear why SRDRN was selected.

Response: Thank you for your comments. We have included the following explanations in Section 3.1.1 of the revised manuscript: "Furthermore, it has been proved that the SRDRN is capable of capturing much finer features than shallow plain CNN architecture (Wang et al. 2021). Comparing with the popular U-Net architecture (Sha et al. 2020b; Sun and Tang 2020), the SRDRN directly extracts feature on the coarse resolution input, and thus can potentially decrease computational and memory complexity."

- Page 6, Line 158. The authors mention that the precipitation classification task and the correction and downscaling tasks are highly relevant. Is this an empirical or theoretically based judgment?

Response: Thank you for your comments. Studies have shown that a multitask DL model could learn to better represent the shared physical processes and better predict the variable of interest (e.g., Sadler et al., 2022). Since P categories and actual values are highly relevant, we expect the added classification task can improve the DL model for bias correcting and downscaling P. We have modified the statement as follows in the Section 3.1.2 of the revised manuscript: "Studies indicated that a multitask DL model could learn to better represent the shared physical processes and better predict the variable that we are interested in (e.g., Sadler et al., 2022). Since P categories and actual values are highly relevant, adding a classification task can potentially improve the DL model for bias correcting and downscaling P."

- Page 7, Line 191. How does weighted cross-entropy as a loss function penalize the heavy rain category more?

Response: Thank you for your comments. Since the weights for categories with rain are relatively larger than no rain category, the weighted cross-entropy loss is relatively large when there are discrepancies between true and predicted categories with rain, resulting in guiding the training towards to decreasing these differences with larger weights and thus better handling class-imbalance issue. We have included the following explanations at the end of Section 3.1.3 of the revised manuscript: "Since the weights for categories with rain are relatively larger than no rain category, the loss is relatively large when there are discrepancies between true and predicted categories with rain, resulting in guiding the training process towards to decreasing these differences with larger weights and thus better handling class-imbalance issue."

- Page 11,Line 296. The author should explain the exact meaning of TP, FP and FN, similar to TP (prediction=1, truth=1).

Response: Thank you for your comments. We have included the following explanations in Section 3.3 of the revised manuscript: "where TP represents true positives (prediction=1, truth=1), FP represents false positives (prediction=1, truth=0) and FN represents false negatives (prediction=0, truth=1). Taking the heavy rain category as an example, TP is an outcome where the model correctly predicts the heavy rain class; FP is an outcome where the model predicts it is a heavy rain class, but the true label is not a heavy rain class; FN is an outcome where the model predicts it is not a heavy rain category, but the true label is a heavy rain class."

- Section 3. No subsection 3.1, layout error or omission?

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

- Table 2. The authors need to have described the units of each variable in the table.

Response: Thank you for pointing that out. We have add a unit column in Table 2.

- Figure 2,3,7 and 8. The authors should label the units of the physical quantities represented in the figure next to the legend.

Response: Thank you for pointing it out. We have added units in the caption of each figure.