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Reply on RC2

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Author comment on "Impact of spatial distribution information of rainfall in runoff simulation using deep learning method" by Yang Wang and Hassan A. Karimi, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-371-AC4, 2021

Authors' response:

1. There is no special reason to use 6 decimal places. Considering the amount of data in each table, we will reduce the number of places in order to make it easier to read.

2. Yes, RMSE is described with unit mm/d. We show the units in each of the tables and will add average value to help the reader get a more intuitive feeling for each type of model.

3-5. The goal of this study is not to find the best-trained model for rain-runoff simulation, but rather to investigate the impact of spatial distribution information in the simulation process. Sufficient training data is the key to building deep learning models, which is why we use most of the data for training. However, we strongly agree that the factors mentioned in the comment are something we have to be aware of when applying deep learning models to hydrological simulations. For example, traditional hydrological models have different simulation effects in different regions. A hydrological model constructed for a humid region may have a worse result for a semi-arid region. (Kratzert et al., 2019).'s results show that if we use data from different regions to train the LSTM simultaneously, the models can achieve good results in different types of regions. Just as it is mentioned in the comment, the question of how to integrate the understanding of hydrology into deep learning models, e.g., whether models need to be trained separately based on different types of rainfall, needs continued research. We think our conclusions are still valid for future research. That is, we should pay attention to the spatial distribution information when performing rainfall-runoff simulation.

6-7. We strongly agree that the look-back windows up to several days are more meaningful when considering the rainfall-runoff mechanism, as they directly influence the follow up runoff generation. 180 and 365 days as look-back windows are often used in other studies that apply deep learning models to the field of hydrology. Considering the advantages of RNN models, as data-driven models, which discover the changing patterns of time series data. We can assume that 80 and 365 days as look-back windows help the model learn the correlation between long series of rainfall, runoff, and other factors. On the one hand, shorter windows conform to the rainfall-runoff mechanism, on the other, data-driven models can handle longer windows, which can provide more information. How to choose look-back windows is a question that needs to be further investigated. This is the reason why we compare different windows in the paper.

8. We will add a table describing basic information about the two watersheds, such as area, average rainfall, average flow, etc.

9. Thank you for the suggestion as zooming in on selected periods of high flows and low flows in the graph would make the figure easier to read.

10. Thank you for the reminder. All the variables and functions are explained in the corresponding places.

11. It should be “rain gauge” or “rain station”. Thank you for the suggestion.

12. It should be “activation function”. Thank you for the suggestion.