Dear Reviewers,

Thank you very much for your time involved in reviewing the manuscript and your very encouraging comments on the merits.

Comments:

“This paper proposed an optimized LSTM-based model applied to early warning and forecasting of ponding in the urban drainage system. It can identify flooding locations and process of ponding quickly with relatively high accuracy. The research ideas and methods are well innovative.”

We also appreciate your clear and detailed feedback and hope that the explanation has fully addressed all of your concerns. In the remainder of this letter, we discuss each of your comments individually along with our corresponding responses.

To facilitate this discussion, we first retype your comments in italic font and then present our responses to the comments.

Comment 1:

My main concern about this paper is related to the case area. The authors said "(Due to these structural characteristics) the performance of the model will not be limited by the size of the case area", but they only applied the proposed method to a small-scale case area (a residential district of 6.128 hm2). I think it would be necessary to explain the capability of the proposed method.

Response 1:

Thanks for your suggestion on improving the accessibility of our manuscript. The explanation about the case area has been amended in the paper(See line 171 of the article for details). The relevant contents are provided below for your quick reference.

In terms of model structure, the output of the runoff process is the lateral inflow of a single node, and the flow confluence process is similar to the runoff process, where the output is the ponding volume at a single node. Regardless of the size of the case area, the output of the model is in nodes. The size of the case area directly affects the network scale, i.e., the number of nodes, which directly affects the training time, not the training effect.

Comment 2:

Section 2.4.2 (Eq. 5) Why you used this formula to design rain intensity? This is the design formula used by the municipality (i.e. a routine in China), orï¼ Need specify.

Response 2:

Thanks for your suggestion. The reason why we use Eq. (5) has been added to line 189 in our paper. The relevant contents are also provided below for your quick reference.

Eq. (5) proposed by Keifer&Chu is a universal design storm pattern at home and abroad, and the storms generated are extreme enough to reflect the state of the pipe networks under the most unfavorable conditions.

Comment 3:

What is Pilgrim & Cordery? Any equations?

Response 3:

Thanks for your comment. The supplement of the Pilgrim & Cordery method has been added to line 201 in the paper. The related contents are also provided below for your quick reference.

The Pilgrim & Cordery is a method to count the historical rainfall data, and deduce the rainstorm pattern from it. To determine the storm pattern, the duration is divided into several periods, for each rainfall event, the sequence number of each period is determined according to the rainfall in each period from large to small, where large rainfall corresponds to a small sequence number. Then, average the serial numbers of each period, calculate the percentage of each rainfall to the total rainfall in each period, and take the average percentage in each period.

Comment 4:

Please show equations to explain how you added the noise as the description is not clear enough.

Response 4:

Thanks for your comment. A supplement about the process of adding noise has been added to line 214, and Figure 8 has also been added to the paper. The related contents are also provided below for your quick reference.

Take the rainfall in the return period of 5a as an example, the following figure shows the process of adding noise. Fig. 8(1) shows the Gaussian white noise generated randomly over the duration, Fig. 8(2) is the distribution of reordered noise, and Fig. 8(3) shows the details around the rainfall peak in Fig. 8(2), Figs. 8(4) - (6) are the rainfall after adding 30%, 50%, and 70% noise respectively. In Fig. 8(2), the noise near the peak is artificially adjusted to be negative to smooth the extreme maximum rainfall. so that the rainfall is closer to the real situation.

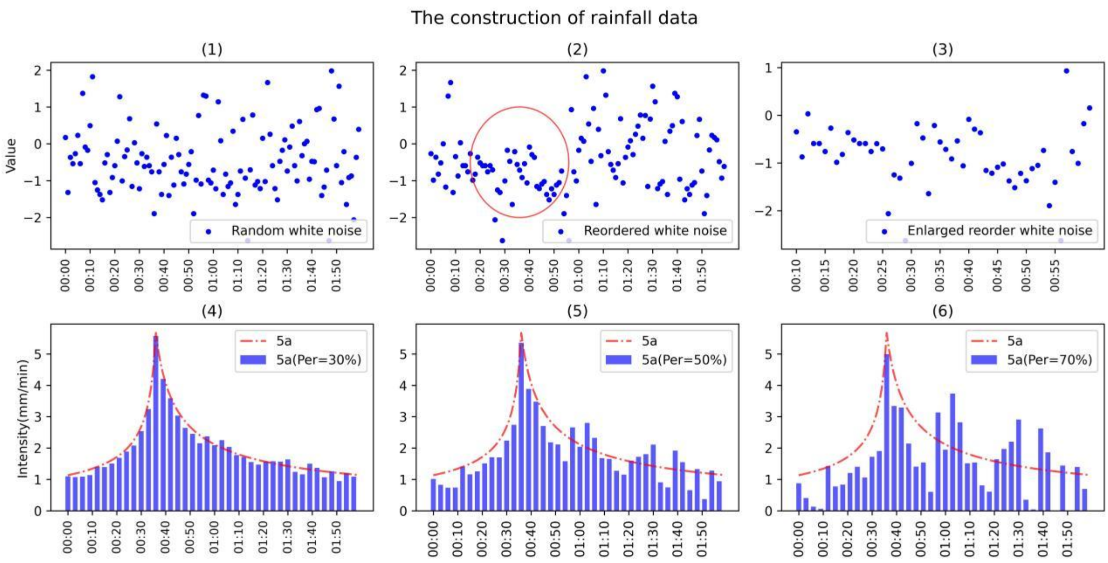

Figure 8: The construction of the design rainfall data.

Comment 5:

Why there are only 5 real-world rainfall events to verify the performance of the corrected model? If it is enough considering that you have 16960 synthetic rainfall events?

Response 5:

Thanks for your suggestion on improving the accessibility of our manuscript. The supplementary explanation has been amended in line 234. The relevant contents are also provided below for your quick reference.

During the model training, a great deal of synthetic rainfall events is intended to cover as many extreme weather conditions as possible. Since the simulation results of the verified hydraulic model can be considered credible, the model correction is only to fine-tune the trained weight parameters without requiring a large amount of measured data. Besides, in the process of model updating, the model is modified by reducing the learning rate on the measurement data set, where the size of the data set does not work.

Comment 6:

It is recommended to add HESS's article to the reference

Response 6:

Thanks for your suggestion. The supplementary references have been added to our paper. The relevant contents are also provided below for your quick reference.

Supplementary References:

Archetti, R., Bolognesi, A., Casadio, A. and Maglionico, M.: Development of flood probability charts for urban drainage network in coastal areas through a simplified joint assessment approach, Hydrology and Earth System Sciences, 15, 3115-3122, http://dx.doi.org/10.5194/hess-15-3115-2011, 2011.

Guo, K., Guan, M. and Yu, D.: Urban surface water flood modelling-a comprehensive review of current models and future challenges, Hydrology and Earth System Sciences, 25, 2843-2860, http://dx.doi.org/10.5194/hess-25-2843-2021, 2021.

Huong, H.T.L. and Pathirana, A.: Urbanization and climate change impacts on future urban flooding in Can Tho city, Vietnam, Hydrology and Earth System Sciences, 17, 379-394, http://dx.doi.org/10.5194/hess-17-379-2013, 2013.

Moy De Vitry, M., Kramer, S., Dirk Wegner, J. and Leitao, J.P.: Scalable flood level trend monitoring with surveillance cameras using a deep convolutional neural network, Hydrology and Earth System Sciences, 23, 4621-4634, http://dx.doi.org/10.5194/hess-23-4621-2019, 2019.

Skougaard Kaspersen, P., Hoegh Ravn, N., Arnbjerg-Nielsen, K., Madsen, H. and Drews, M.: Comparison of the impacts of urban development and climate change on exposing European cities to pluvial flooding, Hydrology and Earth System Sciences, 21, 4131-4147, http://dx.doi.org/10.5194/hess-21-4131-2017, 2017.

Yang, T., Hwang, G., Tsai, C. and Ho, J.: Using rainfall thresholds and ensemble precipitation forecasts to issue and improve urban inundation alerts, Hydrology and Earth System Sciences, 20, 4731-4745, http://dx.doi.org/10.5194/hess-20-4731-2016, 2016.

We would like to take this opportunity to thank you for all your time involved and for this great opportunity for us to improve the manuscript. We hope you will find this revised version satisfactory.

Sincerely,

The Authors