# Responses by authors

We thank Referee #1 for the valuable comments and suggestions which will improve the quality of the manuscript. Detailed responses are provided to your questions. The blue text shows our response, updates that will be incorporated in the manuscript are highlighted in red, and the black text shows the referee's comments.

The manuscript follows a logical order and is generally well-written. I put forward some minor revision suggestions and comments for the authors to consider. I hope that the authors can deal with the comments seriously and make detailed revisions through more in-depth analysis.

Specific comments:

Point 1: Line 446-447. The manuscript mentions that the coupled WRF/HEC-HMS model simplifies hydrological processes for storm events 2 and 4. Could the authors elaborate on the underlying reasons for this limitation?

Response 1: The WRF/HEC-HMS model simplifies several hydrological processes compared to the WRF/WRF-Hydro system. Specifically, the treatment of surface runoff generation, infiltration, evapotranspiration, and routing processes within the HEC-HMS framework involves several assumptions and parameterizations that differ from the more detailed WRF/WRF-Hydro model. For instance, the HEC-HMS model often uses simplified algorithms for surface runoff, assuming uniformity in parameters such as soil properties and land use, which may not capture the spatial variability as effectively as the distributed approach in WRF/WRF-Hydro. These simplifications can significantly impact model accuracy, especially during extreme conditions like storm events 2 and 4. The lumped parameter approach in HEC-HMS might not represent rapid hydrological changes across different sub-basins, leading to less accurate predictions of peak flows and runoff volumes.

To address the reviewer's request for specific details, we updated the following information in the revised manuscript:

"The lumped parameter approach in HEC-HMS, i.e., assuming uniformity in parameters such as soil properties and land use might not be able to present the rapid hydrological changes across different sub-basins."

Point 2: Line 471-475. The manuscript suggests several recommendations for enhancing rainfall simulation, such as using observed rainfall for correction and integrating radar data assimilation.

I suggest the authors add citations of research where these recommendations have been validated or tested.

Response 2: Citations of some of the recommended suggestions for improving WRF rainfall simulation have been added to the manuscript:

"(Vendrasco et al., 2016; Tong et al., 2016; Liu et al., 2021)".

Liu, Y., Liu, J., Li, C., Yu, F., and Wang, W.: Effect of the Assimilation Frequency of Radar Reflectivity on Rain Storm Prediction by Using WRF-3DVAR, https://doi.org/10.3390/rs13112103, 2021.

Tong, W., Li, G., Sun, J., Tang, X., and Zhang, Y.: Design Strategies of an Hourly Update 3DVAR Data Assimilation System for Improved Convective Forecasting, Weather Forecast., 31, 1673–1695, https://doi.org/https://doi.org/10.1175/WAF-D-16-0041.1, 2016.

Vendrasco, E. P., Sun, J., Herdies, D. L., and Frederico de Angelis, C.: Constraining a 3DVAR Radar Data Assimilation System with Large-Scale Analysis to Improve Short-Range Precipitation Forecasts, J. Appl. Meteorol. Climatol., 55, 673–690, https://doi.org/https://doi.org/10.1175/JAMC-D-15-0010.1, 2016.

Point 3: Line 17 and 83 "simi-distributed" should be corrected to "semi-distributed".

Response 3: "Simi-distributed' has been corrected to "semi-distributed".

Point 4: Line 120. "Daqing River basin" should be capitalized as "Daqing River Basin" since it is a proper noun.

Response 4: "Daqing River basin" has been capitalized to "Daqing River Basin".

Point 5: Line 122. "Fuping (2219km2)" and "Zijingguan (1760km2)" should have spaces between the numbers and the unit "km²".

Response 5: The space between the numbers and unit has been added "Fuping (2219 km2)" and "Zijingguan (1760 km2)".

Point 6: Line 125. "Zijigguan" should be corrected to "Zijingguan".

Response 6: “Zijigguan” has been corrected to “Zijingguan”.

Point 7: Line 138. “events happened” can be changed to “events occurred”.

Response 7: “events happened” has been changed to “events occurred”.

Point 8: Line 168. “Figure 2, subfigure for Event 2” is non-uniform compared to the others and should be replaced.

Response 8: “Figure 2, subfigure for Event 2” has been replaced and all subfigures are now uniform.

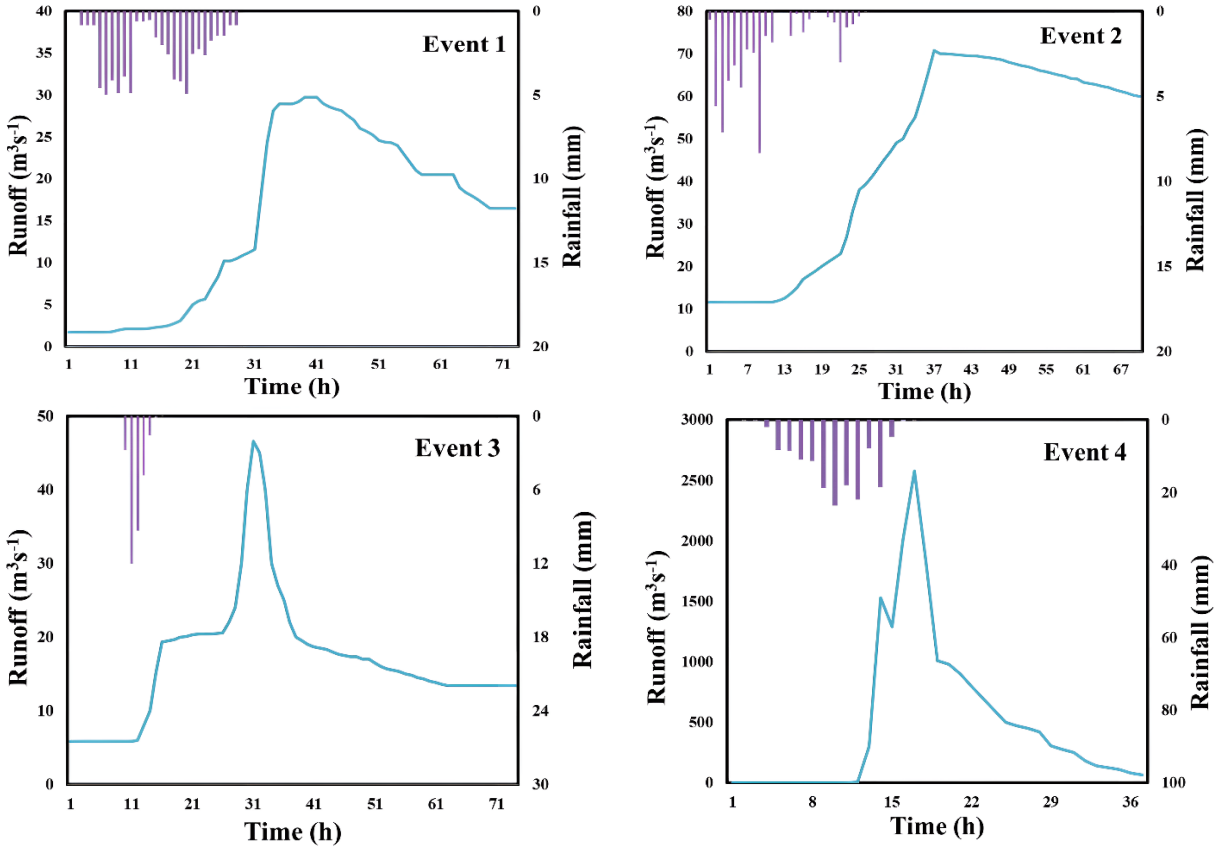


**Figure 2. The rainfall-runoff observations of the four 24-hour storm events.**

Point 9: Line 185. “WRf” should be corrected to “WRF”.

Response 9: “WRf” has been corrected to “WRF”.

Point 10: Line 189. “sub-watershed” should be corrected to “sub-catchment” for consistency with previous terminology in the manuscript.

Response 10: “sub-watershed” has been corrected to “sub-catchment” for consistency.

Point 11: Line 191. “50hPa top-layer pressure” should have spaces between the number and the unit “hPa” for clarity.

Response 11: the spaces between the number and the unit have been added “50 hPa”.

Point 12: Line 256. “Hydrologic” should be "Hydrological” for consistency.

Response 12: “Hydrologic” has been changed to “Hydrological” for consistency.

Point 13: Line 266. “Metrologic data” should be corrected to "Meteorologic data”

Response 13: “Metrologic data” has been corrected to “Meteorologic data”.

Point 14: Lines 371 and 394 “storm Event” should be capitalized as “Storm Event”.

Response 14: “storm Event” has been capitalized as “Storm Event”.

Point 15: Line 404. “as shown in Table 2, has a better simulation result”. This phrase seems to be incorrectly placed, disrupting the flow of the sentence, and should be corrected as “(as shown in Table 2), has a better simulation result”.

Response 15: The phrase “as shown in Table 2, has a better simulation result” has been corrected as “(as shown in Table 2), has a better simulation result”.

Point 16: Line 440. “perform” should be “performs”.

Response 16: “perform” has been corrected to “performs”.

Point 17: Line 482. “simi-distributed” should be “semi-distributed”.

Response 17: “simi-distributed” has been changed to “semi-distributed”.

Point 18: Line 484. “is carried out” should be “are carried out”.

Response 18: “is carried out” has been corrected to “are carried out”.

Point 19: Line 490. “process" should be “processes”.

Response 19: “process” has been changed to “processes”.