

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
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## **Comment on hess-2021-161**

Anonymous Referee #2

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Referee comment on "The impact of the spatiotemporal structure of rainfall on flood frequency over a small urban watershed: an approach coupling stochastic storm transposition and hydrologic modeling" by Zhengzheng Zhou et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-161-RC2>, 2021

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This paper addresses the issue of the impact of small scale spatio-temporal rainfall variability on the hydrologic response of small urbanized catchment. The topic is relevant for the community and HESS journal. The paper is well written, and rather straightforward to read. However I believe that major modifications are needed before a potential publication in HESS. I have three major comments :

- Results are often not so clear with contrasting trends. In order to clarify the outcome of the study, I think that statistical significance of results should be quantified more systematically. This could help to clarify some results.

- Physical interpretation of the results should also be systematically provided, with quantification of the various effect implemented (notably the percentage of imperviousness of the various catchments). This would enable to enlarge the potential application of the paper's results to other locations.

- It is not clear at what spatial scale are the rainfall return periods estimated ? This could have a strong impact on the results.

Detailed comments :

## 2) Data and methods

### 2.1) Study region and data

- Fig. 1.b : could you please clarify the configuration of the catchment, and notably the path of the various rivers through the catchment, which do not seem to converge toward the outlet of the catchment ? Please also update the colours because the map is difficult to read.

- Table 1 : please clarify what is "developed land" and "controlled area".

- l. 94-98 : sentence weirdly written, please rephrase

### 2.2) GSSHA hydrological model

- Please explain how the interactions between surface flow and stormwater system is handled, because it is crucial in highly impervious areas.

### 2.3) SST procedure

- Over which area is rainfall computed to estimate the return periods ?

- l. 153 : "to generate estimates for return periods up to 500 years". I believe an assessment of the corresponding uncertainties should be provided.

### 2.4) Characteristics of rainfall and hydrologic response

- Eq 1 : given it is a basin average at time  $t$ , I guess that the integral should not be over time ( $T$ ), but over the spatial domain.

- Eq. 3 : if  $M(t)$  is a rain rate, I guess the time step should appear in the computation of the cumulative depth. More generally, please indicate units of all the quantities used.

- l. 182-183 : please clarify what you are calling a "unimodal distribution for rainfall".

- Are all the indicators really used ? I do not have the feeling that they are really all used and that the high number is just creating a bit of confusion. I would either really exploit all of them or reduce their number.

### 3) Result and discussion

#### 3.1) Model validation

- I believe that an example of hydrographs should be included in the main document.

- The differences observed in Fig. 2.a are quite significant and should be more discussed.

- Also, limiting the validation of the model to peak discharge and time of peak do not seem sufficient. Adding indicators using the whole hydrographs (such as the imperfect Nash-Sutcliffe efficiency and not only the skewness) would add some relevancy to the validation.

#### 3.2) Flood frequency distributions

- Fig 3.a : clarify how normalization is implemented. Also more explanation/interpretation of the multimodal behaviour for flood should be added. Is it due to location of rainfall ? Is the same behaviour also observed for the other stations.

- l. 242-243 : please provide some explanations / interpretations to this retrieved behaviour.

- Fig. 5 and associated comments : the fact that no clear trend with basin size is found is somehow surprising. Differences in land use are mentioned and should be further explored and quantified I think. Also, was a sensitivity analysis carried out on the choice of rainfall events ?

### 3.3) Rainfall-Flood relationship

- l. 284 : a correlation of 0.16 is very low, so I am not sure the wording "somewhat correlated is appropriate"

- Fig 7 and associated comments : please provide more insights about the "random forest regression model" for the non-specialist reader. Also, a lot of rainfall features while floods are quantified simply by flood peak. How significant are the differences between 10yr and 200 yr results ? Would a different selection of initial rainfall events lead to different results ?

- l. 306-309 : It is not obvious to me how the general conclusion is obtained from the Fig. 8. Please clarify ? Notably, the figure does not provide answers on the rapidness of flood response if I understood it well ...

- l. 311-318 : I believe that the paragraph is actually quite interesting, and that more interpretation should be done. However, the spatial scale used to determine the rainfall return period should be clarified and is likely to play a significant role, notably in relation with the size of the studied catchment. For which of the catchments was Fig. 9 obtained ? Are different trends found for other catchments ?