

Hydrol. Earth Syst. Sci. Discuss., author comment AC3
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Reply on RC2

Ravi Kumar Meena et al.

Author comment on "A contribution to rainfall simulator design – A concept of moving storm automation" by Ravi Kumar Meena et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-502-AC3>, 2022

Reply to Reviewer 2

This is a review report for the manuscript entitled, "Innovatory rainfall simulator design – A concept of moving storm automation" by Dr. Meena et al. This study proposed a designation of rainfall simulator with a AM+BM controller to simulate moving storm conditions. Later on, they used the rainfall simulator with different moving storms to evaluate the effect of storm movements on time to peak (tp) and peak discharge (Qp) of surface and subsurface flow as well as recession slope, respectively. But, I could not find the result of subsurface flow in either the section of result or discussion. Finally, the authors proposed a multiple regression model to estimate the tp and Qp under different conditions. Three independent variables, saying direction, hillslope gradient, and velocity of storm movement were taken into consideration.

Reply: We are thankful to the reviewer for reviewing our manuscript and providing constructive comments. This paper aims to develop a mobile operated programmable moving-storm rainfall simulator and verify the functionality of developed RS by conducting multiple test runs in different velocities and slope conditions. In the current study, we only used the surface flow component of soil flume. However, the sub-surface component of soil flume can be used in future studies.

In general, the study is a good technical note with a preliminary test rather than an article. The structure is well-organized and the writing is good and clear; however, the findings are expected. The effect of storm movement on hydrograph in terms of tp and Qp, in fact, is associated with relativity (or the tension). To deal with this relativity relies on the competition between runoff velocity (including slope, surface roughness, and slope length) and the velocity of storm movement. Only when the difference of the two velocities is large enough, the hydrograph would be changed. Otherwise, the change in hydrograph could not be detected. Certainly, the high recording frequency can help to describe the hydrograph change.

Reply: We agreed with the reviewer's observation. As mentioned previously, this study developed a moving storm rainfall simulator and verified its functionality by conducting rainfall-runoff experiments. Thus, the obtained results are similar

to past studies discussed in the manuscript. Also, the rainfall-runoff experiments were recorded at a temporal frequency of 1m.

Two studies I listed below may help to deal with this issue. What I can suggest for this study is to replace the multiple regression with a conceptual framework to express the relativity issue. Also, two or three additional sets of experiments are encouraged to investigate the effect of storm movement on surface and subsurface flow.

Huang, J.C., Yu, C.K.*, Lee, J.Y., Cheng, L.W., Lee, T.Y., Kao, S.J. (2012) Linking typhoon tracks and spatial rainfall patterns for improving flood lead time predictions over a mesoscale mountainous watershed, *Water Resources Research*, 48: W09540, doi:10.1029/2011WR011508.

Huang, J.C.*, Kao, S.J., Lin, C.Y., Chang, P.L., Lee, T.Y., Li, M.H. (2011) Effect of subsampling tropical cyclone rainfall on flood hydrograph response in a subtropical mountainous catchment, *Journal of Hydrology*, 409 (1-2): 248-261, doi: 10.1016/j.jhydrol. 2011.08.037.

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Reply: We are thankful to the reviewer for suggesting these papers. The data used in above-mentioned studies were collected using radar. Typhoon data is too dynamic and complex to understand.

As per the results of our study, the developed RS can be used to simulate a dynamic storm to study the complex phenomenon under controlled conditions. We used a regression model to explain the obtained results. However, the conceptual framework can be used in future studies to describe the outcomes of rainfall simulator experiments. The scope of this study is limited to the initial test for the moving storm RS capabilities.