

Hydrol. Earth Syst. Sci. Discuss., author comment AC2  
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## Reply on RC2

Harris Ramli et al.

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Author comment on "Influence of drop size distribution and kinetic energy in precipitation modelling for laboratory rainfall simulators" by Harris Ramli et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-462-AC2>, 2022

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The authors wish to thank the editorial team for managing the technical review. The authors also thank the reviewers for the comments and appreciate their support in making the paper more readable and more beneficial. Attached is the response to the comments and suggestions made by the reviewer (in PDF format).

No.	Comment	Action	Notes
1	The authors are kindly advised to revise the article as the authors first fail to show any improvement of their proposed solution over those already available in the literature, starting from the ones presented in papers that are mentioned among the references of this manuscript. There is no evidence in the manuscript, indeed, that the presented setup performs any better than very similar solutions that already exists.	They are considered in the revised manuscript.	The authors thank you for the comments and appreciate the support and involvement of the reviewers to improve the paper.  The novelty of this paper compared to Mendes (2021), is that this paper proves that the usage of drip emitter for a high rainfall intensity is more suitable than spray nozzle. This paper also proves that raindrops' size distribution is more consistent when using drip emitter. This can be seen from

consistent median value in the normal distribution of  $D_{50}$ . This paper also proves that the collection area is important in rainfall simulator selection (drip emitter vs. spray nozzle).

2

The main comments reported in the conclusions do not reflect results of the present manuscript

Terminal velocity is calculated based on the equation (3) – Text in abstract needs to change from monitored to calculated

RC2: the main comments reported in the conclusions do not reflect results of the present manuscript (e.g., no calibration exercise is described in the text, no validation with real rainfall characteristics is provided, etc.). General statements about the dependence of the drop size distribution and the kinetic energy of the raindrops on the rainfall intensity are declared as results of the present study, while obviously they are not.

3

This is correctly states as a requirement but not demonstrated in manuscript

Thanks to the reviewer for this comment. The main

the manuscript.

novelty of our paper is that we prioritise improving the simulated rainfall droplet size distribution, as this is something that other researchers can effectively replicate in comparison to the fall velocity parameter.

"Surely, simulated rainfall should be made to be as close to natural rainfall as possible, especially on droplets' fall velocity and size distribution."

4

Correction of the terminology "...intensity of the raindrop..."

Regarding this comment, the author had changed "raindrop" to "rainfall".

Thanks to the reviewer for this comment and suggestion.

5

This is not demonstrated in the manuscript.

Regarding this comment, the author adds more detailed information on this sentence to give a clearer view, where the sentences have been modified to:

Thanks to the reviewer for this comment and suggestion.

"...capable of producing droplet characteristics identical to natural rainfall."

"...capable of producing droplet characteristics identical to those found in natural rainfall from a drop

size distribution perspective."

- 6 Correction of the terminology. Regarding this comment, the author changed "spray" to "nozzle". Thanks to the reviewer for this comment and suggestion.

"The pipe diameter is 2 cm while the spray diameter is 4 mm."

- 7 It is also important to note that high rainfall intensities degrade the quality of measurements using the disdrometers or imaging techniques, due to background noise (Mendes et al., 2021). No changes in manuscript. Thanks to the reviewer for this comment and suggestion. This sentence intends to emphasise that this study, like Mendes et al. 2021, is not suitable for using disdrometers due to the high rainfall intensity (40 mm/hr to 80 mm/hr).

- 8 Was this calibrated in some way or is it a literature result?  $D_d = 14.56M_f^{0.354}$  and  $D_d$  (mm) =  $0.985D_f$  (mm)<sup>1.02</sup> Regarding this comment, the author omitted the sentences: Thanks to the reviewer for this comment and suggestion. The sentences are omitted because the formula is a literature result based on Navas et al.,

The relationship between the diameter of the drop,  $D_d$  (in mm), and the mass of the flour ball,  $M_f$  (in mg), is  $D_d = 14.56M_f^{0.354}$ , respectively. To estimate the drop diameter as a function of the flour ball diameter  $D_d$  (mm) =  $0.985D_f$  (mm)<sup>1.02</sup>, the diameter of flour balls can be considered practically equivalent to that of the drops.

1990. In our case, we might not need to use the formula since the drop diameter is measured, and the result shows a consistent median value in the normal distribution of  $D_{50}$ .

9 No measurements of fall velocity and kinetic energy are reported

Regarding this comment, the author change the typo " $I = \text{Rainfall Intensity,}$ " to the " $I = \text{Rainfall Intensity.}$ " and missing words added to the sentences:

Thanks to the reviewer for this comment and suggestion.

$I = \text{Rainfall Intensity.}$   
 Kinetic energy can also be measured from the physical properties of simulated rainfall: raindrop size, fall velocity and drop size distribution.

10 Why is this different from Eq. 3 used above?

Regarding this comment, the Equation is same as the Eq.3

Thanks to the reviewer for this comment and suggestion.

11

Could not see any calibration exercise described in this paper. What is the meaning of "calibrated" here ?

Regarding this comment, the author added a paragraph on rainfall simulator calibration to provide a more clear view:

Thanks to the reviewer for this comment and suggestion.

The rainfall simulator was calibrated in terms of rainfall intensity to achieve reproducible and consistent rainfall characteristics. Throughout the calibration and experiment, any element that may affect the changes in wind flow, such as an air conditioner or fan, is controlled to ensure that the raindrop falls vertically within the effective test area. The calibrating process was split into two parts. The first step measured the rainfall intensity and spatial rainfall distribution on the designated surface. To obtain high-resolution datasets, 100 cylindrical rainfall collectors are positioned on an area of 80 cm x 80 cm under the drip used. Each collector was weighed to determine the amount of rain collected after one hour of simulated rainfall. Based on the observations, no droplet crosses the

cylindrical during the calibration and all land directly on the cylindrical beneath the drip. This initial calibration step ensures that each nozzle produces an equal amount of rainfall. A second step involved using a single large, plot-sized collection to determine net rainfall intensities. The volumetric method of flow measurement was utilised to calibrate the simulated real intensity. Two laboratory steel trays with top dimensions of 80cm x 80cm x 10cm and bottom dimensions of 100cm x 100cm x 8cm were used for volume control and placed beneath drip systems. The different heights of the top and bottom are merely a coincidence due to the laboratory's available tray. The primary technical requirement is that the central collection tray (small) must fit within the dimensions of the designed test area and be tall enough to collect the intended rainfall intensity (in this work, the maximum is 80 mm/h.), whereas the secondary collection tray must be larger than the effective test area. Collector boxes were placed in a central location (in relation to the drip location) and collected

the precipitated volume at a set pressure. The volume of precipitated water was determined using a measuring cylinder. A ruler was used to measure the water level, and then the precipitation volume collected was recorded. No raindrops landed on the large bottom tray during the second calibration stage based on the observations. This demonstrates that the raindrop area's uniformity is reproducible.

12

Repeated sentence

Regarding this comment, the author omitted a sentence to avoid repetition in conclusion:

Thanks to the reviewer for this comment and suggestion.

The drop size distributions were obtained by using a flour pellet methodology, described by Kathiravelu et.al (2016).

13

This was not demonstrated in the paper.

Regarding this comment, the author added a sentence to provide a more specific conclusion:

Thanks to the reviewer for this comment and suggestion.

...natural rainfall is achieved from the perspective of rainfall intensity and drop size distribution.

14

The results presented in the manuscript do not show that. It was simply assumed from literature results.

Regarding this comment, the author rewrite a sentence to provide a more specific conclusion:

The sentences have been rewritten so that they are less ambiguous.

This study discovered that DSD might affect both kinetic energy and terminal velocity.

Please also note the supplement to this comment:

<https://hess.copernicus.org/preprints/hess-2021-462/hess-2021-462-AC2-supplement.pdf>