General response:

We sincerely thank the Editor and the referees for their careful review and insightful comments. We have provided detailed, point-by-point responses to the comments and suggestions from the referees. Each response addresses the specific feedback received, with detailed explanations and corresponding modifications to the manuscript where necessary.

Our responses are structured for clarity: Referees comments in black, our responses in blue, and manuscript modifications highlighted in red.

In general, our revisions primarily include the following points:

(1) **Conceptual clarification and improvements in manuscript structure:** We refined several key conceptual statements, added a complete list of model parameters with their physical meaning and acquisition methods, and thoroughly revised the Introduction. The Discussion section was substantially expanded to deepen the interpretation of results, and the overall clarity and readability of the manuscript have been improved.

(2) **Refinement of model formulation and underlying assumptions:** We clarified the theoretical derivations, improved the description and justification of component partitioning, and added discussion on branch/stem drip processes. These revisions strengthen the transparency and interpretability of the model framework.

(3) **Enhancement of model validation, sensitivity analysis, and limitations:** We improved the experimental validation procedures by reporting measurement uncertainty, sampling intervals, and bin aggregation steps. Additional sensitivity analyses were incorporated, and the limitations of the model are now more comprehensively discussed to provide clearer guidance for interpretation and application.

Referees #1 Comments:

#1: This study derived and validated raindrop kinetic energy estimation model for tree canopy based on microphysical processes. The model was developed based on Li and Tian 2025 and Li et al. 2025. The series of papers that take physical properties of leaf, microstructure of the canopy and microphysical processes into consideration are novel and have potential for development. Overall, this present manuscript is well organized and well written.

Response: Thank you for your positive assessment and constructive suggestions on our manuscript. We have thoroughly revised the paper in response to your comments.

#2 The weak point is that variables and constants are difficult to follow because there are numerous of them. That makes the manuscript hard to read. Relevant to that, for some variables and constants, there are no explanations and descriptions. I advise making the list of variables and constants at the end of the text like Li and Tian 2025 did, in addition to describing and defining them in the text firmly. However, it is not feasible to explain all variables and constants perfectly in the manuscript due to large number of them. Instead of omitting exact and detailed explanations on variables and constants, authors should refer readers to Li and Tian 2025 and Li et al. 2025 by explicit description, although I think most readers will likely do so without such description.

Response: Thank you very much for your such valuable comments. In the revised manuscript, we have added explanations for all previously undefined variables in the main text. For several variables with complex or lengthy definitions (e.g., pinning proportion coefficient p, attachment retention coefficient β), we now explicitly refer readers to Li and Tian (2025) and Li et al. (2025) for detailed descriptions. In addition, a comprehensive list of variables and constants has been compiled and placed at the end of the main text, sorted alphabetically.

#3

L18, “external variations”, I think the following description is better. “variations in rainfall characteristics”

L19, “an unchanged”, I think the following description is better. “a certain”

L35 to 36, “the number of raindrops …in kinetic energy”, I suggest modification as follows. -> large raindrops are formed and the number of raindrops beneath the canopy is reduced, which results in a broader distribution range and an increase in kinetic energy

L38 measurement, mainly -> measurement,

L47 DSD -> raindrop size distribution

Response: All Done. Thanks.

#4 L50 to 53 This paragraph looks like the index of the paper. Readers would like to know the objectives of this study at the end of Sect 1 reflecting the background of the study stated earlier in the section. Authors need to add one or more specific objective(s) of this study here.

Response: Thank you very much for your valuable comments. We have revised the end of Section 1 to clearly state the research gap and the specific objectives of this study. The updated version now includes a concise description of the research gap and the specific objectives, which can be found in lines 58-63 of the revised manuscript.

#5 Between L90 and 91 It is advisable to explicitly encourage readers to refer Li and

Tian 2025 and Li et al. 2025. Additionally, compiling a list of variables and constants and presenting it at the end of the main text would be useful for readers.

Response: Thank you very much for your valuable comments. The sentence explicitly encouraging readers to refer to Li and Tian (2025) and Li et al. (2025) has been added in the revised manuscript in Lines 105-106. In addition, a comprehensive list of variables and constants has been compiled and included at the end of the main text.

#6 L96, Please delete "is the total kinetic energy calculation".
Eq. (2) E(D) -> E(Di), Please note that subscripts and superscripts are in the standard font, not italics.
L99, the unit area unit rainfall depth kinetic energy -> kinetic energy per unit area and unit rainfall depth

Response: All Done. Thanks.

#7 L99, What does "(KE)" mean? Does it mean EKp is a function of kinetic energy? If so, I think the expression is redundant and "(KE)" should be deleted.

Response: Agreed. The "(KE)" has been deleted throughout the manuscript. Thanks.

#8 L100, Please replace "t is the drop spectrometer observation time (60s)" with "P is the amount of rainfall", because t does not appear in Eq. (3).
L102, Please delete ", A is the drop spectrometer observation area (54cm2)," as A has already been defined on line 100.
L104, the canopy density -> fractional vegetation cover (FVC)

Response: All Done. Thanks.

#9 Eq. (6), There is no explanation for σ. In the upper equation for smax: The denominator in the root symbol includes sinα, but Eq. (1) in Li et al. 2025, which I think original equation, does not. In the lower equation: Inside the root symbol in Eq. (2) in Li et al. 2025, (sinα)/2 is multiplied, but not in this present manuscript. What is the cause of these differences?

Response: Thank you for your comments. Errors were present in the Eq. (6) in the manuscript: the sinα had been moved into the g term due to the influence of wind load but without corresponding adjustments. This has now been corrected, making the expression consistent with that in Li et al. (2025).

#10 L114, Please insert "that reflects wind load effect and" after "a coefficient".
Eq. (7), Please add explanation for "s".
L119, Pleas insert "Li and Tian, 2025" after "function".
Eq. (10), There is no description on G. It appears on L184 to 185 but should be presented here.
L139, the proportion of splash drops -> the proportion of canopy and stem splash drops
Please consider that in Table 1 the terms "Leaf splashing" and "Stem splashing" are used.
L140, canopy drip -> canopy and stem drip
L164, the splash intensity (mm/h) -> the portion of canopy and stem splash drops
L164 to 165, the canopy dripping intensity (mm/h) -> the portion of canopy and stem dripping
L169 to 175, Please add the stand characteristics like average tree height, average diameter at breast height and stem density.
L187 to 188, "The model was… in Table 3." This sentence describes on validation not the method and should be moved after "these nine rainfall events" on line 198 as in, "these nine rainfall events along with accumulated rainfall, mean wind speed and mean rainfall intensity."
Table 2, Symbol "R" should be replaced with "I" as already shown on line 158.
Symbol "LAD" should be replaced with "f(α)" or "α" because Li and Tian 2025 used them as leaf inclination distribution function and leaf inclination angle, respectively.
L209, Please insert "through the coefficient k" after "wind load effects".
L215, Please insert "in total and dripping energy" after "performance".

Response: All Done. Thanks.

#11 Figure 4, The vertical axis in Figure 4, f(ds), means raindrop size distribution but the maximum values in the figure range from 0.8 in Fig. 4a to 2.5 in Fig. 4b. Does it mean the number of raindrops in the measurement volume in OTT Parsivel2 laser spectrometer?

Response: Thank you for your valuable comments. Figure 4. The ordinate (y-axis) represents the volume fraction per millimeter of raindrop diameter, not the number fraction. The area under the curve between any two diameters (and bounded by the x-axis) corresponds to the proportion of the total rainwater volume contributed by raindrops within that size range. The total area under the entire curve is normalized to 1. This description has been added to the revised manuscript in lines 248-254.

#12 Figure 5: vertical axis labels, For Fig. 5a and 5d, please replace Ek with EK. For Fig. 5b and 5e, please replace Ek with Es. For Fig. 5c and 5f, please replace Ek with Ed.

Figure 6a, b, Please replace Ekt with ΣEK considering Eq. (4).

Response: All Done. Thanks.

#13 Figure 6b, In Table 3, accumulated rainfall on 26 August was 6.71 mm but in Fig. 6b it is some 30 mm or more. Please explain or clarify the cause of the difference.

Response: Thank you very much for your comments. In the previous version, Figure 6b contained an error where rainfall amount was incorrectly used interchangeably with rainfall intensity. This has been corrected in the revised manuscript.

#14 Technical comments
L13, 9 field datasets -> nine field datasets, That holds true throughout the text.
L15, J/m2 h -> J m-2 h-1, That holds true throughout the text.
L50, This section 2 delves into -> In Sect 2., we delve into, The abbreviation holds true throughout the text.
Figure 1, The combination of red, brown and green are not good for readers with color vision deficiencies. Please modify.
L105, Ed and -> and Ed
L106, Please put a space between "1.3" and "mm".
L107, Please put a space between "0.8" and "mm".

Response: All Done. Thanks.

#15 References
In the running text, please replace "&" with "and", e.g. L49 Frasson & Krajewski, 2013.
L303 de Moraes Frasson et al. 2013 is in the reference list but not in the text.

L312 Fernández-Raga et al. 2010 is not in alphabetical order.

L352, 355 There are two Nanko et al. 2008 that are not distinguishable.
The following papers that appear in the text are not found in References. L27 Angulo-Martínez et al., 2016, L29 Jeong et al., 2024, L39 Mosley et al., 1983, L40 Yan et al., 2021, L49, 74 Frasson and Krajewski, 2013,
L36 Katayama et al., 2024 -> Katayama et al., 2023,
L49, 79 Murakami et al., 2021 -> Murakami, 2021
L67 Gash and Morton, Valente and Gash -> Gash and Morton (1978), Valente and Gash (1997)
L75 Rutter et al. (1997) -> Rutter et al. (1971)
L120 Mou J (1983) -> Mou (1983)

Response: All Done. The reference list has been pruned to remove redundant entries, and the citation style has been updated to comply with the journal format. Thanks.

Referees #2 Comments:

#1 The manuscript develops a process-based model of under-canopy throughfall kinetic energy (KE) by partitioning throughfall into splash, drip, and penetration components, assigning each a size and velocity distribution, and integrating to obtain KE. The attempt to link canopy microphysics to under-canopy KE is novel and worth pursuing. However, several core elements-parameter definitions and provenance, observational partitioning of the components, explicit assumptions about drop-size distributions (DSDs), and the consistency of terminology-are currently underspecified. These issues reduce clarity, limit reproducibility, and make it difficult to evaluate the results. A thorough revision focused on reproducible methods, consistent definitions, and transparent validation would substantially improve the manuscript.

Response: Thank you for your positive assessment and constructive suggestions on our manuscript. We have thoroughly revised the paper in response to your comments.

#2 Framing and objectives
The Introduction reviews field work on under-canopy KE, but soon after states that the method for studying KE under canopy mainly uses experimental measurement. Please streamline the framing to avoid internal inconsistencies and clearly articulate the specific research objectives at the end of the Introduction.

Response: Thank you very much for your valuable comments. Thank you for your constructive comment. We have reorganized the Introduction to improve clarity and consistency. The revised structure is as follows: the first paragraph introduces the significance of under-canopy kinetic energy; the second paragraph highlights its complexity and difficulty in estimation; the third paragraph reviews existing methods and points out the limitations of modeling approaches; the fourth paragraph summarizes component partitioning and stem/leaf interception studies as the foundational basis for this work; finally, the last paragraph clearly states the specific research objectives. Transitional sentences have been added between paragraphs to ensure smooth logical flow.

#3 Positioning relative to the throughfall partitioning literature
Because component partitioning is central to your approach, the literature review should explicitly situate the work with respect to key studies on throughfall partitioning, such as Levia et al. (2019, Hydrological Processes, doi:10.1002/hyp.13432), Nanko et al. (2022, Journal of Hydrology, doi:10.1016/j.jhydrol.2022.128144), and Nanko et al. (2025, JGR-Biogeosciences,

doi:10.1029/2024JG008340). Clarifying how your definitions and assumptions align (or intentionally differ) from these studies will help readers evaluate the contribution.

Response: Thank you very much for your valuable comments. The key studies on throughfall partitioning have been incorporated into the Introduction (lines 51-55) to provide mechanistic references for component partitioning in our modeling approach. In the Model derivation section, these studies inform the assumptions underlying our model (lines 121-126 and 138-145). In the Results and Discussion, we compare our findings with these references to highlight the limitations of our model assumptions (lines 363-366).

#4 Consistent terminology for throughfall types
Standard forest hydrology usage distinguishes free/direct throughfall, splash throughfall, and canopy drip (e.g., Levia et al., 2017, WIREs Water, doi:10.1002/wat2.1225). You use "penetration," which risks confusion unless mapped clearly to prior terms. Please define precisely whether "penetration" is synonymous with free/direct throughfall or whether it includes drops secondarily generated by in-canopy splash (as your schematic may imply). If your category differs physically from free/direct throughfall, explain the rationale and adopt consistent wording throughout figures, equations, and text.

Response: We thank the reviewer for the valuable suggestion. The term "penetration" was indeed ambiguous. We have revised the manuscript to use the standard terminology: free throughfall, splash throughfall, and canopy drip consistently. In the revised manuscript in lines 92-94, we added the following clarification with reference:

"From a component perspective, raindrops penetrating the canopy can be classified into three types: free throughfall, splash throughfall, and canopy drip (Levia et al., 2017)."

#5 Equation (5): definition and coefficient consistency
The symbol γ is described as canopy density/FVC in different places, and Eq. (5) scales a KE term by γ. If γ denotes fractional vegetation cover, the direct/free-throughfall fraction is commonly represented by $(1-\gamma)$. Rather than asserting an error, I recommend clarifying the physical meaning of γ and revisiting the coefficient so that the term associated with direct/free-throughfall is consistently represented (which may imply using $(1-\gamma)$). Please ensure that the terminology (FVC vs canopy density) is consistent across the paper.

Response: We thank the reviewer for pointing this out. The symbol γ represents the fractional vegetation cover (FVC). The previous use of "canopy density" was ambiguous and has been corrected throughout the manuscript to consistently refer to FVC. We agree with the reviewer's comment that the fraction of direct/free throughfall should be represented as $(1-\gamma)$. The relevant term in Eq. (5) and other related expressions has been revised accordingly to ensure consistency and clarity.

#6 Section 2.2 parameter definitions and provenance
Several parameters critical to reproducibility lack values, units, or sourcing: leaf surface contact angle θ (and how measured or sourced), the pinning proportion p, the retention coefficient β, surface tension σ, the wind-load parameter k, and the contact-angle hysteresis term X. Please provide a single comprehensive parameter table listing, for every symbol in Eqs. (5)-(14): name, definition, units, typical value or range, whether measured/assumed/fitted, the measurement/estimation method, and literature sources.

Response: Thank you very much for your valuable comments. We have now provided a single comprehensive parameter table in Table 2 of revised manuscript that includes all symbols appearing in Eqs. (5)-(14). The table lists, for each parameter, its name, definition, units, typical value or range, whether it is measured/assumed/fitted, the corresponding measurement or estimation method, and the relevant literature sources.

#7 Observational partitioning of splash, drip, and direct/free components
Tabled statistics are reported separately for splash and drip KE, yet the Methods do not explain how the disdrometer observations were partitioned into these components. Please describe a transparent and reproducible diagnostic (e.g., thresholds in size-velocity space, spectral shape, timing relative to wind gusts or canopy shaking), provide sensitivity to threshold choices, and clarify how any ambiguity was handled. Without this, component-specific R2 and RMSE are difficult to interpret.

Response: Thank you very much for your valuable comments. In this study, the observational partitioning of splash and canopy drip was based on a droplet-diameter threshold. Based on the result of Levia et al. (2019), droplets with diameters < 1.3 mm were classified as splash, whereas those > 1.3 mm were classified as canopy drip after removing direct/free throughfall to simplify the assumption. This fixed threshold was applied consistently across all disdrometer observations to simplify the diagnostic procedure.

we have added a sensitivity analysis (now shown in Fig. 8(a) and described in Lines 318-324), which evaluates how alternative droplet-size thresholds influence component partitioning and the resulting KE statistics. We also clarify the potential ambiguities and limitations associated with using a fixed threshold in the Discussion section in Lines 364-366.

#8 Explicit DSD assumptions for each component
For splash, you indicate a range (e.g., 0.3-1.3 mm) and a central tendency, while for canopy drip you derive a representative size but do not state a distribution form. Because Eq. (14)-type integrals over size strongly depend on f(D), please specify

explicit DSD functional forms for each component (e.g., gamma, lognormal, triangular, uniform), justify them with observations or literature, and ensure they are consistent with Fig. 4. State whether Fig. 4's vertical axis is number-based or volume-based frequency.

Response: Thank you very much for your valuable comments. For splashed droplets, the particle size is mainly distributed between 0.3 and 1.3 mm shown in Figure 4, and their volume distribution can be referenced from the Weibull distribution proposed by Levia et al. (2019) for droplets in the 1-2 mm range. To unify the volume distribution of splashed droplets both ≤1 mm and 1-2 mm and to simplify the modeling, this study approximates their volume distribution using a triangular distribution with a peak at 0.8 mm and zero values at 0.3 mm and 1.3 mm.

The radius of canopy drip is computed using Eqs (6). For a given tree, leaf inclination angle is the only parameter in Eqs (6) that varies among leaves, while the remaining parameters remain constant. Leaves with larger inclination angles produce canopy drip of smaller radius, and vice versa. Therefore, the radius distribution of canopy drip can be derived from the probability distribution function of leaf inclination angles, and the corresponding volume distribution can then be obtained using Eq (7).

These statements have been added to the revised manuscript at lines 121-126 and 138-145.

#9 Wind effects and leaf inclination

You state that Eq. (6) accounts for wind load via parameter k, and leaf inclination α appears elsewhere. Please clarify the physical role and calibration of k, whether α varies with wind, and how these influences were implemented (event-wise or time-varying). If wind effects were ultimately small in your validation, it would help to show a brief sensitivity analysis.

Response: Thank you very much for your valuable comments. In our model, the parameter k in Eqs. (6) represents the effect of wind loading on leaf and branch vibration. It is an empirically fitted parameter derived from controlled experiments in which increasing wind speed was observed to reduce the maximum droplet size (S_{max}) that can remain attached before dripping. Specifically, Eqs. (6) incorporates the term k v_w^2, where v_w is wind speed, indicating that higher wind speeds decrease S_{max} and therefore promote drip formation. The detailed derivation of the k-dependence is provided in Li et al. (2025) as following:

"*Considering that the leaves are approximately symmetrical, and for the sake of simplifying the assumption, the pitch direction of the leaf is the main rotation direction, and the vibration in the other two directions is not considered. Then the angular velocity* w_α *(/s) in the pitch direction when the leaf vibrates is:*

$$w_\alpha = \frac{d\Delta\alpha}{dt} = \frac{d(\emptyset \cdot sin(wt))}{dt} = \emptyset \cdot w \cdot cos(wt) \quad (1)$$

Where, $\Delta\alpha$ is the leaf swing angle, $\emptyset$ is the amplitude, w is the vibration angular frequency, t is the time (s). Taking the leaf itself as the reference system, the centrifugal acceleration of the water droplet α_n (m/s2) is:

$$\alpha_n = R \cdot w^2 \cdot \emptyset^2 \cdot cos(wt)^2, \ w = \frac{2\pi \cdot St}{L} \cdot v_w$$
$$\alpha_n \propto {v_w}^2 \quad (2)$$

where, R is the distance between the water droplet and the petiole (m), L is the characteristic length (m), St is the Strouhal number, and this formula takes into account the leaf vibration caused by wind. Then considering the vibration of the branch where the leaf is located, the centrifugal acceleration of the leaf α_l has the same relationship with the wind speed v_w:

$$\alpha_l \propto {v_w}^2 \quad (3)$$

There is also the relationship between the wind pressure acceleration α_n, wind shear acceleration α_p and wind speed:

$$\alpha_p \propto {v_w}^2, \alpha_\tau \propto {v_w}^2 \quad (4)$$

At this time, the acceleration of the droplet along the leaf surface direction is $(g \cdot sin\alpha + \alpha_n + \alpha_l + \alpha_p + \alpha_\tau)$. Therefore, the l becomes:

$$l = \sqrt{\frac{6\sigma}{\rho}} \cdot \sqrt{\frac{1}{g \cdot sin\alpha + \alpha_n + \alpha_l + \alpha_p + \alpha_\tau}} = \sqrt{\frac{6\sigma}{\rho}} \cdot \sqrt{\frac{1}{g \cdot sin\alpha + k{v_w}^2}} \quad (5)$$

where, k is a coefficient determined by experiment." (Li et al., 2025)

#10 Raindrop velocity relation
Equation (8) uses a piecewise V-D relation with a breakpoint near 1.9 mm. Consider replacing or benchmarking against a widely used continuous relation (e.g., Atlas et al., 1973) to avoid artifacts at the breakpoint, and report the sensitivity of KE to the velocity model.

Response: Thank you very much for your valuable comments. We agree that the piecewise V-D relationship of Mou (1983) introduces a breakpoint near 1.9 mm. In the revised manuscript, we have replaced the Mou (1983) relation with the widely used continuous velocity-diameter model of Atlas et al. (1973) for the applicable diameter range of 0.6-5.8 mm. For droplets smaller than 0.6 mm, we retain the Mou (1983) formulation, as the Atlas relation is not valid in that regime.

To ensure continuity, we benchmarked both formulas at the transition diameter of 0.6 mm. The terminal velocities predicted by the two models at this point are 2.46 m/s (Atlas et al., 1973) and 2.36 m/s (Mou, 1983), respectively with a difference of only 0.1 m/s. As shown in Figure R1, the relative error between the two relations is approximately 0.2%, and their correlation coefficient exceeds 0.9999.

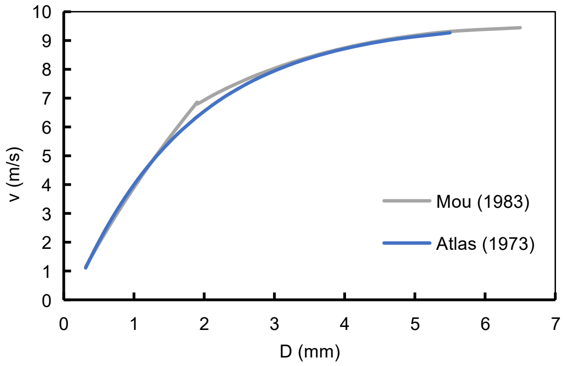

Figure R1. The comparison of Mou (1983) and Atlas (1973) model

#11 Fall height for drip and splash
The fall height h appears to be fixed as the mid-height of the last canopy layer for both drip and splash. Because origins differ (leaf tips vs branch edges) and canopy structure is heterogeneous, please justify this assumption or, preferably, derive h from your LiDAR geometry (e.g., distributions of likely origin heights) and examine sensitivity.

Response: Thank you very much for your valuable comments. In the revised manuscript, we extracted the full distribution of likely droplet-origin heights directly from the LiDAR-derived canopy geometry. The resulting height distribution is shown in the revised Figure 3(b).

To evaluate the impact of this refinement, Section 3.3 now compares model results obtained using (1) a single mean fall height and (2) the full LiDAR-derived height distribution shown in Table 5. The mean deviation in splash kinetic energy between the two approaches is only 0.1%, while deviations for drip kinetic energy and total kinetic energy are approximately 1.65%. All correlation coefficients exceed 0.999, indicating that the differences are relatively negligible.

The primary reason is that for this tree species, branch heights are relatively large (> 4 m), meaning that droplets reach more than 90% of their terminal velocity regardless of the exact origin height. In addition, the species has high leaf-area density, producing a narrow origin-height distribution concentrated between 4.7 and 5.1 m, which further limits the variability in fall height.

#12 Definition and wording for pt

pt is defined as SAI/(LAI+SAI) but is referred to as "stem flow ratio" in places. In

forest hydrology, "stemflow ratio" usually denotes the fraction of rainfall routed as stemflow, not an area fraction. Please adopt "stem area proportion" (or similar) consistently to avoid confusion.

Response: Thank you very much for your valuable comments. The terminology has been revised for consistency: pt is now referred to as "stem area proportion" throughout the manuscript.

#13 Figure 4 - axis definition only
Please clarify the axis definitions: specify whether the vertical axis represents number-based or volume-based drop-size frequency (and provide units), indicate any normalization (e.g., per mm, per bin, probability density), and state the bin widths used on both axes.

Response: Thank you very much for your valuable comments. In the revised manuscript, we now clarify that the vertical axis in Figure 4 represents the volume-based drop-size frequency, expressed as the volume fraction per millimeter of raindrop diameter (/mm). The curve is normalized such that the total area under the distribution equals 1, and therefore the area between any two diameters corresponds to the proportion of total rainfall volume contributed by drops within that diameter interval. We also specify the bin widths used on both axes. These clarifications have been added in Lines 248-254.

The full diameter range (0.0625-24.5 mm) is divided into 32 classes with variable bin widths: 0.125 mm for $D < 1.25$ mm, 0.25 mm for 1.25-2.5 mm, 0.5 mm for 2.5-5.0 mm, and 1.0 mm for $D > 5.0$ mm. The Figure 4 is plotted using the midpoint of each bin as the representative value.

#14 Treatment of branch/twig drips
The model and figures emphasize leaf drip, but branch/twig drips can be important-especially in broadleaf canopies-and can alter DSDs. Please clarify whether branch-origin drips are included in your "canopy drip" category, whether they are distinguishable in the data, and how (or if) they are represented in the model. If neglected, state this explicitly and discuss implications.

Response: Thank you very much for your valuable comments. Thank you for raising this important point. We have expanded the discussion of branch- and twig-origin drips in the revised manuscript in Lines 357-362. In our current framework, branch-origin drips are not explicitly separated from leaf drips in the observations and are therefore implicitly included within the overall "canopy drip" category. In the model, parameters such as D_d and *pt* represent the proportions of stem drip and splash, and we assume that the size distributions of drips and splash droplets generated from branches are the same as those generated from leaves.

We acknowledge that this assumption may introduce biases. As reported by Nanko et al. (2022), branch drip points can generate substantially larger droplets, which may meaningfully influence kinetic energy estimates. However, our field observations were conducted during the summer period, when foliage coverage is high and leaf surfaces dominate potential drip points. As a result, the contribution of branch-origin drips was relatively minor in our dataset.

Nonetheless, we agree that the representation of branch and twig drips could be improved, and we highlight this as an important direction for future model refinement.

#15 Validation design, reporting granularity, and interpretability
It is unclear whether R2 and RMSE are computed from 5-min bins within each event, then averaged, or from another aggregation. Please report the exact time aggregation, the number of samples per event, and the comparison targets (modeled vs measured component KE). For each event, provide measured KE (with uncertainty), rainfall duration, and a bias metric (e.g., modeled/observed mean ratio). Without this context, the reported RMSE values (≈20 J m^{-2} h^{-1}) are hard to judge.

Response: Thank you very much for your valuable comments. We have clarified the requested information in the revised manuscript. Specifically, Table 4 now reports, for each rainfall event, the measured KE (including its uncertainty), rainfall duration, and the bias metric (expressed as the modeled/observed mean ratio). The exact temporal aggregation and calculation procedures for R^2 and RMSE are explicitly described in the notes of Table 4.

#16 Discussion depth
The Discussion largely reiterates results. For example, please expand with (i) comparisons to prior under-canopy KE and partitioning studies (agreement/disagreement and causes), (ii) sensitivity to canopy traits (LAI, inclination, θ) and rainfall characteristics, and (iii) implications for erosion modeling and for transferring parameters to other sites/species.

Response: Thank you very much for your valuable comments. In the revised manuscript, we have expanded this section accordingly. First, we added comparisons with prior under-canopy KE and throughfall-partitioning studies, highlighting both areas of agreement and sources of discrepancy, and clarifying limitations arising from differences in stem-drip point representation and component-partitioning assumptions. Second, we incorporated additional analysis of the model's sensitivity to canopy traits (LAI, leaf inclination, and θ) and rainfall characteristics, as illustrated in Figures 7-9. Finally, we elaborated on the implications for erosion modeling and for transferring calibrated parameters to other sites or species, which have been added in Lines 351-356 and 367-372 of the revised Discussion.

#17 Specific comments

Lines ~95: For under-canopy drops, not all reach terminal velocity; "fall velocity" is more accurate than "terminal velocity."

Response: Done, Thanks.

Line ~104 and Table 1 note: Clarify whether γ denotes canopy density or FVC, and use one term consistently; revisit the coefficient in Eq. (5) accordingly.

Response: Done, Thanks. γ is the fractional vegetation cover (FVC).

Eq. (6): Define σ (surface tension), k (wind-load parameter; units and calibration), and X (half the contact-angle hysteresis). Provide values and sources for θ and X for the study species.

Response: Thanks. We have now provided a single comprehensive parameter table in Table 2 of revised manuscript that includes all symbols appearing in Eqs. (5)-(14).

Line ~115: If wind effects are represented through k and/or through variations of α, please explain how α was measured or parameterized and whether it varies in time with wind.

Response: Thanks. The explanation and derivation of the wind-loading coefficient are provided in Response #9 and in Li et al. (2025).

Line ~123: Clarify whether the fall height h is fixed at the mid-height of the last canopy layer for both drip and splash, and justify or test sensitivity.

Response: Done, Thanks. For details, please see Responses #11.

Line ~134: Avoid "stem flow ratio" for pt; use "stem area proportion (SAI/(LAI+SAI))."

Response: Done, Thanks.

Eq. (8): Consider adopting or benchmarking a continuous V-D relation (e.g., Atlas et al., 1973) to avoid artifacts near the current breakpoint.

Response: Done, Thanks. For details, please see Responses #10.

Fig. 2: State explicitly whether "penetration rain" includes splash-generated drops from upper layers. If yes, this differs from "free/direct throughfall" in prior literature; adjust terminology accordingly.

Response: Done, Thanks. For details, please see Responses #4.

Fig. 3 and Table 3: Report the number of time steps per event, the aggregation window used for statistics, event-level measured KE and duration, and a bias measure to contextualize RMSE.

Response: Done, Thanks. For details, please see Responses #15.

Section 3.1 and Fig. 4: Explicitly state that open-site and under-canopy KE were computed from Parsivel size-velocity spectra (referencing the equations), confirm that the open-site DSD shown is observation-based, and indicate whether the vertical axis is number-based or volume-based.

Response: Done, Thanks. For details, please see Responses #8 and #13.

Throughout: Define w, wl, and ws consistently, and supply units for every symbol on first use.

Response: Done, Thanks.