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 Editor and 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: Editor and Referee comments in black, our responses in blue, and manuscript modifications highlighted in red.

In general, our revisions primarily include the following points:

(1) **Substantial revision of the Methods section to improve clarity and logical flow.** The model formulation has been reorganized with clear subheadings, additional explanatory and linking text has been added, symbols and notation have been harmonized for consistency, and wording has been refined throughout to enhance overall readability.

(2) **Comprehensive revision of the English language.** The manuscript has been edited for clarity and precision, addressing all language issues raised by the editor and referees and improving readability across the text.

(3) **Extension of the scientific motivation**. The Introduction has been expanded to clarify the relevance of sub-canopy rainfall kinetic energy, its connection to canopy interception and splash processes, and its implications for soil erosion.

Editor Comments:

#1: Thank you for submitting your revisions and work for improving your submitted manuscript (ms). Three referees have given feedback on your revision, two from the last round and a new one during this review round. The reviewers of the first review round find the the paper is almost ready for submission, reviewer 3 thinks more work is required. I agree that the manuscript has much improved, but have had a closer look at the methods section and I agree with reviewer 3 that more work is required there, before the paper can be considered for publication. Please revise the methods section carefully. Please also note my detailed comments below.

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 Please note that the ms will not be revised for language. Currently there are still some problems throughout the ms that also hinter understanding. I therefore request that you carefully revise for english language. I have given some examples, but they are by no means a complete list.

Response: Thank you very much for your valuable comments. We have carefully revised the manuscript for English language and clarity throughout the text, aiming to improve readability and avoid ambiguity. The examples pointed out by the editor and referees have been corrected, and additional language issues have been addressed consistently across the manuscript (e.g., see Lines 8-9, 23, 68-69, 71, 101-105, 132-133, 138-140, 201).

#3 In addition to the reviewers comments, I also request that the motivation be extended. The ms is heavily based on your recent canopy interception model published in WRR, which relates splash to interception. Here you relate it to kinetic energy. Please add some information on why do we care for kinetic energy under canopy covered areas? Do we have more or less kinetic energy under canopies? Normally rainfall kinetic energy is related to erosion. Is this also a motivation here?

Response: Thank you for your valuable comments. We have extended the motivation in the Introduction to clarify why sub-canopy rainfall kinetic energy is of interest, its relation to canopy interception and splash processes, and whether kinetic energy beneath canopies may be attenuated or enhanced. We also explicitly highlight the relevance of rainfall kinetic energy to soil erosion. These additions are now included in the revised Introduction (see Lines 26-31, 35-37, 42-43, 55-62).

#4 Comments on the methods section
General:
It is very good to have a list of variables. Please order them alphabetically, and there is no need to separate between canopy properties and physical processes.

Response: Thank you for this helpful suggestion. We have reordered the list of variables alphabetically, and removed the separation between canopy properties and physical processes accordingly.

#5 Please revise the use of the symbols: (1) The same symbol should be used for only one variable and use indices to specify. You use for example D for droplet diameter and D_? for drip from the canopy (a water flux). Please use a different letter for one of them. Please check the other symbols as well. (2) Please use indices / subscripts consistently. For example, you use E with subscript k for kinetic energy in Eq. 2, but also only E in Eq. 1 refers to kinetic energy. I propose to use E_k throughout and supplement with more indices, to specify e.g. total kinetic energy as E_kt and total kinetic energy. Please be consistent.
Please revise mathematical typesetting: There has to be precisely one equal sign per equation. Eq 6 and 8 have three and two, the equations stated in Table 1 have none.

Please correct. The multiplication sign is a dot. You use both dot and cross for this, please correct.

Response: Thank you very much for your valuable comments. Thank you for these detailed comments. We have thoroughly revised the notation and mathematical typesetting throughout the manuscript. Specifically, different symbols are now used for distinct variables, with indices applied consistently to avoid ambiguity in Eqs. (1-19).

For example, $E_{Kf\_single}(D)$ is the kinetic energy of a single freely falling raindrop, E_{Kf_total} is the total kinetic energy of free rainfall, E_{Kf} is the kinetic energy of free rainfall outside the canopy (J m^{-2} h^{-1}), E_{Ks} is the splash drop kinetic energy (J m^{-2} h^{-1}), E_{Kd} is the canopy drip kinetic energy (J m^{-2} h^{-1}), E_{K_can} is the kinetic energy of rainfall under the canopy, r_{sa} is the stem area ratio, and r_{sd} is the ratio of canopy drip in the stem flow.

In addition, all equations have been reformatted to include exactly one equal sign per equation number such as Eqs. (6-8) and (10-11), the equations in Table 1 have been corrected accordingly, and the multiplication operator is now consistently represented by a cross. These changes have been implemented consistently throughout the revised manuscript.

#6 Detailed comments methods section
Eq 1., L 109: v_o is called "terminal velocity" normally.

Response: Thank you for your valuable comments. We have corrected the terminology and now refer to v_0 as terminal velocity instead of final velocity in Eq. (1) and the corresponding text (Line 107, 154).

#7 Eq4 In order to obtain energy per time, the division by t_o does not make sense, since this is a point in time and you would need a time interval. Please also check how this affects the results. Also, I do not see how how E_kp * I equals to the term in the middle. Please check.

Response: We thank the reviewer for the valuable suggestion. We corrected the notation by replacing t_0 with Δt in Eq. (4), as t_0 was intended to represent a time interval. In addition, we clarified the derivation of E_{Kf}, explicitly showing how the term·$E_{Kf\_R} \times I$ leads to the intermediate expression in Eq. (4).

#8 Line 117, Eq 5: The nomenclature of E_k_in and E_k_out is highly confusing and unintuitive. "in" and "out" are conventionally used to denominate fluxes in and out of a storage, which for an interception model would be the canopy and "in" would than refer to the above canopy and "out" to the modified below canopy. If you mean "inside the canopy", you could also use "can". Alternativly, using above and below in the index would be possible. Please adapt.

Also, does E_k_out in Eq 5 correspond to E_k in equation 4 ? If yes, please harmonize.

Response: We thank the reviewer for pointing this out. We have revised the nomenclature by replacing the indices "in" and "out" with more intuitive notation, using "can" to denote quantities within the canopy. In addition, we have harmonized the notation by ensuring consistency between Eq. (5) and Eq. (4), where the kinetic energy of free rainfall per unit area per unit time term is now consistently denoted as E_{Kf}. The corresponding changes have been applied throughout the manuscript (see Lines 106-120).

#9 Line 119: "splash drop kinetic energy" This needs more explanation. This is the second time Splash is mentioned, as far as I can see. The first is in the Fig. 1 and its caption. This shows that Splash droplets evaporate. Please explain.

Response: Thank you for your valuable comments. We have added a clarification explaining the origin and physical meaning of splash droplets and splash drop kinetic energy (see Line 119-124).

Here, the splash droplets refer to secondary droplets smaller than the original raindrops, generated by the impact of raindrops on the canopy. The splash drop kinetic energy E_{Ks} is defined as the kinetic energy of those secondary droplets that remain after the splash process and subsequently fall downward, with the evaporation of extremely small splash droplets handled by the canopy interception model of Li and Tian (2025).

#10 Eq 6: There can only be one equal sign per equation and equation number. Here we have three. Please re-organize. Do you imply two different cases for s_max? If yes, please use a notation with a case separation and a bracket. If no, please give context and state separate equation numbers. Please use a separate equation of l.

Response: Thank you for your valuable comments. We have reorganized Eqs. (6-8) to ensure that each equation contains only a single equality. The definition of l is now given in a separate equation with its own equation number, and the expression for s_{max} has been clarified accordingly. The revised formulation follows standard notation and is presented consistently in the updated manuscript (see Lines 132-135).

#11 Line 133: What is meant with "can be selected"? Do you mean "is set"?

Response: Thank you for your valuable comments. We have replaced "can be selected" with "is set to" for clarity (see Line 138).

#12 Line 133-134: "can be taken" is not really appropriate, as the surface tension of water is a physical property. Please reformulate. Please also consider that the surface tension depends on temperature and state which one you assumed here.

Response: Thank you for your valuable comments. We have reformulated the sentence to treat the surface tension as a physical property rather than an arbitrary choice, and now explicitly state the assumed temperature. Specifically, σ is set to 7.2×10^{-2} N m^{-1}, corresponding to pure water at 20 °C (Line 138-139).

#13 L 143: "this model assumes the same model" Do you mean the same mode als in Li et al., 2025? If yes, please state it this way.

Response: Thank you very much for your valuable comments. We have rephrased the sentence to clarify that stem interception is calculated using the same model as in Li et al. (2025) (see Line 149-150).

#14 Eq 8: Second line: No second equal sign required.

Response: Thank you for pointing this out. We have removed the second equal sign in Eq. (8) (now Eq. (11)).

#15 L 147: I believe you mean the "terminal velocity" not "final velocity". Also I believe that v in this equation correspond to v_o in eq 1? If yes, please harmonize and cross-reference.

Response: Yes, this is correct. We have replaced "final velocity" with "terminal velocity", harmonized the notation by consistently using v_0, and added a cross-reference to Eq. (1) (see Line 154).

#16 L 161: "amount of water" seems to be wrong, given that you use the intensity.

Response: Thank you for your valuable comments. We have corrected the wording by replacing "amount of water" with the appropriate term referring to intensity (see Line 169).

#17 Line 172: "D_d": Upper case D is already the droplet diameter. It cannot be used for another variable such as a water flux. Please change.

Response: Thank you for pointing this out. We have replaced D_d with r_{sd} to avoid confusion with the droplet diameter, and updated the notation consistently throughout the manuscript (see Line 180 and Eq. 16).

#18 Table 1; Please make sure the symbol and the equal sign are given in each line.

Response: Thank you for your valuable comments. We have revised Table 1 to ensure that each line includes the symbol and the equal sign.

#19 Comments on the other sections:
Table 1, captions: There should only be one caption per figure, not two. please change "processes" to model and please add the reference to the Rutte model to caption of 1a.

Response: Thank you very much for your valuable comments. We have revised the figure caption to ensure that only one caption is used per figure, replaced "processes" with "model", and added the reference to the Rutter interception model in the caption of Fig. 1a.

Referees #1 Comments:

#1 Overall comments
The manuscript has been significantly modified. I think it is acceptable with very minor corrections, typically made at galley proof stage.

Specific comments
My comment on Figure 1 in the first round of the review, quoted below, was misunderstanding on my part. The original figure is valid.
"Figure 1
The combination of red, brown and green are not good for readers with color vision deficiencies. Please modify."
L248 Please add "The total area under the entire curve is normalized to 1." After "frequency.".
Fig. 5
Vertical axis labels for Fig. 5a and 5d. Please replace Ek with EK: not "k" but "K".
References
L26 Howard, 2022 should be replaced with Howard et al., 2022.
L26 Momiyama, 2023 should be replaced with Momiyama et al., 2023.
L31, 35 and L525 to 530
Both "Nanko, K., Mizugaki, S., and Onda, Y. … 2008" on lines 525 to 528 and "Nanko, K., Onda, Y., Ito, A., and Moriwaki, H. … 2008" on lines 528 to 530 can be described as "Nanko et al. 2008" for short citations. However, they should be distinguished as "Nanko et al. 2008a" and "Nanko et al. 2008b", respectively.
Reflecting the above description, "Nanko, Mizugaki et al., 2008" on line 31 and "Nanko, Onda et al., 2008" on line 35 should be replaced with "Nanko et al. 2008a" and "Nanko et al. 2008b", respectively.
L47 Brandt, 1990 is not in References.
L69 and 78 Please replace Valente and Gash, 1997 with Valente et al. 1997.

L498 Please replace “&” with “and”. This holds true throughout References.

Response: Thank you for your positive assessment and constructive suggestions on our manuscript. All comments have been fully addressed, and the manuscript has been thoroughly revised accordingly.

Referees #2 Comments:

#1 L51: Not stem drip but canopy drip.

Response: Response: Thank you for your comments. The issue has been corrected accordingly (Line 52).

#2 Fig 8. You used 'radius' in the figure legend, but the diameter was shown in the Discussion text.

Response: Thank you for pointing this out. The Figure 8 legend has been revised to use “diameter”, ensuring consistency with the Discussion.

#3 Fig 9. Personally, I found this sensitivity analysis interesting and worth interpreting. The decrease in KE for Splash and Drip as LAI increases is likely due to their respective volumes decreasing. It's intriguing that the contact angle becomes concave downward. When water leaf surface hydrophobicity is low, canopy drip size increases, leading to higher KE. Conversely, when leaf surface hydrophobicity repellency is high, the amount of water that can sit on the leaf decreases, resulting in a larger volume. Greater leaf inclination likely increases volume. While these are just my comments, readers would appreciate an interpretation of this figure in the Discussion section.

Response: Thank you for your valuable comments. The relevant analysis has been added to the revised manuscript. Specifically, we now clarify that the observed increase in sub-canopy kinetic energy corresponds to a reduction in canopy interception volume, reflecting concurrent decreases in splash and drip volumes with increasing LAI and decreasing leaf inclination angle. This concave-downward response to contact angle reflects the role of leaf surface hydrophobicity: lower hydrophobicity allows larger canopy drip size and higher kinetic energy, whereas stronger repellency limits water retention on leaves and increases drip and splash volume (Lines 357-362).

#4 L357-362. I guess another reason is that the disdrometer did not collect branch drips because the woody surface drip points are lower than the foliar drip points.

Response: Thank you for the valuable suggestion. This explanation has been added to the revised manuscript and is discussed in Lines 374-376.

Referees #3 Comments:

#1 Summary:
I found section 2 very hard to understand. The section is not really a derivation, in the sense that the reader becomes explained how the final result is developed, it is more an aggregation of formulas from the literature. Without reading the authors' recent article "Derivation and Validation of a Theoretical Canopy Interception Model Based on Raindrop Microphysical Processes" (doi: 10.1029/2024WR038296) the manuscript is, in my opinion, completely unreadable. That's a pity, because the model - it is a continuation of the authors' above mentioned article from 2025 - is structurally reasonable (as far as I was able to understand it).

Response: Thank you for the detailed and constructive comment. We agree that clarity and logical flow in Section 2 are crucial for the readability of the manuscript. In response, Section 2 has been substantially revised.
Specifically, (1) we introduced clear third-level subheadings (Kinetic Energy of Free Rainfall, Kinetic Energy of Rainfall under the Canopy, and Summary of the Model Equations) to better structure the derivation; (2) additional linking and explanatory text has been added to explicitly guide the reader through the development of the model (Lines 115-116, 119-126, 132-133, 149-150, 152, 163-164); (3) all symbols and notation have been carefully revised and harmonized to avoid confusion and ensure consistency; and (4) wording has been refined throughout the section to improve overall readability (Lines 104-105, 138-140).
These revisions are intended to make the model formulation self-contained and understandable without requiring consultation of our previous work.

#2 Remarks:
-eq. 6: The authors redefine the quantity l from Konrad et al. 2012 in order to include the interaction of wind with a droplet that is attached to the leaf by adding the term k v_w^2 in the denominator of l. I have two objections:
a) in line 133 the authors select for l the dimensionless value 0.9. In order to make sense, the term k v_w^2 should have the same dimension as the gravitational acceleration g (with dimension length/time^2). This requires the dimension of k to be 1/length.

Response: Thank you for your valuable comments. We agree with the reviewer. The dimensional inconsistency has been corrected (Lines 137-138), and the unit of k_w has been revised to m^{-1} to ensure that the term $k_w*v_w^2$ has the same dimension as gravitational acceleration g.

#3 b) Obviously, the authors derive eq. 6 by extending eq. 13 and 14 of Konrad et al. 2012 where conditions for the downslide or detachment of a droplet on or from a leaf are derived from the forces acting on the droplet. From the physics of the situation it is clear that the drag force on the droplet resulting from wind can either add to the component of the gravitational force that tries to detach the droplet from the leaf - or reduce it. Clearly, which alternative is realised depends on the wind direction. But the way in which the authors extend eq. 6 ignores wind direction. Due to the structure of l (as defined in this manuscript), wind always supports downslide or detachment of drops.

Response: Thank you for your valuable comments. **We agree with the reviewer that, at the scale of an individual droplet, wind-induced drag may either promote or inhibit downslope motion or detachment, depending on wind direction.**

In the present study, however, the coefficient k_w (set to 0.09) is obtained from experimental fitting (Li et al., 2025) and represents a canopy-scale, aggregated effect rather than the force balance acting on a single droplet. As detailed in the derivation provided below, both shear and pressure components of wind loading can be positive or negative at the droplet scale; the formulation adopted here reflects their net effect for the studied tree under the experimental conditions. If experimental evidence were to indicate that wind enhances droplet storage, the fitted value of k_w could indeed become negative.

It is indeed the case that a more explicit treatment of wind direction and droplet-scale force balance, as noted by the reviewer, remains an important topic for future investigation.

The detailed derivation of the k_w-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:*

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

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:

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

$$\alpha_n \propto {v_w}^2$$

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*:*

$$\alpha_l \propto {v_w}^2 \tag{3}$$

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

$$\alpha_p \propto {v_w}^2, \alpha_\tau \propto {v_w}^2 \tag{4}$$

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:*

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

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

Reference: Li, Z., Tian, F., Wang, D., and Peng, Z.: A stochastic simulation method for estimating vegetation interception capacity based on mechanical-geometric analysis, Water Resour. Res., 61, e2025WR040267, doi:10.1029/2025WR040267, 2025.

#4 -eq. 8: please omit the expression "v=" in the second line of the cases.

Response: We thank the reviewer for pointing this out. The redundant expression "v =" in the second line of Eq. (8) (now Eq. (11)) has been omitted accordingly.

#5 - line 395 to 454: please sort in the Notation section the letters in an alphabetical order.

Response: Thank you for this helpful suggestion. We have reordered the list of variables alphabetically.