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Hydrology and Earth System Sciences Discussions

Interactive comment on "Throughfall and temporal trends of rainfall redistribution in an open tropical rainforest, south-western Amazonia (Rondônia, Brazil)" *by* S. Germer et al.

S. Germer et al.

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P. Gerard–Marchant (Referee)

(RC = referee comment, AC = author comment)

First we want to thank the referee for his thoughtful and constructive short comments, which we address in detail below:

RC 1: The introduction might be slightly improved. In particular, the authors should stress why their research is original, compared to the state-of-the-art references they present. A short description of the standard methods used to estimate canopy interception could also be useful. Finally, the objectives are clearly stated, but not really introduced. An additional sentence would ensure a smoother transition. **AC 1:** In the

revised manuscript, we will improve the introduction by adding the standard methods used to estimate canopy interception, and by pointing out the originality of our work, providing a smoother transition to our objectives.

RC 2: The structure of the body should be improved. It is more or less customary to present the theoretical aspects first, and then the material and methods. I understand that the authors present a mostly experimental work, which might explain why they presented the experimental design first. **AC 2:** Concerning our argumentation within the results section, we need to present our throughfall results first and then the results of the Gash model. Therefore, we prefer to keep the same sequence in the method section.

RC 3: However, I found it difficult to keep track of which parameters were measured, which were directly estimated from experimental data by statistical analysis, and which were only used in the revised Gash model. For example, two sets of indices could be used to represent throughfall, one representing collectors (e.g., i), the second representing events (e.g., j). Thus, TFi,j would be the throughfall measured at collector i for event j, TFi the throughfalls measured for different events at collector i (as used for the estimation of canopy interception, eq.(4)), and TFj the median throughfall for event j, as used in Table 2. **AC 3:** We agree and will use a second index for the events throughout our revised manuscript.

RC 4: Moreover, parameters and notations are not always properly introduced. For example, the fraction of gross rainfall becoming stemflow, pt, is mentioned in section 2.2.3, but the notation only appears in section 2.3.2. **AC 4:** In the revised manuscript, we will introduce the notation of fraction of gross rainfall becoming stemflow, pt, in section 2.2.3.

RC 5: Similarly, the amount of rainfall needed to saturate the canopy, P , is introduced section 2.3.1, and reintroduced with a completely different definition section 2.3.2. **AC 5:** For the revised manuscript we will delete P2716L3-5 and calculate PG' as intro-

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duced in section 2.3.1.

RC 6: Section 2.3.1 should be rewritten, and possibly presented earlier in the paper (for example as a 'theoretical background' section). The authors start by presenting the basic assumptions the Gash model relies on. Then, they present a simpler model for the estimation of canopy interception, before going back to the Gash model. Ideally, the authors should start with the simple regression equation, explain its limits, then present the basic assumptions of the Gash model and the different steps followed in the calculation of interception, before finishing with details of implementation. **AC 6:** As stated in AC 2, we do not agree with presenting this section earlier in the paper. But in the revised manuscript, we will shift the simple regression equation to the beginning of this section.

RC 7: The authors should make more explicit that the throughfall volumes presented table 2 are median throughfall (Tj , in the proposed notation). **AC 7:** In the revised manuscript, we will use T "bar" to emphasize that we use the median as an estimator, and introduce this notation in section 2.2.2. We rather not use the notation j, because in the last line of table 2, the sum of the throughfall medians of all events is plotted.

RC 8: To compare values of normalized throughfall at different collectors over the whole study, a box-plot might be more illustrative than the dots used by the authors in Figure 2. Thus, the height of each box would be an indicator of the temporal dispersion of throughfall measurements for each collector. **AC 8:** In our opinion, a grouped box-plot with 20 individual boxes would overload figure 2.

RC 9: Moreover, one could wonder why the authors chose to combine resistant and non-resistant statistics (median and standard deviation, respectively) in their normalization strategy. Why not using the interquartile range as a measure of spread? **AC 9:** We didn't use the normal standard deviation here, but the standard deviation of the median, which is calculated in a different way. For details please see the reference (Sachs, 1984).

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RC 10: The link between Figure 2 and 3 is clear, but I have difficulty understanding Figure 3. Figure 3 presents the throughfall percentage of incident rainfall along time, at two collectors. How was the throughfall proportion calculated ? If it was computed from the median throughfall for each event, the two plots should be identical. If the actual throughfall measured at each collector for each event was used instead, I'm quite surprised the authors could measure up to three times more throughfall than gross precipitation for some events (Figure 3b, November). It is also difficult to see the pattern in the second sampling season the authors are referring to. Some rewriting would doubtlessly clarify what the authors mean. **AC 10:** We did indeed measure up to three times more throughfall than gross precipitation in collector number 19 for some events. On P2718L27, we will describe the patterns in more detail to clarify why we see temporal patterns of throughfall in these collectors.

RC 11: The first two paragraphs of section 3.3. could have been presented earlier. **AC 11:** The first two paragraphs present results for parameters that are used in the Gash model. As the parameters are not mentioned in the previous results of gross rainfall (section 3.1) and throughfall (section 3.2), we don't see the point in introducing them earlier.

RC 12: The second half is relatively clear. The authors analyze the time evolution of cumulative interception for different groups of collectors, and its comparison with the values calculated with the Gash model. As the expected (modeled) interception losses look quite the same from one graph to another, one could assume the cumulative interception is in fact the cumulative average interception for all collectors, computed from the average canopy capacity for all collectors. This point should be clarified in the text. This point also raise a problem of methodology. The authors indicated earlier that throughfall was highly variable in time, and from one collector to another, mostly because of the particular morphology of the canopy. In that case, why use average values for the canopy ? Would it have been better to apply the Gash model on a collector basis (ie., estimating canopy capacity and additional parameters for each collector)?

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AC 12: The expected (modeled) interception is calculated for the whole forest and not for the 20 collectors as a mean. It is impossible to calculate the interception for the single collectors with this dataset, because we would need the input parameters listed in table 3 for the canopy right above each collector. Subsequently, in figure 4a-4c the modeled values are the same. We will clarify this fact to avoid any misunderstanding.

Technical corrections

RC 13: P2708-L20: Suppress 'either'. **AC 13:** The first sentence of the introduction will be changed. Please see RC1AC1 of the author answer to referee Savenije.

RC 14: P2711-L07: Precise that the rainy season lasts from October to June. **AC 14:** We will add: ?the rainy season, lasting from October to June.

RC 15: P2713-L08: The proportion of rain diverted to stemflow, pt, should be introduced here. **AC 15:** Please see AC 4.

RC 16: P2713-L09: Precise whether the average stemflow fraction is independent of collectors and events, or not. **AC 16:** We will modify the sentence as follows '?of incident rainfall, for all events.'

RC 17: P2714-L05: Refer to Gash et al., 1995 when introducing eq. (3). **AC 17:** We will modify the sentence as follows '?is expressed by Gash et al. (1995) as'

RC 18: P2714-L18: There are only five equations in table 1., as in Gash et al. (1995), and not six. **AC 18:** We will change the number to five.

RC 19: P2715-L23: The authors estimate the canopy capacity per unit cover area, Sc by regressing measured throughfalls per collector versus stemflow-corrected gross rainfall. However, in the initial Gash and Morton (1979) model, the intercept of the regression line with the PG axis yields the canopy capacity S, not Sc. Is this a mistake from the authors, or did they forget to precise it? In any case, the estimation of canopy cover should be presented first. **AC 19:** The intercept of the regression line with the PG axis yields in fact the canopy capacity per ground area S. The canopy capacity

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per cover area, Sc, is calculated as S/c, were c is the canopy cover. In the revised manuscript, we will correct this and specify throughout the text whether the canopy cover per ground area or per canopy area is meant.

RC 20: P2714-L23: This sentence is a bit awkward, please rephrase. **AC 20:** We will change the sentence to: 'Gash (1979) suggested the determination of Ec by regressing interception loss on gross rainfall, as the regression coefficient provides Ec/R. Due to the high variability of throughfall Ec could not be determined by this method in our study.'

RC 21: P2716-L10: Change 'far too wet' to 'far wetter than average'. **AC 21:** We will change as suggested.

RC 22: P2716-L13: Repeat the dates of the two sampling periods (Aug.-Dec. and Jan.-Apr.). **AC 22:** We will change as suggested.

RC 23: P2718-L03: Replace 'high intensive event' by 'high intensity' event. More generally, what distinction the authors make between the size of an event and its intensity ? Do they refer to the volume of precipitation and the precipitation rate ? Wouldn't it be better to use 'intensity' and 'duration'? **AC 23:** The event size addresses the amount of water per event. The intensity, on the other hand, specifies the amount of water, which has fallen in a certain time period. These are common terms used in rainfall hydrology. We will change 'high intensive events' to 'high intensity events'.

RC 24: P2717-L18: The sentence starting with 'Although several collectors...' is too long and awkward. Please simplify. **AC 24:** Several collectors registered frequently more (e.g. collectors 14 or 20) or less (e.g. collectors 2 or 13) than the median throughfall per event, as indicated by the deviation from the horizontal axis. However none of the collectors deviated persistently in either direction.

RC 25: P2717-L29: Replace 'of throughfall proportions' with 'of throughfall proportions, for two collectors, 2 and 19'. **AC 25:** We will modify as suggested.

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RC 26: P2717-L29: Replace 'In both cases' with 'For both collectors'. **AC 26:** We will modify as suggested.

RC 27: P2718-L01: Repeat what the second study period is (Jan.-Apr.). **AC 27:** We will modify as suggested.

RC 28: P2718-L02: Please clarify the meaning of 'opposite trend'. What trend? In opposition to what? The previous study period? Or should the reader understand that for the second study period, the two collectors exhibit opposite trend. **AC 28:** That will be clarified. Pleas see response 10.

RC 29: P2718-L06: Please specify which collectors showed temporal trends, which collectors didn't have any palms above them, and which 'palm-less' collector exhibited some kind of trend. **AC 29:** We will specify these points in the revised manuscript.

RC 30: P2721-L18: Please add a minus sign in the exponent of h. **AC 30:** We will add a minus sign.

RC 31: Table 2. Use 'estimated stemflow' instead of 'computed stemflow'. The events for which TF > PG could be marked with an asterisk, and the events for which TF + SF > PG could be marked with another symbol. **AC 31:** We will modify as suggested.

RC 32: Figure 2. In the text, the normalization is done with the median, not the mean. Is the legend correct? **AC 32:** The normalization is in fact done with the median. We will change the caption as follows: 'normalized to zero median and unit variance'.

RC 33: Figure 3. The variable I10max should first be introduced in the text (and in section 3.2, not in section 3.3). Its pertinence should be addressed. **AC 33:** I10max and I60max will be introduced and explained in more detail in the method section.

RC 34: Figure 4. The authors may want to use a straight line instead of solid dots, to increase readability. **AC 34:** We prefer to stay with the dots and circles in this graph, because a line would suggest continuous measurements, while rainfall events are discrete events.

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Interactive Comment

RC 35: Figure 5. The variable I10max should be introduced in the text. **AC 35:** Please see AC 33.

References: Sachs L. 1984. Applied statistics: a handbook of techniques. Springer: New York; 707.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 2707, 2005.