This paper proposed monitoring system for throughfall with tipping bucket instrument, which authors had developed recently (Paulsen and Weiler, 2025). I agree that spatial distribution of throughfall is highly heterogeneous, and interception studies require instruments which can measure the spatial distribution of throughfall easily and validly. So, I could understand authors' motivations shown in this paper, but I regret to say that this paper should be rewritten very carefully.

We thank the reviewer for the valuable and helpful comments and for reviewing our manuscript. We acknowledge the criticism and suggest the following revisions.

When tipping bucket system is applied to measure inflow of water, static and dynamic calibrations are necessary, as authors cited Shimizu et al. (2018). Authors did very careful calibration of static volume of one tip. Also, increasing underestimation of one tip for increasing inflow must be considered. The static one tip volume is 2.21 to 3.69 mL, ranging 0.037 mm to 0.062 mm, relatively high resolution for gross rainfall and throughfall measurement. Please note that underestimation occurs at every tip under high intensity, and number of tips should increase with higher resolution (smaller volume of one tip), leading to larger underestimation compared with tipping bucket of low resolution (larger volume). As authors stated, throughfall sometimes exceeds gross rainfall, strongly requiring applying correction based on the dynamic calibration. This is "technical note", in which well-known uncertainties must be evaluated carefully. The one tip volume is similar with Onset and Davis rain gauges, and their dynamic calibration curve had been described in Iida et al. (2012, Hydrological Processes) and Iida et al. (2018, Journal of Hydrometeorology).

We agree with the reviewers' comment and acknowledge that measurements of water amounts based on the tipping bucket principle may lead to bias under dynamic conditions, depending on the inflow intensity into the tipping bucket. In our case, the sampler design partially mitigates this issue. The pipes connecting the drainage compartments to the tipping bucket units have an inner diameter of 3 mm, which limits the inflow rate. During high-intensity rainfalls incoming water is collected in the sampler, funnelled and temporally stored in the four drainage compartments that function as a buffer emptying at 0.4 L min^{-1}. We will describe this feature of the sampler design more precisely in section 2.1.3. In general, our measurement approach is designed to appropriately capture the spatio-temporal patterns of most events; extreme events are not the primary focus.

We appreciate the reviewers' suggestion to consider dynamic calibration. As described in section 3.1., we calibrated all single 240 tipping bucket units individually using static calibration at an already relative high rainfall intensity of 40 mm h^{-1}, corresponding to 13.94 tips minute^{-1}. To evaluate under- and overestimation for lower and higher intensities, we conducted a dynamic calibration on a subset of the tipping bucket units (n = 10). At highest tested rainfall intensity of 120 mm h^{-1}, in average 27.83 tips per 100 mL were recorded. Using the mean tip volume from static calibration (2.87 mL), this indicates an undercatch of approximately 23% at very high intensity rainfalls. During 1.5 years of observation, rainfall intensities at the field site exceeded 120 mm h^{-1} for 11 minutes (0.015% of total rainfall duration in 1.5 years) and 40 mm h^{-1} for 2.4 hours (0.2% of total rain duration). The resulting total underestimation from extreme events is less then 0.05%, which we consider acceptable . Like any method, tipping bucket measurements have their limitations. Still, they are simple in principle and cost-effective allowing us to realise an approach for fine-scale spatio-temporal monitoring.

We would also like to emphazise the advantage of the flexible dimensioning of all components of this self-built sampler-including the drainage compartments volume and size, the pipe diameter and tipping bucket volumes made possible through 3D-printing and the use of modular Euro-containers. The selected dimensions of this setup were selected to match the prevailing and most frequent rainfall intensity ranges at the study site. Should field observations and data analysis require rainfalls intensities exceeding the inflow capacity, the user can plan to exchange the measurement units with larger components. This scalability supports also the application of this monitoring approach to drier or wetter climates.

Moreover, we will analyse the recently collected, larger dataset from the 2025 vegetation period with regard to over- and underestimation of the tipping bucket units. We will evaluate rainfall events of varying intensities and test correction approaches for measurements during high intensity rainfall following e.g. Iida et al. (2012, Hydrological Processes) and Iida et al. (2018, Journal of Hydrometeorology).

Title of this paper is "... to measure spatio-temporal throughfall patterns in forests". However, reading the current manuscript, main results are rainwater passing through the litter manually put on the capturing area. Changing logic through the manuscript is not suitable for scientific journals. Please confirm that the current objectives (line 111-114) include throughfall only. If authors want to focus on rainwater passing through the litter, careful revisions must be required for whole manuscript.

I feel strange for expression of "infiltration" measured by this equipment. The tipping bucket measures inflow of rainwater, which passed the litter put on the capturing area of throughfall. I could not think that the inflow is the same as infiltration into soil. To declare infiltration, at least, initial soil water condition, inflow intensity, infiltration capacity and topography (slope or flat) should be considered.

We understand the comment and acknowledge the definitions of forest interception flux components and how we refer to them were not sufficiently outlined. As also explained in the answer to the second reviewer of this manuscript, we will therefore provide a more differentiated description of interception fluxes in a forest ecosystem. In addition, we propose to strengthen the manuscripts' quality as a technical note introducing a novel monitoring system for interception flux components rather than present it as a throughfall study, for which the dataset was too limited at the moment of submission. We hope to thereby clarify the objective of this manuscript.

In the revised introduction, we will therefore provide a more differentiated description of interception fluxes of forest ecosystems. We modify Figure 1 to explicitly mark overstory, understory and forest floor interception fluxes (different throughfall components of overstory canopy drip, understory throughfall and litter percolation) and to group these components according to their affiliation with integrated fluxes such as total vegetation interception ($I_c + I_u + I_l$), total throughfall ($TF_c + TF_u$) or litter percolation as net throughfall after interception losses ($TF_c + TF_u – I_l$) following Gerrits et al. (2010). The measurement setups presented in Figure 1 will be visually linked to these groups underlining their specific applications (e.g. with and without litter, under understory and overstory, only overstory, etc.). Eq. 1 will be adapted accordingly.

In the Methods and Discussion sections, we will elaborate more clearly the flexible application of the sampler for measuring both isolated or integrated throughfall component, and hope to clarify potentials and limitations of presented modifications:

I. Isolated measurement, e.g. overstory throughfall (canopy drip) using the sampler without litter as an alternative to traditional throughfall measurement methods; adjustable in height to target e.g. only overstory throughfall.

II. Integrated measurement of net throughfall after interception losses, a new method for capturing a less frequently observed flux at high spatio-temporal resolution; additional litter trap function

Given its flexible application, we consider our system as a throughfall sampling approach. With the here proposed revisions and clarification of throughfall component definitions, we hope to establish a consistent and precise terminology throughout the manuscript. In the Results and Discussion section, we will place particular emphasis on distinguishing isolated and integrated throughfall. We propose naming our sampler the ***FluxIT-sampler*** *(**Flux** of **I**ntegrated **T**hroughfall **sampler**) to underline the multiple application option of the sampler and avoid further confusion about its measurement focus.*

[Specific comments]

Line 7-21 (abstract)

There is no "infiltration" among these lines. Readers could not expect that this paper describes inflow of rainwater passed through the litter put on the capturing area.

Agreed. As stated above, we will consistently use the terms of litter percolation or integrated throughfall instead of infiltration. Furthermore, we will strengthen the focus of the abstract in correspondence to the refocusing of the overall manuscript: a technical note introducing a novel monitoring system for interception flux components and highlighting its diverse application options for measuring different interception flux components —either in isolation or in an integrated manner—across e.g. forest ecosystems of varying vegetation complexity.

Line 25-85

Detailed background for interception process including throughfall measurement is written here, but these topics are not investigated in this manuscript. I agree that sample size is important issue for throughfall studies, but I could not understand how this equipment contributes to this issue.

By providing a detailed background on interception components in a forest ecosystem, we underline the complexity of the overall process and the connectivity of individual components, such as overstory and understory throughfall. As described above, we will strengthen the link of interception component description and corresponding monitoring approaches.

Regarding the sample size and its relevance in the proposed monitoring scheme, our setup includes 240 tipping units distributed across the field enabling the capture of spatio-temporal dynamics of both integrated or isolated interception fluxes- a feature rarely achieved by other interception measurement methods. For the example of integrated throughfall measurements, we expect the spatial variability of throughfall from canopy drip across a plot to be sufficiently large to (partially) persist through the unfragmented, uppermost litter layer. Consequently, the spatial variability of integrated throughfall (litter percolations throughfall after forest floor interception) measured with our samplers is a result or at least influenced by these patterns. This effect is particularly evident because the unfragmented litter layer in the samplers is thin and relatively homogeneous within each plot, limiting any additional homogenization or heterogenization of throughfall patterns.

Line 192-212

It is somewhat difficult for me to understand the situation. Is it correct that newly developed instruments here were used for only measurement of rainwater inflow passing litter? Troughs collect throughfall, but are these data shown in this MS? If trough data is not used, related sentences must be removed. Rainwater captured by trough was measured by Davis rain gauge, so actual one tip should be very small. Please note that underestimation by Davis gauge is high (Iida et al., 2018), and careful attention should be paid for measurements.

As described in detail above we will address in larger detail the flexible application of the sampler to measure different throughfall components in an isolated or integrated manner and hope to clarify potentials and limitations of presented modifications. But we would exclude the description of traditional trough throughfall measurements to avoid confusion.

Line 245-294, 295-351

These results are "infiltration", that is rainwater inflow passed the litter. However, in discussion section, results are compared with previous throughfall studies. Readers should feel strange. In my opinion, as this equipment is throughfall measurement system, authors should compare the throughfall measurements by this new system and the ordinary gauges like storage type point gauges. That is very simple and clear way to show the validity of new system.

We will refocus the Discussion section in accordance with the reviewers' suggestions and our proposed alterations. As also expressed in our response to the second review, in the context of the dual application options, we will point out more precisely that the data included in this manuscript originate from an early measurement period in which leaves (unfragmented forest litter) were left in the samplers (option II). Effectively, in this configuration net throughfall (or litter percolation) was measured as an integrated flux of throughfall and forest floor interception. We understand that for comparison of the included data to throughfall data from traditional measurement methods, we need to consider pattern modulation by the forest floor litter. However, we believe the example data in combination with the dual application options highlight the networks' potential to depict spatio-temporal dynamics of interception fluxes.

With the larger dataset collected during the 2025 vegetation period, we look forward to investigating the above-mentioned aspects in a detailed throughfall study. We also consider a measurement period using empty samplers (no litter) to collect data directly comparable with traditional throughfall studies.

Line 353-357

These are well-known uncertainties for tipping bucket, which should be considered carefully in this manuscript.

Agreed, we will consider this aspect more strongly in the manuscript. Please refer to the detailed answer on over-/underestimation and dynamic calibration above

Line 370

Not all readers know ECOSENSE. Please take care of readers.

Agreed, we will add a brief description of the ECOSENSE project and include a citation of the publication presenting the field site (Tesch et al. 2025 https://doi.org/10.5194/egusphere-2025-4979).

[Technical corrections]

Line 166

Please check [tips"].

Agreed

Citation: https://doi.org/10.5194/egusphere-2025-4285-RC2