Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-254-AC2, 2019

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Temporal-dependent effects of rainfall characteristics on inter-/intra-event stemflow variability in two xerophytic shrubs" *by* Chuan Yuan et al.

Chuan Yuan et al.

gygao@rcees.ac.cn

Received and published: 19 August 2019

Please see Response to Reviewer #3 at the attached supplement file for the detailed response by the authors.

General Comments: After careful review, I think, in many ways, this is a good manuscript. The work has been well done and the manuscript is well organized. The paper has an appropriate length and the topic is of interest to the general readers of HESS. . .I recommend this manuscript for publication after a minor revision.

Reply: We appreciated the anonymous reviewer for the comments and suggestions.

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Discussion paper

This manuscript will be carefully revised as suggested prior to being submitted.

R3C1: My major concern is the reasonability of the stemflow variables used in this study. For instance, in Line 207, the authors said that the average (SFI) and 10-min maximum (SFI10) stemflow intensities were calculated by the branch stemflow as recorded by the tipping-bucket rain gauges (mm) and rainfall duration (h). In my opinion, stemflow intensities should be defined as the branch stemflow depth (which can be calculated from branch stemflow volume as divided by branch basal area) in a certain time. In the current form, the authors underestimated stemflow intensities. Also, in Line 216, the ratio of the intra-event stemflow intensity (RSFI, unitless) should be calculated basing on the suggested calculation of stemflow intensity.

Reply: Thank you for commenting on the calculation of stemflow variables in this study. As suggested at this comment, it indeed underestimated the eco-hydrological significance of stemflow to compute stemflow intensity by ignoring the limited area of branch base, over which stemflow was received. Therefore, we had re-computed stemflow intensity following the definition as stemflow volume per basal area per unit of time (Herwitz, 1986; Spencer and Meerveld, 2016). It had been calculated at different time intervals, including the event (SFI, mm·h–1), 10-min (SFI10, mm·h–1) and dynamic time interval between neighboring tips (SFIi, mm·h–1). Besides, RSFI had been deleted, and funnelling ratio had been introduced to assess the convergence effect of stemflow at the revised manuscript. It had been quantitatively connected with stemflow intensity for the first time as indicated at Equations 14–15 (Lines 264–265, Page 12). Please see the detailed explanation at Point (1) of Reply to R1C12, and Point (1) of Reply to R2C2.

R3C2: I also state minor comments as follows. L1: Only seven branches were used to measure stemflow for each shrub species (The studied shrubs had a total of 180 and 261 branches), So the suggested title is: Temporal-dependent effects of rainfall characteristics on inter-/intra-event branch-scale stemflow variability in two xerophytic shrubs. Reply: Done.

R3C3: L220-226: It could be better if the authors provide the formula for each stemflow variables.

Reply: Done. The detailed descriptions and calculations of stemflow variables had been stated at the revised manuscript, including stemflow volume (SFV, mL) (Equation 10) at Line 235, Page 11, stemflow duration (SFD, h), time lags stemflow generation (TLG, min), maximization and ending (TLE, min) at Lines 249–257, Page 12, stemflow intensities at the event bases (SFI), the 10-min interval (SFI10) and the dynamic intervals between neighboring tips of TBRG (SFIi) (Equation 11–13) at Lines 246–248, Page 12, funnelling ratio at event base (FR) and the 100-s (FR100) intervals (Equation 14–15) at Lines 264–265, Page 12.

R3C4: L658. Table 1: What is the standard for base diameter (BD) categorization? In the current form, the class interval (5–10, 10–15, 15–18, 18–25, >25 mm) is variable. Why not 5-10, 10-15, 15-20, 20-25, and >25 mm? Please explain it.

Reply: Thanks for this comment. Based on the plot investigation for C. korshinskii and S. psammophila, standard shrubs canopies could be determined. Four shrubs and 1 shrub had been selected for stemflow measurements and allometric equations establishments. By measuring branch morphologies at all the branches at these five shrubs of each species, BD categories was determined to guarantee the minimum branch amount at each category for meeting the statistical significance. There was comparatively smaller amount of the 20–25-mm branches of C. korshinskii. Applying the categories interval of 15–18 and 18–25 was aimed to make sure the minimum branches amount between these two neighboring categories for meeting the statistical significance. Please see Point (4) at Reply to R2C2 and Point (3) at Reply to R2C3 for explaining the representativeness of selected 7 branches and 4 shrubs for stemflow recording, respectively.

R3C5: L662. Table 2: Do the rainfall indicators including RA, RD, RI, I, I10, Ib10 etc differ statically significantly among Event A, Event B, Event C and Others? Please

provide the ANVOA results here. L670. Table 3: The comment is the same with the last one. Please provide the statistical results to depict the difference in the stemflow variables among Event A, Event B, Event C and Others.

Reply: Thank you for this comment. The One-way analysis of variance (ANOVA) with LSD post hoc test had been performed to determine whether rainfall characteristics and stemflow variables differed significantly among event categories, and whether funnelling ratio and stemflow intensities differed significantly among BD categories for C. korshinskii and S. psammophila. The level of significance was set at 95% confidence interval (p=0.05) (Lines 284–289, Pages 13–14). The ANOVA results had been stated in the section 3.1 Rainfall characteristics at Lines 307–312, Page 14–15, Section 3.2 Stemflow volume, intensity, funnelling ratio and temporal dynamics at Lines 337–342, Page 16, and Table 2–4 (Lines 808–829, Pages 40–42).

Reference: Herwitz, S.R.: Infiltration-excess caused by Stemflow in a cyclone-prone tropical rainforest, Earth Surf. Proc. Land, 11, 401–412, https://doi.org/10.1002/esp.3290110406, 1986. Spencer, S. A. and van Meerveld, H. J.: Double funnelling in a mature coastal British Columbia forest: spatial patterns of stemflow after infiltration, Hydrol. Process., 30, 4185–4201, https://doi.org/10.1002/hyp.10936, 2016.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-254/hess-2019-254-AC2-supplement.pdf

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