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Hydrology and Earth System Sciences Discussions

Interactive comment on "Stemflow of desert shrub and its significance in soil moisture replenishment" *by* X.-P. Wang et al.

Anonymous Referee #2

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The authors present a work aiming to study the effect of shrubs stemflow on water fluxes and storage in desert sands. They conclude that the shrubs may concentrate water fluxes to the stem basal area of ten or hundred times the rainwater amount reaching a non-vegetated area. Overall, I think the paper is significant and the paper is written clearly. The title reflects the content of the paper. The objectives are comprehensible. I keep some doubts on the interpretative analysis of the paper (see below).

General comments

Based on my reading of the manuscript, I would distinguish two parts, with different remarks. The first part: The introduction and experimental sections are quite well

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structured. The introduction of the paper illustrates clearly the rationale and the objectives of the work. It provides an exhaustive literature review covering the major topics related to the issue of stemflow in arid areas. The experimental conditions are well explained and are based on field measurements.

The second part: I am not sure the experimental setup and the resulting data set are suitable for supporting the objectives. Especially the results summarised in table 1 seems contradictory. In the following, I have described the reasons for my general comments in more detail.

Equation 2. It is not clear to me what the authors mean with "cumulative" infiltration. Looking at the equation, it seems that the subscripts e and i refer to the final and initial water contents during a rainfall period and thus the term cumulative should refer to that single period. If so, the authors should explain why they use the factor 10 in the equation (Zf and I are both in mm).

Table 1. In the text, the authors emphasise that a rainfall higher than 2.2 mm is necessary in order to observe any effect of stemflow on soil water storage. Actually, in the table the rain of September 8th does not produce any changes in cumulative infiltration fluxes in the soil. If so, it is quite difficult to me figuring out why a quite insignificant increment in the rainfall (3.2 mm measured on September 23rd) produce a completely different behaviour, with significant flux increments up to 40 cm depth (column 5 in the table). This behaviour is even more strange if one considers that a rainfall of 3.5 mm (>3.2mm) only produces cumulative infiltration changes (last column in the table) comparable to those for the 2.2 mm rainfall, even in presence of a significant antecedent rainfall. Moreover, all the rainfalls but one (the 13.7 mm rainfall in the 7th column) only produces soil moisture increases along the whole soil profile, which are always lower (at best equal – see column 2) than the rainfall height, even when the latter is significantly higher then the threshold value of 2.2 mm. Should the stemflow significantly increase the water fluxes to the soil compared to the rainfall height in non vegetated areas? In presence of shrubs, a rainfall of, say, 3.5 mm should at least produce a

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storage increase of 3.5 mm (by neglecting evapotranspiration and deep percolation fluxes). Based on the authors' findings, these values should be ten or even hundred times the rainfall height. Of course, there is the possibility that some of what I see as major shortcomings may instead only be the absence of a complete presentation of what was done in the analysis. If, to the contrary, I am right, the authors should give reasons for these strange values, which clearly contradict their main results. In this case, it is my opinion that a likely reason for this behaviour could be some preferential flows causing water at the stem basis to partly bypass the TDR probes. Thus, the water fluxes calculated by using the TDR probes would result underestimated. Even in absence of any preferential flows, one should consider that a TDR probe only allows estimating average water contents in the whole probe observation window. In other words, the water content "seen" by the probes the authors used (20 cm length) is only partly originated from the stemflow and is, to the contrary, significantly determined by fluxes characteristic of no-shrubs areas. The only way to estimate the actual contribution of the stemflow to the storage increases in the soil profile would have been to measure storages in non-vegetated areas to be compared to those coming from the "shrubs-TDR".

I think the authors should discuss these issues into a major revision. It will increase the significance of the contribution of their paper.

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