

Interactive comment on “Influence of rain pulse characteristics over intrastorm throughfall hot moments” by J. T. Van Stan and T. E. Gay

Anonymous Referee #1

Received and published: 31 October 2014

The topic of this manuscript is of interest to HESS readers. It reports on an analysis of meteorological control on throughfall generation. The processes controlling rainfall storage in and release from the canopy are not well understood. Meteorological influences through rainfall intensity and windspeed have been inferred from many studies, but it remains difficult to discern the mechanistic effects they have on the amount and timing of throughfall delivery to the soil. This paper was written to make a contribution to this field.

Unfortunately this manuscript is written in a wordy, colloquial, and confusing style that frequently obfuscates concepts, and there are inconsistencies in tense, subject-verb agreement, and other errors that make it difficult to read. I list here some examples just from the beginning of the paper. In the title and P11376L12: words enclosed in

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quotes means they are not being used literally and more precise wording is needed; temperature is not being analyzed. P11337L6-10 not all that is stored is evaporated and none that penetrates gaps also drips. The global range of throughfall is greater than 70-90%. P11337L16 the cited papers don't all support that throughfall spatial and temporal variability control those processes, so what is the point of this sentence? P11338L1-12 this paragraph is convoluted and unclear. P11338L8 what does "combinations of thresholds of conditions" mean?

The basis of the analysis is ad hoc classification of temporal variability within storms, which was done free of basis in the meteorological literature. Buried within the methods in section 2.3, is this statement of objectives (P11342L25): "This study seeks to identify transport-driven hot moments during storm events (specifically, enhanced translation of rainfall pulses into throughfall pulses by forest canopies) and characterize the combination of meteorological thresholds under which these throughfall transport hot moments occur." The justification for this concept (on the following page) comes incongruously from the soil biogeochemistry literature. Among the ad hoc decisions were: (1) eliminate about half the data because temporal patterns of throughfall were complex (P11342L11-16); (2) analyze medians of data and use nonparametric statistics; and (3) define "the lower threshold of any throughfall transport hot moment to be 80% of the corresponding rain pulse" (P11343L7-8) (which appears to mean the same thing as "when throughfall amounts are considered high relative to the norm (we chose > 80% of rainfall for this site)" (P11343L25-26). I think this means time periods during which throughfall rate $> 0.8 \times$ rainfall rate, but I am not completely sure). It is possible that the primitive analysis has led to some interesting and reliable findings, but it is much more likely that it has biased results in undetectable ways.

Unfortunately the hypotheses are not written clearly enough to be evaluated, or to determine whether the research adequately tests them.

P11340L2-3 please check whether this meteorological description is correct. I do not think the Bermuda High affects winter weather at the site.

P11341L5 one km is a long distance for rainfall-throughfall data paired at 5 min intervals. I suspect much of the $\sim 50\%$ of disregarded data may have been from incoherence between rainfall and throughfall plots? This might have systematically biased the results to only contain large-scale meteorological events.

P11342L11-16 what is an “identifiable pulse?” The lack of clarity here makes me wonder what was different about the “identifiable” periods of throughfall as compared to those “too close together.” This is a critical step in the analysis, because it controls what data are admissible and seems likely to have biased the analysis against some important meteorological conditions. If my math is correct, it appears at least half the data were removed at this step (in terms of time). Later (P11346L6), we learn that 73% of the rain was retained in the “identifiable pulses,” which suggests that “identifiable pulse” probably means “period of high-intensity rainfall.”

The manuscript is written to presuppose the existence of thresholds in rainfall-throughfall processes, but it is not clear why they should be expected. The same can be said of “pulse types,” are these meaningfully distinct? The cluster analyses that defined pulses need more thorough description. Among the unanswered questions that bear strongly on the interpretation of the results: (1) what distance measure was employed, and were variables transformed prior to analysis? (2) what trimming rules were used—how was the number of clusters chosen? and (3) what relationship does the concept of “pulse” in this manuscript bear to any meteorological concept of pulse? There is a large literature on the parameterization of pulse models for rainfall that is not referenced in this manuscript.

There is a lot of interesting discussion; but without clear physical basis for the analysis, the discussion is a series of just-so stories to explain various phenomena in the complex results.

The conclusions make it sound as if the groupings of rainfall pulse characteristics and thresholds in responses emerged naturally from the data, when in reality the analysis

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forced these to occur: cluster analysis always finds clusters and categorizing data always forces thresholding.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 11335, 2014.

HESSD

11, C4769–C4772, 2014

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