

## ***Interactive comment on “A sprinkling experiment to quantify celerity-velocity differences at the hillslope scale” by Willem J. van Verseveld et al.***

### **Anonymous Referee #2**

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This paper presents an experimenting and modelling study where a tracer is applied to a hillslope and its concentration is recorded in the outflow. I found the paper overall quite well written and structured, and the topic is interesting. Below I give a few suggestions for improvement:

1. Abstract. It is difficult to understand the significance of the study. The first sentence states that the difference between velocity and celerity is poorly understood. I would argue that it is very well understood. Perhaps the mechanisms explaining such differences are poorly understood. Many numbers are given in the abstract, but it is difficult to understand why such numbers would be interesting. I would stress in the abstract more the connection between experimenting and modelling, which I find the most interesting aspect of this work.

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2. In the introduction, I would cite the paper “Velocity and celerity dynamics at plot scale inferred from artificial tracing experiments and time-lapse ERT”, Journal of Hydrology, 2017, as it seems relevant for the study.
3. In section 3.1, before starting to describe what was done, it would be useful to illustrate why it was done it. What were the objectives of the experimental design? Which conditions did you want to recreate? Why? What about natural rainfall in addition to artificial rainfall? Did it happen? If not, what if it happened? Etc.
4. Equation 7 appears to be wrong – the integral of concentration is not equal to mass. What does Mout represent? If it is just the mass of tracer in the outflow, what about Evaporation? I guess the calculation of mean residence time should account also for this. . .
5. What was the recovery rate of water and tracers? Did it differ? Why?
6. Model 1 and Model 2 is a misleading terminology. In fact it appears that the model structure is the same, just the evaluation criteria are different.
7. The criteria used to calculate the behavioural parameter sets for Model 1 and 2 make the comparison difficult as the criteria with which the models are evaluated are very different. I think it would make more sense to make the behavioural parameters of Model 2 a subset of the behavioural parameters for Model 1, by requiring them to satisfy some additional constraints based on the tracers.
8. Indeed, in Figure 6 the two distributions do not appear to differ significantly, and in my opinion, given how they are constructed, they are not even comparable (besides the fact that the caption is not clear, in Figure 6 there are 2 green colors. Which green color do you mean?)

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