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Interactive comment on "Pesticide peak concentration reduction in a small vegetated treatment system controlled by chemograph shape" *by* Jan Greiwe et al.

Anonymous Referee #2

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The paper presents an interesting case study of the effect of vegetated treatment system to reduce contaminant inputs to surface waters. The topic is important, the field and lab work involved a lot of effort and the analysis can help to improve the understanding of contaminant loss and mitigation with vegetated treatment system. Therefore, it is worth publishing after additional clarification and correction. Overall, I have similar issues with the data analysis in the current state as reviewer 1. I support his remarks and think that they are very well stated. The main points to address as described below.

- The uncertainty in the target variables peak-concentration reduction rate and

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mass removal rate are very high and largely ignored in the analysis. Some reasons for the uncertainties are:

  - The contaminant concentrations are highly variable and the dynamics are difficult to capture with the applied measurement resolution. Important peaks can be missed and last data points do not always reflect baseflow concentrations. This missing information can lead to large errors in the peak-concentration reduction rates. Simple linear interpolation of concentration for mass calculation (L 157) can led to even higher bias for the mass removal rates. A flow proportional measurement could have been a better option. Was flow proportion measurements available?
  - The timing of the last application of the investigated substances is completely neglected. However, more pronounced peaks are to be expected shortly after the application. Standardizing the concentrations or considering relative reduction rate does not completely solve this issue.

- I think a much better understanding of the uncertainty of the contamination measurement could be gained from a detailed analysis of the discharge behavior during the investigated events. This data is available in a much higher resolution (L86: Stream flow was measured every minute . . .). Unfortunately, they are neither shown in detail nor really used in the analysis. It would be interesting to see the sample points/concentrations during an event together with the discharge measurement on a higher resolution, since the dynamics of the contaminants are driven mainly by the hydrology. I think this additional information would give an inside about how well the concentration dynamics have been captured. Moreover, information about the application patterns would improve the interpretation as well.

- The regression analysis is done rather poorly and the procedure is neither well explained nor well presented.

- It is not shown that the condition for a simple multiple linear regression are fulfilled, since the results are not validated or at least this information is not shown. I would at least expect a classical residual analysis in the supporting information.
  - Automatically remove outliers based on a doubtful model without further analysis is not a proper way to go. For example, if outliers are a real problem, robust regression could be a solution (e.g. library robustbase).
  - I don't think the requirement of independence of the data is fulfilled in this context. Data points of the same discharge event for the different components are not expected to be independent. Maybe a mixed model (with the discharge event as random effect) could help (e.g. library lme4). However, I doubt that more than a nice qualitative analysis of contaminate dynamics in a catchment with a vegetated treatment system will be possible with this setup.

- It is somehow obvious that dispersion has a stronger effect on substances with a more pronounced peak (as explained by reviewer 1).

- Although the clustering is done correctly, the connection with the discharge events is not well elaborated. Moreover, they are other clustering algorithms, which might be more robust (e.g. k-medoids. hierarchical Clustering). In L 207 it is written:"With the exception of cluster B which rather represented similar events (event 1 and event 4 in Fig. 2), overall clustering was controlled by similar behavior of contaminant groups." What was special by the event 1 and 4? Are these really exceptions? The contaminant groups seem to be important, however, I think the discharge dynamic and the application timing are important as well. Maybe it would also been interesting to cluster the discharge events. This data are also available in a higher resolution.

Detailed comments:

- L100: Fig. 2: I guess the discharge shown in Fig. 2 is from G1. This should be included in the description.
- L 108: Overall, herbicides have been also shown to be very persistence. For examples, atrazine has been detected after 10 years without application. (e.g. https://doi.org/10.1021/acs.est.7b02529)
- L 110: Azole pesticides are also persistent as indicated by many studies (e.g. https://doi.org/10.1016/j.envint.2020.105708)
- L 131: What is the accuracy and precision of the method? Has the analytical method validated?
- L145: Why is the cluster analysis important for the calculation of the dispersion sensitivity index? The index could also be calculated without clustering.
- L 191: From which mean? Do you mean 2 standard deviation from the prediction?
- L 205: It doesn't make sense to talk about a peak in Cluster C ("$T_{peak} = 6h$"). Not even the mean has a peak there.
- L 212: The surface runoff from the elevated vineyard has also to flow through the lower terrain slope to reach the river, expect that there are other shortcuts (streets, drains). See also reviewer 1).
- L 315: I do not understand the explanatory power for the different variable. Are they calculated by a univariate analyses? At least for me, the R-Output would be much easier to interpret.