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Interactive comment on "Complex interactions of in-stream DOM and nutrient spiralling unravelled by Bayesian regression analysis" *by* Matthias Pucher et al.

Anonymous Referee #2

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In their manuscript entitled "Complex interactions of in-stream DOM and nutrient spiralling unravelled by Bayesian regression analysis", Pucher et al. investigate the interactions between DOM and nutrient uptakes in a small stream based on an experimental setup. They used five different leachates having contrasting DOM properties based on optical measurements (PARAFAC), added these leachates into the stream and then measured DOC and nutrient concentrations and DOM properties along a 215 m reach. For interpreting their data and calculate uptake velocities, they proposed a new approach based on the spiralling concept and called Interactions in Nutrient Spirals using BayesIan REgression (INSBIRE).

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Discussion paper

The topic is of great interest, however the manuscript is hard to follow for readers that are not familiar with this type of approach. Furthermore, some clarification are required regarding the relevance of INSBIRE. Indeed, it seems to me that the model requires a lot of parametrization that is subjective (e.g. lines 365-378 or lines 390-400). It is like turning buttons to fit each data individually without clear ideas about the processes behind. It is therefore hard to interpret the data, as recognized by the authors (line 454 for instance) that finally can only make hypothesis on the processes occurring (e.g. lines 482-487). It doesn't seem to me that INSBIRE allows finally to investigate or quantify properly the interactions between DOM and nutrients uptakes, and I was also wondering to which extent this approach could be used by other researcher and/or in other study sites.

Introduction :

The introduction lacks of context regarding the interactions between DOM and nutrients, and why this is an important issue. The two first paragraphs are very broad, focusing on the importance of DOM on the biogeochemical and ecological functioning of freshwater ecosystems and on the impact of agriculture on DOM (which is not the subject of the study), and do not help the reader to understand why "the effects of changed DOM and nutrient supply on the DOM and nutrient uptake in streams remains in the dark" (lines 54-55) or why the authors "expect a complex interaction between the different DOM fractions and the available N and P to explicate the bioavailability and the aquatic retention of the DOM" (lines 66-67). The introduction could be improve by including more context about DOM/nutrient interactions based on previous works (e.g. Guillemette and del Giorgio 2012; Vonk et al. 2015; Catalán et al. 2018). The conclusions/limitations of these studies should be added/discussed in the introduction in order to clearly identify the big picture of the manuscript.

The last paragraph is I think the most interesting part as the authors propose a new model based on the nutrient spiralling concept to quantify DOM/N/P interactions. However it is very technical (e.g. lines 76-85) and hard to follow for readers that are not

familiar with these concepts. Thus, while I fell that the INSBIRE is of potential interest, I was lost before the end of the introduction and didn't understand how it may differ from existing models. I think this paragraph should be reformulated in a more understandable way, details being provided in the Material and methods section.

Lines 45-47 : problem with references.

Line 48 : add references.

Line 60: add reference.

Lines 62-63: this sentence is quite abusive. Moreover, the authors face the same problem with their approach as they are not able to identify any transformation pathways (they only make hypothesis).

Methods:

Line 94: Please provide information regarding the water residence time of the study site.

Line 113: After how long the plateau was reached after leachate additions, and how it compares with the travelling time of the stream?

Line 138: some additions are very low compared to ambient DOC, so how the authors can be sure that they are measuring uptake for leachates and not from ambient DOM? Please provide more justification here.

Line 149: specify the number and origin of EEMs included in the PARAFAC model.

Line 181: overall the description of INSBIRE, including equation and hypothesis made, is very hard to follow. It seems that several choices are made but justification and/or implications on the model results are not provided. For instance, how is defined the threshold that determines if some data are removed or not (line 204-205)? How do the authors justify the addition of a product of power functions to include interaction, and what do they mean by interaction (line 239)? How do they determine if/when adding

the wetted width is beneficial (line 240) and how do they related wetted witch to stream surface bed and/or retention processes? I think that all the presentation of INSBIRE should be reconsidered. Also, I didn't see any figures about errors from the model.

Lines 197-199: I don't understand these sentences.

Lines 259-260: and? What does it imply?

Results & Discussion

Lines 306-307: some statistic tests would be helpful to measure the level of significance of trends.

Figure 4: this figure is confusing. What I see here is mixing between leachates and stream waters along the stream reach, while the authors argue that at point 0 the mixing is full. If I understand well, these data are data collected directly in the stream, it would be interesting also to see the data corrected for dilution. Table 5: hard to read.

Line 501 & 517: these statements are a lit bit ambitious.

References

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