Response to reviewer 1

In this document, we address the reviewer´s remarks and points, and we indicate where the changes included in the manuscript to fulfil the comments.

"The manuscript is very much improved now… However, some of my comments were not addressed. I still do not see convincing evidences that total nitrogen plays important role in the particular study catchment, as its concentration seems to be much lower compared to the nitrate. Moreover, there is still some ambiguity in event definition and a lack of rationale for selecting particular set of event characteristics for the explorative analysis."

Organic nitrogen (represented in this study by the TKN because NH_4 was always found below detection limits) accounts for a moderate fraction (> 25%) of the nitrogen exported from the catchment; its contribution to total nitrogen increases significantly during runoff events (Rodríguez-Blanco et al., 2015). In the revised manuscript, the NO3 concentrations have been shown as NO_3-N rather than NO_3^- for ease of comparison. As a result, the graphs and tables have been updated. L. 370-376.

We attempted to complete the characterization of the rain and runoff events by describing how we chose the start and finish points of the runoff. Hopefully, it is now more clear.

Figure 1: Please provide in the caption details on how the width is computed (i.e., at which point).

We included information suggested by reviewer. L. 58-60

Line 73-76: What is a meaningful quantity for total nitrogen? Are the quantities measured in the study catchments are actually "meaningful"? Please clarify.

We've added a paragraph to illustrate the importance of organic nitrogen in many catchments with different land uses.79-85.

Figure 3: Indicate a and b panels. In the panel a it seems like there should be labels for different arrows, but labels are missing. Without the labels the meaning of the arrows is not clear. It is not clear how the starting point is identified (neither from the text nor from this figure). On panel b the meaning of green line is not explained and the line reaches beyond the plot. The meaning of the red line below the legend is not clear. It will be helpful to show two different cases described in the text: single event and event that is immediately followed by the next event, to understand how the cutoff was done.

Indeed, if there is a label; we have re-added the graphic. Hopefully, they may now be appreciated properly. We also changed the graph in panel b and included a new graph depicting a sequence of events as well as the progression of nitrate and TKN concentrations. Please see new Figure 3.

Lines 133-135: This is still not clear. Are these the rules that were applied for autosampler or for further assessment of rainfall events? Does this mean that the autosampler starts to sample no earlier than 10 hours after the end of the previous event? (between event, 10 hours) How the end of the event is defined? The last non-zero rainfall pulse? Does 5 mm rainfall threshold apply to rainfall rates or rainfall volume? Please revise and be more rigorous in your descriptions.

We have revised the text and completed the definition of rainfall and runoff events. L. 141-146.

Rainfall threshold: 5 mm rainfall volume. L. 147.

Line 139: Not clear which hydrological responses are meant here. Please clarify.

It is the hydrological response of the catchment to the rainfall events. L. 149-150.

Lines 150: Please clarify how the beginning of the event is defined.

We attempted to clarify this issue in the revised manuscript. L. 160-166.

Line 154-155: What does unit "cms" stands for? Please explain. What are these three consecutive hydrological records? Do you mean three time steps? Please revise.

The paragraph was modified.

You are right, three time steps.

Line 157: What is meant here by "abrupt change"? Please clarify. Please also explain if the abrupt change is only evaluated for a single time step or only abrupt changes of certain duration are considered? Why an event can only have one abrupt change?

This point, we believe, has already been clarified in the revised manuscript. We examine the change over three time steps (30 minutes). Obviously, there can be more than one abrupt changes, but we're referring to the one at the start of the events. L. 166-166.

Line 158-159: This is not clear. Please revise.

It was modified

Lines 174-178: This is very general and generic description that does not provide any justification about the set of the characteristics selected for the analysis, nor does it clarify which hypotheses the authors were testing in this study.

The paragraph was modified; hopefully it´s clearer now. L. 170-176

Table 1. The values of total runoff look erroneous. Please revise.
Sorry for the mistake; it was corrected. The values were in m^3. Please see the table 1.

Equation 2: It is not clear why the authors chose to use different denominator here. Butturini et al 2006 only used Cmax for normalization. Please clarify.

Sorry, its Butturini et al. 2008 not 2006. It was corrected.

Figure 4: The definition of the boxplots is unclear. Please revise. Provide the number of events for each season on top of the corresponding box.

Following the reviewer comment, the caption and the figure were completed in the revised manuscript. L. 267-271.

Table 2: The correlation between Cinitial, Cmean and Cmax is quite high with the deltaC, but these concentrations are actually used to compute deltaC (equation 2). Does it make sense to evaluate their correlations?

Certainly, deltaC is calculated using Cmax and Cinitial. However, we believe that the corrections help to demonstrate the differences in the behavior of NO_3 and TKN concentration. For this reason, we chose not to remove them from the manuscript.

Figure 7: Please explain the caption the meaning of the axes, and vectors to help the readers to interpret the results presented in this Figure.

The figure caption was completed according to the reviewer's specifications. We also had to change the figure after discovering a mistake in it. L. 343-348.

Editorial comments:

Line 12: not clear what is meant here by “from streams”.

It was corrected. L. 12

Line 16: clockwise, anticlockwise and no hysteresis.

It was corrected. L. 16

Line 20-26: acronyms can be avoided in the abstract.

The acronyms were deleted.

Line 35: these countries

It was added. L. 35

Line 44-46: Please revise this sentence, it is not clear.

It was revised. L. 44-46

Line 53: spatio-temporal

It was corrected. L. 53

Line 109-110: keep units on the same line

It was corrected.

Figure 2: catchment boundary and railroad have identical symbols.

The catchment boundary was modified

Line 181: a runoff event

It was corrected

Line 401: clarify which pattern is meant here

It was clarified. L. 431