Author's Response to Referee #1

We would like to thank the Referee for the helpful and constructive comments, which will greatly improve the manuscript. Our detailed responses to the comments are listed below.

 # The objectives could be improved by a clearer focus and formulation of hypotheses or research questions. The major drawback is the only fair scientific and presentation quality that needs to be improved. My major criticism is the simpified verbal description of the results that lacks quantitative assessments of concentrations/ component levels, seasonality and event behavior. Also, a quantitative statistical analysis on major governing factors such as temperature is needed.

Response: In our revised manuscript we will have reworked the last section of our introduction to clarify our objectives and research question. Additionally, we add statistical analysis (descriptive, as well as correlations and tests of significant differences) to our data to strengthen our statements. These issues will be addressed in further detail in the specific comments of this response (see below).

 # Specific comments and technical corrections

 # Abstract: For me, it reads a bit to technical and focussed on the results. I would like to see terms and variables like "C2%" to be reduced in favor of a stronger focus on discussion and implications (expanding the messages now in the last sentence).

Response: As suggested by the referee we will adjust the focus of the abstract rather to discussion and conclusions and will shorten the result section. We will revise the abstract also in view of the comments of referee #2. We will include major outcomes of the study like the high variability of DOM quality due to hydrologic conditions, which makes it necessary to cover discharge events during monitoring studies. We will outline the differences between both studied catchments (bog/forested riparian zone) and shortly discuss the suitability of spectrofluorometric indices to track DOM origin and dynamics in this headwater stream.

 # Introduction: P2Line5: The first sentence need a reference.

Response: We will include a reference in the revised version of the manuscript (Mulholland 2003).

 # P2Line 7f: This also needs a reference. Check also for this paper: Ledesma JLJ, Grabs T, Bishop KH, Schiff SL, Kohler SJ (2015) Potential for long-term transfer of dissolved organic

carbon from riparian zones to streams in boreal catchments. Global Change Biology, 21, 2963-2979

Response: We will include a reference in the revised version of the manuscript as well and thank the referee for his/her literature suggestion, which slipped our thorough literature search. We intend to use that study as reference at another point. We will refer to e.g. Fellman et al. 2009, Perdrial et al. 2014 and Wallin et al. 2015 at this point instead.

 # P2L34: Change citation parenthesis.

Response: We will change that in the revised manuscript.

 # P3Line19: Better define what you mean with changes by adding space and time! Do you mean surface water DOM at the catchment outlet or variability within the study site – do you mean seasonal changes, daily fluctuations...: Something like "spatiotemporal dynamic of DOM quality over the course of one year" ...

Response: We will rephrase that sentence to avoid misunderstanding. The study aim described here is to elucidate different spatiotemporal dynamics in DOM quality over a year in a headwater stream, as the reviewer suggested. Those dynamics are supposed to be controlled by the bog and forested peaty riparian zone catchment.

P3Line23: Two times starting a sentence with "on the other hand"

Response: We used the English phrase "on the one hand… On the other hand…" here, which we think is used correctly in our manuscript.

 # P3Line31: This last section is not well integrated with the objectives in the section before: I suggest restructuring the objectives a bit starting from P3Line23; there is more or less everything there: What is the general aim? What are specific questions you want to answer/ Hypotheses to follow? Where do you perform this research (references on previous studies) and why there? What are the methods you want to apply? What are discussion/ conclusion and implications aiming at?

Response: We agree with the referee and will revise this section of the manuscript in view of the mentioned deficiencies and comments of referee #2. We will clarify our objectives/hypothesis in view of these points: I) To test if spectrofluorometric indices can be used to track origin and dynamics of DOM. II) That DOM quality is highly variable in a headwater stream depending on hydrologic conditions and season. We expect short-term

DOM quality changes due to high discharge events, which cause changes in hydrologic connectivity of different DOM pools and possible leachate effects of labile DOM during strong rain events. This short-term pattern is expected to be overlain by seasonal DOM changes due to changes of DOM production and consumption over the year. III) We expect general differences in DOM quality between the bog and forested riparian zone catchment. The riparian zone is characterized by accelerated water level fluctuations and a nutrient-richer vegetation than at the bog site, which leads to the hypothesis that DOM quality is strongly affected by changes in hydrologic conditions and is more labile than at the bog site. We will point out the suitability of this particular catchment as the stream origins within the bog and enables us to retrieve a exclusively bog derived DOM signal within this headwater stream. We will also refer to our previous study at this catchment and the applied spectrofluorometric methods, which are $SUVA_{254}$, S_R, FI, HIX and PARAFAC modeling of excitation emission matrices.

 # Materials and methods: P4Line1-14: I am not convinced of the study site description in combination with Fig. 1: I suggest to show a soil map or something comparable to better see the position of the bog and the differences between the two sampling locations.

Response: The provided Figure 1 is actually a soil map. We admit that the figure might not sufficiently highlight the information, which is important to this study. To make the figure more comprehensible we will extend the figure caption and modify the map, clarifying the declaration of soil type distributions and sampling spots.

 # P4Line15: "Discharge sampling" sounds strange – just water sampling?

Response: We agree with the referee and will rephrase that expression.

 # P4L15ff: Please state the number of different types of samples and the temporal resolution of the discharge measurements..

Response: We will include this information in the revised manuscript. In short, we took 30 grab samples, 44 water samples by the automated water sampler and 191 samples during high frequency storm event sampling. Discharge was recorded in a 10 minute time interval.

 # P4Line27: Unit of absorption?

Response: The missing unit of absorption is m^{-1}. We will correct that in the revision.

 # P4Line29f: Superscript in units!

Response: We will edit this mistake.

 # Results: Fig. 2: What do you mean by "trends during rain events"? I suppose the concentration trends?

Response: We agree that this is a poor expression. We will rephrase it to "trend of concentration" or "trend of quality indices", respectively.

 # P5Line29f: Please put that statement in numbers (e.g. CV or standard deviation of seasonal concentrations and storm event concentrations).

Response: We pick up the referees comment and will strengthen our statements with a table (Table 1 in a revised manuscript) of descriptive statistics including mean, median, standard deviation and minimum and maximum values. In order to present the data more comprehensively we also consider to present boxplots for parts of the data.

 # P5Line30f: You mean the highest recorded concentrations during the entire study period? This is not clear from this sentence.

Response: The referee is right, the statement refers to the entire study period. We will rephrase that sentence for clarification.

 # P6Line1: Again – put that into numbers (e.g. mean or median concentrations)

Response: As described to a previous comment we will include a new table, which will provide the requested numbers.

 # P6Line23ff: I struggle with the interpretation of the components as a "too early" discussion. Maybe a introduction sentence on that?

Response: We included the interpretation of the components in the results after careful consideration and with regard to existing literature to facilitate reading and help the reader understand the common use of these indices. Therefore, we did not consider this as a real "discussion" here. If we include this information only in the discussion section, the result section describing characteristics of different rain events would more difficult to follow, e.g. as the description of components would remain very technical and abstract. Furthermore the focus of the discussion would be less clear, if we introduce the common interpretation of

components only there. From our point of view this interpretation is thus rather a description of the modelled components, in terms of 'results', backed up by literature data (which is admittedly unusual for a normal result section). Such description is found also in the results or method sections in other studies. Nevertheless, to address this unease of an early discussion we will include an introducing sentence.

 # P7Line19ff: Again, I have problems with this type of interpretation in the result section. This more belongs to the discussion chapter.

Response: We will revise that mentioned section (see above) and put the interpreting statements of the last two sentences (P7Line19ff) to the discussion section. We will limit the description solely to the components and their contributions (referring to studies identifying similar components) without assigning a source of these components here, but putting this source assignment into the discussion.

 # In general I am not convinced of the discussion of seasonal trends: For a seasonality assessment I would expect a more in depth evaluation of seasonal min and max and potential controls: e.g. Is the seasonality in line with water temperature (which is likely close to soil water temperature), air temperature, light intensity... So, better quantify and describe the seasonality!

Response: We thank the referee for this constructive comment. We agree that statistical indications are helpful to underline our statements in regard to seasonality. We will include a description of minimum and maximum values in the revised version. Unfortunately, we did not measure soil temperature and only occasionally water temperature, which limits options to further evaluate seasonality effects as suggested. We chose to use air temperature as a proxy for seasonality, however further parameters from a meteorological weather station (such as light intensity) would be available in case the reviewer suggests to include more data here.

 # Discussion: P9Line 6f: This type of statement belongs to the end of discussion/ conclusions!

Response: We agree with the referee and move this point in the revised manuscript.

References:

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Perdrial, J.N., McIntosh, J., Harpold, A., Brooks, P. D., Zapata-Rios, X., Ray, J., Meixner, T., Kanduc, T., Litvak, M., Troch, P. A. and Chorover, J.: Stream water carbon controls in seasonally snow-covered mountain catchments: impact of inter-annual variability of water fluxes, catchment aspect and seasonal processes, Biogeochemistry, 118, 273-290, doi:10.1007/s10533-013-9929-y, 2014

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