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Biogeosciences Discussions

Interactive comment on "Along-stream transport and transformation of dissolved organic matter in a large tropical river" *by* Thibault Lambert et al.

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Author response to Anonymous Referee #1

The submitted MS presents a detailed analysis of transport and transformation of DOM along the main stem of the Zambesi and its largest tributary. A particular focus is put on the effects of floodplains/wetlands and reservoirs as well as low-flow vs high flow conditions on the longitudinal patterns in DOM concentration and composition. It is the first study to present such a detailed analysis for a whole, large river system, and in particular for a tropical river other than the Amazon. Thus, the subject of the study will be of interest for the readership of Biogeosciences. Methods and results are presented in a clear, comprehensive way. The discussion features a satisfying review of the literature and compares results of this study to the state of the art in that field.

The manuscript is well written and tables and figures are mainly of good quality. I suggest publication of the MS after minor revisions.

- Reply: We thank the reviewer for the positive evaluation of our manuscript and for his/her comments and suggestions.

Major comment:

In addition to spectral properties, the authors measured delta13C of the DOM. They present the results, but they do not interpret and discuss the values. I suggest that the authors include a short interpretation of these delta13C values based on an isotopic mixing model to estimate the proportions of different terrestrial and autochtonous sources.

- Reply: We have added in the revised manuscript a new section that focuses more in depth on the results of δ13C of DOC (section 4.2 in the revised manuscript). First, we compared our data with previously published data from other African tropical rivers. Secondly, we discussed the possible reasons leading to the increase of values along the Zambezi mainstem. Based on the lack of marked 13C-depletion DOC in the reservoirs, we suggest that phytoplankton production has little effect on the δ13C of DOC and that the increased in δ13CDOC is to a large extent due to increased contribution from C4 vegetation. Finally, we performed a mass balance calculation to estimate the relative contribution of C3 and C4 plants on the DOM pool in the Zambezi basin. End-members values were fixed at -27.1 ‰ for C3 plants and -12.1 ‰ for C4 plants. The value of -27.1 ‰ was calculated in a geographical information system (ArcGIS), based on the equation of Kohn (2010) that estimates the δ13C signature of C3 vegetation based on mean annual precipitation, altitude and latitude. Available and public datasets for annual rainfall (Hijmans et al., 2005) and digital elevation model (HydroSHEDs) were used. The value of -12.1 ‰ was chosen based on a study conducted in the Tana River basin (Kenya) which presents similar shift in vegetation cover (Tamooh et al., 2012). We have also added another supplementary figure that shows the spatial

variability of the estimated δ13C signature of C3 plants in the Zambezi basin. Also, the first paragraph of the section 4.3.1 (previously 4.2.1) has been slightly modified in order to avoid repetition with the previous section.

General comments

L100: Maybe I am wrong, but wouldn't that rather be a unimodal distribution? Bimodal would mean that there is a second maximum. Is there a second, smaller maximum? If yes, please clarify.

- Reply: Indeed it is a unimodal distribution. The text has been corrected.

L114-118 & L121-123: Please, give a reference for these values (volumes and surface areas).

- Reply: We have added references for each reservoir.

L150-151: Please, replace 'most cases' by a number of cases or the percentage. Or report e.g. the 95th percentile of the reproducibility.

- Reply: The percentage of samples with a reproducibility higher than 5% for DOC and 2% for δ13CDOC was lower than 5%. This precision has been added in the revised manuscript.

Section 2.6: You should start this section with one to two sentences explaining what the aim of this PCA is.

- Reply: This has been made.

Section 3.1: When you describe the longitudinal and seasonal patterns of all these indices, you should shortly repeat what each of these indices indicates. That would increase the comprehensibility for the broader readership. That is in particular true for the delta13C values. Here, you should maybe cite some typical end-member values.

- Reply: This has been made.

L350-351: Where do you show the correlation between dominant land cover and DOM gradients?

- Reply: In fact the effect of land cover and DOM gradient is discussed just below, in the section 4.3.1. In order to make the manuscript clearer, this sentence has been removed and we reworked the paragraph 4.3.

L355: You should discuss the delta13C values. What does a low delta13C indicate? What are the endmembers?

- Reply: This comment has been been addressed by adding the new section 4.2, see also our reply to earlier comments above.

Figure 3: Overall, the figures are of a very good quality. However, in Figure 3, at least when printed, it is hard to distinguish between the numbers I, II, III.

- Reply: We appreciate this comment. The figure 3 has been modified.

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