Dear Associate Editor - Dr. Silvio Pantoja,

Thank you for your comments and for the opportunity to submit this revised version of our manuscript to Biogeosciences. We also appreciate the contribution of both referees, which has largely contributed to improve the document.

We are submitting an updated manuscript file that was prepared considering all comments and suggestions raised. Please find below (1) our response to each of the points raised by you and (2) a list of modifications we made following the referees' comments. The reference to page and line numbers match the manuscript document we are submitting now (file name: bg-2015-536 - manuscript)

We hope you will find this version suitable for publication.

Best regards, also on the behalf of all co-authors,

Raquel Mendonça

1. Author's responses to Associate Editor's comments

Editor: 1. Acknowledging previous work and show consistencies and inconsistencies such as studies by Sikar et al. (2009 and 2012), etc. is necessary for this journal, moreover if general issues are similar (organic carbon in sediments). If one novelty of your work is intensive sampling and more accurate estimates of carbon sequestration and gas emission, then those need to be compared to other reservoirs, both by area unit and as a whole and to other terrestrial systems such as lakes. There are estimates in the scientific literature.

Authors: The data in Sikar et al. 2012 is more complete and includes all data from Sikar et al. 2009, so we cite only the latest publication in our manuscript. We now cite Sikar et al. 2012 in the introduction and in the discussion, as follows:

- Page 2, line 26: the text "*…assessments of the OC burial efficiency in hydroelectric reservoirs are, to our knowledge, so far limited to one tropical (Kunz et al., 2011) and one temperate system (Sobek et al., 2012) and none of these assessments are based on integrative (whole-system) data*" was replaced with "*…assessments of the OC burial efficiency in hydroelectric reservoirs are, to our knowledge, so far limited to two studies on tropical and subtropical systems (Kunz et al., 2011; Sikar et al., 2012) and one in a temperate system (Sobek et al., 2012).* None of these assessments are based on integrative (whole-system) data."
- Page 9, line 22: the word "two" in the sentence "*Measurements of OCBE in man-made reservoirs are scarce, and to the best of our knowledge limited to two studies*" was replaced with "three".

- Page 9, line 28: the following sentence was added: "*The third study is in 8 tropical and sub-tropical Brazilian systems, including the Mascarenhas de Moraes reservoir, and OCBE varied roughly from 6 to 16% (Sikar et al., 2012). These low OCBE values may be related to the sampling strategy adopted: the (one to three) sites sampled in the Brazilian reservoirs were mostly located in small arms and close to the shore. Sediment accumulation is typically low in these areas as compared to the deeper areas (e.g. Mendonça et al. 2014). Additionally, the OCBE calculations are based on current silicate settling rates, whereas historical rates were likely higher (Sikar et al. 2012) which may lead to an underestimation of OCBE.*"

Editor: 2. Regarding to carbon burial efficiency values, What is the magnitude of this burial compared to lakes for instance? This will allow sustaining assessments such as "Being the first whole-basin assessment of OCBE in a reservoir, these results suggest that reservoirs may bury OC more efficiently than natural lakes."

Authors: We compare our results with OCBE assessments in lakes in the following parts of the manuscript:

- Page 9, line 12: In this paragraph we compare our data to assessments of OCBE in natural lakes and we make a statement about the probable range of values for tropical lakes, for which no data can be found in the literature: "*Sediment OC burial was higher than, or similar to OC mineralization in all pelagic sites in the Mascarenhas de Moraes reservoir, leading to site-specific OC burial efficiencies varying from 48 to 86% in pelagic sites (mean 67%; Table 1). These values are close to the upper end of OCBE of natural lakes. An evaluation of OCBE in lakes mostly situated at latitude >30°N (with one exception at 2°S) resulted in efficiencies varying from 3% to 93% (median and mean 48%; Sobek et al. (2009)). Due to the positive effect of temperature on OC* mineralization (Gudasz et al., 2010; Cardoso et al., 2014) *OCBE may be expected to be lower in tropical lakes* (Alin and Johnson, 2007). *A recent assessment on arctic lakes with low OCBE (mean 22%, ranging from 11 to 32%), however, indicated that the strong effect of environmental conditions may overrule the effect of latitude on OCBE (Sobek et al., 2014).*"

- Page 15, line 1: Here we compare our integrative OCBE value with the only study that we know that accessed lake-wide OCBE (Ferland et al. 2014): "*This is the first reservoir-wide OCBE assessment that we know of. A similar approach has been used in natural boreal lakes, most of which showed integrative OCBE of 5% to ~40% (only one lake had OCBE of 62%; Ferland et al. (2014)). The high sedimentation rates in some areas of the tropical MSM reservoir resulted in a higher integrative OCBE than in the boreal lakes, despite the negative effect of temperature OC burial (Gudasz et al., 2010; Cardoso et al., 2014).*"

Editor: 3. How do your CO2 and CH4 fluxes compare to other similar systems (dams, lakes, etc.)?

Authors: We thank the editor for pointing out the lack of comparison between our CO2 and CH4 fluxes and literature data. We now make this comparison in the discussion. The text "*The range of OC mineralization in the MSM sediments (17 to 48 gC m^{-2} yr^{-1}) corresponded to the lower end in the range of values reported for lakes (16 to 740 gC m^{-2} yr^{-1}, Gudasz et al. 2010) and was similar to the rates*

reported for three other reservoirs in the Brazilian Cerrado (mean 66 gC m^{-2} yr^{-1}; Cardoso et al. (2013))" was replaced with: "*The OC mineralization in the Mascarenhas de Moraes sediments (17 to 48 gC m^{-2} yr^{-1}) was low when compared to other freshwater systems (e.g. 15 to 198 gC m^{-2} yr^{-1} in temperate lakes; (Sobek et al., 2009)), especially due to the low CO_2 fluxes. The range of CO_2 fluxes (4 to 32 gC m^{-2} yr^{-1}) corresponded to the lower end in the ranges of values reported for sediments of boreal and temperate (5 to 269 gC m^{-2} yr^{-1}, Gudasz et al. 2010) and of sub-tropical and tropical freshwater systems (18 to 2412 gC m^{-2} yr^{-1}, Cardoso et al. 2014). CO_2 fluxes in Mascaranhas de Moraes were similar to the rates reported for three other reservoirs in the Brazilian Cerrado (mean 66 gC m^{-2} yr^{-1}; (Cardoso et al., 2014)). The range of CH_4 fluxes from the Mascarenhas de Moraes sediments (3 to 23 gC m^{-2} yr^{-1}) was low when compared to a set of temperate lakes (0.2 to 46 gC m^{-2} yr^{-1}, (Sobek et al., 2009)*" (Page 10, line 12).

Editor: 4. Please use "Mascarenhas de Moraes" instead MSM since use of non-standard abbreviations makes reading more difficult. Same with OCS (only used twice in text, except for table 1), OM, and SAR.

Authors: Thank you for the suggestion. We wrote the terms in full along the manuscript. The abbreviations were only kept in the figures and tables, which include the corresponding explanations.

Editor: 5. Page 18515, line 5. Carbon balance of what? Please explain

Authors: We meant the balance between in- and out-flows of carbon in the sediment, but it was indeed not clear. We, therefore, replaced the term "*carbon balance*" with "*carbon fluxes*" for an easier interpretation (on page 2, line 16 of updated file).

2. Modifications following the referees' comments

Modifications made to the manuscript as explained in the responses to the reviewers:

Besides the modifications described above, we made the following changes to the manuscript based on the comments by Reviewers 1 (anonymous) and 2 (Philip Fearnside). These changes are exactly the ones mentioned in the responses to the reviewers.

- Page 10, line 21: the sentence "Terrestrially derived sediments have been shown to degrade slowly (Gudasz et al., 2012), especially under low oxygen concentrations (Sobek et al., 2009)" was replaced with "Terrestrially derived sediments have been shown to be less labile and degrade more slowly than aquatic-derived sediments (Gudasz et al., 2012), especially under low oxygen concentrations (Sobek et al., 2009)".

- We agree with P.M. Fearnside that it is more appropriate to consider that the Mascarenhas de Moraes reservoir is located in the sub-tropical zone and hence replaced "tropical" with "sub-tropical" throughout the text.

- The following paragraph was added to the last section of the discussion (page 14, line 22): "*The 43% of the deposited OC that is mineralized in the MSM sediments may contribute to the*

CO_2 and CH_4 emissions to the atmosphere. Particularly, the share emitted as CH_4 represents a potential impact of dams on global warming when compared to the previous fluvial environment. Importantly, this impact cannot be estimated based on our data, which only refer to the carbon balance of the sediment, since a considerable portion of the CH_4 produced in the sediment may be oxidized before reaching the atmosphere (Guerin and Abril, 2007). However, as part of the OC burial may alleviate emissions, our robust account of OCBE adds important information to the current knowledge about the net GHG emissions from hydroelectric reservoirs".

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