

Interactive comment on “Historic carbon burial spike in an Amazon floodplain lake linked to riparian deforestation near Santarem, Brazil” by Luciana M. Sanders et al.

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Interactive comment on “Historic carbon burial spike in an Amazon floodplain lake linked to riparian deforestation near Santarem, Brazil” by Luciana M. Sanders et al.

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Please see attached file (Supplement PDF) for revised manuscript.

General Comments: Sanders and co-authors analyzed a core from an Amazon floodplain lake in order to assess whether the lake's C accumulation is related to anthropogenic changes in the region. This manuscript does a good job of introduc-

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ing the topic and appears to have performed data collection in an appropriate manner. However, the ultimately analyses of collected data are lacking, and I recommend the authors to further their exploration of this data set.

We appreciate the positive feedback. Below we respond to each comment individually. In particular, additional or alternative plots showing mass accumulation rates as well as cumulative burial would be welcome.

Response: We agree and have included an excess $^{210}\text{Pb}(\text{ex})$ profile vs cumulative dry mass figure (see Figure 4). We also include additional plots showing the statistical analyses of the major finding found in this work (see Figure 7).

The authors attribute changes in carbon burial rates to anthropogenic disturbance, but neither back this claim up in a statistically rigorous manner nor do they seriously (i.e., in a statistically rigorous manner) consider alternative causes for their burial rate changes. These problems of data analysis need to be resolved before the merits of this study can be fully judged.

Response: We agree with the Reviewer, and we have included additional statistical approaches to test the differences between the peak in OC burial with the periods before and after the deforestation period, by adding new panels to Figure 7, showing the statistical differences among these phases. The Figure 7 captions now contain the following: "Panels below each vertical profile represents respective data grouped by the phases >1934, 1934-1975 and 1975-2008. Filled square symbols represent means of a given variable in each sediment layer, and the vertical bars show the mean with the standard deviation of the respective phase. Equal letters in each panel represent non-significant differences ($p > 0.05$, one-way ANOVA followed by Tukey's post test)."

Furthermore we have added the following the Discussion section (Line 258): "The stable isotope results and OC burial rates, when grouped into different phases, showed assumptions required for parametric analyses, including normal distribution (Kolmogorov-

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Smirnov, $p > 0.05$) and homogeneity of variance (Bartlett, $p > 0.05$) (Figure 7). Thus, when examining the means and standard errors to represent the distribution of values, and parametric tests, different sedimentary phases are noted. These different sedimentary phases are confirmed by statistical differences as tested using a one-way ANOVA test followed by Tukey's post test (significance was defined as $p < 0.05$). "Also, we highlighted that this lake is situated in a region relatively preserved in the Amazon Forest, and that another explanation than deforestation in the margins to the peak of sedimentation might be not reasonable. To highlight these this, we now include the following (Line 279): " The lake is in a region relatively preserved, and therefore there is no other explanation other than deforestation in the margins which may have caused the peak in OC burial found between 1934 and 1975."

SpeciñAc Comments: Line 213: I am not sure what is meant by 'important' here, consider clarifying or removing.

Response: We agree and "important" was replaced by "an" to read (Line 213): "showed an increases towards the center of the sediment core".

Line 214-216: Given that a much better separation is found between d15N and OC source (Figure 6), why not regress d15N against the instantaneous C accumulation rate as you did for d13C in Figure 7?

Response: We agree and d15N against OC accumulation panel has been added to this Figure 6.

Line 232-235: This bit about data processing should likely be in the methods.

Response: We agree and have added the follow to Methods section (Line 156): "Organic carbon accumulation rates were estimated from an average between these the two dating methods, $^{239+240}\text{Pu}$ and ^{210}Pb the dry bulk density (g cm⁻³) and carbon content for each interval of the entire sediment core."

Line 259: Do you have evidence of the 'silting up' of this lake? Perhaps in the form of

mass accumulation rates rather than OC, or, alternatively, looking for changes in DBD with depth.

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Response: Mass accumulation rates, directly related to changes in DBD with depth, indicate a change in sediment source. However, this lake is situated in a region relatively preserved in the Amazon Forest. We now include the following (Line 279): "The lake is a region relatively preserved, and therefore there is no other explanation other than deforestation in the margins which may have caused the peak in OC burial found between 1934 and 1975."

Line 264-272: An ANOVA (or similar approach) would be an appropriate test here to help put some weight behind this statement.

Response: We agree and tested statistical differences (one-way ANOVA followed by the Tukey's post test) among phases of sedimentation. See new Fig 7 and captions. We also have added information on the statistical analyse throughout the manuscript, including on the sentence added in the Results section of (Line 220): " The peak of greater $\delta^{13}\text{C}$ and lower $\delta^{15}\text{N}$ values coupled to higher OC burial rates were observed in the phase between 1934-1975 in Jupindá Lake (one-way ANOVA followed by Tukey's post test, $p<0,05$; Fig. 7). The $\delta^{13}\text{C}$ values were around 3 and 5% greater in the phase 1934-1975 in relation to those previous and after respectively (one-way ANOVA followed by Tukey's post test, $p<0,05$). This peak between 1934-1975 also showed delta $\delta^{15}\text{N}$ values around 30% lower and OC burial rates around 40 % higher than other phases (one-way ANOVA followed by Tukey's post test, $p<0,05$)."

Figures 6 and 7: The C accumulation rates should probably be g/m²/yr, right? Response: The Reviewer is right and these corrections have been made to Figures 6 and 7 as suggested.

Once again, we thank the Reviewer for these constructive comments. We feel that these comments significantly strengthened our manuscript. END

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Please also note the supplement to this comment:

<https://www.biogeosciences-discuss.net/bg-2017-151/bg-2017-151-AC1-supplement.pdf>

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