Biogeosciences Discussions

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Comment on bg-2021-172

Anonymous Referee #1

Referee comment on "Origin, transport, and retention of fluvial sedimentary organic matter in South Africa's largest freshwater wetland, Mkhuze Wetland System" by Julia Gensel et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-172-RC1, 2021

Julia Gensel and colleagues have presented a paper that characterizes organic matter and its recent spatial distribution in the Mkhuze Wetland System and its catchment. Overall, the paper is sound, but there are some major issues to clarify, especially concerning the *n*-alkane data.

Overall, I suggest major minor revisions to this paper. Two broad comments I have: The separation in three end-member, i.e. aquatic (C_{25}), woody (C_{29}) and grassy (C_{33}) is not visible in the *n*-alkane pattern of modern plants presented in this study. Please clarify why these end-member were chosen, because the vegetation in the studied area likely shows a different pattern for aquatic and grassy vegetation while woody plants were not investigated.

Additionally, it is demonstrated that organic matter in lake surface sediments is dominated by local vegetation. I suggest a more clear statement there: What does this imply for paleoenvironmental and –hydrological studies at the end of the respective section and in the conclusions, where it is stated that this study is of great importance for future studies.

Specific comments:

L. 3ff.: Please rephrase this sentence.

L. 7f.: Please indicate which signal is present in the upstream area.

L. 9f.: […] higher dD values. Compared to what?

L. 10ff.: I cannot follow these two sentences. First you state that lake surface sediments are dominated by local vegetation incorporating a local hydrological signal. Afterwards, you state that those sediments integrate hydrological conditions of the whole watershed. Please clarify these contradicting statements.

L. 27: The Mkhuze Wetland System, […], is […].

L. 53ff.: Move this paragraph to line 23-28 to discuss risks and benefits of wetlands in one paragraph.

L. 60: I suggest a short section introducing to *n*-alkanes and their compound-specific (CS) $d^{13}C$ and dD isotopic composition including their interpretation. Here you could introduce why you choose C_{25}, C_{29}, C_{33} and you can refer to recent studies analyzing CS $d^{13}C$ and CS dD in topsoils (e.g. Carr et al., 2014, org. geochem., Herrmann et al., 2016, QSR, 2017, org. geochem., Strobel et al. 2020, STOTEN).

L. 69: Please avoid one-sentence paragraphs in the whole manuscript.

L. 71ff.: It seems like a word is missing?

L. 73: Can you please characterize the river a bit more in detail, e.g. as episodic/periodic/… river system?

L. 110: Please provide a reference for this numbers and also for % precip. in the next line.

L. 119ff.: Please provide references for all these information.

L. 131: Can you please provide information about the potential natural vegetation in your studied area?

L. 229ff.: Repetition of "Here" at the beginning of the sentence, please modify.

L. 270ff.: Is there a table to which you can refer, that the reader can follow this numbers? If not, please provide or add these data to table 1.

L. 290ff.: Can you please refer to a figure? Figure 8?

L. 321ff.: Please check if a minus is missing prior to the dD values.

L. 339ff.: In figure 8A, B both show a distinct (C_{27}) C_{29} dominance. Please clarify.

L. 345ff.: Okay, and how can you distinguish the two woody and grassy end-member when modern grassy plant samples in your study show distinct contribution of C_{29} (figure 8C, E, F)?

L. 353ff.: When there are differences in photosynthetic pathway, what does this mean for the dD signal? Does the photosynthetic pathway has an influence on this signal – see e.g. Sachse et al., 2012. If the abundance of C4 vegetation in the studied area changed during the past, what does this mean for the interpretation of dD in sedimentary record?

L. 358ff.: This section is more or less a data description, and a discussion of the data is very limited. I suggest to provide a statement if your findings match the expected environmental conditions in each sub-environment.

L. 378: Would the odd-over-even predominance (OEP) of the *n*-alkanes may also provide useful information concerning the state of degradation?

L. 379ff.: Closing bracket is missing. Does this approach really work out at your study site? I agree that this approach is widely applied and I also noticed your statement in lines 332-339, but does this really work in your setting? The data are great, but could you may make this vegetation statement a little more cautious?

L. 387: Please see comments above (C_{29} vs C_{33}). Additionally, I suggest to provide a figure showing the *n*-alkane patterns in each sub-environment.

L. 394: Please provide a short paragraph in the introduction how the isotopic signals are interpreted at your site for both d13C (C3/CAM/C4) and dD (amount/source/continentality…). Recent calibration studies provide a nice overview for South Africa. Are there any plants using CAM-metabolism in your studied area?

L. 413: Please provide a figure showing the *n*-alkane patterns in each sub-environment, as mentioned above.

L. 426: Can I see this sub-deviation in any plot?

L. 430: Please highlight these cluster in the respective figure.

L. 435: Please refer to the respective figure(s).

L. 442f.: What is the base of this argumentation? Please introduce to the site-specific dD-interpretation earlier.

L. 453: One sentence paragraph which is a result and no discussion. Please modify.

L. 465: […] which use the lake's water as dominant water source? How about the effects of lake water evaporation, salinity to the dD and $d^{13}C$ signal, and emergent/submerged plants contributing to the C_{25} to C_{33} *n*-alkane pool?

L. 489: Please highlight these clusters in the respective figure. For example, use colored/shaded circles in the background of the data points

L. 496: Does this statement implies that organic (bio)markers in the wetland are of local origin and thus reflect local eco-hydrological conditions instead of an integrated signal including the wetlands catchment? Please clarify, because it is an essential finding of your study and of great importance for future studies at the site.

L. 517: Remove space before comma.

L. 535: A trap for local organic material – see comment above.

L. 549: Isn't this also the case at your site now – see comments above? Please clarify.

L. 565. Generally, I agree with the conclusions, but doesn't the results demonstrate that the lake sediments are dominated by local organic matter representing very local eco-hydrological condition instead of the lakes catchment. This absolutely limits the usage of dD and $d^{13}C$ as paleoecological markers because local effects might overprint the environmental signal, which is a very important finding for future records – although it might be unexpected.

Figures:

Figure 2: The grey shaded area is very hard to identify. Numbers at the precipitation and evaporation isolines are also very hard to read, please enlarge them.

Figure 3: Please place the figure to the section where it is mentioned in the text. Are there any more recent data than 1996, which is already 25 years ago? Or is this land-cover/-usage still present? It seems very important for your study to have the most recent land-cover map for comparison with your data and correct interpretations and implications for future paleo-studies.

Figure 4: Overall, this figure provides a very nice overview of the analyses you did. However, I suggest to remove all the lab-steps, e.g. lipid extraction, and provide a little more details in the respective text and therefore reduce the size of the figure. Just keep the sample (e.g. plant samples [g]), used machines (e.g. GC-FID) and results (e.g. quantity n-alkanes).

Figure 5: Please name the figures in the text first and show them thereafter (Please check for all figures and tables)

Figure 8: Why is CS $d^{13}C$ of C_{23} and C_{35} distinctly more positive compared to the other chain-length? Is there an amount-dependency in the IrMS? Please check to note if you did an amount and/or drift correction of your data for both $d^{13}C$ and dD. Additionally, none of the aquatic plant samples show a C_{25}-dominance, which is used as aquatic end-member later, but a distinct C_{29}-dominance which is interpreted as woody end-member later. Moreover, except for 8F, none of the grasses shows a C_{33}-dominance, which is used as grassy end-member in the following. Please clarify these issue, because it is very important for your manuscript.

Figure 9: How can C_{25} be the aquatic end-member when your plants show a (C_{27}) C_{29} predominance? The same applies for C_{29} and C_{33} for woody and grassy vegetation, respectively. Is there a local study showing that C_{29} is a woody end-member in ZA? There are respective end-member based on you modern aquatic and grassy plant samples, but they are ignored in this figure. Overall, I have to note that the presentation of the data is very nice! However, please consider valid end-member.

Figure 10: I really like this figure! Maybe also indicate the pastures, which distinctly contribute to the C4 signal in the floodplains.

Tables:

Table 1: I suggest to move this table to the Results section.