

Interactive comment on “Technical note: A closed chamber method to measure greenhouse gas fluxes from dry sediments” by Lukas Lesmeister and Matthias Koschorreck

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"The study by Lesmeister & Koschorreck addresses the problem of measuring greenhouse gas (GHG) gas (primarily CO₂) fluxes from dry aquatic sediments with coarse particles. They address this methodological issue by combining in a concise way both laboratory and field tests. My major concerns are: - The lack of consistent testing of all three GHG analyzed here (CO₂, CH₄, N₂O). - The lack of testing of the wetting of clay. - The lack of references to studies in terrestrial soils that have addressed some of these methodological problems in the past. Also, address how the results presented here could be applied to terrestrial soils. This would make the better also more interesting for a wider audience."

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We address these points in our detailed reply below.

"See also some specific comments:

P1, Title: I suggest adding "aquatic" before "dry sediments". This is a good suggestion – we changed the title.

"P1, L14: I suggest using "terrestrial" instead of "normal". OK – we changed the text.

"P1, L21: There are some recent studies on GHG fluxes from dry sediments from other regions too (e.g. Bolpagni, Rossano, et al. "Role of ephemeral vegetation of emerging river bottoms in modulating CO₂ exchanges across a temperate large lowland river stretch." *Aquatic Sciences*: 1-10; Jin, Hyojin, et al. "Enhanced greenhouse gas emission from exposed sediments along a hydroelectric reservoir during an extreme drought event." *Environmental Research Letters* 11.12 (2016): 124003; Gilbert, Peter J., et al. "Quantifying rapid spatial and temporal variations of CO₂ fluxes from small, lowland freshwater ponds." *Hydrobiologia* (2016): 1-11.)." We added those references

"P1, L22-30: Make clear that it is possible to measure GHG fluxes from aquatic sediments, but that this measures have so far been limited to fine sediments because of methodological constraints." Thanks for this suggestion. We added: "This approach has been successfully used to quantify GHG fluxes from muddy dry aquatic sediments (Hyojin et al., 2016; Koschorreck, 2000). However, dry sediments in streams or at the shore of lentic waterbodies at low water level are often rocky and pushing the chamber into the ground is not possible."

"P1, L23: "widespread". corrected

"P2, L8: There is some methods, but only for fine sediments." Correct – we added this aspect as explained above and by adding "stony" at this point.

"P2, L10: I think you should add "on" before "how". " Corrected.

"P2, L20: It is unclear if you really test CH₄ flux (and N₂O)." We tested both CO₂ and

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CH4. Some information on CH4 was added to the results section: "We did not detect a significant production of CH4 in our inertness experiments (data not shown)."

"P2, L25: This detection limit is for CO2 and CH4?" For CO2. We added the detection limits for the other gases to the method section.

"P2, L25: "Three replicate measurements"?" Yes – corrected.

"P3, L13; I miss more information on the characteristics of the chambers used." We used exactly the same chamber as in the laboratory experiments. The design of the chamber is explained on page 3, l.2-3.

"P3, L14: The effect of adding water was not tested in the lab, was it? This may have influenced the results and needs at least some discussion." Unfortunately we did not perform wetting experiments with the clay. However, the clay we used was not really dry and we only added very little water to increase plasticity. In fact, we only wetted our fingers before placing the clay around the chamber. The results in Figure 1a show that the clay was not producing CO2. Thus, we think that wetting of the clay did not affect our measurements. We changed in the method section: "We wetted our fingers before handling the clay to increase its plasticity". We also added to the discussion: "It is well known that wetting of dry soils triggers CO2 production (Birch, 1958). In our experiment, the clay was slightly wetted but the data do not show any CO2 production. Thus, wetting the clay to increase its plasticity was not a problem."

"P3, L17: Specify if the temperatures reported here and in other parts of the text are air or sediment temperatures." We measured air temperature near to the soil. This is now specified in the text.

"P4, L5: It seems strange that CH4 and N2O are presented so late. The title is about GHG but then the manuscript deals mostly with CO2. What were the limits of detection for CH4 and N2O?" We added the detection limits for the CH4 and N2O flux: The lowest detectable CO2 flux in a 5-minute measurement was 4.05 mmol m⁻² d⁻¹, for

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CH4 and N2O the detection limit was 0.14 mmol m⁻² d⁻¹

"P4, L8-L22: For clarity and consistency, the text here could refer more explicitly to the concepts of inertness and tightness." We re-formulated the paragraph to make those concepts more clear.

"Table 1: Any brand name for the clay?" We do not have a brand name. It was ordinary pottery clay. We add the company where we bought it.

"Figure 1: Is "CO2 mixing ratio" the correct name for the y-axis?" Yes. We corrected the figure legend accordingly. "Why was the incubation for some materials shorter (<4h)?" As soon as the CO2 mixing ratio in the chamber exceeded the atmospheric mixing ratio, it was clear that the sealing material was producing CO2. There was no need to continue the experiment beyond this point. That is why we stopped the experiments as soon as the atmospheric mixing ratio was exceeded. In the cases where CO2 did not reach the atmospheric mixing ratio we extended the experiment to see, whether there was a slow leaking in of atmospheric CO2.

"Figure 2: Put the units of flux in parentheses." corrected. "Statistical tests comparing the fluxes could be added to this figure." Difference was checked by a t-test after checking for normality and homogeneity of variance. We added this information to the method section. We also added the information about statistical difference to the figure.

"The SRC results should be highlighted more in the text." We added a comment on the SRC results in the text: "The results obtained with clay at the reservoir site were similar to the measurements with a tested (Pumpanen et al., 2004) soil respiration chamber, showing the reliability of our measurement setup."

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