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Atmospheric Measurement Techniques
Discussions

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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Reply to RC3

"The study of Lesmeister and Koschorreck addresses the important issue of an airtight, non-influencing sealing strategy of chambers when measuring GHG emissions from dried aquatic sediments with coarse particles. Therefore different materials are tested within an approach, which combines a laboratory experimental setup with a short field study to find the most appropriate sealing material. In general the study is well designed and written, and thus suitable for publication in AMT. However, I have some major concerns: - within the abstract/ introduction especially the problem of coarse (rocky) material is mentioned (L7), however, the field study seems to only test the dif-

ferent sealing materials on sand and mud but not on coarse material (e.g. gravel)." Actually, our field measurements were not done on sand or mud but on quite stony ground with a lot of gravel. The '"on-site" material used for sealing was taken in the vicinity of our measuring site. We were especially looking for stone free material for sealing. Our original method description was misleading. We changed it to: "Tests were carried out on stony sediments. . .". We attach a photograph for illustration.

"- did you tested whether only slightly inserting the chamber into the sand or mud would have yield in similar results during the field study (important for generalization of made statements!)?" It was not possible to insert our chamber into the substrate. At the reservoir site it was possible to insert a commercially available soil respiration chamber (with sharp edges) a little bit into the substrate. We comment on those measurements in the results and discussion.

"- testing silicone for sealing is mentioned in section 1.1 (L14), but not tested during the field study (or mentioned)" Yes – that is right. Both clay and putty performed acceptable in the laboratory test. We decided to proceed only with clay, because it was cheaper and environment friendly. Furthermore the putty material was releasing ammonia. We added this information to the results.

"- was the wetted clay tested during the laboratory test as well (L14: "a little water was added to the clay")?" Unfortunately we did not perfom an "inertness experiment" with wetted clay. As explained in our reply to reviewer 2 we do not think that wetting the clay triggered microbial activity. We now address this aspect in the discussion.

"- I am curious about the drastic differences between on-site material and clay used for sealing at the river sand site and at the reservoir site during the field study. From where was the on-site material taken to seal the chamber? Might it be that the measurements were generally disturbed cause the material was taken from around the chamber?" No – the material was taken several meters away from the chamber.

"- is it right, that the field study only consisted of three to four repetitious measurements per sealing material and site?" Yes. The effects were quite clear. So we decided that more replicates were not necessary.

"- might the time needed for sealing (1-2 min) yield in an already increased chamber starting concentration which biases lateron flux calculation?" Yes – there was slight increase during sealing – but only a few ppm of CO2. ppm versus time curves were apparently linear. We do not think that this affected our measurements. For future measurements, however, we recommend the use of a chamber with removable lid. Then the sealing can be done while the chamber is still open to the atmosphere. We added this suggestion to the discussion: "To prevent concentration changes in the chamber during the sealing process, we recommend the use of a chamber with removable lid. Such a chamber could be sealed to the ground while open to the atmosphere."

"Depite of this, there are also some minor concerns:

- Did you test for saturation effects (due to small chamber size and rather high CO2-emissions)?" We are not sure whether we understand this comment. We did not perform long term measurements in the field. We wanted to measure in-situ fluxes. Thus, we tried to do the measurements as fast as possible.

"- what kind of statistic test was performed (P4, L24) and was the test performed for the n of only 3-4. - in general more details about used statistics are needed! Statistical tests comparing the fluxes should be added to this figure. The low n should be mentioned here." Difference was checked by a t-test checking for normality and homogeneity of variance. We add to the methods: "Differences between treatments were checked by a t-test after checking for normality (Shapiro-Wilk) and homogeneity of variance (Bartlett) using the software R (R-Core-Team, 2016)."

"- P1 L4 erases "probably"" The reviewer is probably right, but we think that there are currently not enough data to be 100% sure about this statement. There is actually a global initiative trying to verify the global relevance (http://www.ufz.de/dryflux/). We would like to keep the "probably"

"- P7 Tab. 2 caption: capitalize "number"" corrected.

"- Fig. 1: check the y-axis?" The Y-axis label is correct. We changed the figure legend accordingly. "Why was the incubation time different for the different materials?" 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 were CO2 did not reach the atmospheric mixing ratio we extended the experiment to see, whether there was a slow leaking in of atmospheric CO2.

"Could you add a error band around the line displaying the deviation during the three repetitive measurements (same for Fig. 3)?" Figure 1 shows the results of single measurements. Thus, it is not possible to ad error bands. Obviously, our method description was not clear here. We modified it to: "We performed 3 repetitive short term (12 min) measurements. After the third measurement we kept the chamber in place and continued recording the mixing ratio of CO2 and CH4 for up to 17 h." We added error bands to Figure 3.

"- Fig. 3: how was the leakage measurement performed during the field study?" We just placed the chamber on the sediment without any sealing. There were small holes visible. We extended the figure legend accordingly.

"- please add "aquatic" to the titel ("dry aquatic sediments")" OK – we changed the title.

"- How does Lorke et al. fit as a reference to the MS, if measurements were not performed on dried sediments but water (floating chamber)?" We cited that paper not because it contains measurements on dry sites but because it contains an innovative chamber sealing strategy: a foil sealing to a non-flat and moving water surface. We think that at least considering the use of a flexible foil fits well to our introduction. During the revision process we discovered references were a foil was used on soils. Thus, we replaced the Lorke et al reference by Steudler and Peterson (1985).

"- Numbering is wrong (1.3 comes before 1.2)" Right – corrected.

"- please add a space between 28 and âŮęC at P2 L26" corrected.

"- please directly address that the laboratory test is only able to detect the combined effect of leakage and CO2 production (which is still suitable for the purpose of the study)!" That is only partly right. In the cases were we had CO2 production we indeed could not get information about tightness. However, in cases where we have a long term value below the atmospheric mixing ratio we are pretty sure, that the material is both inert and tight. Theoretically, a continuous leakage of CO2 into the chamber could be exactly compensated by CO2 consumption in the chamber. But we have no reason to assume that our chamber or sealing material consume CO2 to keep the CO2 concentration sustainable below ambient.

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Fig. 1.