This document contains point-by-point responses to the comments of referee #2. Comments by referee are in blue, author responses in black and changes in the manuscript in italics.

Referee #2, Helge Niemann:

Unfortunately, one of the reviewers could not deliver a report because of very understandable private reasons. In order to not prolong the review process further, I will act as the second reviewer (in edition to my role as editor for this MS). The first reviewer already pointed out the most important issues, which I will not repeat here. In the following I have listed further concerns with this MS. Most importantly, the MS sometimes lacks precision (eg. the technical drawings are rather sketchy, the authors mention that the chambers are cheap but a cost estimate is only provided in the discussion). Sometimes, data are not well enough described (ie values of min/max/trend). I also miss a comparison to independent methods. The authors mention that the data are within the range of previously published data, but this seems a bit redundant in light of the large variation of CO2 fluxes from individual ponds/lakes. The authors measured CO2-aq/atmosphere and wind velocity, which allows calculation of fluxes (eg Wannikhof et al., 2009 and refs therein) and could be used for comparison.

The MS is generally written well and the contents fit to the scope of Biogeosciences.

We thank for Helge Niemann for taking the role as the second reviewer. Furthermore, we thank for the constructive comments. We have made changes in the manuscript accordingly, which have resulted in several improvements and increased the descriptive precision.

Abstract P1, l9; add comma after 'often'

A comma has been added.

Intro P1, l25; add more diverse refs for lakes as ch4 and co2 source

Two references on methane emissions from freshwater and lakes added (Bastviken 2011, Science and Wik 2016 Nature Geoscience).

P2, l5; add ref to formula

A general reference for equation 1 has been added, this reference is also added for the controls on gas exchange (MacIntyre 1995). We also added a reference to equation 2.

P2, l8; add more proper refs for controls on gas exchange velocity

Yes, see the correction above.

P2, l14; in comparison to what are small lakes abundant? Perhaps it's better to say: 'small lakes (XX-XX m2) are globally abundant' Better even if you could add some info as to what the total surface area of theses lakes is (ie globally) in comparison to large lakes. That would set this statement in a nice global perspective and adds to the importance of your study.

We have added the percentage (upper limit) of the global lake surface area represented by small lakes (<0.01 km2) using numbers from Holgerson and Raymond 2016.

P2, l29; unclear what you mean by ‘pressure problems’

The mentioning of pressure problems has been deleted; it did indeed come out of nowhere, and could only cause potential confusion.

M&M General: improve the quality of the technical drawing of the chamber. Add all components including the CO2 and T loggers (I also presume that there was an anemometer installed on top of the chamber)?

All the components are shown in the technical drawing but we agree that it is hard to recognize some of the parts. Instead of adding too many details in the overview drawing (Fig. 1), we have added a supplementary material with detailed information on the parts with accompanying pictures. The CO2 sensor also measures relative humidity and air temperature in order to correct the CO2 readings accordingly, therefore no additional temperature loggers were installed. The anemometer was installed close to the chamber on the lake, this has been clarified in the methods section now.

Information on the placement of the anemometer during the example deployment has been added.

There should also be references in the text to Fig. 1. In your MS, Fig. 2 is mentioned first.

We agree.

Reference to Fig. 1 have now been added in the first paragraph of the results.

Also, be more precise with values you provide. E.g. why was the tubing sometimes 2 and sometimes 3m long?

We have used different lengths and have not found any differences in performance. It is just important that the tubing is “long” so that diffusion is negligible.

We have changed the value in the manuscript to 2 meter now (deleted the “3”) to avoid potential confusion.

You often mention that the chamber is cheap. How cheap? This value comes in the discussion but is a bit out of the blue there.

We agree that the price range of the floating chamber and modifications should be mentioned before the discussion.

The part from the discussion mentioning the price range have now been moved up to the method section.

P3, l13. Unclear how the outlet is designed. You added a 2-3m hose connected to the chamber (I presume you used a long tubing so that leakage becomes negligible). Furthermore, you then already refer to outcomes of tests introduced in the next section. This is a bit confusing as leak-tightness is important for the chamber design and should thus be appropriately introduced and discussed. For example, I’m missing an estimate as to how robust the measurements remain if eg small waves travel through the chamber causing a temporary volume change of the chamber’s interior. This’ll be equilibrated by the open tubing but the volume of the hose is limited. Thus, exchange of the chamber’s interior atmosphere with the outside atmosphere may occur.

We agree that detailed information was sparse and a supplementary text has now been added (see also response to comment 7 by David Bastviken). We also agree that the results of the test should not be mentioned before the tests are described and we have changed the wording accordingly. We have deployed the floating chamber on several occasions with variable weather conditions (see also response to comment number 6 by David Bastviken) and we have not experienced that small waves or similar should affect the

measurements. If exchange between the chamber headspace and atmosphere would occur it should be visible in the raw data. The influence of for example small waves would also be related to the chamber headspace volume. The floating chamber itself is easily replaced with this kind of design, if this phenomenon is a potential problem.

We changed the wording of the first paragraph to avoid referring to the tests introduced late on.

P3, l29. Specify the vol of CO2 that was injected. Also, how was it injected?

This has been clarified in the manuscript now.

P4, l4; lat/lon designations are incomplete (add N and E)

Directions have now been added to the coordinate.

P4, l8; provide location of the metrological station and distance to your study side.

The meterological data (only the ambient pressure) is from the "DMI" daily archive, Danish Meterological Institute, covering the region of Copenhagen/north-Zealand and is not from a specific meterological station. This should not be a problem in our calculations as the region is small in area, and from experience, the daily data available are representative of the study area. Furthermore, slight positive/negative deviations in the ambient pressure would only have very minor influence on the final values.

The reference in the original manuscript was missing, so this has been added with a link to the web-site.

P4, l13; Is something missing in this formula? I only see the temporal change of air pressure and constants but not CO2

Everything should be there (but see also response to comment from David Bastviken and the removal of the pressure term), but we see how the equation could be clarified further.

The term dC/dt is the change in CO2 partial pressure over time. This has been changed to dCO2/dt in order to clarify.

P4, l19; elaborate how alkalinity was measured

Alkalinity was measured by acidimetric titration; this has been clarified in the manuscript.

Results General: I'm missing description of data, the reader should get a rough idea how these look like (min, max, general behaviour) - tests of CO2 leakage should be shown (and not only mentioned)

We agree that the general description of data was sparse.

We have added general description of data (flux, gas transfer velocity and CO2 partial pressure) as mean, min and max values to the results section. We have added a second plot to figure 2, so the figure now shows both the pressure (a) and tightness (b) tests.

Discussion General: comparison to data from other methods missing

We acknowledge that the comparisons are sparse. While it is hard to compare the flux values, we can only see that they are within the expected range compared to previous studies.

We have added comparisons to other studies investigating gas transfer velocity in small lakes using different methods. We have mentioned how the calculated gas transfer velocity is in agreement with other studies on other small lakes. Both from a study using whole-lake tracer addition (propane Holgerson 2017, helium and

sf6 Clark 1995) and from a conventional floating chambers connected to an IRGA (Kragh 2017) or floating chambers measuring methane (Cole 2010).