Response to Reviewer 2 (Dr. Maciej Bartosiewicz)
Dear Dr. Bartosiewicz,

Many thanks for your valuable comments and detailed remarks on our manuscript and your suggestions to improve the system. We very much appreciate your review efforts that will be very helpful in improving our manuscript.

As noted earlier, we aim for providing a detailed, fully open-source description of the system that can contribute to more extensive data collection and to inspire technical improvements by the broader community. Our response to your specific review comments are given below.

1.0 RC 1: This is an excellent and timely description of low-costs system allowing to monitor fluxes of CO2 and CH4 in aqautic setting with relatively high precision. I believe that this article/techincal note is suitable for publication but further care must be taken to improve the presentation. The text reads well mostly but a few places the flow should be improved. I think that even a Technical Notes will get more attention if properly streamlined. Also, and most importantly, I strongly suggest that a visual representation of the sampling system is included in the main body of the paper. I found some illustrations in the SI but a compact and clear technical scheme of the described system should be available in the main ms. After these rather minor issues are resolved I recommend this draft for publication.

1.0 AR1: Given that this type of manuscript is expected to be short we decided to move the visual representation to the supplemental information (SI) section.

1.0 ACM1: We will discuss with the editor if we can add a more substantial visual representation of the sampling system to the main body of the paper.

1.0 RC2 Page1 Line 35: You state that " the flux chamber method which can trap both diffusive and ebullitive (bubble) fluxes, has been demonstrated to not bias gas fluxes at the air water interface" There is a number of publications (see Vachon et al. 2010 for example) providing evidence that chambers themselves can affect turbulence (and thus the flux) at the water- air interface. I also support using chambers as reference direct method for flux estimation but you should, at least, acknowledge that there is a potential effect on turbulence from the static chamber.

1.0 AR2: Clear turbulence effects have been noted for some chambers designs/approaches, such as chambers attached to a stationary and heavy objects (e.g. ADV instrument in the mentioned reference), while the chamber design used here, with light weight, limited intrusion of chamber walls into the water, and chamber mooring to enable the chamber to following wave or water motion as much as possible, has repeatedly shown negligible bias compared to non-invasive techniques under variable conditions ranging from coastal water, small lakes and streams (Cole at al 2010; Gålfalk et al 2013; Lorke et al. 2015).

1.0 ACM2: As we have stated in Response to Reviewer 1 comments *2.1 ACM6:* The choice of the chamber design and evidence in support of it will be clarified. In this clarification we will show awareness of the possible turbulence effects as suggested here.

1.0 RC3 (line 1-5, page 2): You later state that (line 1-5, page 2) "these methods are inexpensive in terms of equipment and work well to quantify gas emission in a confined area but they are labor intensive and have low temporal resolution" This is correct if the gas inside of the chamber is somehow homogenized. I understand that this is, in fact, tedious and adds another layer of complexity but I found it better to have a pump connected on the top of the chamber that would mix the gas inside. Otherwise, during longer deployments, CO_2 can accumulate inside your chamber and may bias the flux estimates.

1.0 AR3: In our statement "*these methods are inexpensive in terms of equipment and work well to quantify gas emission in a confined area but they are labor intensive and have low temporal resolution* ", we were referring to the entire sampling process which in most sampling setups on a lake requires traveling (often rowing) out to deploy and then returning some time later to sample and returning samples to the laboratory for analyses. We agree also that adding the manual mixing of the headspace also adds time.

1.0 ACM3: We will correct the sentence in the manuscript to read "*Both these methods are inexpensive in terms of equipment and work well to quantify gas emission in a confined area however they are labor intensive due to repeated visits for both deployment and sample collection and therefore often have low temporal resolution*."

1.0 RC4 (line 30 page 2): Using eddy covariance is well established in lakes – please reword your statement; aside from being costly and logistically complex to install, eddy covariance datasets often require labour intensive re-processing. . . but it is certainly well established.

1.0 AR4: As in our response to reviewer 1 comments 2.2 AR 1, we did not intend to unfairly describe EC measurements. Given the discussions on issues such as lateral fluxes (land/sea breeze effects), wind shadow zones around forested lake shores, other irregularities in wind patterns over lakes, challenges interpreting footprint locations and shape for small lakes, and other discussions on suitable equipment (e.g. open or closed path), we simply had the impression that method evaluation and development was still ongoing. Because the referee comment clearly signals we were wrong we will remove this statement.

1.0 ACM4: We will reword the sentence to: "The eddy covariance (EC) technique is increasingly used for long-term monitoring of terrestrial and lake-dominated landscapes, but it is expensive in terms of equipment."

1.0 RC5: Specify what is the sensor in your Panthera (Neodym?), it sounds to me that these three configurations use the same methane sensor. . . "TGS2611-E00 sensor is equipped with a filter to reduce the influence of interference" what filter???? Please specify as this may be important for future use.

1.0 AR5: The manufacturer does not provide information about the filter in the product description only that it is meant to "eliminate the influence of interference gases such as alcohol, resulting in highly selective response to methane gas".

1.0 ACM5: We will modify the sentence to include this information from the manufacturer: "The TGS2611-E00 sensor is equipped with a filter to eliminate the influence of interference gases such as alcohol, resulting in a selective response to CH_4.". and we will add the manufacturer's product website (http://www.figarosensor.com/product/entry/tgs2611-e00.html) as a reference.

1.0 RC6: There seems to be a problem with your bubble counter as limiting your measurements to bubbles are larger than 3-4 ml may bias total flux estimates, would it make sense to use a pre-trapping system for small bubbles?? I do not know how would/if this can be integrated but imagine a system that when CH_4 bubble is detected but not quantified because of its low volume then it is directed toward another trap where cumulative volume of such small bubbles can be assessed?

1.0 AR6: We appreciate the suggestion for modification to pre-trap small bubbles. We decided on this design of an "accumulation trap" so that all the bubbles will be trapped, but the limitation in technology and the variable conditions of deployment outdoors does not allow us to resolve very small bubbles.

1.0 ACM6: We will clarify that ours system accumulates all bubbles and perform the measurements when the bubble volume is large enough. Hence the limited resolution of small bubbles does not mean that the small bubbles are missed but more that the pressure sensor measurements do not resolve individual small bubbles but instead measure the average volume of many bubbles.

1.0 RC7: You state that: "If bubbles entered the trap and were large enough to activate the venting mechanism during a non-logging period, it was missed in the logged data file" How often did this happen during your experiments and what was the size of bubbles activating venting.

1.0 AR7: The upper threshold of the bubble trap is a technical feature of the trap design however we have not observed this during any of our tests. In this study the accumulated bubble volume of 28 ml will activate the venting, and we did not experience any bubble events larger than this threshold, but we think it is important to report this setting and the need to consider it to potential users.

1.0 ACM7: We will add a statement to clarify this in the manuscript.

References:

Cole, J.J., Bade, D.L., Bastviken, D., Pace, M.L. and Van de Bogert, M. (2010) Multiple approaches to estimating air-water gas exchange in small lakes. Limnology and Oceanography-Methods 8, 285-293.

Gålfalk, M., Bastviken, D., Fredriksson, S. and Arneborg, L. (2013) Determination of the piston velocity for water-air interfaces using flux chambers, acoustic Doppler velocimetry, and IR imaging of the water surface. Journal of Geophysical Research: Biogeosciences 118, 770-782.

Lorke, A., Bodmer, P., Noss, C., Alshboul, Z., Koschorreck, M., Somlai-Haase, C., Bastviken, D., Flury, S., McGinnis, D.F., Maeck, A., Muller, D. and Premke, K. (2015) Technical note: drifting versus anchored flux chambers for measuring greenhouse gas emissions from running waters. Biogeosciences 12, 7013-7024.