Referee 2

I think that the authors spend too much effort on the area and general lakes description, especially regarding their chemistry. Although this is interesting, it is somehow disconnected to the GHG emissions and biogeochemistry function story. The authors made very little (if no) links between the lake chemistry and GHG emission/biogeochemical function. I suggest the authors to reduce significantly the description of the lake chemistry in the region, which I think other studies did properly.

We agree with the comment and the ms has been reorganized. Instead of providing chemistry data specific to the lakes studied here, in the form of results, we recall as a site background that lakes of nhecolândia follow a known evolution already mentioned in previous publications. This reorganization makes it possible to reduce the sections "methods", "results" and "discussion", and reinforces the "site background", also suggested by referee 1. Consequently, Fig. 2 has been removed.

Linked to the previous comment that the authors emphasized on the chemical diversity of the lakes in the study area, choosing only 6 lakes might be not representative of this highly diverse/heterogeneous region. I acknowledge however that sampling many lakes is labor (and money) intensive, and that 6 lakes are better than none. I, however, suggest the authors to rework the manuscript to better reconcile and link the great diversity of lakes to the limited sampled lakes. What makes the authors think that these lakes are representative? It seems that they are representative chemically (if I understood right figure 2), but how are they biogeochemically? This should be clearer in the manuscript.

In the new version, we mention in the "study site" section that the lakes are representative of the region from the point of view of the major elements chemistry. Only 4 lakes have been maintained for the study, 1 black-water and 3 with green-water lakes. We rely on Martins (2012) who carried out a typology of alkaline lakes, to declare that these lakes are the most representative of the alkaline lakes of the Pantanal. See below:

"The study was carried out in two different forested regions of Nhecolândia, in 3 lakes (V, P, G) at the Centenário farm (private land), and 1 lake (M) at the Nhumirím farm that belong to the Brazilian Agricultural Research Corporation (Fig. 1). The main activity of these farms is cattle breeding. The selected lakes, with a surface area between 0.05 and 0.29 km^2 (Table 1), are shallow with water columns hardly exceeding 1 m during the rainy season, with the exception of lake P, which can reach 2 m in its deepest point. These 4 lakes are alkaline with pH ranging from 8.9 to 10.5 throughout the year. We have previously verified that the changes in their water chemical composition are consistent with the results obtained by Furian et al. (2013) from a regional study. The alkaline lakes were selected so as to cover a wide range of water electrical conductivity, and according to the presence and magnitude of phytoplankton blooms. Lakes M, V and G are green water lakes, while P is a black water lake. These two types of lake are the most representative of the saline alkaline lakes of Nhecolândia (Martins, 2012). Because of flooding that makes it impossible to access the studied site, no data were collected in the height of the wet season, and fieldwork was concentrated in the early (May-June), medium (July-September), and in the late dry season (October-December) from 2012 to 2015. The gas emission data were acquired during 24-hour cycle monitoring (usually every 2 or 3 hours) and are supplemented by data acquired occasionally but systematically in each field campaign."

While a thorough description of the sampled area (Pantanal lakes) was provided, the sampled lakes themselves were barely described. Basic information on lake depth, size, and thermal stratification is needed to properly interpret the chemical and biogeochemical results. Also, it is mentioned that the lakes are private and located on a farm. Are the catchments natural or managed? Forested or agriculture?

Depth, size, are now given in the table, and we mentioned that the main activity of these farms is cattle breeding. It is not relevant to refer to a catchment in the flat Nhecolândia. We just maintained the sentence that was already in the first ms: “Nhecolândia has relatively closed drainage with little connection to major fluvial systems”. We also mentioned in the text where the samples have been taken (distance from the lake shore, depth, etc…)

Figure 1 shows 6 lakes, but Table 1 only 4. This is very confusing for the reader. I thus strongly suggest adding a paragraph in the method section to properly describe the sampled lakes and the data used (and data not used), in which lakes, and the statistics made on the data.

We agree. As a result of the reorganization of the manuscript, lakes F and R, which were used only to strengthen the chemical framework of the sampling, were removed from the study. So there are now 4 lakes, in both the figure and the table. Sampling and statistics are better described. See below.

“Gas fluxes were calculated by the linear change in the amount of gas in the chambers as a function of sampled time. Thus, for example for a 6-chambers protocol, the mean and standard deviation on 12 measurements are presented as single gas emission value and error bars, respectively, for a given hour that corresponds to the launching of the first chambers. This operation was repeated every two or three hours or in order to present a complete 24-hour cycle.”

It has been also described in the figure caption of the Supplement S1. See below.

Photo 2: Gas collection from a train of 6 slowly moving chambers on green water lake M in the absence of cyanobacteria bloom (December 2014). The first floating chamber has just reached the point of collection. Two samples will be collected in each chamber. The average of these 12 samples will provide 1 flux data for each gas (CH_4, CO_2 and N_2O).

And in the result section, we mentioned:
“The measurement times varying from 21 to 43 min (Table 1) on the chamber trains made it possible to verify that majority of the gas accumulation rates were tightly linear in time.”

Also, all the figure captions should be more descriptive. For example, in Figure 3, the caption should mention what are the 4 panels, the different symbols, which day of the year it represents ... etc.).

The figure was reviewed in accordance with the suggestions; the day of measurement is now reported in the caption and "similar climate conditions" is mentioned in the text. All the figure captions are more descriptive and informative. See below example of Fig. 2 (Former Fig. 3)

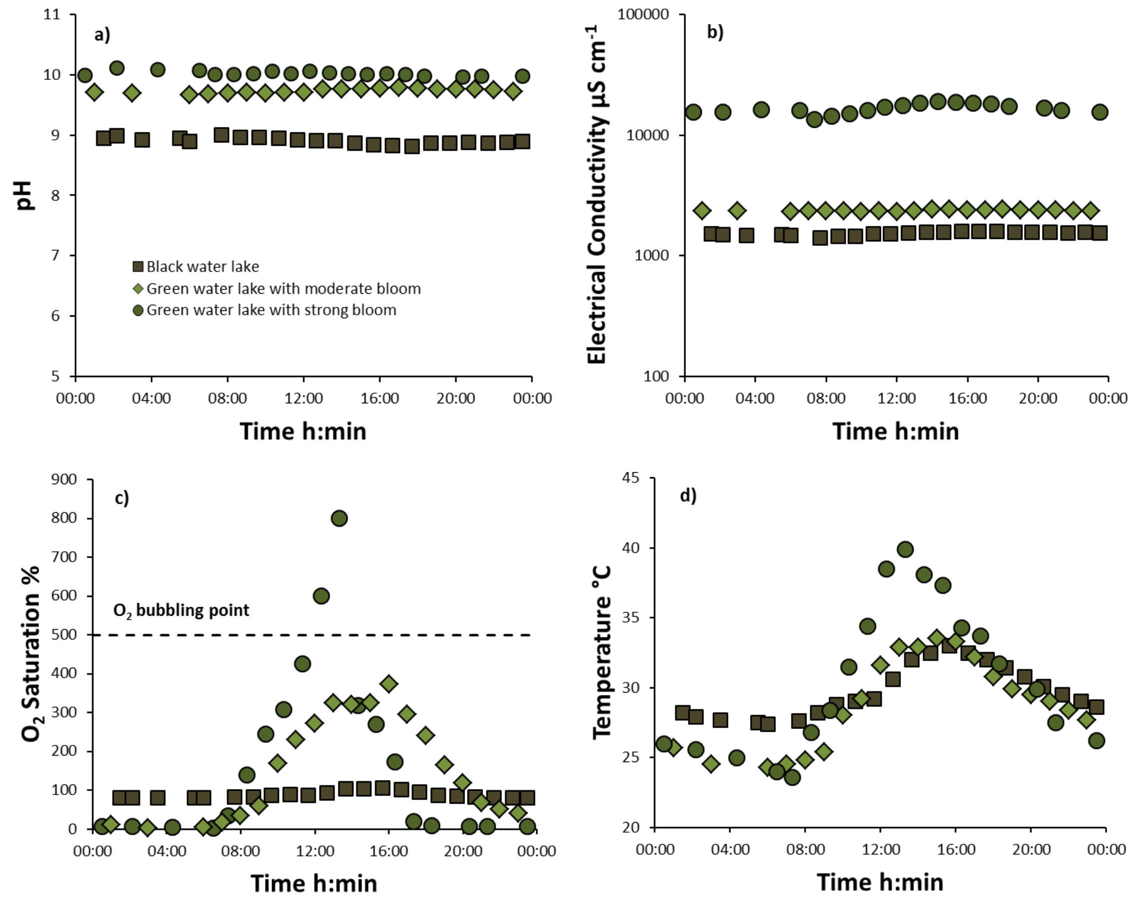

Figure 2: Changes in (a) pH, (b) E.C., (c) dissolved O_2 and (d) temperature at 5 cm below the lake surface, over 24-hours monitoring. The measurement were carried out with similar climate conditions on September 13$^{th.}$, 2012 for black water lake P and green water lake G with strong bloom, and on September 14$^{th.}$, 2012 for lake V with moderate bloom. The dashed line in Fig. 2c represents the O_2 bubbling point for a solution at the equilibrium with atmospheric O_2.

Chambers methodology: It is obvious to me that dragging chambers over the water induce artificial turbulence inside the chamber. The fluxes derived from this technique should overestimate real fluxes. The authors should provide further explanation of the potential impact of this bias on the interpretation of the results.

We understand very well the basis of this comment. As mentioned in the manuscript, this choice was motivated by the results of Bastviken (2010), so as to integrate all the heights of water column over a lake diameter. We mentioned the maximum speed of the chambers of 5 m / min. This velocity is slow but likely to create vortices in the chamber and alter water-atmosphere exchanges. However, movements of the fixed chambers were also observed under the influence of the irregular wind. Indeed, in order not to disturb the sediment just below the chamber, these chambers are anchored at a distance of 10 m, the vertical of the anchor being visualized by a float. Although anchored, these chambers can move abruptly a few m in small gusts. The bias induced by these displacements is similar. In addition, "slowly moving chambers" collection was only used twice on Lake M (see table). If the results were overestimated, values remain among the lowest in our dataset. This has no influence on the main message we want to convey, the emissions are largely changed when the O2 bubble point is exceeded, and these key data have been obtained from "fixed" chambers, collected from inflated boat. The conditions have been more detailed in both the text and the Table. See the table below.

Table 1: Date, location, lake characteristics and general conditions during greenhouse gas emission monitoring.

Date	Type of lake (name) Surface km^2	Weather conditions	Phyt. Bloom conditions	EC range $\mu S.cm^{-1}$	pH range	DOC $mg.L^{-1}$	Procedure Numb of chambers	Water column range meter	Time of gas coll. Minute
Sept. 13, 2012	Black (P) 0.087	Sunny	-	1400-1599	8.81-8.99	51	Fixed 3	0.3 – 0.8	20
Sept. 14, 2012	Green (V) 0.109	Sunny	Moderate	2420-2888	9.48-9.73	236	Fixed 3	0.1 – 0.4	20
Aug. 30, 2013	Black (P) 0.091	Sunny	-	1715-1855	9.21-9.33	37	Fixed 3	0.3 – 1.1	20
Sept. 1, 2013	Green (V) 0.109	Partially cloudy	Strong	2302-2410	9.67-9.78	265	Fixed 3	0.1 – 0.5	20
Dec. 2, 2014	Green (M) 0.053	sunny	No	2014-2204	9.37-9.51	102	Sl. moving 6	0.1 – 0.4	23 to 43
Jul. 7, 2015	Green (M) 0.055	sunny	No	1940-2030	9.28-9.37	82	Sl. moving 3	0.1 – 0.4	21 to 37
Sept. 10, 2015	Green (G) 0.285	Sunny (evening storm)	Strong	34000-35100	10.3-10.44	326	Fixed 3	0.1 – 0.2	20
Sept. 12, 2015	Black (P) 0.093	Strongly rainy	-	1382-1450	9.3-9.4	36	Fixed 3	0.4 – 0.7	20

4) In the green water lakes, the authors estimated annual CH4 flux of 8850 mmol m-2 yr-1, while CO2 influx was 1140 mmol m-2 yr-1. Even if all this CO2 consumption goes into biomass and that this biomass is completely used for methanogenesis, there is still about 7500 mmol of CH4 that is missing and must be produced elsewhere. Where this methane comes from? Do the authors have ideas?

Of course we agree with this constructive comment. A discussion was added on this topic: “From these data, the balance points to a carbon deficit of the order of 7500 mmol m^{-2} Y^{-1} in green-water lakes. This imbalance is significant, and several hypotheses must be put forward. The first point is that CO_2 capture was measured when the phytoplankton bloom was already very advanced. Maximum CO_2 capture should occur during the growth of the bloom but no data are available for this period, and the annual CO_2 capture budget may be underestimated. Another hypothesis is that the C budget of the lake is not balanced every year, but over the long term. A surplus year may succeed to a deficit year in terms of emission of C. This can be conceived for example in the case of a single consequent rain (> 20 mm) rather early in the dry season. This rain is likely to make the bloom disappear. It will then resume its growth but reach a sufficient density to induce O_2-supersaturation only close to the beginning of the rainy season when it will disappear again. Periods with O_2-supersaturation will be restricted, thus considerably limiting methane emissions during this year. Finally, it is possible to imagine an influx of C from the surrounding forest. However, it would be in disagreement with our observations on alkaline lakes hydrology (Furian et al., 2013; Barbiero et al., 2016). These are supplied by subsurface flows of low C-charge waters during the rainy season. On the other hand, during the dry season, transfers are made from the lake towards the beach via a soil solution with a high MO content (up to 750 mg_C l^{-1}). This functioning would therefore tend to increase the carbon deficit in the lake.”

Technical corrections

All technical corrections have been incorporated