Reviewer 2

We thank the reviewer for his/her positive assessment of our work and sincerely appreciate his/ compliments. We provide below a point-by-point reply to the comments. Reviewer comments are italicized while our responses are not italicized.

Reviewer : In their paper, the authors undertake and extremely comprehensive set of measurements to assess the methane paradox in freshwater lakes. The authors are to be commended for such a comprehensive set of experiments, in what must have been difficult environments to work in. Overall, I found the manuscript well written, and the data supported the conclusions raised. I would suggest that some parts be toned down however, due to the (understandable) lack of replication spatially and temporally. For example, the mass balance calculations are derived from short term experiments/measurements with restricted spatial replication. While this in itself is not a terminal flaw, I think a more nuanced assessment of the results is required. I certainly appreciate the trade-off with doing a large number of experiments and measurements over a range of systems, versus long term intensive experiments on a single system. I would also suggest separating results and discussion to simplify the narrative, this would improve the readability of the paper, and also prevent some of the interesting findings being lost in a sea of descriptive text.

Reply : We followed the reviewers' suggestion and split the results and in two different sections. We hope it will improve the readability of the paper. We also took care to tone down the last part of the discussion.

Reviewer : Specific comments: Line 18 Dissolution flux was modeled rather than measured right?

Reply : Indeed, we agree with the reviewer. The sentence has been corrected.

Reviewer : Line 46 "Among others", reword to clarify

Reply : The sentence has been changed. It now reads "Primary production, methanogenic and methanotrophic activities, and cyanobacterial dominance are potentially much higher in tropical lakes due to favorable temperature (Lewis 1987, Kosten et al. 2012)".

Reviewer : Section 2.5 I appreciate that measuring benthic fluxes of CH_4 are difficult, but I wonder how represenattive these core experiments are to insitu rates. The cores had water drained, what affect might this have on the microbial community (i.e. introducing O2 into sediments). Further, the shallow sediment depth may also introduce artifacts. Is there any information on sediment characteristics that may help the reader to intepret the potential issues associated with this (e.g. porosity etc.). Further, are bottom waters anoxic in the lakes (as the water used for incubations was anoxic).

Reply : We would like to clarify that only the overlying water was drained. We also took care to avoid sediment disturbance using a tube connected to a 50 ml luer syringe to drain the water. Overlying water was then replaced by Helium-purged filtered (0.2 µm) water which was previously collected at the lake bottom. We are then confident with the fact that O_2 wasn't introduced in the sediments. The method description might have been confusing, it has been modified to improve its clarity.

However, "natural" bottom lake water was indeed oxic, while our incubation was carried out under anoxia. Aerobic CH_4 oxidation in the uppermost part of the sediment might have been inhibited following the removal of O_2. This will be clarified in the material and method of the revised manuscript. The term "CH_4 flux across the sediment water interface" will also be changed to "potential CH_4 flux across the sediment interface".

Reviewer : Would the method used for d^{13}C-DIC measurement also pick up any labeled ^{13}C-CH_4? I would expect that the EA-IRMS method would oxidize CH$ to CO2 and that this may introduce an artifact, but maybe I missed something with the method description.

Reply : The setup of the EA-IRMS we used for the d^{13}C-DIC was modified as described in Gillikin & Bouillon (2007). Briefly, we installed an injection port in the Helium carrier gas line between the reduction column of the EA and the water trap. Since the sample gas is injected after the two EA furnaces (but before the water trap and the chromatography column), a contamination of the d^{13}C-DIC by some ^{13}C-labelled CH_4 is impossible. A reference to the paper of Gillikin & Bouillon 2007 has been added in the revised version of the manuscript in order to clarify our method.

Reviewer : Line 200 Was ambient concentrations of ambient acetate and methionine measured or just estimated?

Reply : Ambient acetate was assumed to be 1 µmol L^{-1} or lower based on literature values (Allen 1968 Ho et al. 2002, Tang et al. 2014). Final concentration of acetate in the bottles spiked with ^{13}C labelled acetate was estimated at 100 µmol L^{-1}) Methionine was assumed to be lower than 0.1 µmol L^{-1} (Sarmento et al. 2013). Final concentration of methionine in the bottles spiked with ^{13}C labelled methionine was 10 µmol L^{-1}.