

## ***Interactive comment on “Reliable reference for the methane concentrations in Lake Kivu at the beginning of industrial exploitation” by Bertram Boehrer et al.***

### **Anonymous Referee #2**

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The authors interested in the measurements of gases concentrations in very deep waters of Lake Kivu. This work is very interesting, since the latest studies were alarming and suggested that methane concentrations in Lake Kivu were increasing, and that a limnic eruption was possible in a near future. This study shows that gases concentrations, and especially methane concentrations, did not increase since the first measurements made by Schmitz and Tietze, and thus that methane production is not higher than methane oxidation+methane fluxes to the atmosphere. I think that this study is important and overall reliable, with good measurements methods. Actually, I decided to put this manuscript in "major revisions" mainly for grammatical and language reasons, and also because numerous specifications and details must be added.

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In particular, I have some questions on M&M (please see below).

- P2 L3: "large amounts of dissolved methane" => please specify how much, the readers who do not work on Lake Kivu won't know - P2 L8-9: "The survey of the management prescription" => What does that mean? - P2 L16: "an increasing risk of limnic eruption" - P2 L17-19: Sentence not clear, please reformulate - P2 L24: "All of them, even the more recent measurements trials, had to struggle with the loss of gas and water while recovering samples to the surface". - P2-3 L29-2: Sentence not clear, please reformulate. - P3 L14: separate what? - P3 L23: dissolved solids => which ones? - P4 L5: "Map of Lake Kivu, showing the sampling sites (GIS and DEEP) and the area of the resource zone (below 260m). - P4 L10: "at a maximum depth of 410 m": not clear. Did you make only one depth (410 m) or the depth 410 m was the maximum one, and you also sampled other depths. Please be clearer about the depths sampled. You also sampled the deepest location DEEP, but there is not precision on the depth sampled at this location. So, which depths did you sample at the platform GIS and which depths did you sample at the location DEEP? - P5 L1: Also see the study of Borges et al (2011) for the horizontal variability/homogeneity - P6 L3: "Gas sampling device, with pump controller...." - P7 L8: "over night" => samples were not preserved with anything. Do you consider that any biological activity can occur over night in the water (methane production for example), and thus that the gas composition cannot change during the night? How can you stipulate this? Were the bags well kept in dark? Please give more details and specify. - P7 L9: What is the gas in the headspace? - P8 L8-11: Sentence not clear, please reformulate and clarify - P8 L20-24: This conclusion must not be in the M&M. Please move it in the discussion or conclusion sections. - P9 L4-6: Sentence not clear, please reformulate - P9 L29-31: grammatically not correct, please reformulate. Also, what is a "compensation reservoir"? - P10: The norm ISO is not a protocol. The reader needs more details of the analytical methods. Please well describe the steps of the analyses. - P10 L16: according to Koroleff ??? Reference? - P11 L4: According to DO vertical profiles, 2 field campaigns were conducted during the dry season (27/5/17 and 2/6/17) and 2 field campaigns during the rainy season (9/3/18 and 13/3/18). Why

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did you choose to make measurements during both seasons? Indeed, this study focuses on very deep waters, where there is no influence of seasonality. Please clarify - P11 L7-10 : In the results section, you must not reference other studies. Referencing the literature is a discussion, not results - P11 L13: The resolution of the figure 3 is not good, especially the writing. Please improve. Also, please remove the minus in front of the depths - P11 L14: "against depth" => according to depth - P12 L1-2: Please add this limit on the graph - P12 L8: "Successfully" => What does that mean? - P 12 L9: The previous results used in this study should be specified above (in the section 2.1). At this stage, it was not clear that the authors did not sample in 27/5 and 2/6 for this study. - P12 L10-11: Please better describe your results. Example: "CH4 concentrations reached 18 mmol/l at 450m", etc. - P13 L1: Please put letters for identify panels, it is easier for the reader (upper panel = A; middle panel = B, etc) - P13 L2: "from the platform GIS" - P13 L4: Until now, the authors did not use the terms "site 2" and "site 1", but "GIS" and "DEEP". Please stay constant - P14 L2: "greater" => "deeper" - P14 L5: What is the potential resource zone? Please well define the different zones of the lake, and overall showing them on vertical profiles graphs - P14 L6-7: It is not a result, it is a discussion - P14 L8-9: It is not a result, it is a discussion - P15 L6: I don't understand "some variability of temperatures"; please clarify - P15 L8-9: I don't see how you can conclude this, only on the base on the "look" of the vertical profiles. Please detail - P15 L10-16: Nothing new, already well developed in all the papers on Lake Kivu. Please summarize - P15 L20-23: The studies are not properly referenced. Please reformulate; example: "... with previous observations (Schmitz and Kufferath 1952, Tietze 1974, Schmid et al 2005)" - P16 L5: Methane concentrations (mmol/l) - P17 L10: Carbon dioxide concentrations (mmol/l) - P18 L4: The study of Roland et al 2018 is the only study that quantified in situ methane oxidation in Lake Kivu. As the authors talk about methane oxidation, it would be correct to also reference this study - P18 L16-19: Already said above - P19 L15-26: I don't see what these data bring to the manuscript. They are unuseful for the purpose of the present study, and they are not well developed - P19 L16: "previous ones" - P19 L20: You did not study Kabuno Bay in

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the present study - P19 L21-22: I agree with you, numerous errors are published in the study of Tassi et al 2009 - P19 L22-23: I don't understand why the authors talk about the limit for drinking water in Germany. It does not make sense in this study! - P20 L16 and L19: "on the base on" - P24: The design of the table is not clear and not beautiful. Please improve

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