

# ***Interactive comment on “Responses of N<sub>2</sub>O flux to water level fluctuation and other environmental factors at littoral zone of Miyun Reservoir: a comparison with CH<sub>4</sub> fluxes” by M. Yang et al.***

## **Anonymous Referee #2**

Received and published: 8 May 2015

Review of ‘Responses of N<sub>2</sub>O flux to water level fluctuation and other environmental factors at littoral zone of Miyun Reservoir: a comparison with CH<sub>4</sub> fluxes’ By Yang et al.

This manuscript discusses a detailed field study on N<sub>2</sub>O emissions in the littoral zone (which they define as from non-flooded to permanently inundated waters) of a large Chinese reservoir. They describe the sampling design well and included 7 campaigns throughout various seasons, including the flooding season which is most important to their study. They compare their results of N<sub>2</sub>O fluxes and its controls to a similar study on CH<sub>4</sub> fluxes at the same reservoir. The detail of experimental/sampling setup makes this study relatively unique as does the comparison of N<sub>2</sub>O to CH<sub>4</sub> fluxes in the same

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area of a reservoir. The focus on greenhouse gas emissions from seasonally inundated regions of a reservoir is an extremely important topic. While I do have some issues with data interpretation and the discussion (but include ways how to improve it), I believe after some major revision that this paper could be accepted for publication.

General comments:

1. My biggest concern with the manuscript is their definition of the littoral zone. From what I can gather, the authors included an area next to the lake that is never flooded (Site NF) in their analyses (in Table 1, for example). The littoral zone of a lake is the nearest to shore portion of a lake that is underwater. In the case of a reservoir, where water levels can change dramatically, I would think the definition of a littoral zone could be robust enough to include the drawdown region of the reservoir where changing water levels will leave a portion of the littoral zone seasonally dry. However, I find it hard to call a portion of the lake that is never inundated as part of the littoral zone. I thus find it strange to include measurements from such an area in regressions between flux from the littoral zone and the environmental parameters considered. The fact that Figure 5d (site NF) is a completely different scale to the other three panels containing the other three sites is enough of a reason to cause concern when including this site in your correlations. If by chance I misunderstood and site NF was not considered in the correlations, then I believe the authors should make that very explicit. However, if this site was included in the correlations then I strongly suggest that the authors re-do their analyses without these measurements. I also have an issue with the soil analyses and using site DW with the others. See comments below too.

2. There were many times in the discussion that I felt the authors skipped details crucial to understanding their line of thinking. Please take special note of those when implementing my comments below.

3. There is an incredible amount of data in this study and I believe the authors have not drawn as much out of the data as they could and should. Their 24-hr measurements

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are impressive as not many researchers spend the time to perform flux measurements every 3 or so hours. I highly encourage the authors to go into more detail regarding temporal variability in their data, while taking care about the spatial variability and not to compare apples to oranges.

4. I believe the paper could benefit from some type of summary/conclusion paragraph. This will also help the authors find their focus in regards to the main findings/results of this study.

Specific comments:

Abstract:

1. Line 7-9: Don't use the word 'area' so much when describing the five sampling locations. 2. Line 19 – were N<sub>2</sub>O and CH<sub>4</sub> measurements made at the exact same time? Why only comparable methods? I would be clear in the abstract but not give too much detail. For example, '...compared with a previously published study of CH<sub>4</sub> emissions from the same sites as those in this study which was carried out simultaneously.'

Introduction:

1. P5335, L4 – list some of the man-made sources of N<sub>2</sub>O 2. L9 – where have the variations in N<sub>2</sub>O flux been noted? List some refs 3. L9-13 – make this one long sentence into 2 4. P5336, L8 – 'microbial activity' instead of 'activity of microbes'

Methods/Results/Discussion

1. P5337, L23-25 – there should be more explanation as to how this unusual flooding impacted your sampling design or results. If this is not an every year occurrence then this will have implications for your results.

2. Figure 1 – The figure is nice but I'm confused about how many plots within a site there were. This needs to be made explicit in the figure caption and text. I believe there are the 5 major sites relative to water level, then at each site you had 3 sampling

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locations and at each of those you made 4 replicates – these last two numbers would explain the many ovals in the figure, correct? And then you performed this sampling 7 times each day you sampled (so over almost a 24 hr period) and you did this 6 times in the year to cover different seasons and covering the transition in and out of the flooding season well. Is this correct? Please present a more organized way to say all of this in the methods section and again in the figure caption.

3. P5341, L2 – you say that significant differences were found between the 5 sample areas, but it looks like from Figure 4 that only NF is different from the other sites and that the other sites are all similar. Is this true? This also lends to my concern that NF does not belong in the analyses. And now that I look closer, I see that C in every panel (at every site) is different than the rest. What makes C so special? I see that A, B, and C represent different vegetation but you don't describe this anywhere in the text. Please sort this out and explain the vegetation types and why C would be so different.

4. Table 1 – define 'SWC' in a footnote or somewhere.

5. P5342, L6 – is this Austrian lake study the only other temperate lake that had emissions measured in the littoral zone? Make that clear if it's the case.

6. P5342, L9-12 – this is not a fair comparison -> while both of these systems are located in temperate regions like yours, the Diem paper looks at only high elevation lakes and presumably the Jacinthe study was done on a low elevation reservoir. I think this paragraph needs a bit more reworking to make sense logically. Also, you state later on line 20-21 that your emissions are much lower than those from boreal and Antarctic lakes. Then mention something important about water quality that comes up again later (P5347,L5-6). The comparisons with other lakes and reservoirs have to be done in a logical way considering major factors, such as latitude and climate zone but also elevation and general characteristics. There is potential here for a nice literature comparison but it needs work.

7. L12 – where is this Jacinthe reservoir located? Put it in the text.

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8. L13 – why do all the ‘ffi’ look funny throughout the paper?
9. L22 – ‘might be because’
10. P5343, L7 – You should definitely give some more details about why your earlier report was more biased because of the flooding.
11. P5344, L6 – it ‘could’ or it ‘should’ inhibit? Is this is a proper debate? Or there is just no consensus?
12. L8 – I believe what you meant to say here was ‘While our results did not reject this possibility, they did not completely support that hypothesis either.’
13. L11 – this ‘extraordinary’ observation at SF-C is interesting and I noted it earlier as well. This C vegetation needs to be explained.
14. P5345, L4 – ‘emission even more challenging’
15. L5-7 – the English here needs to be improved
16. L8 – the subtitle is ‘other soil conditions’ – are you using the word ‘soil’ here to also represent ‘sediment’? For the most part, the bottom of a lake would be considered sediment and not soil. This is perhaps not the case when you are in the littoral zone and have seasonally flooded soils. However, you site DW seems to have very different ‘soil’ than the other sites based on Figure 3. Was DW also used in the correlations? Again, this may be a situation where you are comparing apples and oranges. I would take a look at the correlations with and without DW.
17. L13 – what were the other five soil variables that correlated with CH<sub>4</sub> flux and not N<sub>2</sub>O flux? This entire paragraph should be comparing these relationships but it is not clear to me what the correlations with CH<sub>4</sub> flux were and thus I cannot tell how they were different from those with N<sub>2</sub>O. You seem to be just listing possibilities for soil-N<sub>2</sub>O correlations from previous findings. Either make more reference to CH<sub>4</sub> in this paragraph or not at all. This point of this paragraph needs to be better focused.

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18. P5346, L7 – there are more relevant papers than the Schilder one to describe gas exchange processes in water. Use a more commonly cited paper.

19. L10 – why do you assume that wind influences gas exchange over soil more than over water? I wouldn't necessarily assume that and you shouldn't in this case. If this is known, then present a reference. This needs further discussion. And in general, this paragraph needs to focus more on how YOUR wind data impacted fluxes at each of your sites. You have saturated and unsaturated sites. Use that to draw more conclusions.

20. L21-23 – Improve these sentences: 'For N<sub>2</sub>O, negative relationships between N<sub>2</sub>O flux and oxygen are reported in both laboratory experiments and field studies (xxx). This is explained by the fact that denitrification, which is activated in anoxic environments, is likely controlling N<sub>2</sub>O emissions ().'

21. Line 24-25 – '...those previous conclusions because a significantly positive correlation...'

22. Line 25-26 – 'This implies that in some environments different processes may control N<sub>2</sub>O emission rates.'

23. P5347, L1 – 'in the water column has been shown to depend not only...'

24. L3 – 'might provide an explanation for our finding'... please explain this more. How does this explain??

25. L5-8 – are you saying that your reservoir is clean and that is why you didn't find a negative relationship with DO? Please explain more clearly your point with this last statement.

26. Line 24 – 'Reservoir construction does provide an...'

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Interactive comment on Biogeosciences Discuss., 12, 5333, 2015.

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