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Interactive comment on "Responses of N_2O flux to water level fluctuation and other environmental factors at littoral zone of Miyun Reservoir: a comparison with CH_4 fluxes" *by* M. Yang et al.

Anonymous Referee #1

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Review of M. Yang et al., Responses of N2O flux to water level fluctuation and other environmental factors at littoral zone of Miyun Reservoir: a comparison with CH4 fluxes. Biogeosciences Discuss., 12, 5333–5363, 2015. www.biogeosciences-discuss.net/12/5333/2015/. doi:10.5194/bgd-12-5333-2015.

General comments This is a study of N2O emissions from a reservoir in China. Based on the area change upon a difference in low and high water level of 5 m the reservoir appears to be shallow over large areas. The sampling design seem rigorous by covering many water level regimes, being based on multiple sampling over the year to cover different seasons, diel sampling at each sampling day(?), flux chamber replication in space both taking nearby and more remote spatial variability within each water

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level zone. This extensive sampling gives the study a high potential for increased understanding of variability in space and time including spatial variaility by water level, spatial variability by vegetation types, diel variability, and seasonal or Monthly variability.

At the moment I do not think this potential is fully explored. There are many levels of variability studied that is not even mentioned in the paper. Further, the aims and unique contributions of the paper are not clearly expressed. The data is analyzed based on primarily single correlations and regressions without any outspoken strategy in terms of trying to explain different type of variability occurring at different levels in space and time with different environmental variables having synchronous variability. One way to approach this is to ask "What variability was greatest and need most attention in the future?". The "dimension" with greatest variability also dictates what environmental factors are likely to be important regulators. To just give an example (perhaps not relevant here): If the diel variability is greater than other types of variability, then it is not likely to find strong correlations with daily averages of environmental factors and variables having diel variability is needed to explain the observed diel flux patterns. It is not clear how such considerations are made when looking for correlations with environmental factors.

Several significant relationships are presented but the predictive power is very low and graphically it looks like the type of situation where statistical significance is reached because of a large number of data points, while the significant patterns do not help us gain new clear or improved understanding because of low predictive power. Some of these cases perhaps, and interestingly, point at a decoupling between N2O fluxes and environmental variables. Finally, the implications of the study are not explained clearly and with the amount of data available it would be nice to try to expand the results into more general implications in a clear way. I think this study has great potential if just these issues and the other comments below are considered carefully.

Detailed comments

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Abstract Line 7: Unclear what control site means here as stable control conditions may be difficult to maintain under fluctuating water. Please clarify in what way these two sites served as control. (This is explained in the later text so this comment is about clarity for those only reading the abstract. However I think the word control site signals something else than what is the case here and what is called control site here does not stand out as very different from the other sites with stable water moisture, e.g. the NF site, so I wonder if it would not be good to omit using the word “control” to reduce the risk of confusion.)

L17: Were N2O and CH4 measurements performed simultaneously or at different times? This is essential for the interpretation of the comparison.

L 18-20: The sentence “It showed that N2O flux and CH4 flux was influenced by distinct factors and in differing ways.” is a bit vague. Would it be possible to briefly explain how N2O and CH4 fluxes and regulation differed instead?

L20-22: Instead of ending the abstract with emphasizing the complexity and challenges – please highlight the unique implications from this study and how it leads forward towards better understanding the complexity and reducing the future challenges.

1 Introduction After reading the introduction it was not clear to me what the unique contribution of this study will be. I am not contesting the uniqueness of the work but just note that this needs to be clarified. What specific knowledge gaps are addressed that has not been considered properly before? Are there any hypotheses to be tested? Even though I understand the need of descriptive studies tageting similar things at different locations to generate data for later synthesis work, it is beneficial if such studies could also test hypotheses or specifically address knowledge gaps. At the moment, the message I get from the Introduction is that similar work to in a few previous studies is now repeated in a new location, but I think this impression may not be true, and I would wish to learn from the introduction in what way this study is leading forward and providing a unique contribution (e.g. new hypotheses, better study design or mea-

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surements...etc; a now location may be fine too if there are very special reasons for believing that this location is important)

Below also a few references that I think could be important in the context of this study (both in the Introduction and Discussion parts) but do not seem to be considered at present:

Guerin, F., Abril, G., Tremblay, A., Delmas, R., 2008. Nitrous oxide emissions from tropical hydroelectric reservoirs. Geophysical Research Letters 35.

Huttunen, J.T., Vaisanen, T.S., Hellsten, S.K., Heikkinen, M., Nykanen, H., Jungner, H., Niskanen, A., Virtanen, M.O., Lindqvist, O.V., Nenonen, O.S., Martikainen, P.J., 2002. Fluxes of CH4,CO2, and N2O in hydroelectric reservoirs Lokka and Porttipahta in the northern boreal zone in Finland. Global Biogeochem. Cycles 16, 3-1 to 3-17.

Liengaard, L., Nielsen, L.P., Revsbech, N.P., Priemé, A., Elberling, B., Enrich-Prast, A., Kühl, M., 2013. Extreme emission of N2O from tropical wetland soil (Pantanal, South America). Front. Microbio. 3.

Methods and onwards (Page and Line numbers or section used from here).

P5337 L18. Is there any suitable reference for Level II Environmental Quality Standards?

P5338 L7. It is unclear what the site NF is representative for. This is important for future attempts to upscale fluxes from different environments. Please clarify.

P5338 L24-28. Does opaque here mean that chambers were not transparent to PAR? If so, how could this have affected potential fluxes from plants?

P5338 L25. What brand of gas sampling bags was used. Has these bags been tested for N2O?

P5339 L5. Please describe briefly how fluxes were calculated.

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P5339 L6. So, new positions each time. Could this have affected the results by introducing unknown variability? What is known about local variability?

P5339 L10-16. So the time span of the different analyses varied? Please see comment to figure about drawing lines between sample points implying that data are valid for integration. This may not always be the case.

P5340 L4. How was the soil extracted for pH measurements? There are several common protocols.

P5340 L9-16. See comment to figure regarding the piecewise regression (which I am not convinced is a good idea).

P5341 L2-9. Are the negative results considered? In one figure they were apparently not. I think an equally thorough analysis of the negative results could be interesting. ...I also think that the main fluxes should for at least one value be presented also in mmol m-2 h-1 units to give a reference point for those used to this unit.

P5341 Section 3.3. Figure 6, showing no visible correlation with log-transformed data, makes it very difficult to imagine any important relationships. It is a bit surprising that Table 1 indicates so many significant relationships. The highest r2 (correlation coefficient) is 0.35 vs DO which is very low given that the regression coefficient R2 is the square of r2 right? Further if the piecewise relationship for temp and nitrate is true this should substantially weaken any linear correlation. With enough data points almost all correlations become significant, but at low R2 they may not have any practical meaning. This is an important discussion I think and it is also important to show awareness of this when choosing what results are most important and should be highlighted from the study. I would consider emphasizing the low R2 and the absence if clear relationships rather than stressing that there were significant relationships.

P5342 L5. Why is the lowest flux noted in the text -2.29 when much lower fluxes are noted and visible in Figure 6 (as low as -27). If many negative fluxes are ignored very

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good reasons for this should be given. At present I do not understand how data were treated and how to interpret the results...and this undermines my confidence in the study. Please make necessary clarifications.

P5342 Section 4.1. Why not also refer to Table 2 for comparisons with other studies?

P5343 L1-16. CH4 fluxes and thereby the N2O to CH4 ratio cannot be properly evaluated without more information about the CH4 fluxes. Were they measured from the same chambers (if so good; if not comparability can be compromized by spatial or temporal variability)? Is ebulliton included or not in the CH4 fluxes?

P5344 L15-17. Does this mean that there may be a flooding pulse in N2O emissions for a few hours that is likely missed if there is not continuous sampling? If so, what does this mean for the interpretation of the presented results?

P 5345 and onwards - Section 4.3.2 - 4.3.4. I am not really convinced by this discussion because I am not sure there are any clear relationships between N2O fluxes and the environmental variables in this study. Significant regressions do not mean much if there are many data points and low R2. I would try to reanalyze the data and combine fluxes and variables acting at similar time scales. I would also try multiple regressions trying selected combinations of variables.

If this does not reveal any stronger relationships the data may even indicate decoupling between flux and many environmental variables thought to be important, which is also interesting.

Another question - why is not the diel variability shown and discussed more if the data exist?

P5347 L20-22. I do not understand the meaning of this sentence. Can it be clarified?

Section 4.4. I miss a discussion of the implications of this study.

Figure 1. I think then concept of this figure is nice. It seems that the figure includes

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some information that is not mentioned in the legend (e.g. difference between high WL and low WL and why SFC is referred to as a control and not just a different regime as any of the others). I do not understand the distances noted between sites A, B and C and would prefer to not have to find another paper to check this up. Can the legend be further clarified so that all its parts can be understood independently from the text?

Figure 2. Both wind speed and air temperature are highly variable over the day. What is really shown in the graphs? Is it snapshot measurements indicated with the points (if so I wonder if interpolation is valid as the time of the day for the sampling may be critical) or is it some kind of daily or weekly average?

Figure 3. Interesting that the sum of NH4+ and NO3- is substantially lower at SFC than at the other sites. Why is that and could this be of importance when interpreting the data?

Figure 4. What type of environment is NF representative for? All types of non-flooded soils? A narrow zone of moist soil near the water?

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