

## ***Interactive comment on “Timescale dependence of environmental controls on methane efflux in Poyang Lake, China” by Lixiang Liu et al.***

### **Anonymous Referee #1**

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#### General comments

The manuscript reports on the temporal patterns of methane (CH<sub>4</sub>) efflux in the largest lake in China and the various factors that influence these fluxes over different timescales. CH<sub>4</sub> efflux was slightly greater than other lakes with an area greater than 1 km, but was comparable to that found in tropical lakes. The variables best explaining variation on CH<sub>4</sub> efflux was timescale dependent but, overall, temperature was important over seasonal scales and wind speed on a bihourly scale.

The paper is well written despite a few grammatical errors. As the authors point out, there is a lack of data explaining CH<sub>4</sub> effluxes in this region and also in larger, non-alpine lakes more generally. As such, the results from this paper will add to the limited understanding of CH<sub>4</sub> dynamics in these lake types. However, I cannot recommend

C1

that this paper be published in its current form. I have major issues with a) the premise of the paper, b) some overreaching statements that are made, and c) the statistical approaches used - all have major implications for the generalisation of the results. It is difficult for me to assess the results and technical aspects of this study until statistical changes are made.

One major concern is that the study was undertaken in a very small area (three sites with 20 km of each other) even though the lake is the largest in China by area (3283 sq km). Further, the study sites are situated in a section of the lake that appears to be relatively confined. There is nothing wrong with the site selection. However, the authors cannot make statements about the whole lake because they don't know if the spatial and temporal patterns of CH<sub>4</sub> vary the same way across the lake. They need to qualify in all statements that the research was undertaken in one small section of the lake. It is not a study of CH<sub>4</sub> effluxes from Poyang Lake, but it is a study of CH<sub>4</sub> effluxes from one section of Poyang Lake.

Another major concern is a statistical one. The authors use average values from three different locations in Poyang Lake for all analyses. The justification for this was to 'minimize the effect of the spatial variation of CH<sub>4</sub> efflux on the temporal dynamics of the efflux'. However I suspect the main motivation for doing this was because the environmental variables were only collected at one location (it is not clear where the environmental variables were collected). Was this the case? Given that CH<sub>4</sub> was only measured in three locations of the lake, surely the degree of variation between them is very important to a) understand and/or b) account for in statistical analyses. The authors should re-analyse their results in one of the following ways: • Treat each study site as a random effect in mixed effects models so that variation among the three sites is taken into account when investigating the annual, seasonal, and diurnal variation, as well as the relationships with measured explanatory variables. Including site as a random effect would enable the researchers to make more general statements about CH<sub>4</sub> fluxes from Poyang Lake – this is just common practice these days and

C2

should be incorporated into the study design / statistical analyses. A random effect for site effectively means that these study sites are a random sample of all potential sites in the lake – this is where the generalisability comes in. Please see Section 8.1.1 (Types of predictor variables (factors)) in Quinn & Keough (2002; Experimental Design & Data Analysis for Biologists) or another similar book for information about mixed effects models and random and fixed factors. • Split the analyses into two parts. The first analysis will not average the three study sites prior to the analysis and investigate the spatial and temporal patterns in CH<sub>4</sub> among them. The second analysis could average the study sites (still preferably treat study site as a random factor) and relate this to the measured explanatory variables.

One more major concern is the notion that this is a long-term study. 4 years is not long term. Remove all reference to this study being long term, including the second sentence of the Abstract which introduces the idea that this research is filling the knowledge gap around the lack of long term research on CH<sub>4</sub> fluxes. Instead, the authors should frame this 'knowledge gap' around the lack of multi-seasonal investigations into CH<sub>4</sub> effluxes – this is exactly what this paper addresses.

#### Specific comments

Line 18. It is stated continuous measurements of CH<sub>4</sub> efflux was measured, but measurements were not continuous. Monthly measurements were made. Change all reference to continuous measurements in the manuscript to monthly measurements. Line 121-124. Are these parameters an average of the entire lake or for a specific location? Please specify. Section 2.3. Environmental variables. Where were the environmental variables collected from? Where samples collected at each of the three study sites and then averaged or from just one site? This information is very important. Line 331-332. This concluding sentence only relates to the first sentence of this paragraph and does not relate or link to the remaining text in the paragraph. This sentence should only be left if a re-working of the paragraph better supports this argument. Line 337-341. An argument is made that this study has lower diurnal variation in CH<sub>4</sub> efflux than other

C3

studies and this may be due to differences in sample size in other studies. I would think that more frequent sampling would in-fact lead to more variation. The authors need to report on how much diurnal variability in CH<sub>4</sub> efflux there was among the study sites.

#### Technical comments

Line 163-182. The description of how CH<sub>4</sub> efflux due to ebullition is very confusing and long. From Line 125, where the ebullition and diffusive fluxes are introduced, I would suggest briefly describing how, or how not, the chambers can be used to differentiate these two fluxes. Line 312. Remove 'obviously'.

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C4