

## ***Interactive comment on “Diel and seasonal variability of methane emissions from a shallow and eutrophic pond” by Wenli Zhang et al.***

**Anonymous Referee #2**

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This work seeks to identify patterns in diel and seasonal methane emissions in a sub-tropical, artificial pond and temperature is presented as a driver of both diffusive fluxes and ebullition. The strength of the work lies in the high-resolution temporal data from a relatively understudied region. However, there is a lack of spatial variability and, at present, it is difficult to extrapolate the study's findings beyond the sampling site. In addition, the justification for this study needs to be revised. Some general comments are provided below that could improve the relevance of the study's findings as well as its justification:

**Introduction:** The justification for the study relies heavily on the lack of studies on ponds outside the boreal region, whilst there may be fewer studies outside the boreal, the authors do not include a number of relevant of studies. There has been an increas-

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ing number of studies on artificial ponds, e.g. additional Swedish ponds, China, Germany, Canada and Australia, that would provide better context for the study as many of these ponds are located in temperate and sub-tropical regions. Please include these or specifically address why they should not be considered. The introduction as well as the study justification will have to be revised to accommodate these additional studies. A rather dated reference to the IPCC is used, the more recent 2019 IPCC methodology refinement provides an updated summary of the current state of knowledge and critical gaps (of which small water bodies is one).

**Methods:** The authors appear to use a single chamber at the same sampling site, there needs to be further justification as to how representative emissions from this sampling site are of the pond itself. The site is shallower than the average depth of the pond and located close to the edge, if located downwind of the prevailing wind direction would wind driven resuspension of sediment porewaters be more likely to occur in this zone. How representative is the pond to other urban ponds in the region, urban ponds are extremely diverse and concrete lined systems are not particularly common in other regions of the world. Please include more details about the site as well as aerial image or photograph of the pond. Did the authors monitor water level during or between monitoring events, this coupled with air pressure changes can be an important driver of ebullition. At present the focus in the results is almost exclusively on temperature as a driver of ebullition. Another consideration is the consolidation state of benthic sediments, this is of particularly relevance to silt and clay dominated beds. These fine sediments generally experience less consolidation and have less developed sediment gas pockets, do the authors have any additional information about the consolidation state such as bulk density or particle size. This information could support the relatively low ebullition rates observed in this study.

**Results:** The relationship between air and water temperature is usually strong in shallow systems although daily range in water temperature range is lower compared with air temperature. Major disruptions to water temperature can occur particularly during

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inflow events, were any major rainfall events captured during the monitoring period. There is a very strong focus on temperature as a driver of emission rates, this is relatively well known and it is difficult to understand the novelty of this finding. Given the rich temporal dataset it would be interesting to explore whether variables such as wind fetch, water level or atmospheric pressure could improve the temperature relationship, was this attempted by the authors.

Discussion: I would urge the authors to include the findings of studies on artificial ponds from other temperate and sub-tropical regions in their discussion. There are a number of relevant findings in these studies including drivers of methane emissions, the dominance of ebullition, contrast in emissions between different urban pond types, seasonality in pond emissions and so on. This will allow readers a far clearer understanding as to the importance of this study's findings.

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