Response to Anonymous Referee #2

Comment1:

This work seeks to identify patterns in diel and seasonal methane emissions in a subtropical, 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.

Response1：

The pond our study is an artificial pond with concrete bottom. The main differences of this type of pond in cities are the size, depth, whether there is large vegetation on the surface, and the degree of eutrophication of the water. Our study focused on the same pond and avoided these factors. Besides, our study was fixed in the same place and focused on timescales of days and seasons to primarily study temporal variability, which is distinguishing from other studies. Of course, in future studies, we will consider studying and discussing the law of methane emission from different ponds in space.

Comment2:

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 increasing 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.

Response2：

We agree with the reviewer suggested. Fewer studies outside the boreal zone should not be taken as a reason for our research. Instead, in the background of the revised manuscript, we should not only add the introduction of the research status of artificial pond, but also highlight the prevalence of this type of artificial pond in China.

Comment3:
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).
Response3：
Thanks. We will update it in the revised draft.

Comment4:
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.
Response4：
First of all, we apologize for the incorrect description in section 2.1. This should have been referred from another article when we were preparing the paper, but we forgot to modify some specific data. We will rewrite this section in the revised draft.
In fact, the pond our study is an artificial pond with concrete bottom. This type of pond is relatively flat at the bottom and has no large vegetation on the water surface. The whole water surface is relatively homogeneous. There is little difference in depth across the water. But there are seasonal variations in the water level, with a difference of about 15 cm.
Besides, we monitored the wind speed. However, wind speed was too low to be measured during most campaigns (maximum wind speed was < 1.5 m s^{-1}) and disregarded from further analysis.

Comment5:
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.
Response5：
These concrete ponds at the bottom are very common in Chinese towns, especially in southern China, where there are two or three ponds per

community.

Comment6:
Please include more details about the site as well as aerial image or photograph of the pond.
Response6：
Good suggestions. We will provide photos of the pond in the supplements of revised draft.

Comment7:
Did the authors monitor water level during or between monitoring events, this coupled with air pressure changes can be an important driver of ebullition.
Response7：
The water level barely fluctuates during the day and does not change much within the season. But the water level varies from season to season, with a difference of about 15cm. Therefore, we did not observe the water level continuously, only the quarterly average.

Comment8:
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.
Response8：
Good suggestions. However, we didn’t have any information about the consolidation state such as bulk density or particle size of sediments, which should be very useful in explaining the CH_4 dynamics of the seasons.

Comment9:

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 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.

Response9：

The reviewer's Suggestions are very good. However, we did not consider rainfall and only chose sunny weather for in situ field monitoring every time. Besides, we monitored the wind speed. However, wind speed was too low to be measured during most campaigns (maximum wind speed was < 1.5 m s^{-1}) and disregarded from further analysis. We analyzed atmospheric pressure, but we didn't find anything new.

Comment10:

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.

Response10：

Good suggestions. We will add some methane studies from artificial ponds to the discussion to compare with our results in the revised manuscript.