This manuscript deals with an important issue, namely emissions of the strong greenhouse gas methane from the numerous small ponds in Queensland, Australia, in the context of climate changes and ponds number increase. Assessment of methane emissions supposes two steps: first the survey of small ponds and their relevant characteristics, second the assessment of methane emissions, depending on the pond characteristics (including size, type, location, climate and seasonality).

In this manuscript, the first step is realized based on existing data bases, the second on quite heavy emissions, and the dependence on emissions rate on inundated/non-inundated status of soil, the authors carried out complementary measures to characterize these causes of variability. The observations are then used to extrapolate emissions assessment to the global set of ponds, with two alternative extrapolation methods. This approach seems relevant. Anyway, several choices should have been discussed more in detail, and some underling hypothesis should have been clarified. In its present status, the manuscript is based on a large amount of data, not fully exploited. In particular, the way the "complementary" data is used (or not) is not clear.

Here are some more specific comments illustrating the above comments:

Introduction:

Introduction could have also cited the other kinds of greenhouse gases y emitted by artificial ponds (CO2, N2O), and could have evoked their potential role of organic carbon sink. Balancing these two antagonist influences would give a larger context to the rest of the manuscript.

P2 - l40, it would be interesting to give some orders of magnitude of the CH4 sink effect of soils prior inundation, to compare with the emission rates presented later.

P3-l5: it seems a 5th point is missing, which is the extrapolation of the four other points results in a regional emission assessment: at this is not straightforward, it should be mentioned. Point 3 is a bit misleading, as spatial and temporal variability in emission rate is in fact assessed only for one pond, independently of the pond's area variation.

2.1 Study area description

The link between the fact that the majority of artificial water bodies are less than 5 ML and the choice to study emissions from ponds which area is less than $10^5 m^2$ is not clear. Why this threshold?

2.2 Relative surface area of ponds across the region

Given the discrepancy between the different sources of data and the difficulty to identify ponds and their characteristics within a large area, it would have been useful to give more details on the building of these three databases: how is data acquired, which kind of characteristic does each database include, at which periodicity is it revised, …

Given the strong dependency of CH4 emission rate on the ponds' size, why choosing an average area for ponds <625m², instead of using a size distribution. The same question arises for the classification in the three classes of the GRanD. This seems premature before the later results. Anyhow, it would have been interesting to present a histogram of the ponds' sizes. It is also disappointing not to know more about the types of ponds (and the potential link between type and size), their location, the way they are supplied in water, … all characteristic which may influence methane emissions and which may be available in the databases?

2.3 CH4 emissions from broad spectrum of pond types

It would have been useful for readers not familiar with methane emission from waterbodies to present the different kind of methane emissions measures, their advantages and limits, and to argument the choice performed here. Above all, the choice of the studied ponds should have been discussed, and their representativeness of the whole ponds set variety assessed.

How was the number of floating chambers per pond chosen? It seems not to be only in function on the pond's size? Was the uncertainty arising from measuring only 6 to 8 hours of emission for 3 ponds assessed? Is the emission process known to be varying at the daily scale? When did the monitoring occurred during the year (and which year rather dry or wet) ?

Nothing is said about the way the pond global emission rate is assessed from the punctual measures: given the variability at the pond scale illustrated with 2.4.1 results, it yet seems crucial. Uncertainty arising from how this calculation was performed may be as high as those arising from the choice of arithmetical or geometrical means between ponds' emission rates later on (2.6).

2.4 Spatial and temporal variability in surface area and emission rate

2.4.1

Here also it is not clear why this pond was chosen rather than another. What about its representativeness? For example, one can expect that the temporal variability of a weir's emission rate to be higher than an urban's lake one? The year when this monitoring was performed is not specified, neither corresponding rainfall, which may be of influence on the pond supply and the emission processes? Air and water temperature may also be influent factors?

2.4.2

Is rainfall variability homogeneous at the state scale? In other words, are the percentages of A_{FSL} calculated for the ponds which were monitored relevant for the regional scaling which is performed in 4.1?

2.5

As for the 2.4.1 section, it is not clear why this pond was chosen rather than another. What assures its representativeness of other small ponds which area varies a lot depending on rainfall?

These complementary field campaigns are honest and interesting attempts to deepen the study, but should be more detailed and argued to be totally useful and convincing to strengthen the results which are the main scope of the paper.

3.2 CH4 emissions from ponds

Some considerations on ebullition/diffusive emissions would be necessary to support the conclusion that ebullition is the dominant emission pathway. If so, spatial heterogeneity of emission must be high: is the monitoring protocol adapted to capture this heterogeneity?

As said before, a histogram of sizes and types of ponds would be useful to contextualize the results. Detail of the way the emissions are assessed at the pond scale too.

As weirs present high emission rates compared to other types of ponds, is it relevant to group them with other small ponds/stock ponds to assess the regional scale emissions?

3.3.1 Spatial and temporal variability within a single pond

These data are no doubt very interesting, but what they bring to this study is not clear for me. How are they used to the following regional scaling? If it is by considering that observed emissions from the other ponds can be taken as annual averages, this should be clarified. If this is the case, the validity of this hypothesis should be discussed, as only one type of pond was considered for this analysis.

It seems to me that this part could be cut from this manuscript, and maybe give the material for another paper, which would allow to analyse more in depth the emissions variability and the factor which influence it.

4.1

In India, numerous ponds are used to increase groundwater discharges. As a consequence, CH4 emission from these ponds may differ from the types of ponds which were studied here. This could be specified to be rigorous in this discussion about the importance to take into account ponds in methane emission rates assessment.

4.2

Again, more details should have been given above on the different emission pathways and their influencing factors.

As depth, the way water is supplied in pond and substrate seem to be influential, this discussion could address the question of the availability of such data in current databases.

5 Future research

Some sources of uncertainties are taken into account in this manuscript, other are not: this section could emphasize these points, and discuss how to handle them (assessment of a whole pond emission rate given punctual data in time and space; identification of emission pathways, characterisation of the way some factors influence emission rates–type, depth, purpose, water supply, temperature …) . At the moment, the research perspectives are more or less an extension of the work which was already performed.