

Comment on bg-2021-182

Anonymous Referee #2

Referee comment on "Quantification of potential methane emissions associated with organic matter amendments following oxic-soil inundation" by Brian Scott et al.,
Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-182-RC2>, 2021

The manuscript is focused on wetland soils affected by organic matter amendment and its effect on gases (carbon dioxide and methane) production and on iron reduction. The topic of the manuscript is important and actual. Carbon balance in wetland ecosystems, organic matter accumulation and greenhouse gases production are often studied within last ten years. In the study, two soils from newly constructed wetlands differing in soil texture and organic matter content were used and amended by four types of organic matter: hay, manure, compost, biosolid. Then gases production and iron reduction were studied under anaerobic conditions in the laboratory microcosm system.

In the result section I would expect to find the data which would show, what was the percentage of methane production from the total gas produced or the ratio of methane to CO₂ production. Some data are shown in the supplemental table S2, but this table is not too helpful, as it is complicated to read it and to find the numbers, which I need. Some smaller clear summarizing table or graph of these data would be much better and it should be included in the manuscript.

The authors did a conclusion that organic matter amendment to soil is dangerous as it increases methane emission from soil. However, methane emissions in the field were not measured but only potential methane production under laboratory conditions. It is therefore very difficult to make any conclusion about methane emissions from the soil in the field based only on data measured under controlled laboratory conditions. The problem is, that in the field many other factors affect methane emissions from the soil, which were not measured. These factors include especially water level, presence of vegetation and its

composition, presence and activity of methane oxidizing bacteria (methanotrophs) in the aerobic layer on the soil surface and in the rhizosphere, presence and activity of anaerobic methane oxidizing bacteria in the soil, soil physico-chemical conditions like concentration of other electron acceptors in the soil profile (oxygen, nitrates, sulphates etc.).

Methane production increased after addition of organic matter to soil, which is not surprising and it is known phenomenon. The data are then interpreted in sense that it is dangerous to add organic matter to soil due to increased methane production. But I miss any calculation, estimation or extrapolation of measured gases production rates to the field conditions. What happens in the field after organic matter amendment? How much would be methane emission from soil increased? And are then these values really much higher as compared to other sites, e.g. to natural wetlands? Is it possible to do such calculation/estimation based on the data measured under laboratory conditions? If we assume that constructed wetlands should function as natural wetlands, then there will be some methane emitted from flooded soil – this is nothing wrong, methanogenesis is natural process occurring in wetlands generally and it will never disappear.

Also it is known, that wetlands are source of methane but it must be also taken into account that they accumulate carbon in soil organic matter. If these two processes are calculated and assumed in long-term (hundreds and thousands of years) the wetlands have generally cooling effect on both local and global climate because the effect of fixation of C to the soil is stronger than emission of methane to the atmosphere. This is also due to shorter retention time of methane in the atmosphere (so higher turnover rate) as compared to carbon dioxide.

Moreover, there are other effects of organic matter amendment on soil characteristics and they may be even more important for soil and whole ecosystem functioning: effect on soil physico-chemical conditions like soil structure (soil aggregates, porosity, aeration), effect on humic substances, on sorption capacity (fixation of ions on humic substances), support of microbial activity and support of plant germination and growth etc. Generally addition of organic matter to the soil and increase of its content in soil have positive effect on soil and it is desirable. Therefore the conclusion

The units used for gases production: "cc" – for me unusual, I guess, these are cubic centimeters? You should use either "mL" or "cm³" as SI units instead of "cc".