Biogeosciences Discussions

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Comment on bg-2021-198

Anonymous Referee #2

Referee comment on "Assessing the spatial and temporal variability of greenhouse gas emissions from different configurations of on-site wastewater treatment system using discrete and continuous gas flux measurement" by Jan Knappe et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-198-RC2, 2021

This manuscript describes differences in greenhouse gas fluxes measured continuously or discretely from two onsite wastewater treatment systems that include secondary treatment as part of the treatment train: one with a rotating biological contactor, the other with a coconut husk media filter. The treated water is dispersed to a soil treatment unit and, in both cases, untreated septic tank effluent is also dispersed to the STU. Comparisons of flux values obtained using continuous and discrete measurements are made for the septic tank, the soil above the STU, and the vents at the end of the pipes that deliver effluent to the STU. GHG fluxes from the STU are compared to those from a Control area.

There are a number of issues that I think need to be addressed:

- The difference in CO_2 flux between Control and STUs is often negative, that is, the STU is somehow acting as a sink for CO_2. The possible mechanism(s) by which this takes place are not really discussed in the paper. Very few microbial processes assimilate CO_2 in wastewater (e.g., autotrophic ammonia oxidation), and these would likely be minimized by both secondary treatment processes, which promote ammonia oxidation before it reaches the STU. One large difference between the Control and STU soils is the absence of subsurface horizons in the latter, which would have been removed to install the effluent delivery system. The removed soil would contribute to CO_2 flux at the soil surface which, when compared to Control soil, would have a lower CO_2 The authors should, then, reconsider comparisons with Control soil, not only for CO_2, but for all three gases (assuming they don't have data for an STU that did not receive effluent), since gross consumption and production of CH_4 and N_2O can take place in the "missing" soil.
- There are several published studies on GHG emissions from secondary treatment units that show that these can be considerable. The treatment units used in this study both rely heavily on microbial processes to remove and transform C and N, which produces

CO_2 and N_2O. In addition, mechanical mixing and/or turbulent flow in these units tends to result in loss of CH_4 and N_2O form effluent to the atmosphere. In the absence of values for these emissions, the flux values that were measured lack context. Differences in flux between secondary treated effluent and tank effluent could help provide some context.

- There is, in general, very little discussion of biogeochemical processes that could explain results in this paper, and limited discussion of results in the context of the current published literature. For the most part flux values are reported and compared within the study, without getting into the biogeochemical and/or abiotic processes that may that drive these in the soil or the effluent. It may be that Biogeosciences is not a good match for this work.
- Most researchers working in this area will not have access to the equipment needed for continuous measurements of GHG fluxes; rather, discreet flux measurements are more likely to be made by most. As such, the results of this study could be made more useful by developing a minimum data set (spatially and temporally) required to approximate the accuracy of flux estimates made using continuous measurements. Although I understand this has clear limitations related to climate, treatment train, etc., it would be a good start, and a meaningful contribution to the field.