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Interactive comment on "Methane emissions from a sediment-deposited island in a Lancang-Mekong reservoir" *by* Wenqing Shi et al.

Anonymous Referee #1

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The paper deals with CH4 dynamics in relation with methanotrophic and methanogenic bacteria abundance in the sediment/soils following topography from the shoreline to the top of an island located in a hydroelectric reservoir.

This is a very original study with unexpected outcomes: -negative CH4 fluxes at the water or sediment interface, never observed in aquatic systems and moist soils -maximum abundance of methanotrophs in the water saturated and organic soils/sediments of the shoreline, an environment supposed to be ideal for methanogens –maximum abundance of methanogens at the top of the highland which is more often uncovered with water and which therefore might favor oxygen diffusion and occurrence of methanotrophs

Major comments

-In the community studying greenhouse gas emissions from hydroelectric reservoir, the littoral zone and the area undergoing the water level variations is called the drawdown area. Some reference listed at the end of the review might be considered for improving the description of the research context of this study and some comparison with those results could be interesting and more papers can be found on this topic

-The sketch of the chamber in Supplementary material (S.5) did not show any vent for preventing an increase of the pressure in the chamber during the installation resulting from the decrease of the chamber volume when the edge of the chamber penetrates either in the water or the soils/sediment. Overpressure generate bias to the flux measurement by increasing the solubility of CH4 in the surface water or interstitial water. Such phenomenon could explain some of the negative fluxes and might have influence all CH4 fluxes measurements.

-No information is given in the manuscript for air-soil flux measurements (L148). Again, the design of the chamber calls into doubt the validity of the soil fluxes (See supplementary material S.5)). Usually, soil flux measurements are performed with chambers with collar which allow the installation of the collar a few hours before the flux measurement in order to avoid measuring a flux that might mostly result from the perturbation associated with the penetration of the chamber or collar edges in the soil/sediment. This might have increased significantly the soil fluxes.

-Sediment sampling strategy (L116) is not ideal if one wants to link fluxes at the air-water interface or air soil interface with bacterial abundance and functions. Fluxes are controlled by the balance between methanogenesis and methanotroph, the former being mostly active in "deep" anoxic horizons (10 cm in soils, sediments. . .) and the latter above the oxic-anoxic interface (typically in the first mm at the air soil interface). Therefore, a bulk sample of the first ten cm in the sediment might fail at describing the expected vertical structure of the bacterial community involved in the CH4 cycle. Cores might have been more adapted

-16S rDNA can be used for the detection of active bacteria and biogeochemical pathways in combination with isotopic labelling. Without labelling, DNA prove the presence of the bacteria (since it is very stable in natural environment) but it does not clearly demonstrate they are active. RNA might have been more adapted because of its shorter life time. Relationships between the CH4 fluxes and the bacterial abundance based on DNA must therefore be considered with care.

According to the doubts on the methodology and the sampling strategy, it is recommended to the authors to clarify those points before the quality of the paper can be fully evaluated

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