Implications of methane emissions in biogeochemical budgeting: A study from a eutrophic tropical lake of South India

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Greenhouse gases (GHGs), especially, methane (CH₄) emissions from the littoral zones of the lakes play an important role in regional biogeochemical budgets. Only a few studies are available in literature highlighting the direct flux measurements of CH₄ from the aquatic systems. In the present study, an attempt has been made to quantify the spatio-temporal variations of CH₄ efflux and the key physical factors controlling the emission rate, from the vegetated littoral zones of lake Vellayani (5.55Km²), located in the urbanized area of Thiruvananthapuram city, Kerala, South-West India. CH₄ efflux were collected from different vegetations in littoral zones, using a static chamber, during the peak growing seasons from March to October in 2016 and further analyses were carried out by using Gas Chromatograph (PE Clarus 500, PerkinElmer, Inc.). The mean efflux rate of CH₄ from the emergent plant species (Phragmites australis and Typha spp.) was 114.4 mg CH₄ m⁻² h⁻¹; while, in the floating leaved species (Nymphaea spp. and Nelumbo Spp.), it was observed to be 32.6 mg CH₄ m⁻² h⁻¹. The results reveal that CH₄ efflux in the zone of emergent vegetation was significantly higher than the floating-leaved zone indicating the importance of plant biomass and standing water depths for the spatial variations of CH₄ efflux. However, no significant temporal variations were noticed in the physical factors during the peak growing seasons. These results indicate that the vegetated littoral zones of lake, especially the emergent plant zones were supersaturated with CH₄, facilitating the production of carbon for CH₄ emission but also enable the release of CH₄ by the diffusion from the intercellular gas lacunas. We conclude that the atmospheric CH₄ emissions will be affected by the growth of exotic species in the lake systems and may be the reason for enhancing the climate warming in local/regional scale.