

Interactive comment on “Reviews and syntheses: Methane biogeochemistry in Sundarbans mangrove ecosystem, NE coast” by M. K. Dutta and S. K. Mukhopadhyay

Anonymous Referee #2

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This manuscript presents an interesting study with major focus on the various sub-ecosystem processes associated with the Methane biogeochemistry in the world's largest mangrove forest. I think that the manuscript includes a lot of useful and interesting information, while in the present form it lacks a clear message, mainly because it is too disorganized with an uneven balance (some parts being too detailed and others incomplete). In general, the manuscript needs to be condensed, partly rearranged and more to the point to be worthwhile for the audience of a scientific journal like Biogeosciences Discussion. I further feel that the reviewer 1, has given detailed and well motivated comments In summary, I think the manuscript needs a major revision before being considered for publication. Below I offer some general suggestions on how to

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improve the manuscript. Abstract: The abstract would benefit from getting a better flow as well as a clear aim and few more synthesizing sentences added. Line 11: “The sediment was CH₄ supersaturated with mean. . .” A solution can be supersaturated but how can sediment? Please use uniform units for various CH₄ exchange fluxes (e, g. advective, diffusive, biosphere atmosphere flux etc.)

Introduction: The introduction includes some errors and text partly out of subject. Some suggested changes are found below.

Line 31-32: “. in 1750 to 1.77 ppbv in 2005 (IPCC, 2007)” please provide some recent reference. Line 45- 62: This part may be summarized in 1 or 2 sentence/s. “.of methanogenesis (Wang et al. 1993).”

Study location: The main drawback of the study is that it is rather limited spatially (only 1 station), which means that extrapolations of the observed results to the entire Sundarban have to be made with caution.

According to Ray et al, (2011) the major mangrove species in the western and eastern part of Indian Sundarbans are different. *Avicennia marina*, *Avicennia alba*, *Avicennia officinalis*, *Excoecaria agallocha* and *Ceriops decandra* are predominant in the western part of Sundarbans, whereas *Aegialitis rotundifolia*, *A. alba* etc are predominant in the eastern part. Does this spatial difference in species distribution have any influence on sediment organic carbon and CH₄ emission from water and soil?

Additionally, in mangrove ecosystems, there are often significant spatial differences in sediment biogeochemical characters between mud flat area, deep forest with pneumatophores, deep forest without pneumatophores etc. Here the sediments experience varying degrees of Eh and O₂ conditions, supply of organic carbon (mangrove litter, allochthonous C etc.), moisture content etc. These issues must be discussed justifying the selection of the present sampling station.

Materials and methods: Line 128: What were the light conditions (dark/ ambient

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light/artificial light) during the incubation experiment? Line 133-134: Please mention here, how the CH₄ production rate was expressed? ie. Production per unit wet/dry sediment. Line 140: “A fixed volume of surface sediment (~6 ml) was taken in 60 ml flasks.” What do you mean by “fixed volume”? Is it a liquid slurry of dry/wet sediment? The volume of wet sediment often changes with its moisture content. Line 188-190: please mention Time period and water depth of the in situ incubation for measuring primary productivity and respiration. Line 191: “Samples for measurement of CH₄ mixing ratio were collected.” Did you make any correction for water vapor in the measurement of the CH₄ mixing ratio? Varying amount of moisture (wet and dry period) may substantially influence the CH₄ mixing ratio. Line 197 – 198: What was the fetch of the CH₄ measurement tower? Results and discussion: The result section is a bit too long and includes some redundant information. I think it can certainly be reduced to two thirds of the current length. Below are a few minor comments. Line 215-220: Was there any consistent gradient in CH₄ production potential with depth? Please discuss. Line 362- 363: “During the observation period.” If I assume that sediment is the source of CH₄, then how the bottom water shows lower CH₄ concentrations than the surface water? Please explain. Line 364 -367: Dissolved CH₄ concentrations of Sundarban waters may be compared with other tropical estuaries which are less influenced by anthropogenic input. Line 367-369: The author stated that the high CH₄ concentration in the post monsoon may be attributed to the cumulative effect of the maximal supply of dissolved CH₄ rich pore water from intertidal mangrove sediment and minimal CH₄ oxidation. Again salinity is the major controlling factor for variability of CH₄ levels in this estuary. The estuarine dissolved CH₄ is entirely exogenous in nature. Does the supply of dissolved CH₄ rich pore water from intertidal mangrove sediment is considered as exogenous?

Line 382: “Being well oxygenated, the water column, presumably restrained methanogenesis but induced methanotrophy.” At the same time, Post-monsoon season showed highest dissolved CH₄, DO, SD and higher salinity than monsoon. Please explain. Line 382-407: This section must be shortened substantially. In no season salinity

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was recorded below 6. Line 401 and 416: Several references from various freshwater lakes in this section may be irrelevant as estuaries and its associated microbial community experience a vast range of salinity. Line 459-460: "Values of other micrometeorological indices such as drag coefficient and roughness height are presented in table 5." Here the table number is wrong. Line 483: "Monthly variation of biosphere – atmosphere." please rewrite the sentence.

Conclusion Line 600: No need to mention pore water CH₄ concentration here. Line 602: "The process of methanogenesis is totally. . ." Please rewrite the sentence. Line 606: "CH₄ oxidation, being." Is this in water/sediment or biosphere?

Tables Number of tables may be reduced in the main text Table 4: DO values should be expressed in mM. Table 7: Please check the H (W m⁻²) values. These seem very low.

Figures

Fig.3 : Temporal variation in depth profile not given. Do these represent the annual mean? Fig. 7: please provide the units for individual parameters.

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