

## ***Interactive comment on “Warming enhances carbon dioxide and methane fluxes from Red Sea seagrass (*Halophila stipulacea*) sediments” by Celina Burkholz et al.***

### **Anonymous Referee #1**

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This manuscript presents the results of a study in which experiments on impacts of warming and prolonged darkness on CO<sub>2</sub> and CH<sub>4</sub> fluxes are conducted in seagrass ecosystems of the Red Sea. Results show upward shifts in carbon dioxide and methane fluxes with warming and in the dark with a few exceptions under varied experimental conditions. Though it is known that a rise in temperature would increase metabolic rates the present set of results confirm thus driven elevated CO<sub>2</sub> and CH<sub>4</sub> fluxes for seagrass meadows in the Red sea. These results are of significance to understanding and quantifying the forcings and feedbacks of climate system. The Results and Discussion Sections were presented well but I found it difficult to follow some statements in Introduction section. Besides there is need to improve clarity to Material and

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Methods Section by furnishing more details. Specific comments are given below:

Page 2 Lines 8-10: “where autotrophic communities [net community production (NCP) > respiration (R)] act as a sink for carbon dioxide (CO<sub>2</sub>), while heterotrophic communities [net community production (NCP) < respiration (R)] act as a source of CO<sub>2</sub> (Duarte et al., 10 2011).” - Why not make it simple? Say ‘where net community production (NCP) > respiration (R)] the system becomes a sink for carbon dioxide (CO<sub>2</sub>).’?

Line 38-39: “warming at higher rates than those of the global ocean” - at what rates? Specific information will be helpful.

Page 3 Line 30: “Once the cores were opened, the first 10 cm of the sediment and the plant biomass were collected and dried” - Is this biomass picked from the same sediment core or was it collected separately? In fact Line 24 says that sediments were collected to a depth of 10 cm. If yes, then what is ‘the first 10 cm’ in Line 30? This is confusing.

Page 4 Line 16 “triplicate cores from vegetated and adjacent bare (about 5 m from the edge of the seagrass patch)” - Can a sample just 5 m away from the edge of the seagrass patch be true representative of ‘bare’ sediment? Table 1 shows that sediment characteristics between vegetated and bare sediments of S2 are nearly the same but for marginal high organic matter content in the former. Only the other differences expected under these circumstances could be nature and density of microbes on which ‘respiration rate’ essentially depends on!

Line 22: “We then sampled 10 mL of air from each core using a syringe”. Which replacement air was used to put into headspace each time 10 ml of air sample was drawn and how?

Line 30-31: “In March 2018, we collected eight vegetated and eight bare sediment cores from site S2 to evaluate the response of greenhouse gas fluxes to warming.” - This sentence says eight cores each from vegetated and bare sediments. But how

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the number became NINE each in Lines 32-33 (“Nine vegetated and nine bare sediment cores were placed in each two aquaria”)? Also what is ‘were placed in each two aquaria’? Did they mean ‘were placed separately in two aquaria’? Since they collected 8 cores each from vegetative and bare sediment zones I would expect them to place 4 cores from each zone (total 8 cores) in each aquarium! Their write-up is confusing!!! Or more clarity is needed in presentation.

Page 6: Lines 24-25: “Carbon, nitrogen, and phosphorus concentrations in seagrass leaves were low, but C, N and P leaf concentrations were 4- to 25 40-fold” - Did the authors mean ‘vegetative sediments or sediments for seagrass leaves’?

Page 8: Line 8: “ranging from a minimum average of  $-11.55 \pm 5.32$  ‰ to a maximum average of  $-17.89 \pm 1.81$  ‰  $\delta^{13}\text{C}$ ” – are minimum and maximum interchanged? Please note that these values are bear negative sign.

Lines 20-21: “CO<sub>2</sub> fluxes were also 10-fold higher in vegetated compared to adjacent, but bare sediments, indicating elevated microbial remineralization rates in vegetated sediments.” Rewrite as words are repetitive and a bit confusing too. Given this statement minimal microbial description of these sediments will be very helpful.

Lines 34-35: “Mean CH<sub>4</sub> fluxes at in situ temperature (25 °C) in vegetated sediments were lower than the mean value of  $85.09 \pm 27.80$   $\mu\text{mol CH}_4 \text{ m}^{-2} \text{ d}^{-1}$ ” - Caution needs to be exercised when expressing flux values to the second decimal. This is unnecessary given the uncertainties associated with flux estimates in general and large mean deviation in this particular case. \*\*\*

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