

## ***Interactive comment on “Carbon Dioxide and Methane Emissions from Red Sea Mangrove Sediments” by Mallory A. Sea et al.***

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We would like to thank both anonymous reviewers for their thoughts, which will greatly enhance the thoroughness and readability of our manuscript.

RC 1: “Both [methodological] approaches assume that all CO<sub>2</sub> produced in – and released from – the sediment accumulates as CO<sub>2</sub> in the overlying water, and equilibrates with CO<sub>2</sub> in the headspace (for the 2nd approach), but ignores the fact that dissolved CO<sub>2</sub> will rapidly equilibrate with dissolved HCO<sub>3</sub><sup>-</sup> and CO<sub>3</sub><sup>2-</sup>... What should be determined is the change in the total DIC concentration, rather than only looking at CO<sub>2</sub>.”

AC 1: Reviewer one provides thought-provoking insights on carbonate chemistry in

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seawater, with specific concerns focusing on the need to consider DIC fractionation in order to properly assess the fluxes of DIC between sediment and water due to photosynthesis, respiration and numerous Red-Ox processes. We absolutely agree with the comment of reviewer 1, however, our intent is to measure the fluxes at the air-sea interface, i.e. quantify the net GHG emissions to the atmosphere. It seems that our language in several places made our intent more ambiguous than realized. Air-sea equilibrators have been used in numerous studies to assess net CO<sub>2</sub> emissions by marine ecosystems, such as in Borges et al., 2003 in inundated mangrove swamps.

In a newer version of the MS, we will make our scientific goals and interests more transparent, notably by clarifying that our study does not measure the fluxes of carbon from the sediment as only a full determination of the CO<sub>2</sub> system would allow to do so, but only the potential net emission of CO<sub>2</sub> to the atmosphere from the biological activities in the sediment and overlying water.

We will discuss the limitations of our method compared to the DIC variation method and perform a careful comparison between our results and the results from published studies, depending on the method used.

RC 2: “Since there is isotope fractionation in the inorganic C system, with CO<sub>2</sub> being substantially depleted in <sup>13</sup>C relative to bicarbonate, the changes in δ<sup>13</sup>C in CO<sub>2</sub> in the headspace are not directly linked to the CO<sub>2</sub> produced in the sediment by respiration, but are transformed during equilibration in the water column overlying the sediment, and there is an additional fractionation step between aqueous (dissolved) and gaseous CO<sub>2</sub> (in the headspace).”

AC 2: We will clearly discuss the limitation of our method, acknowledging that our resulting δ<sup>13</sup>C signals in the air phase come after several steps of isotopic segregation.