	Comment	Response and action taken
Reviewer 2		
Overall comment	This manuscript investigates CO_2 and CH_4 fluxes in arid mangroves along the Red Sea. The main findings are GHG fluxes offsets 95% of soil carbon burial in seaward mangrove sites and become net sources during high emission events. However, when total alkalinity enhancement is incorporated, < 4% of carbon sequestration potential is offset by the GHG fluxes. The study also finds that temperature is the most important single variable in predicting CO_2 flux under light conditions, second only to the year of sampling due to temporal interannual variability. This study also looked at the relationship between isotopic signature and found a negative correlation between $\delta^{13}C$-CH_4, and CO_2 flux in both dark and light conditions, which offer insights into how microbial processing are affecting resulting GHG fluxes. Overall, It's a very well written and novel piece of research.	Thank you for taking the time to review our manuscript and providing valuable comments. We appreciate the positive feedback and have addressed the specific points below.
Major comments	The main recommendation I have is for authors to include a couple of sentences to acknowledge limitations related to how incubation technique used in this study could have affected GHG gases relative to the field-based observation such as static chambers and continuous eddy covariance.	We agree that there are limitations to the incubation technique, we have added a short discussion on this and justified the reasons for choosing this method. Namely, better ability to control and manipulate conditions, e.g. constant temperature, and consistent light intensity. Although this is an area that could be extensively discussed, we have tried to keep it brief. Action taken: Added a paragraph discussing the limitations of incubation studies and issues with comparison across different methods (e.g. *in situ, ex situ*) It now reads: *"While comparisons can, and should, be drawn across different studies, the methodology of the study should be considered when interpreting results. For example, in-situ studies have the advantage of natural conditions with minimal disturbance caused by sampling, whereas ex-situ studies, such as incubation techniques, allow for greater control of variables but typically cannot entirely replicate in situ conditions such as diel temperature variation, changes in light intensity and meteorological conditions (Toczydlowski et al., 2020; Sjögersten et al., 2018). For example, one study found mangrove ecosystem flux of CH_4 was the most variable on a daily basis due to meteorological variables and plant activities, both of which were*

		excluded in this study (Liu et al., 2022). However, this study utilized incubations to maintain stringent control of environmental variables during the measurement period. The caveat of this approach is that it limits applicability to field conditions, but is useful in separating the effects of individual drivers of GHG flux variation from mangrove soil and minimising the number of confounding variables (Bond-Lamberty et al., 2016). An additional element of variation comes from different measurement techniques, as results can differ markedly between laser-based spectrometers, chamber-based systems, and eddy covariance measurements (Brannon et al., 2016; Podgrajsek et al., 2014). All studies compared in Table 3 are of in situ design, but there are a range of techniques and calculations used. These elements of variability complicate comparison across studies. There is often a large variation in GHG flux across studies and it should be considered whether this variation is due to environmental conditions or different study designs. For example, in the same study site, CH4 fluxes from eddy covariance measurements have been lower than closed static chamber designs (Gnanamoorthy et al., 2022).”
	Tables 1 and 2. Consider adding significance test results to this table, e.g., compact letter display.	This is a very useful suggestion, which neatly adds a substantial additional information to our results. Action taken: The methods have been updated to include the significance tests conducted for the table. CLD has been added to Tables 1 and 2
	Figure 4. I’d remove the left panel. I didn’t find this zoomed in graph helpful to visualize and understand your results.	This panel was intended to show the differences in the range and median fluxes between the sea-air interface from the landward and seaward site, which is otherwise obscured by the much larger range of fluxes from the soil-air interface from the landward site, although we can see how this may be visually misleading. Action taken: The zoomed in element of Figure 4 has been removed and the single figure has been enlarged to fit the page, making the differences in flux easier to see.
	I agree with you. No one study will ever account for all possible drivers of GHG fluxes. And you are right, lots of these variables can be autocorrelated or have multicollinearity issues. But the relative importance you	Agreed, our random forest models can only include the variables measured so the results cannot not be taken as absolute importance. The text has been updated to more clearly

	found could have been very different had you included, say, for example, ammonium or Fe2 in your analyses, right? With that in mind, I think you could offer a sentence or two on this limitation and implications for follow up studies.	reflect this. Action taken: Added to the discussion regarding the limited number of soil and environmental properties included in the study and scope for further research on this. We clarified that the random forest models only considered the variables we chose to measure, and are not representative of all soil, temporal and environmental properties. It now reads: *"However, there were variables mentioned above that were found to be important in GHG flux in other studies but were not measured in this study, for example, ammonium, iron, and soil grain size. There are limitations on the number of variables relative to a fairly small number of observations as in this study (Kiers and Smilde, 2007), along with practical limitations of time and resources. There is substantial scope in future research to comprehensively investigate more variables than those reported here over a longer sampling period, or with more frequent observations. An analysis of a greater number of chemical and physical characteristics of the soil beyond carbon and nitrogen would be particularly relevant for GHG flux (Nóbrega et al., 2016; Chen et al., 2010). This limitation must be acknowledged when interpreting our results as there may have been significantly important factors which were not measured and thus not considered in our analysis of the most important drivers of GHG flux."*
Minor comments	Ln 43. 'physiological' or 'ecophysiological' instead?	Action taken: Replaced physiochemical with physiological It now reads: *"Consequently, Avicennia marina, the predominant mangrove species in the Red Sea, exists at the thresholds of its physiological tolerance."*
	Ln 104. 'cores' instead of 'scores'	Thank you for identifying this error. The text has been updated.
	Ln 268. Remove 'good' or replace it by 'high'.	We agree with this suggestion and have removed 'good'. It now reads: *"Although the remaining 13 variables all had a feature*

		importance below 0.1 this combination contributed towards an R score of 0.63.
	Ln 313. below 'the' salinity or below 'salinities'	We have changed 'below salinity' to 'below the salinity' It now reads: *"There is a proposed salinity threshold of 18 ppt, where CH_4 flux may become negligible which is significantly below the salinity found in the Red Sea."*
	Ln 317. Remove the first 'is' from 'this is method is'	Thank you for pointing this out. The correction has been made. It now reads: "*However, this method is likely to result in larger errors in estimates without attempting to determine factors driving this variation."*
	Ln 317. 'plotsseaaaaaaaaaaaa'?	Thank you for identifying this error. The correction has been made
	Ln 320. 'physico-chemical' instead?	Indeed, 'physiochemical' should read as 'physicochemical'. Action taken: physiochemical has been replaced by physicochemical for all occurrences within the manuscript.

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