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<tr><td colspan="2">Reviewer #2</td></tr>
<tr><td>1</td><td>**General Comments**: *Sigid and others quantify the impact of the WPL correction on eddy covariance measurements using an open path sensor over a coastal sea near the shore. I read the manuscript with interest but feel that unfortunately the framing of the manuscript misses the mark. This is because the WPL correction either should be applied to measured fluxes in open path systems – because it is required to satisfy the mass balance – or it should not in closed path systems with adequate pressure and temperature dampening because not applying it satisfies the mass balance. Studying its impacts serves little purpose because one is studying the consequences of balancing mass or not, which is not of interest.*</td></tr>
<tr><td></td><td>Thank you for your concern and comment.

Accurate measurements of CO_2 flux in coastal waters are essential for the comprehensive understanding of global carbon processes, which ensures the precision of carbon source and sequestration projections.

We believe investigating the application of the WPL correction over tropical coastal waters is essential and of great interest due to the different environments the tropical coastal seas present, e.g., low wind speeds, high air temperature, humidity, sizeable latent heat influences, etc. These conditions may not only lead to small CO_2 fluxes but also affect the values of the terms of the WPL. Previous research on WPL and open-path systems has focused on investigations in open seas with high wind speeds, lower air temperature, and humidity. Therefore, we aim to enumerate the extent of the WPL application for tropical coastal waters.

The WPL correction method was reported to introduce inaccuracies to CO_2 flux measurements of small fluxes in the European High Arctic due to the influence of sensible heat fluxes. They found that the correction can substantially affect the actual flux (Jentzsch et al., 2021). Furthermore, our motivation to investigate the WPL correction for these waters is due to the previously observed small CO_2 flux values near 0 μmol m^{-2} s^{-1}, rooted in the previous work by Yusup et al. (2023). Hence, this prompted the initiation of this study and included even more relevant parameters in the analysis than what was studied in the aforementioned paper (i.e., air temperature, pressure, molar density of water vapor, dry air, and wind speed).

Building on those findings, we hypothesized that the WPL correction might not be accurate or sensitive enough, especially in the small CO_2 flux ranges in the proximity of 0 μmol m^{-2} s^{-1} for the tropical coastal waters due to its associated environmental conditions. One notable implication is that the negative CO_2 flux can become a positive flux when the WPL correction is applied, which would change the classification of the site from a carbon sink to a carbon source.</td></tr>
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	Therefore, we insist that this study is timely and of great interest to researchers who intend to survey the carbon emissions and uptake of the tropical coastal sea using similar methodologies.
2	**Comment 1.1**: *There may be some important technical notes to be made over a warm sea dominated by latent heat fluxes where the WPL terms will be quite small, and it is interesting that they impact CO2 fluxes, but this may be more of a curiosity. Perhaps worthy of very brief mention if only to emphasize the importance of WPL correction for open path systems. (As an aside, I have heard the argument that open path eddy covariance shouldn't be applied over open water, but from the materials presented I was unable to ascertain why.)*
	Response 1.1: Thank you for your suggestion. For your information, this was also suggested by reviewer 1. The following describes latent and sensible heat changes and their influences on WPL. In Fig. 2d, the latent heat flux ranges from 6.5 to 14.5 W m^{-2}, with an average of 10.42 ± 0.25 W m^{-2}. Similar to the uncertainty of sensible heat flux, the uncertainty of latent heat flux escalates in the morning, reaching beyond 2 W m^{-2}. Evidently, the more substantial uncertainty of sensible heat flux between 07:30 LT and 09:30 LT (exceeding 0.3 W m^{-2}), especially the uncertainty spike of 0.911 W m^{-2} at 08:00 LT, coincided with higher uncertainty levels of CO$_2$ flux in the morning. Furthermore, peaks in latent heat flux were observed to occur at 08:30 LT (13.66 W m^{-2}) and 19:00 LT (14.35 W m^{-2}), while lows were observed around 06:30 LT (6.89 W m^{-2}) and 20:30 LT (6.69 W m^{-2}). Notably, the spike of latent heat flux around 08:30 LT coincided with the peak of sensible heat flux, whereas the dip of latent heat flux around 20:30 LT corresponded to the reduced sensible heat flux. The difference between F_c and $F_{c,0}$, shown in Fig. 3a, is generally within the range of 0.05–0.2 μmol m^{-2} s^{-1}, with the third term of the WPL correction potentially making a substantial contribution, and latent heat flux could be influencing the correction alongside sensible heat flux. The reduced WPL correction values coincided with the notable drop in latent heat flux and lower sensible heat flux around 06:30 LT before the peaks at 08:30 LT and around 20:30 LT. Meanwhile, the rising trend in latent heat flux from 09:00 LT to 19:00 LT corresponded with the increase in the WPL correction value. Notably, the peak of difference value between F_c and $F_{c,0}$ is 0.29 μmol m^{-2} s^{-1} at 08:00 LT, with a substantial increase of 0.2 μmol m^{-2} s^{-1} from the prior time (07:30 LT) and a noticeable decrease of 0.16 μmol m^{-2} s^{-1} at the following time (08:30 LT), coinciding with the spike in latent heat flux and high sensible heat flux during this period.

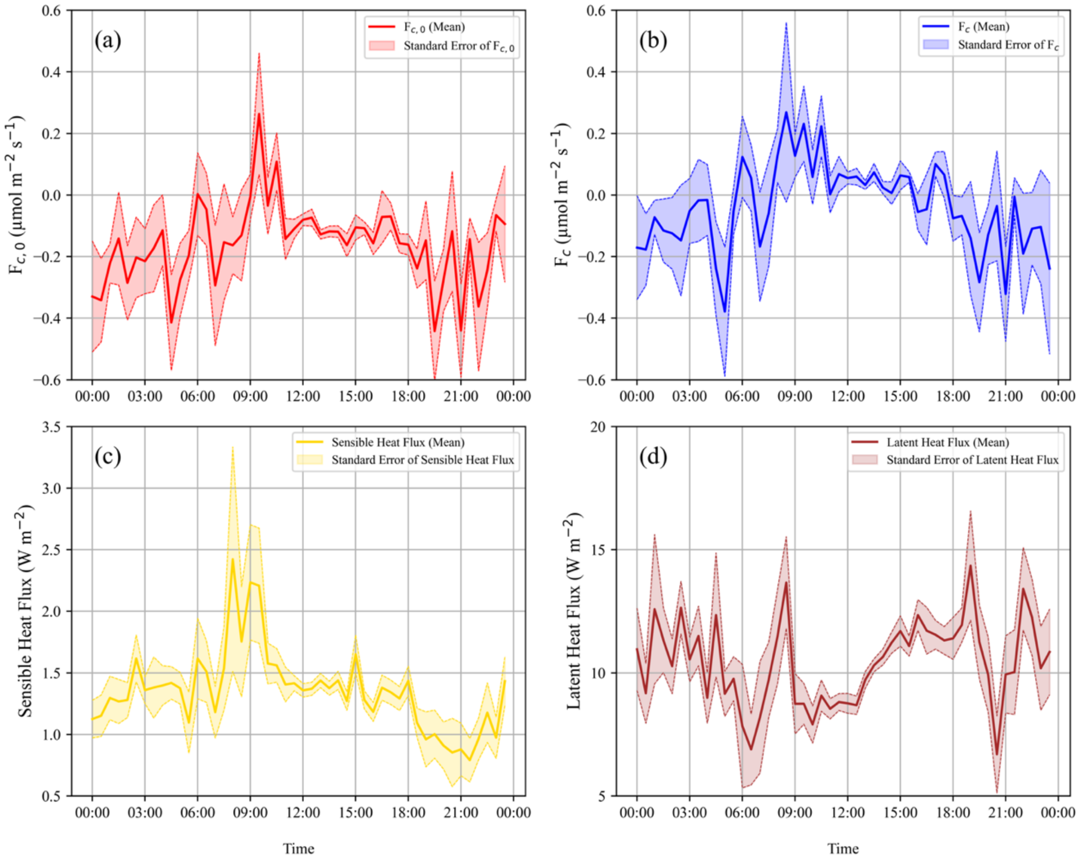

Figure 2: The climatological variation of diel (a) $F_{c,0}$, (b) F_c, (c) sensible heat flux, and (d) latent heat flux in 2016. The diel cycle values were averaged over the entire year from January to December 2016.

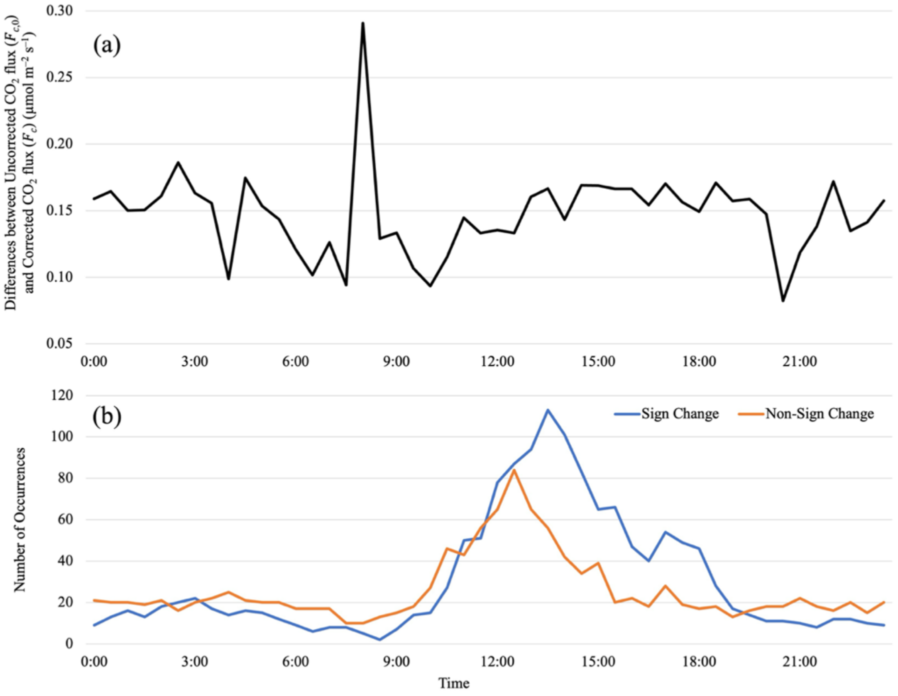

Figure 3: (a) The difference value between $F_{c,0}$ and F_c, and (b) the quantification of sign change and non-sign change occurrences in a diel cycle.

3	**Comment 1.2**: *For these reasons the manuscript should be rejected in its present form as it explains – in quite a bit of detail – the consequences of not balancing mass. It misses an enormous opportunity to explain the mechanisms that underlie the observed fluxes, especially the interesting results that CO2 uptake is greater at night (this was unexpected for me, and I am curious to know why), seasonal patterns in flux, the potential influence of different currents and water movements on flux, and how fluxes may or may not be changing over time. Reframing the manuscript to focus on the causes of observations after applying the WPL term would make it interesting and help the community understand this unique system.*
	Response 1.2: We appreciate your comment and concern. Our prior work extensively addressed the mechanisms underlying the observed fluxes, i.e., Yusup et al. (2023) and Swesi et al. (2023). The papers included the seasonal patterns analysis. A summary of what was discussed in those papers is below. Diverse environmental and atmospheric surface layer parameters influence the CO_2 exchange between the coastal sea and the atmosphere. According to Yusup et al. (2023), the shift in CO_2 flux from functioning as a carbon sink during the night to a carbon source during the day was linked to the differential temperature between the water and air temperatures. A higher (lower) difference in seawater temperature to air temperature tended to support increased CO_2 emission (uptake). Under stable conditions, a positive and higher temperature difference resulted in enhanced positive CO_2 flux, while the conditions with a lower temperature difference led to heightened negative CO_2 flux. Additionally, research by Yusup et al. (2023) discovered that under stable atmospheric conditions, low wind speeds intensified CO_2 flux, while stronger winds resulted in high negative flux during unstable circumstances. The study also highlights the impact of developing waves on CO_2 flux in stable atmospheric conditions, contrasting with smoother waves observed during unstable circumstances. As negative flux was noted in developing waves and positive flux exhibited the opposite pattern, surface roughness changes had a more substantial impact on negative flux than positive flux. These underscore the influence of atmospheric stability, winds, and waves on CO_2 flux at the study location. The tropical coastal sea's capability to absorb or release CO_2 is also influenced by seasonal changes at the study site, with the Southwest Monsoon acting as a source and the Northeast Monsoon as a sink (Yusup et al., 2023; Swesi et al., 2023). The Southwest Monsoon experienced very unstable atmospheric stability to potentially intensify CO_2 emission from the water surface, while the Northeast Monsoon was characterized by weaker unstable circumstances and strong winds (Yusup et al., 2023). Furthermore, according to Swesi et al. (2023), the coastal sea's CO_2 source capability during the Southwest Monsoon can be attributed to both low photosynthetically active radiation and concentration of chlorophyll-a, which is the opposite of the high chlorophyll

	concentration during the Northeast Monsoon to cause CO$_2$ uptake. The elevated levels of chlorophyll observed during the Northeast Monsoon may result from upwelling mechanisms and increased nutrient accessibility linked to the rise in wind speed and the decline in water temperature (Swesi et al., 2023). Responding to the comment, we elaborated below on the difference in the WPL correction values between daytime and nighttime, further clarifying the transition from negative to positive CO$_2$ flux during the daytime due to the WPL correction. On average, the WPL correction values are not significantly different between daytime and nighttime. The average value of the WPL correction during the daytime is 0.150 μmol m^{-2} s^{-1}, while the average during the nighttime is 0.146 μmol m^{-2} s^{-1}. However, the range of WPL correction values during the daytime (–1.019 to 2.749 μmol m^{-2} s^{-1}) shows a considerable difference compared to the range during the nighttime (–2.552 to 1.322 μmol m^{-2} s^{-1}). The higher positive range values of the WPL correction during the daytime can further explain the more frequent occurrences of a sign change from negative CO$_2$ flux to positive CO$_2$ flux during the daytime.
4	**Comment 1.3**: *As minor comments I'm not sure why so many wind directions were removed from the analysis; was this due to the impact of the tower? It seemed a bit extreme and perhaps unnecessary to remove so many datapoints. The manuscript is also overly verbose; any word and sentence that isn't necessary to explain key findings should be removed. Focusing the study on science rather than required technical corrections will result in a valuable contribution to the literature.*
	Response 1.3: Thank you for your feedback. Apart from the poor-quality flags in the recorded measurements, as discussed in Section 2.1, the removal of CO$_2$ fluxes by the wind directions primarily stems from the research focus on fluxes originating from the water surface. We have included this explanation in the same section, as detailed below: In this research, CO$_2$ fluxes associated with winds originating from directions >315° and <45° were retained, whereas the fluxes with winds coming from other directions were removed during the data processing. This removal of CO$_2$ fluxes by the wind directions is mainly due to the research focus on fluxes coming from the water surface, and this was based on the standard deviation ratio for the vertical wind speed component and the friction velocity, applicable only to wind directions >315° and <90° (Yusup et al., 2018). Furthermore, wind speed data collected inland from the south to the west of the station (>45° and <315°) were omitted because of the poor-quality flags in the recorded measurements. Additionally, we have carefully revisited the manuscript to address verbosity. We have made necessary revisions, removing extraneous words and sentences that do not contribute significantly to explaining key findings.

References

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