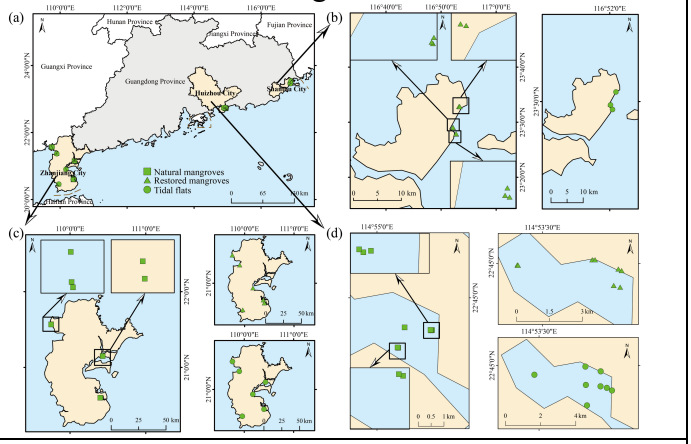
Referee Comment 1

General Comments

Comments	Responses
In my opinion, this paper addresses relevant scientific questions within the scope of BG and presents novel ideas and tools. I believe the topics addressed are well represented in the manuscript title and abstract and are important for the field of environmental science as a whole.	We sincerely thank you for your positive evaluation of our manuscript.
Figures: All of your figures look very different from each other. Similar categories (Natural mangroves, Restored mangroves, Tidal flats or High, Moderate, Low-urbanization) are shown in several different colors or layouts throughout your figures. It might be easier for the reader if you picked a consistent color scheme throughout (example: applying the green, yellow, red scheme you used to depict High, Moderate, and Low-urbanizations in Figure 6 to all of your relevant figures) or consistent layout (like the clearly differentiated column and row headings in Figure 5).	Thank you very much for your valuable suggestion. We have standardized all figures in the revised manuscript by adopting a consistent color scheme to represent different urbanization levels, thereby improving consistency across figures and enhancing overall readability and clarity.

Specific Comments

Comments	Responses
line 28: Do you want to include this image as Figure 1? If so, please add a figure description and adjust figure numbering throughout the manuscript accordingly.	Thank you very much for your valuable and constructive suggestion. In response, we have carefully checked and unified the figure numbering in the revised manuscript. This figure was not included as Figure 1 and has been renumbered as Figure 7 according to its position in the main text. Meanwhile, we have added the corresponding caption: "Figure 7. Variations in soil organic carbon stocks, source composition, and turnover rates in natural mangroves, restored mangroves, and unvegetated tidal flats across different urbanization gradients." In addition, we have thoroughly checked all figure numbering throughout the manuscript to ensure consistency between figures and in-text citations.
line 72: Both "blue-carbon" and "blue carbon" have been used in the manuscript so far. Please choose one format and apply throughout the whole manuscript.	Thank you very much for your valuable suggestion. In response, we have carefully revised the entire manuscript to ensure consistency in terminology, replacing "blue-carbon" with "blue carbon"

	throughout the text to improve standardization and linguistic consistency.
line 90: Figure 1. Please make some adjustments to Figure 1. Inset C is very clear and easy to understand. Insets B and D are not as clear. It would be helpful to have the first views for Insets B and D zoomed out more so we can tell where we are (as you did with Inset A). It would also be helpful to keep the color scheme consistent throughout all of the maps (water always shown as blue, adjoining land always the same gray or white as they are in Inset A).	Thank you very much for your valuable comments. In response to your suggestions, we have revised Figure 1 accordingly (as shown below). Specifically, panels (b) and (d) have been appropriately adjusted by expanding the map extents to improve spatial context and clarity. In addition, we have unified the color scheme across all maps, with water bodies consistently represented in blue, thereby enhancing the overall consistency, readability, and standardization of the figures. 
lines 91-92: Figure 1 description. I do not see urbanization gradients depicted in your Figure 1. Please either add urbanization gradients to the figure (or make them more obvious if I have missed them) or adjust this figure description.	Thank you very much for your valuable suggestion. In response, we have revised the caption of Figure 1 accordingly. The updated caption is as follows: "Figure 1. Location of sampling sites across high, moderate, and low urbanization gradients in southern China, showing natural mangroves, restored mangroves, and tidal flats. Panels (b), (c), and (d) show the sampling sites in Shantou, Zhanjiang, and Huizhou, representing moderate, low, and high urbanization levels, respectively." This revision further clarifies the information presented in the figure, ensures consistency between the figure and its caption, and more accurately specifies the urbanization levels corresponding to the three study regions.
lines 106-107: Is this soil bulk density dry or wet? Based on information further down in the manuscript, it seems like you looked at dry bulk density, specifically. If this is the case, please clarify here.	Thank you very much for your valuable comment. In this study, soil bulk density refers to dry soil bulk density. In response to your suggestion, we have revised the Methods section accordingly by changing "soil bulk density (SBD)" to "dry soil bulk density (SBD)" throughout the manuscript to avoid potential ambiguity and to improve the accuracy and completeness of the methodological description.
lines 107-108: Please explain your leaf sample methodology further. What do you mean by "according to	Thank you very much for your valuable comment. Due to the lack of clarity in the original description, it may have led to ambiguity. In the revised

the local mangrove community composition"?	manuscript, we have further clarified the leaf sampling procedure as follows: within each plot, all mangrove species present were identified according to the actual community composition, and mature and healthy leaves were collected from each species. Three replicate samples were set for each species to more comprehensively characterize the stable isotope signatures of mangrove plant leaves in the study area.
line 110: Please provide information on what kind of soil corer you used as you mention compaction issues further down.	Thank you very much for your valuable comment. In response, we have further clarified the soil sampling method in the Methods section of the revised manuscript. Specifically, soil samples were collected using a custom-made stainless-steel coring device (inner diameter: 5 cm). The design of the corer and the sampling procedure follow the protocol recommended by the International Blue Carbon Initiative, as described in the "Coastal Blue Carbon: Methods for Assessing Carbon Stocks and Emissions in Mangroves, Salt Marshes, and Seagrasses" manual (https://www.thebluecarboninitiative.org/manual), ensuring consistency with internationally recognized standards.
lines 111-112: Please provide details on why you adjusted your soil core section intervals as you got deeper.	Thank you very much for your valuable comments. In the Methods section of the revised manuscript, we have further clarified that soil samples were collected using a custom-made stainless-steel coring device (inner diameter: 5 cm). The design of the corer and the sampling procedures follow the guidelines of the International Blue Carbon Initiative, specifically the "Coastal Blue Carbon: Methods for Assessing Carbon Stocks and Emissions in Mangroves, Salt Marshes, and Seagrasses" manual (https://www.thebluecarboninitiative.org/manual). Many coastal sediment studies adopt a similar sampling strategy characterized by high-resolution sampling in surface layers and coarser intervals at deeper depths (Hu et al., 2024; Rani et al., 2023; Santos-Andrade et al., 2021; Sasmito et al., 2020; Yu et al., 2021; Zhang et al., 2012). Therefore, this widely used stratification approach was adopted in our study to ensure methodological comparability and improve analytical efficiency.
line 117: At what temperature did you refrigerate the samples?	Thank you very much for your valuable comment. In response to your suggestion, we have further clarified the statement in the Methods section of the revised manuscript by replacing "All samples were

	labeled and refrigerated prior to laboratory processing and analysis" with "All samples were labeled and stored at −80 °C prior to laboratory processing and analysis" to ensure greater accuracy and methodological clarity.
lines 120-121: Please provide an explanation and a citation for a publication to support this assumption.	Thank you very much for your valuable comment. We clarify that this hypothesis was primarily intended to explain the rationale for selecting one representative sediment core for ^{210}Pb dating within each ecosystem type and urbanization level, and subsequently using the derived sediment accretion rate to estimate soil organic carbon burial rates for the corresponding ecosystem. Due to the relatively high cost, labor intensity, and technical requirements associated with ^{210}Pb dating analyses, regional-scale blue carbon studies often require the selection of representative sediment cores for estimating sediment accretion rates based on specific research objectives. Previous studies have demonstrated that sediment accretion rates may show relatively limited variation among different locations or restoration conditions within the same mangrove ecosystem under similar environmental settings. For example, MacKenzie et al. (2016) reported no significant differences in sediment accretion rates among disturbed and undisturbed mangroves, edge and interior mangrove habitats, as well as naturally recovering and artificially restored mangroves, suggesting relatively consistent sedimentation dynamics within comparable mangrove systems. In addition, Huang et al.(2025b) adopted a similar sampling strategy for sediment accretion rate estimation in mangrove ecosystems. Following your suggestion, we have added these relevant references (Huang et al., 2025b; MacKenzie et al., 2016) to the revised manuscript to provide further support for our sampling approach.
line 121: Please provide more information in this section of the manuscript on why you did not assess sediment accumulation rates for tidal flats.	Thank you very much for your valuable comment. In this study, ^{210}Pb dating and sediment accretion rate estimation were not conducted in unvegetated tidal flats, mainly because tidal flats are strongly influenced by dynamic tidal processes and generally lack stable and continuous sedimentary sequences. The frequent resuspension and disturbance of sediments in these environments may compromise the assumptions required for ^{210}Pb dating and reduce the reliability of sediment accretion rate estimates. Furthermore, previous studies have demonstrated that the long-term carbon storage capacity of

	unvegetated tidal flats is generally lower than that of vegetated mangrove ecosystems (Alongi, 2014; Bouillon et al., 2008; Pendleton et al., 2012). Considering the current research priorities related to global mangrove restoration and blue carbon management, we prioritized sediment accretion rate assessments in mangrove ecosystems during the initial sampling design. In future studies, we will further improve the sampling framework by incorporating sediment accretion measurements in tidal flats, enabling a more comprehensive comparison of sedimentary processes and carbon burial contributions among different coastal ecosystems.
lines 125-135: Please provide citations for your soil parameter measurement protocols.	Thank you very much for your valuable comment. In the Methods section of the revised manuscript, we have added relevant references for the determination of soil physicochemical properties (Huang et al., 2025a, 2024) to clearly specify the standard analytical methods used for each parameter. In addition, all soil analyses were conducted by a certified third-party laboratory, while only sample pre-treatment was performed by our team, ensuring the standardization, reliability, and reproducibility of the data.
lines 134-135: It might be worthwhile to define SBD as DBD (dry bulk density) to be more specific about the kind of soil bulk density your measured.	Thank you very much for your valuable suggestion. In response, we have further clarified in the Methods section of the revised manuscript that "soil bulk density (SBD)" has been revised to "dry bulk density (DBD)" to more accurately describe the measured soil property. This revision helps avoid potential ambiguity and improves the clarity and consistency of the methodological description throughout the manuscript.
lines 158-159: I think this methodology is probably fine. Ideally, data exploration would involve a few more steps than listed here. A paper that provides a detailed protocol for data exploration with ecological data is Zuur, A. F., Ieno, E.N., and Elphick, C. S. 2010. A protocol for data exploration to avoid common statistical problems. Methods in Ecology and Evolution. https://doi.org/10.1111/j.2041-210X.2009.00001.x.	Thank you very much for your valuable comment. In response to your suggestion, we further consulted the ecological data exploration guidelines proposed by Zuur et al. (2010) and carefully reviewed our data analysis workflow. Prior to statistical analyses, we had already examined data distributions, potential outliers, and model assumptions to ensure the appropriateness of the applied statistical approaches. The data preprocessing and statistical analysis procedures were conducted following approaches described in previous studies (Xia et al., 2021; Zhang et al., 2022). In the revised manuscript, we have added the relevant references and further clarified these procedures in the Methods section to

	improve the transparency and reproducibility of the statistical analysis workflow.
line 191: Table 1, line 1, column 3 (High-urbanization natural mangroves, Salinity): 52 g kg ^-1 seems high for this part of the world. Please double-check this is not a typo. If this is correct, please discuss the high salinity in more depth in your discussion section. If this salinity level is a known feature of this particular area, please include that in section 2.1 Study area.	Thank you very much for your valuable comment. We have further checked the soil salinity data for highly urbanized natural mangroves in Table 1 and confirmed that the reported value is correct. The relatively high salinity may be related to the unique geographical and hydrological characteristics of the study area. Specifically, the Huizhou study site is located within a semi-enclosed drowned valley bay formed by the inland extension of Honghai Bay, where local water exchange is relatively restricted. These conditions may enhance evaporation–concentration processes and salt retention, leading to greater accumulation of salts in sediments. In addition, previous studies have reported that seawater salinity in this region generally exceeds 30 ppt (Aslam and Wang, 2025), indicating a naturally high-salinity background. The long-term presence of salt production activities in this area further reflects its distinctive saline environmental conditions. Therefore, although the measured soil salinity value is relatively high compared with other mangrove regions, it is reasonable considering the local hydrological setting and regional salinity characteristics. Following your suggestion, we have added relevant environmental information in Section 2.1 “Study area” of the revised manuscript to provide further context for interpreting this high salinity value.
lines 194-196: Figure 2 description: Please include units in all of your figure descriptions.	Thank you very much for your valuable suggestion. In response, we have revised the caption of Figure 2 in the revised manuscript by adding the units of all relevant variables to improve clarity, consistency, and standardization of figure presentation.
lines 198-199: Figure 3 description: Please include units in all of your figure descriptions. What do you mean by "different letters indicated significant differences in soil organic carbon among urbanization levels within the same ecosystem type..."? Define what the letters are and what each of them means, exactly.	Thank you very much for your comment. In the revised manuscript, we have added the units of all relevant variables in the caption of Figure 3 to improve completeness, clarity, and standardization of figure presentation. In addition, we have briefly clarified the meaning of the significance letters. Specifically, in Figure 3a, letters should be interpreted within each ecosystem type. For example, in restored mangroves, different letters (a and b) under high and moderate urbanization indicate a statistically significant difference in soil organic carbon between these two levels. The same interpretation applies to natural mangroves and bare

	tidal flats, where letters should be understood within each ecosystem category rather than across different ecosystem types.
line 208: Figure 4: It seems you have two main rows for these figure insets (Natural Mangroves and Restored Mangroves) and three main columns (High-urbanization, Moderate-urbanization, and Low-urbanization). Can you adjust the figure so it is more obvious that these insets all fit inside these different categories? Simply making the row and column titles bigger may achieve this or you could add a background grid or ribbons like you did in Figure 6.	Thank you very much for your valuable suggestion. In response, we have revised Figure 4 by enhancing the visual emphasis of row and column headers to improve structural clarity. In addition, we have further clarified the description of each panel in the figure caption to explicitly specify the corresponding ecosystem types and urbanization gradients. The revised caption is as follows: "Panels (a) and (b) show the vertical profiles of SOC burial rates and sediment ages in natural mangroves under high and low urbanization gradients, respectively. Panels (c), (d), and (e) present the corresponding profiles for restored mangroves under high, moderate, and low urbanization levels, respectively." These revisions improve the clarity of grouping relationships and make the figure more intuitive and easier to interpret.
lines 209-210: Figure 4 description: Please provide more details in your figure description, such as units. This would also be a good place to clarify which of the Inset Figures are natural mangroves vs restored mangroves and high vs moderate vs low-urbanization	Thank you very much for your valuable suggestion. In response, we have revised Figure 4 by adding the units of all relevant variables in the figure caption to improve completeness and standardization. We have also further clarified the correspondence between ecosystem types and urbanization gradients for each panel, thereby enhancing the structural clarity and readability of the figure. The revised description is as follows: "Panels (a) and (b) show the vertical profiles of SOC burial rates and sediment ages in natural mangroves under high and low urbanization gradients, respectively. Panels (c), (d), and (e) present the corresponding profiles for restored mangroves under high, moderate, and low urbanization levels, respectively." These revisions improve the clarity of grouping relationships and ensure more consistent interpretation of the figure content.
lines 208-210: What locations do Inset Figures A, B, C, D, and E correspond with (ex: Shantou, Zhanjiang, or Huizhou)? Please provide the location names in either the figure or in the figure description.	Thank you very much for your valuable comment. In response, we have further revised the caption of Figure 4 in the manuscript to explicitly clarify the correspondence between ecosystem types and urbanization gradients. The revised description is as follows: "Panels (a) and (b) show the vertical profiles of SOC burial rates and sediment ages in natural mangroves under high and low urbanization gradients, respectively. Panels (c), (d), and (e)

	present the corresponding profiles for restored mangroves under high, moderate, and low urbanization levels, respectively." In addition, we have clarified that Huizhou, Shantou, and Zhanjiang represent high, moderate, and low urbanization levels, respectively, as stated in the Methods section. This information has been consistently applied throughout the manuscript to ensure coherence in figure interpretation.
lines 231-232: Figure 5 description: Please include more details in your figure description. What do the different colored boxes for your different depth intervals represent? Do Insets A, B, C, D, and E correspond with the same Insets in Figure 4? If so, it may be helpful to include the locations for each of these either in the figure or in the figure description.	Thank you very much for your valuable suggestion. In response, we have further refined the caption of Figure 5 in the revised manuscript to explicitly clarify the correspondence between ecosystem types and urbanization gradients. In addition, different colored boxes represent distinct soil depth intervals, and the corresponding depth ranges are clearly labeled on the right side of each box in Figure 5. These revisions improve the clarity, readability, and interpretability of the figure. Furthermore, the inset panels A, B, C, D, and E in Figure 5 correspond to the same sampling locations as those presented in Figure 4. Following your suggestion, we have added the relevant location information to the caption of Figure 5 to provide clearer descriptions of the spatial context.
lines 246-247: Figure 6 description: Please provide more details in this figure description. What do you mean by "different letters indicated significant differences in Beta values among urbanization levels within the same ecosystem type..."? Define what the letters are and what each of them means, exactly.	Thank you very much for your valuable comment. Here, we further clarify the meaning of the significance letters in Figure 6. The interpretation of letters should be conducted within each ecosystem type. For example, in restored mangroves, different letters (b and a) corresponding to high and moderate urbanization levels indicate a statistically significant difference in β-value between these two levels. The same interpretation applies to natural mangroves and bare tidal flats, where letters should be interpreted within each ecosystem category rather than across different ecosystem types.
line 270: "Once those limits are crossed, previously buried horizons return to active cycling and carbon stock decline rapidly…" Provide citation.	Thank you very much for your valuable comment. In response to your suggestion, we have added relevant references in the revised manuscript to provide further support for this statement. These additional citations strengthen the scientific basis of the discussion and improve the reliability of the interpretation.