RC1

The authors conducted two cruises along the Guangdong Coast in summer to reveal how water mass mixing, physical and biogeochemical features of suspended particles affect the horizontal and vertical distributions of particles in the Northern South China Sea (NSCS) shelf. Multiple physical and biochemical parameters were used to define the possible source of particles and the underlying processes. The manuscript is well written and presents an interesting story. However, I don't think some of the data are properly interpretated in this manuscript. More details need to be clarified. I would recommend a major revision.

We sincerely thank the reviewer's help for the constructive and insightful comments. We carefully considered each suggestion and revised the manuscript accordingly. Our detailed responses to the specific points are provided below.

Major comments:

1. **It is more prevalent that the d13C of POM increases as salinity increases in the coastal sea because the terrestrial OM (e.g., -27‰) has a more depleted d13C than marine OM (e.g., -20‰). However, it has a opposite trend in the Appendix Fig. A7 of this manuscript. Can the authors compile more data (d13C-POC vs. Salinity) from the published paper and see if it's a general feature for the particles in the NSCS?**

Reply: We concurred with the reviewer that terrestrial POM generally has lower $\delta^{13}C_{POC}$ values (e.g., around -27‰), while marine POM is more enriched (e.g., around -20‰). The negative relationship between $\delta^{13}C_{POC}$ and salinity observed in our study appears to be a particular feature of the northeastward-moving Zhujiang River plume (ZRP), which is largely dominated by marine-sourced POM. Supporting evidence can be found in Huang et al. (2021), who reported relatively enriched $\delta^{13}C_{POC}$ values in diluted waters with lower salinity (<33 PSU) along a similar transect (see Fig. 1 below). To further examine this, we roughly digitized hydrographic data from Huang et al. (2021) based on their published figures and added it into Fig. 11 of our manuscript (see Fig. 2 below). This comparison suggests that the observed pattern in our work is not unique but is also consistent with previous observations.

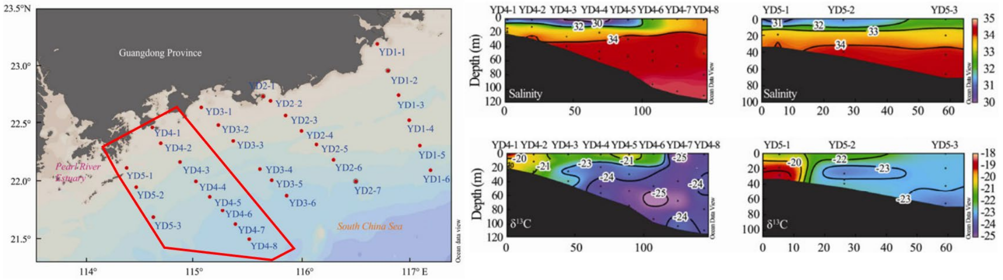

Fig. 1. (Left) Study area and transect layout from Huang et al. (2021). Red dots indicate sampling stations along transects in the northern South China Sea. The Y4 and Y5 transects are highlighted within the red box. (Right) 2-D structures of of hydrographic and biogeochemical properties along transects Y4 and Y5. Upper panels show salinity distributions along the transects, and lower panels show the corresponding $\delta^{13}C_{POC}$ values.

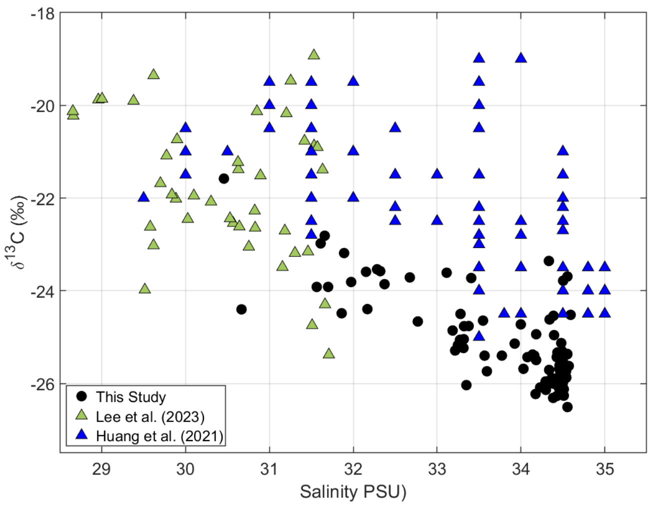

Fig. 2. $\delta^{13}C_{POC}$ and C/N ratio results from our previous work, Lee et al. (2023), and Huang et al. (2021)

Reference:

Huang, C., Lao, Q., Chen, F., Zhang, S., Chen, C., Bian, P., & Zhu, Q. (2021). Distribution and sources of particulate organic matter in the northern South China Sea: Implications of human activity. Journal of Ocean University of China, 20(5), 1136-1146. https://doi.org/10.1007/s11802-021-4807-z

2. With a decreasing trend of d13C-POC vs C/N similar to the Fig. 10 in KK Liu et al. (2007), in the main text should reflect the physical mixing between terrestrial and marine OM, while their corresponding salinity seems unreasonable, i.e., higher salinity for terrestrial OM and lower salinity for marine OM. Moreover, in the main text the author neglected the contribution from terrestrial source, and only interpretated the more depleted d13C-POC value as a result of phytoplankton composition and isotopic fractionation during growth without proper explanation for the simultaneous high C/N

values. I suggest the authors add the coverages of different end-members in panel (a) of Fig. 11, similar to the author's previous work, i.e., Fig. 6F in Lee et al. (2023).

Reply: We concurred with the reviewer that the decreasing trend of $\delta^{13}C_{POC}$ versus C/N observed in sediment-trap samples, as reported by Liu et al. (2007, Fig. 10A), generally reflects two-end member mixing between terrestrial and marine POM. However, Liu et al. (2007) also showed that suspended POM (Fig. 10B) deviates from this trend, with more than half of the samples not accounted for by the two-endmember model. In particular, suspended POM in summer exhibited relatively enriched $\delta^{13}C_{POC}$ values in Liu's work. Liu et al. further noted that the $\delta^{13}C_{POC}$ value of the marine end-member sometimes extends to as low as ~-26‰ in May, overlapping isotopically with terrestrial POM. These observations suggest that a simple terrestrial-marine mixing framework is insufficient to explain the $\delta^{13}C_{POC}$-salinity relationship in suspended POM of the northern South China Sea (NSCS), implying contributions from additional biological or biogeochemical processes.

Regarding the suggestion to add terrestrial and freshwater end-member ranges (e.g., as in Lee et al., 2023) in Fig. 11, we respectfully chose not to include them here. This is because the particles in our study are predominantly marine-sourced; including terrestrial end-members in Fig. 11 could mislead readers into overestimating riverine POM contributions. Instead, we have clarified this point in the revised text (see below descriptions) to avoid potential misunderstanding.

Line 488-491: "…Previous studies on the upper reaches of the ZRP have shown that most entrained particles in the river plume originate from marine biogenic sources, as substantial terrestrial particles are either trapped upstream by dam operations or rapidly settle to the seabed upon entering the Zhujiang River Estuary…"

Line 524-527: "…Our findings, consistent with Lee et al. (2023), indicate that particles transported by the northeastward-flowing ZRP are primarily marine-derived biogenic substances (Fig. 2, 4, 5, and Table 2), with riverine input largely limited to dissolved nutrients rather than particulate matter. The presence of marine POM within the river plume suggests a high carbon settling flux in the eastern NSCS shelf …"

Reference:

Liu, K.-K., Kao, S.-J., Hu, H.-C., Chou, W.-C., Hung, G.-W., & Tseng, C.-M. (2007). Carbon isotopic composition of suspended and sinking particulate organic matter in the northern South China Sea-From production to deposition. *Deep-Sea Research Part II: Topical Studies in Oceanography, 54*(14), 1504–1527. https://doi.org/10.1016/j.dsr2.2007.05.010

3. **Moreover, in the main text the author neglected the contribution from terrestrial source, and only interpretated the more depleted d13C-POC value as a result of**

phytoplankton composition and isotopic fractionation during growth without proper explanation for the simultaneous high C/N values.

Reply: The depleted $\delta^{13}C_{POC}$ signature could be attributed to terrestrial POM if interpreted solely from the $\delta^{13}C_{POC}$ variable. However, a multivariable constraint (PC ratio, bulk density, and water salinity) does not support this explanation. The low PC ratio and particle bulk density indicate that POM in the SCM is newly produced (or at least rarely degraded). Salinity measurements further suggest that the SCM water, which carries those fresh POM, is ambient seawater rather than riverine water. Therefore, we infer that the POM in the SCM is primarily marine-sourced, despite its relatively low $\delta^{13}C_{POC}$ values. A similar isotopic signature has also been reported in other marginal seas (e.g., the East China Sea and Yellow Sea; Liu et al., 2018; Liu et al., 2022), reinforcing our interpretation.

Regarding the high C/N ratios shown in Fig. 11, we attribute these to the low nitrogen concentration (~0.4 μM) relative to that of carbon, which may reflect remineralization or preferential degradation under the N-limited condition in the northern SCS. Importantly, these high C/N signatures were observed under high-salinity conditions, further reducing the likelihood of terrestrial contributions. We have added further explanation in the revised manuscript to clarify this point.

Line 535-537: "In the distal region of the ZRP near offshore Shanwei, $\delta^{13}C_{POC}$ decreases to -23.45‰ with a C/N ratio of 10.25, indicating a progressive dilution with a seawater end-member ($\delta^{13}C_{POC}$ value of -25.4‰ and a C/N ratio of 14.73). The high C/N ratios observed in Fig. 11 can be attributed to the low nitrogen concentration (~0.4 μM) relative to organic carbon, which may reflect remineralization or preferential degradation under the N-limited condition in the NSCS (Yin et al., 2001)…"

References

Liu, Q., Kandasamy, S., Lin, B., Wang, H., Chen, C.T.A., (2018c). Biogeochemical characteristics of suspended particulate matter in deep chlorophyll maximum layers in the southern East China Sea. *Biogeosciences* 15, 2091-2109.

Liu, Q., Kandasamy, S., Zhai, W., Wang, H., Veeran, Y., Aiguo Gao, et al. (2022). Temperature is a better predictor of stable carbon isotopic compositions in marine particulates than dissolved CO_2 concentration. Communications Earth & Environment, 3, Article 303. https://doi.org/10.1038/s43247-022-00627-y

Yin, K., Qian, P.-Y., Wu, M. C. S., Chen, J. C., Huang, L., Song, X., & Jian, W. (2001). Shift from P to N limitation of phytoplankton growth across the Pearl River Estuarine Plume during summer. Marine Ecology Progress Series, 221, 17–28. http://www.jstor.org/stable/24865282

4. **I suggest the authors add the coverages of different end-members in panel (a) of Fig. 11, similar to the author's previous work, i.e., Fig. 6F in Lee et al. (2023).**

Reply: As noted in our earlier responses, we respectfully chose not to include terrestrial and freshwater end-member ranges in Fig. 11 (e.g., as in Lee et al., 2023). This is because the particles analyzed in our study predominantly represent marine-sourced POM in the ZRP, and including terrestrial end-members could lead to an overestimation of riverine contributions. Moreover, the inclusion of multiple end-member ranges could make the figure unnecessarily complex and risk diverting attention from the primary message, the potential of $\delta^{13}C_{POC}$ as a tracer for the ZRP to other issues. We have clarified this point in the text to avoid potential misunderstanding.

Line 488-491: "Previous studies on the upper reaches of the ZRP have shown that most entrained particles in the river plume originate from marine biogenic sources, as substantial terrestrial particles are either trapped upstream by dams or rapidly settle to the seabed upon entering the Zhujiang River Estuary "

5. **The sources (terrestrial vs. marine) and bioavailability (fresh/labile vs. degraded) of particles and their correlation with the particle size and water stability should be clarified in the main text. For instance, the contribution fractions of different sources can be calculated using an isotope mixing model (Yu et al., 2010 ECSC).**
Reply: We thank the reviewer for this constructive suggestion. In our study area, the northeastward ZRP mainly delivers terrestrial output as dissolved nutrients rather than particulate matter (Lee et al., 2023). Consequently, the suspended particles in the river plume predominantly consist of newly produced marine phytoplankton.

Regarding particle bioavailability, we have assessed POM degradation using the PC ratio and particle bulk density (Table 2). The role of water stability in regulating the distribution of degraded particles is also described in the main text (e.g., Line 570-572). With respect to particle size, we agree that this is an important factor. While a detailed analysis is not included here, we note that the SCM was largely composed of fine particles in the main text (<10 μm; Fig. 10a, b; Line 482-484), which may partly explain the relatively depleted $\delta^{13}C_{POC}$ signatures of fresh POM at this depth. We will further investigate particle-size effects in future work.

Finally, we acknowledge that isotope mixing models (Yu et al., 2010) are indeed valuable for quantifying source contributions. However, applying such an approach to our dataset would require the definition of multiple marine end-members, as terrestrial POM is not a dominant source in this region. To avoid broadening the scope of the present manuscript, we chose to emphasize $\delta^{13}C_{POC}$ and related parameters as tracers of the ZRP. We agree that the potential application of mixing models will be an important direction for future studies with broader datasets.

Reference:

Lee, J., Liu, J. T., Lin, Y.-S., Chen, C.-T. A., & Wang, B.-S. (2023). The contrast in suspended particle dynamics at surface and near bottom on the river-dominated northern South China Sea shelf in summer: Implication on physics and biogeochemistry coupling. *Frontiers in Marine Science, 10*. https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2023.1156915

Minor comments:

P2, L29: Specify what biogeochemical signatures.

Reply: We have clarified the description as shown below:

Line 29: "Although the ZRP and subsurface chlorophyll maximum shared similar signatures of high Chl-a and elevated POC concentrations…"

P2, L31: Only one parameter like $\delta^{13}C_{POC}$ may lead to misinterpretation. It is better to use multiple parameters to constrain the source and transport of the suspended particles.

Reply: We agree that relying on a single parameter may lead to misinterpretation. In our study, $\delta^{13}C_{POC}$ was not interpreted in isolation; rather, we constrained it with multiple supporting parameters, including C/N ratios, Chl-a concentrations, particle bulk density, and salinity. We also compared our results with data at the upstream ZRP (Lee et al., 2023), which provides additional constraints on the particle source. These multiple lines of evidence consistently support the conclusion that $\delta^{13}C_{POC}$ provides a more reliable tracer of the ZRP than the conventional N/P ratio. We have revised the description at Line 478-480, Line 556-558, etc., to clarify this point.

Reference:

Lee, J., Liu, J. T., Lin, Y.-S., Chen, C.-T. A., & Wang, B.-S. (2023). The contrast in suspended particle dynamics at surface and near bottom on the river-dominated northern South China Sea shelf in summer: Implication on physics and biogeochemistry coupling. *Frontiers in Marine Science, 10*. https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2023.1156915

P3, L58: Delete the period after NSCS.

Reply: We revised the description accordingly.

"P4, L84: Delete the period after systems.

Reply: We revised the description accordingly.

P6, L135: The two 500 mL samples are used for what parameters?

Reply: The two 500 mL seawater samples were used separately: one sample was filtered for Chl-a analysis, while the other was filtered for both SSC and POM. We have revised the text as follows to clarify:

Line 135-139: "Additionally, two 500 mL seawater samples were collected and stored in HDPE opaque amber bottles. One sample was filtered through a pre-combusted GF/F filter (Whatman; diameter: 25 mm; pore size: 0.7 µm; pre-combusted at 500°C for 6 hours) for chlorophyll-a (Chl-a) analysis, while the other was filtered using the same procedure for suspended sediment concentration (SSC) and POM."

P6, L136: "Onboard"

Reply: We revised the description accordingly.

Line 136: "…opaque amber bottles. Onboard water samples were filtered …"

P8, L160-162: Check out the over-citation problem.

Reply: We thank the reviewer for this valuable suggestion and have revised the citation as

Line 160-162: "(Du and Liu, 2017; Liu et al., 2018b; Neumann, 1966)"

P10, L232-233: Is there any validation plot from the author?

Reply: We thank the reviewer for this suggestion and have added the validation plot in Appendix Fig. 1 (see figures below). The satellite Chl-a and *in-situ* Chl-a show a generally positive correlation. We note that the overall R^2 is moderate, which can be partly attributed to the spatio-temporal resolution mismatch between satellite observations (daily, 1/24° pixels) and shipboard water sampling (point measurements at a specific time). This mismatch is particularly evident at Station J1, located near the river plume front, where fine-scale gradients are not fully resolved by satellite data.

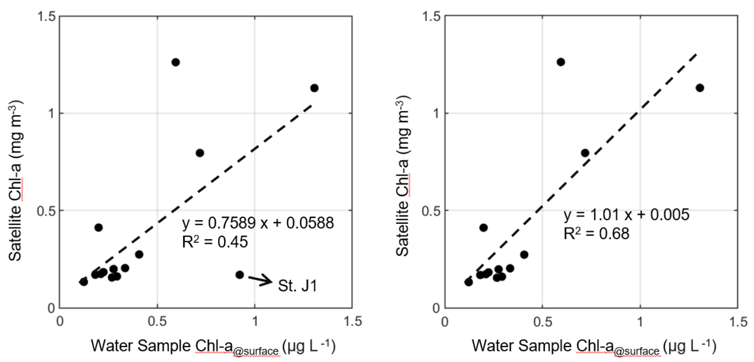

Fig. 3: The validation for Chl-a recorded by satellite. (Left) Data with the measurement at Station J1. (Right) Data without the measurement at Station J1.

P11, L255: "fresher"?

Reply: We revised the description accordingly.

P15, L301: How about the C/N ratio in the SCM water? Why the terrestrial source can be excluded?

Reply: We acknowledge that the C/N ratio in the SCM water (14.13) is relatively high. However, this value is close to the ranges for both terrestrial and marine POM. Considered in isolation, the high C/N ratio together with the depleted $\delta^{13}C_{POC}$ could suggest a terrestrial contribution. Nevertheless, multiple independent variables suggest a predominantly marine origin. The low PC ratio and particle bulk density indicate that the POM is fresh, while the salinity profile demonstrates that the SCM layer represents ambient seawater rather than riverine input. Taken together, these lines of evidence indicate that the POM in the SCM is largely marine-derived, although a minor terrestrial contribution cannot be completely excluded. Therefore, we have highlighted it in the manuscript to provide a more cautious interpretation.

Line 475-480: "Although low $\delta^{13}C_{POC}$ values are traditionally considered indicative of terrestrial input (Cai et al., 1988), misidentification of POM sources could occur without multivariable constraints (Lee et al., 2023). "

P15, L303-305: Is there any other paper presenting such depleted d13C-POC in the shelf sea?

Reply: Liu et al. (2022) reported $\delta^{13}C_{POM}$ values ranging from -29.9 to -19.8‰ in the southern Yellow Sea, which they primarily attributed to temperature-dependent phytoplankton metabolism. In addition, Close et al. (2020) documented similarly depleted $\delta^{13}C_{POC}$ signals in the lower euphotic zone of the open ocean, reinforcing that such low values can occur in subsurface chlorophyll maximum layers without requiring a dominant terrestrial contribution. We have added more references in the main text.

Line 303-305: "Similar $\delta^{13}C_{POC}$ depletion has been reported on the East China Sea shelf, attributed to phytoplankton size composition and the intrusion of the offshore water having a low $\delta^{13}C_{POC}$ value (Liu et al., 2018c). More broadly, recent evidence also suggests that temperature-dependent metabolic effects provide an important control on such depleted signatures in marine particulates (Liu et al., 2022)."

References:

Close, H. G., & Henderson, G. M. (2020). Open-Ocean Minima in $\delta^{13}C$ Values of Particulate Organic

Carbon in the Lower Euphotic Zone. Frontiers in Marine Science, 7, Article 604165. https://doi.org/10.3389/fmars.2020.604165

Liu, Q., Kandasamy, S., Zhai, W., Wang, H., Veeran, Y., Aiguo Gao, et al. (2022). Temperature is a better predictor of stable carbon isotopic compositions in marine particulates than dissolved CO_2 concentration. Communications Earth & Environment, 3, Article 303. https://doi.org/10.1038/s43247-022-00627-y

Liu, Q., Kandasamy, S., Lin, B., Wang, H., Chen, C.T.A., (2018c). Biogeochemical characteristics of suspended particulate matter in deep chlorophyll maximum layers in the southern East China Sea. *Biogeosciences* 15, 2091-2109.

P20, L406: Please check "finer" or "coarser".

Reply: We confirm that the correct description should be "coarser." The 3rd mode indicates that cold seawater enhanced water column stability and transported "relatively" coarser particles to the SCM.

P22, L440: to shoal "with" depths…

Reply: We revised the description accordingly.

P25, L497: resulting in

Reply: We revised the description accordingly.

P28, L546-537: It's wired to see such kind of seawater end-member values. Can you provide any other studies using similar definition?

Reply: We concurred with the reviewer that the seawater end-member values identified in our study appear relatively depleted compared with the general concept. However, similar observations have been reported in other regions. For instance, Close and Henderson (2020) documented open-ocean minima in $\delta^{13}C_{POC}$ in the lower euphotic zone; Huang et al. (2021) found depleted $\delta^{13}C_{POC}$ signatures of POM in the northern South China Sea; Liu et al. (2007) observed negative $\delta^{13}C_{POC}$ values in suspended POM in the northern South China Sea; and Liu et al. (2022) showed that temperature-dependent phytoplankton metabolism could result in relatively depleted $\delta^{13}C_{POM}$ at Yellow Sea. These studies demonstrate that such values are possible under specific biogeochemical conditions, including isotope fractionation, carbon concentrating mechanisms, and physiological responses of phytoplankton. We have revised the text to clarify this point and added the above references for support.

Line 536-537: "…indicating a progressive dilution with a seawater end-member ($\delta^{13}C_{POC}$ value of -25.4‰ and a C/N ratio of 14.73). While this value is relatively depleted compared with the general marine end-member concept, similar $\delta^{13}C_{POC}$ values have been reported in other regions under specific biogeochemical conditions (Close and Henderson, 2020; Huang et al., 2021; Liu et al., 2007; Liu et al., 2022). In our study, although POM within the ZRP… "

References

Close, H. G., & Henderson, G. M. (2020). Open-Ocean Minima in $\delta^{13}C$ Values of Particulate Organic Carbon in the Lower Euphotic Zone. Frontiers in Marine Science, 7, Article 604165. https://doi.org/10.3389/fmars.2020.604165

Huang, C., Lao, Q., Chen, F., Zhang, S., Chen, C., Bian, P., & Zhu, Q. (2021). Distribution and sources of particulate organic matter in the northern South China Sea: Implications of human activity. Journal of Ocean University of China, 20(5), 1136-1146. https://doi.org/10.1007/s11802-021-4807-z

Liu, K.-K., Kao, S.-J., Hu, H.-C., Chou, W.-C., Hung, G.-W., & Tseng, C.-M. (2007). Carbon isotopic composition of suspended and sinking particulate organic matter in the northern South China Sea-From production to deposition. *Deep-Sea Research Part II: Topical Studies in Oceanography, 54*(14), 1504–1527. https://doi.org/10.1016/j.dsr2.2007.05.010

Liu, Q., Kandasamy, S., Zhai, W., Wang, H., Veeran, Y., Aiguo Gao, et al. (2022). Temperature is a better predictor of stable carbon isotopic compositions in marine particulates than dissolved CO_2 concentration. Communications Earth & Environment, 3, Article 303. https://doi.org/10.1038/s43247-022-00627-y

P28, L542-544: The interpretation of d13C-POC mainly composed of phytoplankton in the ZRP (stable fractionation) is contradict to that in the SCM (distinct fractionation). Any explanation for such difference?

Reply: We appreciate this insightful question by the reviewer. Our statement at L542-544 referred to the similarity in $\delta^{13}C_{POC}$ fractionation patterns between the ZRP (nearshore, eutrophic) and offshore waters reported by Liu et al. (2007), where phytoplankton-derived POM exhibited similar carbon fractionation. By contrast, the SCM implies a distinct ecological niche. Although the POM in the SCM is the freshest, being newly produced in-situ, it forms under relatively low-light and high CO2 supply rates (comparing to the surface water). Such conditions typically reduce phytoplankton growth rates and increase the isotopic fractionation factor (εp), thereby leading to more depleted $\delta^{13}C_{POC}$ values (Close & Henderson, 2020). In addition, shifts in phytoplankton community composition (e.g., dominance of small cells) and temperature-dependent metabolic effects may further enhance the depletion, as documented in the East China Sea (Liu et al., 2018), the Yellow Sea (Liu et al., 2022), and the global lower euphotic zone (Close & Henderson, 2020).

Therefore, the difference between the ZRP and SCM does not represent a contradiction but rather reflects contrasting environmental controls: in the ZRP, rapid surface production fueled by riverine nutrients results in enriched stable carbon isotopic signatures, whereas in the SCM, in-situ production under low-light and high CO2 supply leads to enhanced physiological fractionation and more depleted $\delta^{13}C_{POC}$ values. We have added further description to clarify this point.

Line 542-546: "This suggests that stable carbon isotope fractionation follows a similar mechanism in both eutrophic (nearshore) and oligotrophic (offshore) environments, despite differences in plankton communities across water masses (Ho et al., 2015; Huang et al., 2010; Li et al., 2018, 2021; Lu et al., 2015; Miller et al., 2008; Phillips et al., 2005; Quay et al., 2015; Yin et al., 2001). However, the exceptionally depleted $\delta^{13}C_{POC}$ signatures observed in the SCM of the NSCS indicate that additional in-situ processes, such as low-light growth conditions, high CO_2 supply, and shifts in phytoplankton community composition, can lead to distinct fractionation patterns compared with the surface ZRP (Close et al., 2020; Liu et al., 2022)."

References

Close, H. G., & Henderson, G. M. (2020). Open-Ocean Minima in $\delta^{13}C$ Values of Particulate Organic Carbon in the Lower Euphotic Zone. Frontiers in Marine Science, 7, Article 604165. https://doi.org/10.3389/fmars.2020.604165

Huang, C., Lao, Q., Chen, F., Zhang, S., Chen, C., Bian, P., & Zhu, Q. (2021). Distribution and sources of particulate organic matter in the northern South China Sea: Implications of human activity. Journal of Ocean University of China, 20(5), 1136-1146. https://doi.org/10.1007/s11802-021-4807-z

Liu, K.-K., Kao, S.-J., Hu, H.-C., Chou, W.-C., Hung, G.-W., & Tseng, C.-M. (2007). Carbon isotopic composition of suspended and sinking particulate organic matter in the northern South China Sea-From production to deposition. *Deep-Sea Research Part II: Topical Studies in Oceanography, 54*(14), 1504–1527. https://doi.org/10.1016/j.dsr2.2007.05.010

Liu, Q., Kandasamy, S., Zhai, W., Wang, H., Veeran, Y., Aiguo Gao, et al. (2022). Temperature is a better predictor of stable carbon isotopic compositions in marine particulates than dissolved CO_2 concentration. Communications Earth & Environment, 3, Article 303. https://doi.org/10.1038/s43247-022-00627-y

Table 1&2: Some elements of the table (e.g. the footnote) are repeated several times. Please refine the tables.

Reply: We revised the table accordingly. Please see the below Table 1 as the example.

2018

N/P Ratio	ZHJ3	ZHJ4	G1	H1	J1	K1	L1(ZRP)
Surface	-	-	4.20	3.75	1.72	8.14	4.89
Middle	-	-	12.26	2.42	11.70	14.23	12.19
Bottom	-	-	12.40	12.25	11.69	10.70	12.39

2020

N/P Ratio	ZHJ3	ZHJ4	G1	H1	J1	K1	L1(ZRP)
Surface	22.18	88.43	-	368.31	89.47	22.69	14.01
Middle	13.29	23.18	626.08	15.59	15.10	13.87	13.99
Bottom	14.28	14.64	13.93	12.26	11.43	12.44	38.02

* "-" symbol indicates missing or error data.
* Gray value indicates the N or P under the dectection limit.

The revised Table 1.

Fig. 11: It's better to remove panel (b), and add the coverages of the different end-members.

Reply: We revised the figure accordingly.

Fig. 12: Add the C/N ratio, and try to reveal the fractions between marine vs terrestrial.

Reply: We thank the reviewer for the suggestion. We agree that the C/N ratio is a widely used indicator to distinguish between terrestrial and marine POM sources. In our study area, however, the suspended particles are predominantly marine-sourced, as the northeastward ZRP delivers terrestrial materials mainly in dissolved rather than particulate form. Therefore, while the C/N ratio has been included for completeness (revised Appendix Fig. A6 and A7 as follows), it is not an effective tracer to identify terrestrial versus marine fractions in this case. Instead, to better constrain particle characteristics, we emphasize parameters most relevant to our dataset, such as particle size (coarse vs. fine) and PC ratio (fresh vs. degraded), which provide meaningful classification within marine-derived POM and highlight the biogeochemical contrasts in the system. We have clarified this point in the revised manuscript.

Line 473-480: "The lower PC ratio and particle bulk density in the SCM suggest the presence of relatively fresher bio-particles compared to those in the ZRP (Appendix Fig. A6). The depleted $\delta^{13}C_{POC}$ in the SCM may result from factors such as phytoplankton size composition and biological metabolism under conditions of low dissolved CO2 concentration (Close et al., 2020; Law et al., 1995; Liu et al., 2018c; Miller et al., 2008). Although low $\delta^{13}C_{POC}$ values are traditionally considered indicative of terrestrial input (Cai et al., 1988), misidentification of POM sources can occur without multivariable constraints (Lee et al., 2023)."

Line 535-537: "In the distal region of the ZRP near offshore Shanwei, $\delta^{13}C_{POC}$ decreases to -23.45‰ with a C/N ratio of 10.25, indicating a progressive dilution with a seawater end-member ($\delta^{13}C_{POC}$ value of -25.4‰ and a C/N ratio of 14.73). The high C/N ratios observed in Fig. 11 can be attributed to the low nitrogen concentration (~0.4 µM) relative to organic carbon, which may reflect remineralization or biodegradation processes…"

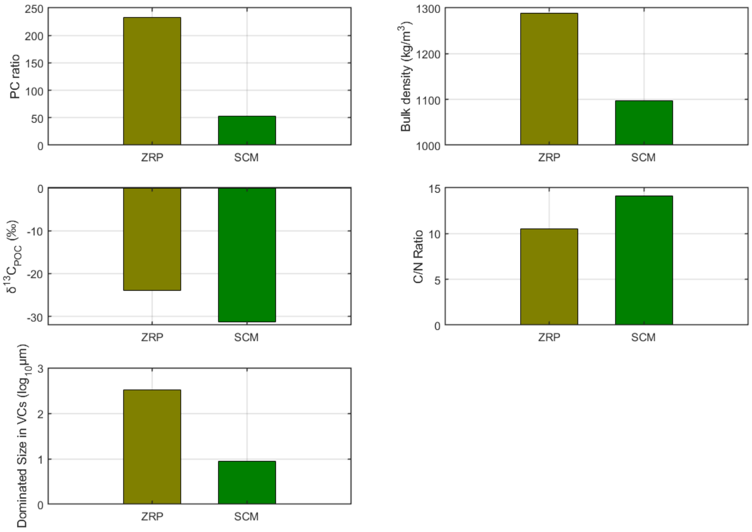

Fig. 4: Same as Appendix Fig. A6 of the manuscript, but with C/N ratios included on the figure.

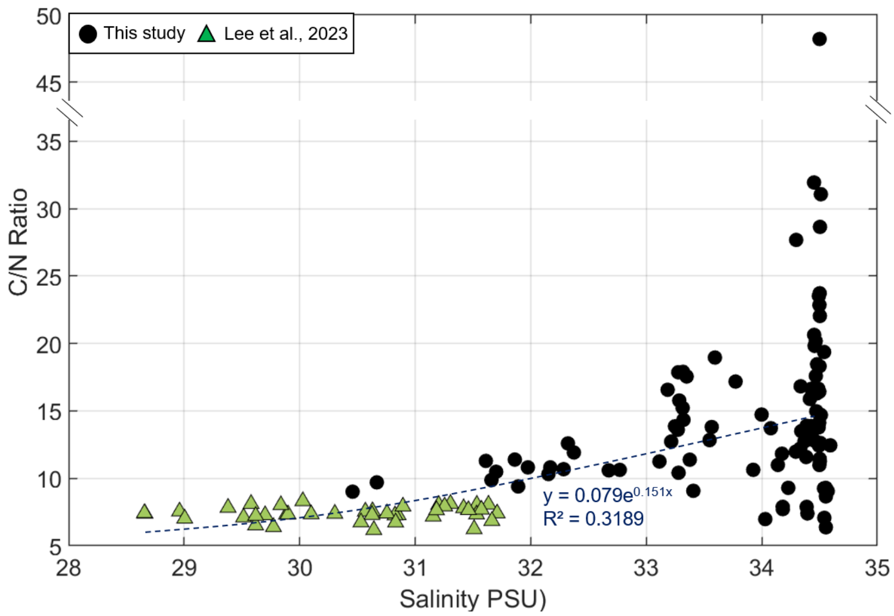

Fig. 5: Salinity and C/N ratio from 2018 and 2020. Blue dashed lines indicate regression line between salinity and C/N ratio.