Reviewer 2

At first, I apologize a delay of my comments.

Authors aimed to understand the sources, distribution, and controls of particulate organic matter (POM) in the northeastern Taiwan Strait through a full-water-column in this manuscript. They showed relative proportion of terrigenous sourced POC using biomarker (mainly lignin) and $\delta^{13}C_{OC}$. In addition, an export flux of terrigenous POC was calculated by combining with current velocity models.

It is important to estimate the source to sink of POM in a shallow and energetic shelf system such as Taiwan Strait. I respect authors' challenge and effort to comprehensive research of POM distribution and clarifying some aspects help improving the manuscript.

Comments

[1] Authors have already published sedimentary POM assessments in the same region in Lin et al. (2025). I recommend clarifying new findings in this paper, which is different from the previous study. Although several datasets were derived from the previous study, it is sometimes unclear which data is newly measured.

Ans: We added a sub-section "3.1 Data sources and previously published data" to clarify which part of the dataset has been used in Lin et al. (2025a), and which part of the dataset is new.

> **3 Data**
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> **3.1 Data sources and previously published data**
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> A subset of the hydrographic observations used in this study was previously reported in Lin et al. (2025a), which focused primarily on sedimentary geochemistry. In that study, Chl, surface-water salinity, bottom-water temperature, and bottom-water TSM were used only to provide environmental context. Lin et al. (2025b) is the companion dataset associated with the present study and archived in Zenodo. It provides the underlying measurements, including geochemical data POM that are analyzed and discussed here for the first time.

[2] Authors applied two step estimation of terrigenous POC based on lignin ($\Sigma 8$) data and $\delta^{13}C_{OC}$ mixing model. $\Sigma 8$ was primarily sourced by resuspended sediment because of stronger correlation with TSM than salinity. However, $\Sigma 8$ was also transported by riverine input. Thus, are there lignin preserved in sediments and fresh lignin transported by rivers? Did the differences in lignin affect the subsequent calculations of terrigenous POC?

Ans: We thank the reviewer for this insightful comment. In the original manuscript, we adopted $\Lambda 8_{terr,s}$ values from either riverine TSM or seabed sediments. In the revised manuscript, we now acknowledge that there may be a mixed contribution from these two sources. Such mixing would lead to overestimation of POC_{terr} in surface waters and underestimation in subsurface and bottom waters. Given the larger volume of subsurface and bottom waters, our overall estimate is therefore likely biased low. We did not apply a detailed correction due to the lack of quantitative constraints on the relative contributions of these sources.

> One possibility is the mixed contribution of lignin-rich and lignin-poor source materials. In estimating POC_{terr} (Table A2), we adopted $\Lambda 8_{terr,s}$ values from either riverine TSM (4.6–11.2 mg lignin g^{-1} OC) or seabed sediments (5.3–72.4 mg lignin g^{-1} OC). If the actual source is a mixture of both, POC_{terr} would be overestimated in surface waters but underestimated in subsurface and bottom waters. Given the larger volume of subsurface and bottom waters, our estimates are likely biased low overall. Another possibility is preferential resuspension of lignin-poor OM. This is supported by density-fractionation experiments (Wakeham et al., 2009), which showed that although lignin concentrations (normalized to sediment dry weight) increased in low-density fractions, Λ8 decreased because OC was enriched more strongly than lignin. The magnitude of Λ8 reduction relative to bulk sediments was highly variable and site-specific, precluding a robust correction. Instead of a detailed correction of the POC_{terr} estimates for low-TSM samples, we provide a first-order assessment of the potential magnitude of the bias. If the average $\Lambda 8_{cal}/\Lambda 8_{terr,s}$ ratio were applied to low-TSM samples, f_{terr} would increase by approximately sixfold (1/0.17). Even under this scenario, terrigenous OM would remain a secondary component for low-TSM samples. Therefore, our results support the conclusions of previous studies that terrigenous POM makes only a limited contribution to shelf waters above the benthic nepheloid layer (e.g., Ho et al., 2021; Liu et al., 2018a, 2022).

[3] After L301, authors assessed lignin-based estimates (underestimation) and $^{13}C_{OC}$-based mixing model (overestimation). Which estimation is better? So, is it the conclusion that "terrigenous POM has a limited contribution in shelf water, but it is main component in seabed sediments" for this paragraph?

Ans: We thank the reviewer for this question. In the revised manuscript (Sect. 5.1.2), we clarify that the $\delta^{13}C$-based mixing model provides more reliable estimates for high-TSM samples, as these are primarily derived from seabed sediments that contain a high terrigenous OM content.

> Lignin-based estimates yielded low POC_{terr} concentrations, with f_{terr} averaging 0.14 ± 0.08 and 0.06 ± 0.09 for high- and low-TSM samples, respectively (Table A2). In contrast, f_{terr} values of high-TSM samples were revised to 0.68 ± 0.14 using the $\delta^{13}C_{OC}$-based mixing model (Table A4). The higher f_{terr} values from the $\delta^{13}C$-based approach are considered more reliable for high-TSM samples, as these are primarily sourced from seabed sediments known to contain a high proportion of terrigenous OM (Lin et al., 2025a). To investigate the discrepancy between the two approaches, we back-calculated $\Lambda 8_{cal}$ that would

For low-TSM samples, however, $\delta^{13}C_{OC}$ is less suitable as a tracer due to ambiguity in interpreting low-$\delta^{13}C_{OC}$ signatures. The lignin-based estimates are likely biased low overall, and a first-order assessment using the average $\Lambda 8_{cal}/\Lambda 8_{terr,s}$ ratio suggests that f_{terr} could increase by up to sixfold. Under this scenario, terrigenous OM would still represent a secondary component in these samples. Therefore, our results support the conclusion that terrigenous POM makes only a limited contribution to shelf waters above the benthic nepheloid layer.

The conclusion that the terrigenous source is the main component of seabed sedimentary OM is based on

Lin et a. (2025a), not the present study.

[4] Authors suggest "terrigenous correction can be reasonably omitted in future analyses of low-TSM shelf waters, even without lignin data" in L330-331. If the correction did not alter the POM features, POM source is estimated primarily to be marine organisms. Please clarify the importance of accurately estimating the terrigenous POC contribution which is quite small.

Ans: We thank the reviewer for this insightful comment. We agree that terrigenous POM represents only a minor fraction of bulk POM in low-TSM shelf waters, and that its removal does not significantly alter the overall biogeochemical characteristics of POM. This is now clarified in Sect. 5.2, where we show that terrigenous POM exerts limited influence on bulk properties and that the main conclusions are insensitive to whether the correction is applied.

> As discussed in Sect. 5.1.2, the lignin-based approach likely underestimates POC_{terr}, which may partly contribute to the limited differences observed after correction. However, even when accounting for the potential magnitude of this underestimation, terrigenous POM remains a secondary component in low-TSM samples. The weak correlations between POC and Σ8 ($r = 0.14$, $p = 0.27$) and between $\delta^{13}C_{OC}$ and Λ8 ($r = -0.04$, $p = 0.76$) in low-TSM samples further indicates that additional upward revision of lignin-based POC_{terr} estimates is unlikely to substantially alter the slopes of linear regressions used to assess overall characteristics. In the following discussion, we therefore focus on the corrected low-TSM dataset, while noting that the conclusions are insensitive to whether the correction is applied.

However, accurately constraining POC_{terr} remains important for understanding its transport and fate. As revised in Sect. 5.1.3, even though the fractional contribution of terrigenous OM is small, low-TSM shelf waters can account for a substantial portion of its lateral export, particularly if the potential underestimation associated with the lignin-based approach is taken into account. This indicates that low-TSM waters, despite their low terrigenous signal, can play a non-negligible role in advective transport.

> Notably, 48 % of exported POC_{terr} exited via waters above the narrow (< 10 km) nearshore mud belt, underscoring its dual role as both a temporary sink of fluvial inputs and a source fuelling along-shelf, long-distance transport. An additional 36 % was exported via the nepheloid layer above the offshore mud belt, whereas only 17 % was carried by clear shelf waters. However, as discussed above, POC_{terr} concentrations in low-TSM samples are likely underestimated by the lignin-based approach. If the sixfold correction derived from the average $\Lambda8_{cal}/\Lambda8_{terr,s}$ ratio is applied to these samples, the contribution of clear shelf waters would increase to 43 %. This suggests that low-TSM shelf waters, though having a minor contribution from terrigenous OM, may play a non-negligible role in its advective transport.

We have revised the manuscript to better distinguish between these two aspects, namely the limited role of terrigenous POM in controlling bulk POM properties and its potentially important role in regional carbon transport.