

Re: "Partitioning of carbon export in the euphotic zone of the oligotrophic South China Sea" by Ma et al.

25th April 2023

Dear Editor,

Thank you for your time in handling our paper. We are pleased to submit our further revised MS entitled "Partitioning of carbon export in the euphotic zone of the oligotrophic South China Sea" by Yifan Ma et al.

Throughout the revisions, we carefully considered the comments and suggestions from the reviewers. Specifically, we improved the abstract to better highlight our findings and changed the title from "upper water column" to "euphotic zone" to better reflect the study foci. Additionally, we thoroughly checked the manuscript for typos, as per the reviewers' comments.

Finally, we would like to take this opportunity to thank you and the reviewers for the comments and suggestions, which have significantly improved the quality of our paper. We sincerely hope that our revision meets the standards of *Biogeosciences*.

Sincerely,



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Anonymous Referee #1

The revised manuscript is greatly improved. The result and interpretation are convincing. There are only some technical points that need to be corrected.

[Response]: We appreciate the Reviewer's positive feedback on our revisions.

In Eq. 2, the del sign before A_{Th} total is a typo.

[Response]: Fixed. We have updated Eq. (2) as per the suggested modification as shown below:

$$\frac{\partial A_{Th}^{total}}{\partial t} = \lambda (A_U - A_{Th}^{total}) - F_{Th} + V \quad (2)$$

L495, 48% is almost the half. It seems hard to suggest a major role of subsurface nutrients. Here needs some clarification.

[Response]: In the revised manuscript, we have further clarified this issue, which now reads: "...is estimated to be 48%, suggesting that 52% of PN flux at this depth is supported by subsurface nitrate. The derived $f_{NO_3^-}$ based on mass balance is slightly lower than that obtained from the isotopic balance at the NDL base (59-67%). This might be due to an overestimation of the nitrogen fixation rate and the flux of atmospheric nitrogen deposition in the mass balance model. For example, the nitrogen fixation rate used is observed in the northeastern SCS where the Kuroshio intrudes frequently (Kao et al., 2012). Higher rates of nitrogen fixation were detected in the Kuroshio-influenced waters compared to those in the northern basin (e.g., at SEATS station; Lu et al., 2019). Similarly, the observed flux of atmospheric nitrogen deposition at Dongsha Island, which is close to mainland China, is likely higher than that at the station SEATS. Despite uncertainties, the two independent estimates both suggest a substantial role of subsurface nitrate in supporting particle export out of the NDL base."

Anonymous Referee #2

The authors greatly improved the manuscript. However it remains details that need to be improved.

[Response]: We express our appreciation for the positive feedback from the reviewer. We have made further revisions following the Reviewer's comments as elaborated in our responses provided below.

- update the state of the art line 48 to 53,

[Response]: In the revised manuscript we have updated some recently published papers, as detailed below:

“...such as ^{234}Th . Cai et al. (2008) also observed variable particle scavenging rates in the upper euphotic zone (above 50 m) but consistently lower rates in the lower euphotic zone (between 50 and 100 m) in the oligotrophic SCS. With increasing high-resolution samplings, such partitionings of ^{234}Th -based particle scavenging were frequently observable in oligotrophic ecosystems (Buesseler et al., 2009; Umhau et al., 2019; Zhou et al., 2020; Stukel et al., 2022).”

- improve the abstract

[Response]: Following the Reviewer's comment, we have improved the abstract to clearly show our findings and the implication of the study.

- improve the title that does not reflect the content of the article, "upper water column" is not enough precise regarding the objectives of the work

[Response]: As our study primarily examines the partitioning of carbon export within the euphotic zone, we will revise the title to “Partitioning of carbon export in the euphotic zone of the oligotrophic South China Sea”.

- figure 2: again to improve, it is not total ^{234}Th that is exported but particulate Th, then AU --> $A_{\text{Th}}^{\text{dissolved}}$ --> $A_{\text{Th}}^{\text{particulate}}$

[Response]: We have incorporated the terms “ $A_{\text{Th}}^{\text{dissolved}}$ ” and “ $A_{\text{Th}}^{\text{particulate}}$ ” to represent the total ^{234}Th in the Figure 2 in our revised manuscript. Arrows are placed directly below the $A_{\text{Th}}^{\text{particulate}}$ to

denote that the particles, including the ^{234}Th in particulate phase are scavenging.

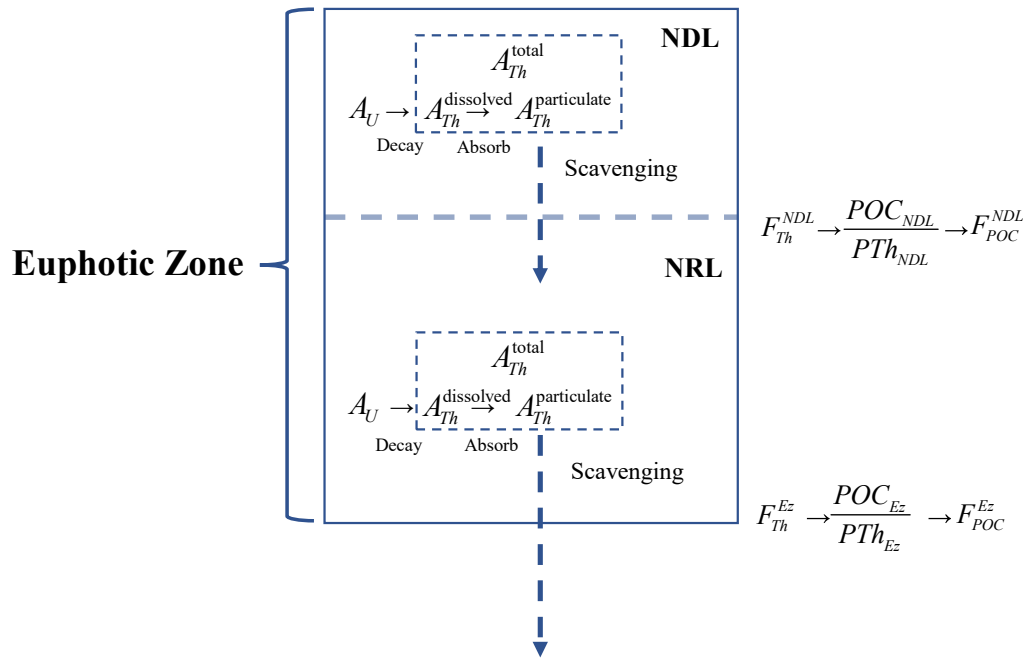


Figure 2: Schematic of the ^{234}Th model under the two-layer nutrient structure. The terms are defined in Eq. (2)-(4) and Eq. (7)-(9).

References

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