Response to Reviewer #1

The reviewer's comments and our responses are shown in black, and excerpts from the revised manuscript are shown in blue. Line numbers cited in our responses are shown in red and refer to the PDF of the revised manuscript without changes marked.

General comments:

This manuscript presents a valuable and timely contribution by introducing a global gap-free daily 4 km dataset of particulate organic carbon (POC), particulate organic nitrogen (PON), and their ratio spanning more than two decades (1998–2023). The development of a consistent long-term dataset addressing spatial and temporal gaps in existing POM products is highly relevant for studies of marine biogeochemistry, carbon and nitrogen cycling, and ecosystem dynamics.
The manuscript is generally well structured, and the methodology is clearly presented. The authors provide extensive validation, which strengthens confidence in the generated dataset. The dataset itself has the potential to become a valuable resource for the scientific community.

Some minor revisions require clarification and I have a few very minor suggestions the authors may wish to consider.
Response: We thank the reviewer for the positive assessment of our manuscript and for the constructive suggestions. We have revised the manuscript in response to these comments and address each point below.

Data accessibility and usability

The dataset is openly available through the provided TPDC link; however, the current download procedure requires the use of temporary FTP credentials, which are given through the data doi and an external FTP client is need to use them. I acknowledge that FTP-based access is commonly used for large scientific datasets. However, the current access instructions may be challenging for users who are unfamiliar with FTP workflows. Please provide clearer documentation regarding the download procedure, including whether registration is required, how the provided credentials should be used, and the organization of the downloaded files.
Response: Thank you for this suggestion. We expanded the Data availability section to clarify whether TPDC registration is required and to explain where to obtain the temporary FTP credentials and how to enter them in an FTP client. The revised Data availability is: "The GDR-POM dataset is openly available from the National Tibetan Plateau Data Center (TPDC) at https://doi.org/10.11888/Ocean.tpdc.303488 (Zhang and Liu, 2026). No TPDC account is required. To download the files, enter the FTP host, port, temporary username, and password provided in the download section of the dataset landing page into an FTP client such as FileZilla. Once connected, select the desired year folders or individual files. If the credentials expire, return to the landing page to obtain a new set. The landing page also explains how the daily NetCDF files are organised by year and named by date." (lines 687 to 692)

Technical corrections

1 Line 36: Remove "the" before POC and PON.

Response: Thank you for this suggestion. We have removed "the" before POC and PON and revised

the opening clause to read "Particulate organic carbon (POC) and particulate organic nitrogen (PON) are primarily produced by phytoplankton through photosynthesis" (lines 35 to 36).

2. Line 77: Change "environment" to "environments".

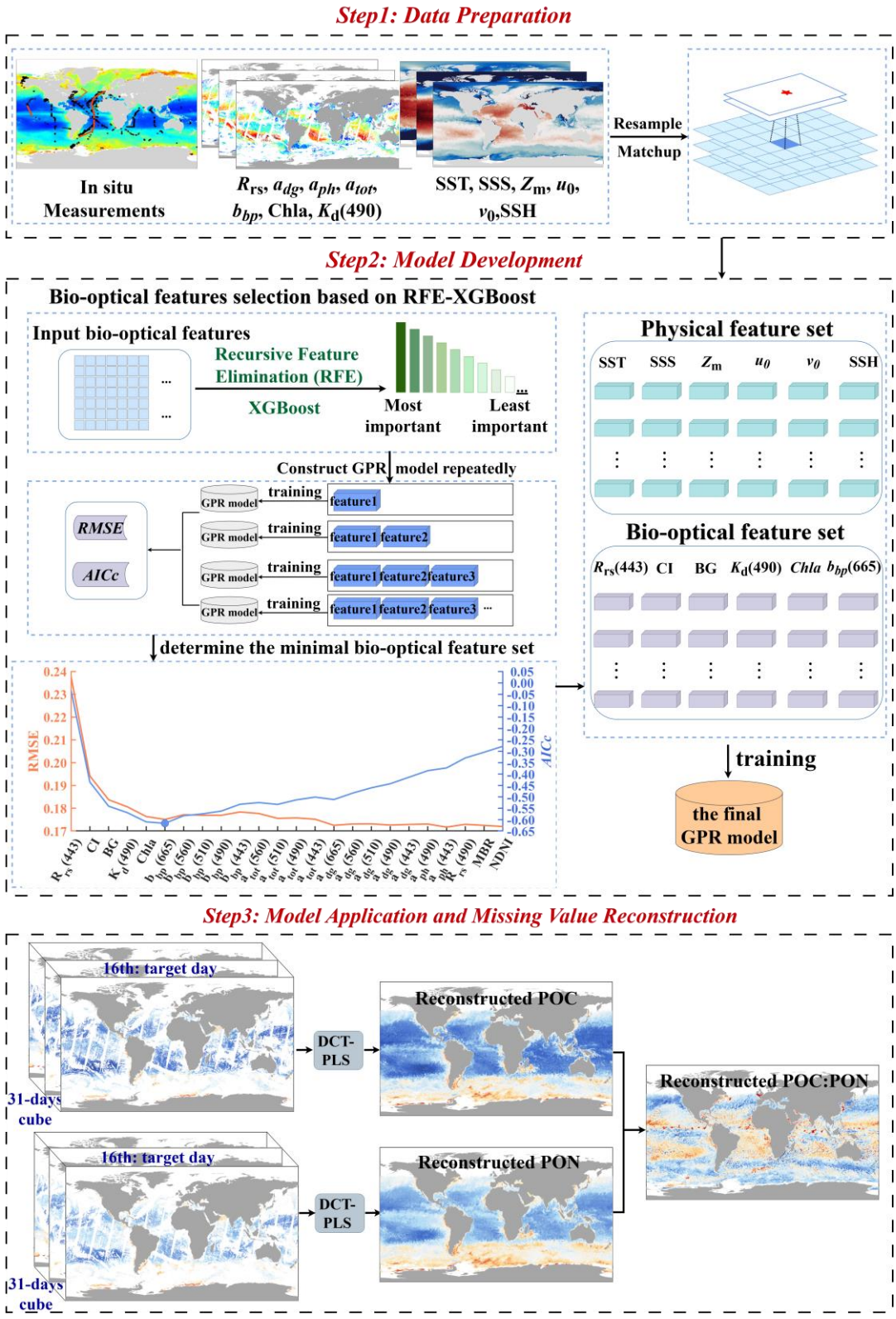
Response: Thank you for this suggestion. We have changed "environment" to "environments" (line 76).

3. Dates are currently presented in different formats throughout the manuscript (e.g., "1st January" vs. "1 January 1998"). I suggest to use one consistent date format throughout the manuscript, including tables.

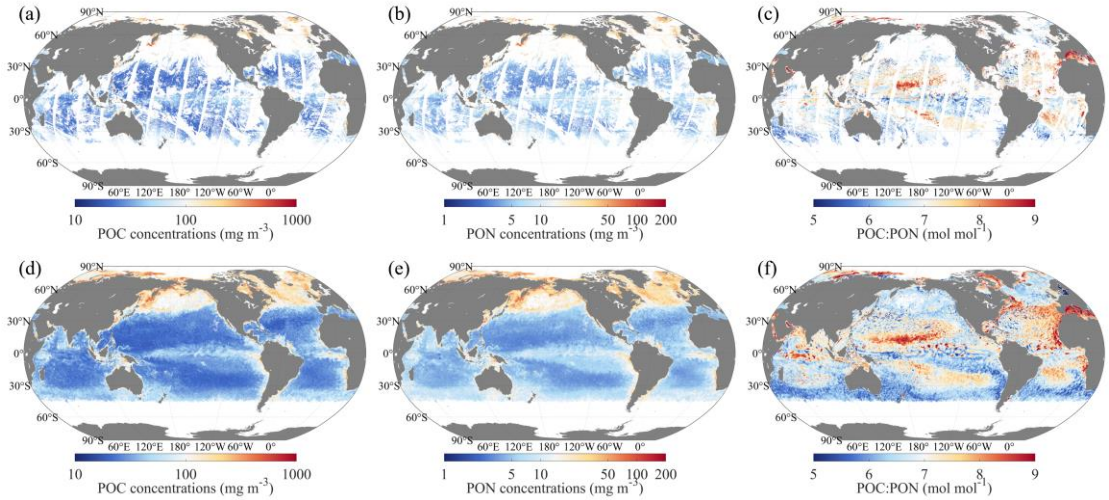
Response: Thank you for this suggestion. We have standardised dates throughout the manuscript, including in the tables, using the day–month–year format without ordinal suffixes. Examples include "1 July 2020" (lines 410–411 and 413) and "1 January 1998 to 31 December 2023" (line 117).

4. Figures in general are relatively small. Increasing the size of Figures 1, 5, 6, 8, and 10 would improve readability.

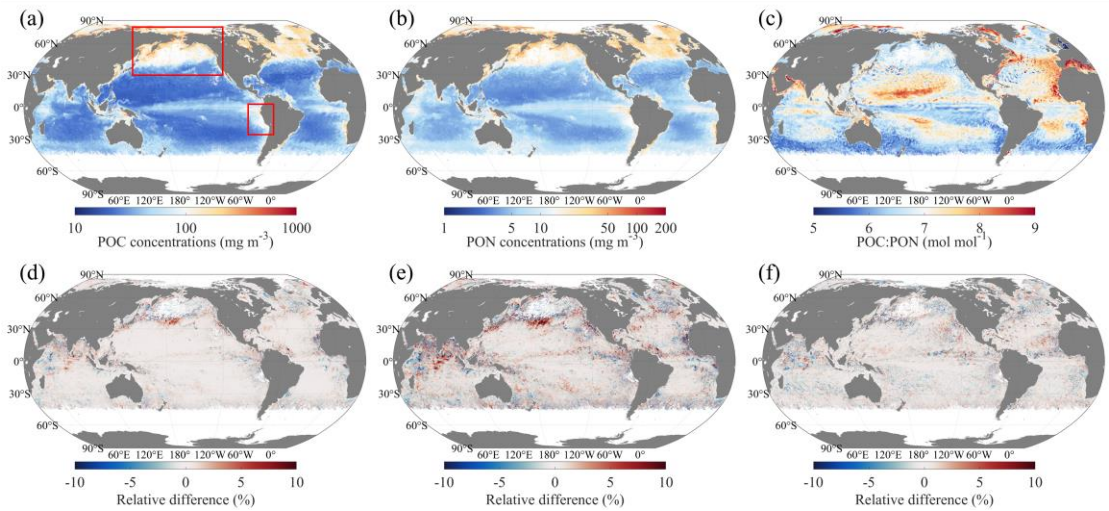
Response: Thank you for this suggestion. We enlarged Figs. 1, 5, 6, and 8 and increased the font size in Fig. 1 to improve readability. The figure numbered Fig. 10 in the original submission was removed as part of the revision of Sect. 4.1. We also reviewed the size of all figures in the revised manuscript and enlarged them wherever the page layout allowed.



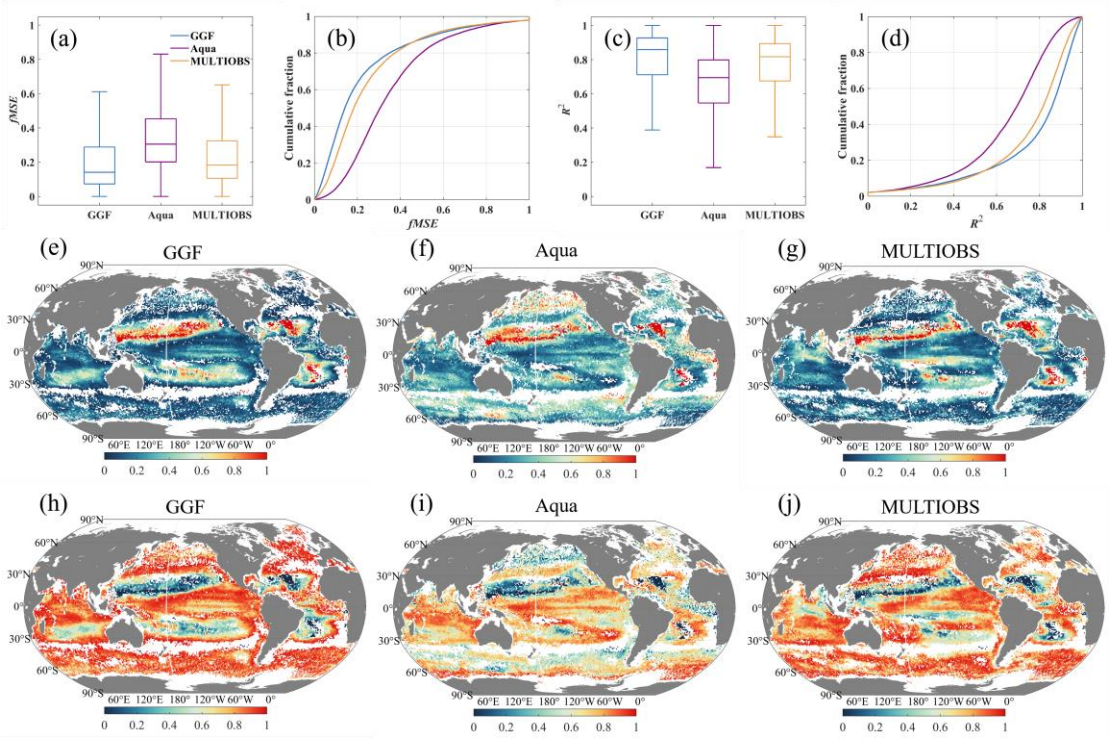
"Figure 1. Workflow for generating GDR-POM, a global daily dataset of POC, PON, and POC:PON at 4 km resolution for 1998–2023." (lines 125 to 127)



“Figure 5. Global oceanic distributions of POC concentration (a, d), PON concentration (b, e), and POC:PON ratios (c, f) on 1 July 2020. Panels (a–c) show the satellite-retrieved fields, while panels (d–f) show the reconstructed fields.” (lines 409 to 411)



“Figure 6. Monthly mean spatial distributions of reconstructed POC, PON, and POC:PON (a-c) and the corresponding relative differences between reconstructed and satellite-derived fields (d-f) for July 2020. Red rectangles in panel (a) outline areas where data gaps persisted after reconstruction.” (lines 423 to 425)



"Figure 8. TCA results for GDR, MODIS-Aqua, and MULTIOBS monthly POC products. (a)-(b) show global oceanic statistics of fMSE, and (c)-(d) show those of R^2; (e)-(g) illustrate the spatial distribution of fMSE, and (h)-(j) present the spatial distribution of R^2 for GDR, MODIS-Aqua, and MULTIOBS, respectively." **(lines 483 to 486)**

5. Throughout the manuscript, a space is missing between numerical values and the percentage unit (e.g., "5%" should be written as "5 %" according to journal style). Please check all occurrences (e.g., lines 170, 213, 261, 264, 265, 271, 272, 317, 326, 327, 330, 333, 345, 367, 369–371, 386, 388, 398–399, 447, 482–483).

Response: Thank you for this suggestion. We have inserted a space between numerical values and the percent sign throughout the manuscript, including in the newly revised text. Examples include "26.75 %" (line 337) and "For POC, URD ranged from -41.58 % to 58.55 %, with a spatial mean ± standard deviation of 0.10 % ± 1.55 %. PON exhibited a wider range of -70.45 % to 124.97 % and greater spatial variability, with -0.24 % ± 2.82 %. The derived POC:PON ratio exhibited the narrowest URD range, from -41.60 % to 40.78 %, with a spatial mean ± standard deviation of -0.003 % ± 1.89 %." (lines 428 to 431).

6. Throughout the manuscript, a space could be placed between ± and the numerical value for readability (e.g., "±5" -> "± 5"). Please check all occurrences (e.g., lines 146, 150, 200, 369–371, 452–456).

Response: Thank you for this suggestion. We have inserted a space between the ± sign and the following numerical value throughout the manuscript. Examples include "± 1-day" (line 154) and "a spatial mean ± standard deviation of 0.10 % ± 1.55 %" (line 429).

7. In Table 1, chlorophyll a is written as "Chl-a", whereas the abbreviation is written differently in the main text (Chla) (lines 278–282, 304). I suggest a consistent notation throughout the manuscript.

Response: Thank you for this suggestion. We standardised the abbreviation for chlorophyll *a* as "Chla" throughout the revised manuscript, including in Table 1. Examples in the main text can be found at lines 92, 175, and 354.

8. Table 3: The table title appears to be missing "and" between POC and PON.

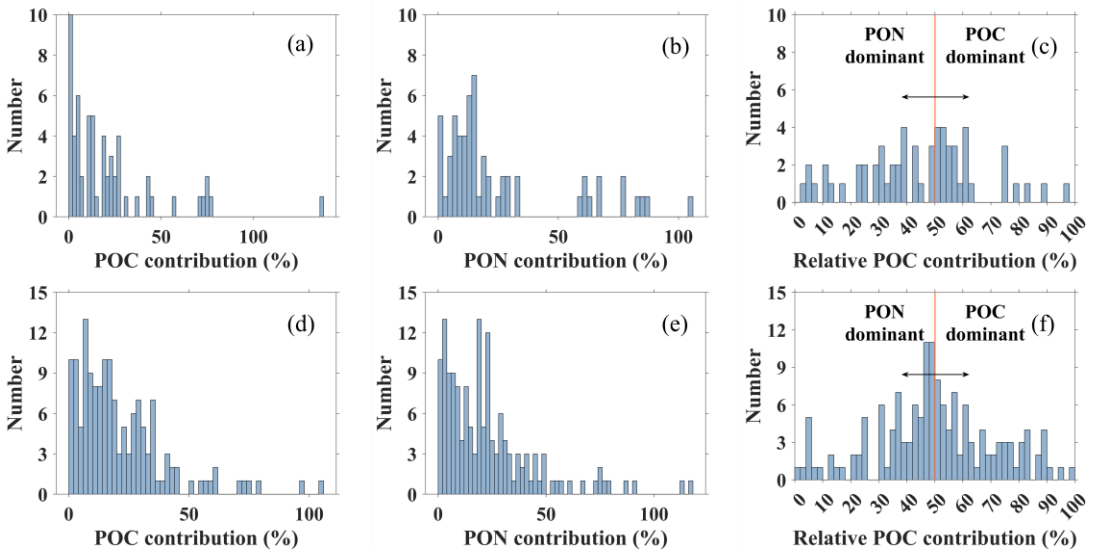
Response: Thank you for this suggestion. We have revised the caption to read "Table 3. Pearson correlations of the predictors with POC and PON concentrations." (line 383)

9. Line 409: Replace "were showed" with "were shown".

Response: Thank you for this suggestion. We have replaced "were showed" with "are shown" (line 466).

10. Figure 11: Some symbols/marks in panel 11d appear to be unintended artifacts and should be removed.

Response: Thank you for pointing this out. We removed the unintended marks from panel (d). We also corrected an operator-precedence error in the MATLAB code used to generate Fig. 11. MATLAB evaluated x.^1/2 as (x.^1)/2, so the code divided x by two instead of taking its square root. The revised Fig. 11 is shown as follows.



"Figure 11. Propagated uncertainty in POC:PON attributable to POC alone (a, d) or PON alone (b, e), and the relative contribution of POC uncertainty to POC:PON uncertainty (c, f). The top row shows retrievals (a–c), and the bottom row shows reconstructions (d–f). The vertical line at 50 % in panels (c) and (f) indicates equal contributions from POC and PON. Values below and above this line indicate PON and POC dominance, respectively." (lines 600 to 604).