

30 June 2025

Dear Editor,

Journal of Biogeosciences

5 We hereby resubmit the revised manuscript entitled "Estimation of Particulate Organic Carbon Export to the Ocean from Lateral Degradations of Tropical Peatland Coasts" for further consideration in the Journal of Biogeosciences.

10 We sincerely appreciate your thoughtful review and the valuable feedback provided by the reviewers. We are grateful for the opportunity to revise our manuscript and for the constructive suggestions that have helped us improve the clarity and quality of our work.

15 We have thoroughly addressed each of the reviewers' comments, and a point-by-point response is included in the accompanying file. In this revision, we focused primarily on improving the Introduction and Discussion sections to enhance the logical flow and clarity of our arguments. We also adjusted the overall structure of the manuscript to better align the narrative with the study objectives and key findings. These revisions aim to present the significance of our work more clearly and ensure that the manuscript meets the expectations of the journal and its readership.

20 We sincerely appreciate your time and effort, as well as those of the reviewers, in evaluating our work. We hope that the revised manuscript meets the expectations of the journal, and we look forward to your decision.

We remain open to further suggestions from the reviewers to improve the manuscript, should additional revisions be required.

Best regards,

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30 My point-by-point responses are as follows:

Associate editor decision: Reconsider after major revisions

35 The revised manuscript has been reassessed by the reviewers. In light of their reports, I cannot accept the manuscript for publication in its current form. The manuscript is lengthy and difficult to read, and some discussion about biogeochemical implications of organic carbon export is needed. I invite you to resubmit a revised manuscript, given some major revisions, that will be sent back to review. Please provide a point-by-point response to the reviewers, and seriously address the raised concerns, in particular:

- 40 - The manuscript should be shorter: in line with recommendations from both reviewers, to improve readability, please cut at least one third of the introduction, and move some of the rest of the text and figures to the supplement, particularly, but not only, about the geomorphic and remote sensing methodology.
- Improve the discussion section by adding more text and references on the biogeochemical implications of the newly documented organic carbon export and its potential feedback.

45 **Response1.**

We sincerely appreciate the reviewer's thoughtful comments and the time dedicated to evaluating our manuscript. Based on our understanding of the feedback, we recognized the need for improvements in three major aspects:

50 First, regarding the Introduction, the reviewer rightly pointed out that it was too lengthy. In the previous version of the manuscript, the Introduction alone consisted of 2,713 words. To address this, we reduced the Introduction to 917 words in the revised version. Additionally, we created Appendix A to relocate supplementary background content that was informative but not essential to the main narrative.

55 Second, concerning the overall structure of the manuscript, we acknowledged that the previous version may have inadvertently given the impression that the focus was primarily on geomorphological and remote sensing techniques. To clarify the main research focus, we moved the methodological details and results related to geomorphological and remote sensing analyses to Appendices B through H. We also revised the Abstract to better reflect the true emphasis and findings of the study.

60 Third, we improved the Discussion section, particularly the part addressing the biogeochemical implications of particulate organic carbon (POC) export and its potential feedback mechanisms. We extended the comparative analysis by including POC fluxes associated with gully erosion in boreal peatlands, in addition to those from tropical humid regions. Furthermore, we cited findings from a recent study published on 10 June 2025, which provided insight into the fate of peat exported from our study area to the marine environment. This new reference supports and strengthens the broader significance of our findings.

We hope these revisions adequately address the reviewer's concerns and improve the clarity, structure, and scientific contribution of the manuscript.

RC1 Suggestions for revision:

65 **RC1-Suggestion1.** I do not think the Introduction has been well organized. In the revised manuscript, the authors added many texts to introduce cases of coastal erosion affecting peatlands in Siberia, Canada, Alaska, and the Baltic Sea coast of northern Germany. They also reviewed peatland degradation processes, peat landslides commonly studied in boreal peatlands, and a collapse example from Florida. However, these texts are lengthy and boring. The authors simply listed the existing relevant studies without summarizing them. Moreover, I do not think it is good to involve three figures in
70 the Introduction. To my experience, a good Introduction should be concise and logically structured. In the introduction, the authors should describe why the topic of their study is important, review the current state of the research on this topic, point out the knowledge gap or limitation in this study area, and finally briefly describe what they have done to address existing knowledge gap and limitations. Response1.

RC1-Response1.

75 We sincerely thank the reviewer for their valuable comments and for taking the time to evaluate our manuscript. We especially appreciate the suggestion to improve the Introduction, which we now recognize required substantial revision.

Upon re-evaluating our manuscript, we found that the previous version of the Introduction listed related studies without adequately synthesizing them into a coherent narrative. In response, we thoroughly revised and reorganized the Introduction to enhance clarity and focus.

80 In the previous version of the manuscript, the Introduction alone contained 2,713 words. In the revised version, we reduced it to 917 words. To accommodate informative but non-essential content, we created Appendix A, which provides a concise review of global peatland degradation case studies.

We also addressed the issue of excessive figures in the Introduction. Specifically, we moved the global peatland distribution map and illustrations of degradation cases to Appendix A. However, we retained two essential conceptual
85 figures—now renumbered—in the main text, as they help convey the core ideas of our study to readers.

Furthermore, we improved the structure of the Introduction. In the earlier version, we simply presented a series of examples of coastal erosion and peatland failures in various regions, which contributed to excessive length and lack of cohesion. In the current revision, we rewrote the literature review to more clearly emphasize the knowledge gap and the contrast with our study site.

90 To further highlight the novelty of our study and its distinction from previous research, we also added Table 1, which presents a comparative summary of POC export across different climatic zones. This new table supports our key claim that lateral POC export from tropical peatlands has been underrecognized and under quantified in past literature.

We hope these revisions sufficiently address the reviewer's concerns and improve the clarity and quality of our manuscript.

95 **RC1-Suggestion2.** There are 25 figures and 5 tables in this manuscript. I would suggest to keep the core figures and tables in the main text yet move some supporting Figures to the appendix. For example, the Fig. 1.

RC1-Response2.

100 Thank you very much for your constructive comment. We understand that your concern was that the manuscript might give the impression that the core focus lies in the geomorphological and remote sensing methods, rather than on the actual coastal erosion, peatland failures, and the estimation of particulate organic carbon (POC) export.

105 To address this concern, we revised the manuscript to emphasize the key objective—quantifying the impacts of coastal erosion and peat mass movement (PMM) events on POC export. Specifically, we have moved the content related to geomorphological and remote sensing methods—including Figures 7, 8, 9, and 13 from the first revised manuscript—to the appendices (Appendices B–E). The corresponding sections in the main text—Sections 3.2.1, 3.2.2, 3.2.3, 3.2.5, 3.2.6, and parts of Sections 4.1 and 4.2—have also been relocated to the appendices and revised accordingly in the main text.

This restructuring ensures that the manuscript maintains a clear focus on the main findings, while still providing methodological transparency in the supplementary materials.

110 **RC1-Suggestion3.** I still find some typo and incorrect text formats in the manuscript. I would suggest the authors double-check the whole manuscript to correct all types. e.g. line 108: **Sterr, 2008** is in bold; line 690: **the point between height.at** should be a space.

RC1-Response3.

Thank you very much for pointing this out. Upon careful review, we confirmed that there were indeed some typographical errors in the previous version, as you noted. We have corrected these errors in the revised manuscript.

115 In addition, we identified that legends were missing from Figures 1 and 14 in the first revised version. We have now added appropriate legends to both figures to improve clarity and ensure consistency.

Moreover, we found that the place name “Selatbaru” was incorrectly written. The correct spelling is Selat Baru (two separate words), and we have revised both the figures and the main text accordingly.

RC2 Suggestions for revision:

120 The overall length remains excessive, and the manuscript is still challenging to follow due to structural and thematic imbalance.

As previously noted, the title, abstract, introduction, and conclusion frame the study around organic carbon fluxes associated with peatland degradation, particularly in the context of coastal erosion and peat mass movement events (PMMs). While this framing is appropriate and compelling, the core sections of the manuscript — particularly the Methods, Results,

and Discussion — remain disproportionately focused on geomorphic analysis and technical methodology, with relatively limited engagement in the biogeochemical implications of carbon flux and feedback.

The Discussion section lacks depth in interpreting the carbon-related findings. It remains largely descriptive and does not sufficiently explore the implications of particulate organic carbon (POC) export for regional or global carbon budgets, nor does it address the fate of exported carbon in marine systems — both of which are key to supporting the stated objectives of the study.

130 **RC2-Suggestion1. Coastal erosion and geomorphic processes [focusing on remote sensing methods];**

RC2-Response 1.

Thank you very much for your insightful comment. In response, we have revised the manuscript to ensure that the focus of the study is clearly interpreted as the investigation of coastal erosion and peatland failure processes, rather than as a remote sensing-centered study.

135 As you correctly pointed out in other comments, the description of remote sensing procedures used during the research process may have inadvertently led to confusion among readers. To address this, we have relocated the more general remote sensing methodological content to the appendices.

The revised manuscript now places greater emphasis on remote sensing methods specifically used for quantifying coastal erosion, peat mass movements, and POC export, aligning more closely with the core objectives of the study.

140 **RC2-Suggestion2. Carbon flux and biogeochemical feedback [focusing on fluxes and potential feedback].**

RC2-Response 2.

Thank you for your valuable comment. We understand that the concern relates to the lack of depth in the discussion of the biogeochemical implications of the estimated POC flux presented in Section 4.6 (Results and Discussion).

145 In response, we have revised the section to improve the scientific depth of the discussion. We emphasized a comparative perspective by referencing the POC fluxes associated with gully erosion in boreal peatlands, which are known to be substantial. These values are now included in Table 1 in the Introduction, and we have added comparative discussion in Section 4.6 to contextualize the magnitude of our findings.

Additionally, we have incorporated recently published studies that describe the fate of peat exported from our study region, allowing us to discuss the potential transformation and long-term storage of POC in marine systems.

150 To ensure transparency, we also added a discussion of the limitations of this study and highlighted areas where further investigation is needed. Finally, we have explicitly stated the biogeochemical significance of our findings at the end of Section 4.6, summarizing their relevance in the context of lateral carbon export from tropical peatlands.

Major comments

155 **RC2-Suggestion1. Introduction:** This section has been extended from 6 paragraphs to 15 paragraphs; I appreciate
authors' effort demonstrating a strong command of the literature and addresses a novel and timely topic—lateral
carbon export from tropical peatlands due to coastal erosion and peat mass movements (PMMs). However, it is overly
long and reads more like a review article than a focused opening to a research paper. The structure lacks a clear
narrative flow, with the main research problem and objective introduced too late. Numerous detailed global case studies,
while informative, are not well-integrated into the tropical context and could be more effectively summarized. To
160 improve clarity and impact, the introduction should be significantly shortened, the research gap and objectives stated
earlier, and the content reorganized to highlight the study's relevance in a more concise, reader-friendly manner. I
break your introduction into 6 sections: paragraph 1-2; 3 and 11-12; 4-6 and 9-10; 7-8; 13-14; 15. I provide my
comments for these sections as below:

RC2-Response 1.

165 Thank you very much for your constructive evaluation of our work. We also sincerely appreciate your detailed comments and
suggestions regarding specific aspects of the manuscript. Below, we provide point-by-point responses to each of your
comments, along with a description of the corresponding revisions made to the manuscript.

RC2-Suggestion2. Paragraphs 2: Authors are focusing on tropical peatlands, especially coastal types, their formation,
and distribution in Southeast Asia. However, it has a sudden switch from formation history to carbon loss due to fire
and drainage without a transition. What is the reason blending these two points in one paragraph.
170

RC2-Response 2.

Thank you very much for your valuable comment. We acknowledge your observation regarding the abrupt transition in the
Introduction section. To address this, we have added a bridging sentence to clarify the shift in focus. Specifically, we inserted
a sentence stating that peatlands, which have historically functioned as carbon sinks, are now increasingly becoming carbon
175 sources. This revision was made to ensure a smoother and more logical flow between the topics and to avoid sudden changes
in the narrative.

RC2-Suggestion3. Paragraphs 3 and 11-12: I These paragraphs introduce key physical degradation processes—coastal
erosion and peat mass movement events (PMMs)—and articulate the study's research gap and objective. Paragraphs
11 and 12 emphasize the scarcity of tropical PMM research. Paragraphs 14 and 15 highlight the implications for carbon
export and present the study aim. Can authors focus on introducing PMMs and erosion, and emphasizing the research
gap with concluding the study's objective?
180

RC2-Response 3.

Thank you very much for your insightful suggestion to strengthen the content of our manuscript. We understand that the
content of Suggestion 4 addresses a similar concern, and we have therefore responded to both points together under Response
185 4. Please kindly refer to Response 4 for our detailed explanation and corresponding revisions.

190 **RC2-Suggestion4. Paragraphs 4-6 and 9-10: It is valuable for establishing a precedent and broader relevance. However, the level of detail is disproportionate relative to the study's tropical focus. I would recommend authors condense these paragraphs into a single, comparative overview, and focus on drawing contrasts relevant to tropical PMMs and erosion. I would also suggest authors make sure each example is explicitly linked to the central theme-the poorly constrained role of lateral degradation in tropical systems.**

RC2-Response 4.

Thank you very much for your valuable comment regarding the need to better emphasize the novelty and significance of our study. We recognize that this is one of the most important aspects to improve in our manuscript.

195 In response, and considering other related comments, we have revised the Introduction to better highlight the research gap. Specifically, we now introduce related studies in Appendix A rather than listing them extensively in the main text.

Additionally, we rewrote key paragraphs to emphasize the contrast between boreal peatlands and tropical peatlands affected by coastal erosion and peat mass movements (PMMs). To clearly illustrate this contrast, we added Table 1, which provides a comparative summary of peat carbon export quantities and their primary drivers in both boreal and tropical contexts.

200 This revision helps to highlight the fact that carbon fluxes from tropical peatlands have been traditionally considered to be dominated by dissolved organic carbon (DOC), whereas the lateral export of particulate organic carbon (POC) to the ocean via coastal erosion and PMMs remains poorly quantified and underrecognized. We believe this improved framing now more clearly presents the novelty and broader importance of our study.

205 **RC2-Suggestion5. Paragraphs 7-8: I would recommend integrate only those aspects of coastal wetland vulnerability that directly relate to peatland systems or carbon loss via erosion. Please remove or significantly truncate the Amazon research review unless framed as an example of regional under representation in peatland degradation studies.**

RC2-Response 5.

210 Thank you for your helpful comment. We, the authors, have also come to recognize that the Introduction was overly long, and we appreciate your guidance in identifying unnecessary sections. As you rightly pointed out, the review of Amazon-related studies was not essential to the core focus of our manuscript. Accordingly, we have removed the Amazon-related content from the Introduction in the revised version.

RC2-Suggestion6. Paragraph 13-14: I would suggest authors to reframe the discussion to just emphasize the hypothesis that tropical peat erosion and PMMs represent a potentially significant and under-quantified pathway of terrestrial carbon export to the ocean.

RC2-Response6.

215 Thank you very much for your helpful suggestions. In the revised manuscript, we have modified the beginning of the Introduction to clearly present the central focus and significance of our study, aiming to engage readers from the outset. We

explicitly state that particulate organic carbon (POC) export to the ocean via lateral degradation of tropical peatlands remains poorly quantified, highlighting the research gap this study seeks to address.

220 As you suggested, we have also revised the third paragraph of the Introduction to more clearly emphasize the hypothesis that coastal erosion and peat mass movements (PMMs) in tropical peatlands represent a potentially important yet under-quantified pathway for land-to-ocean carbon fluxes. To support this point, we have added Table 1, which compares well-established carbon transport drivers and their magnitudes between boreal and tropical peatlands based on previous literature.

225 This table helps clarify the positioning and novelty of our study by providing a comparative context. In addition, to make our hypothesis more explicit, we have clearly stated it in the revised manuscript at lines 49–59 of the Introduction section.

Detailed comments

RC2-Suggestion7. Line 77: I recommend rephrase, authors can describe the global distribution of peatlands and then just refer to Fig.1. For example: (see Fig. 1).

RC2-Response7.

230 Thank you very much for your helpful comment. As you rightly pointed out, we now recognize that including detailed numerical values in the main text may have inadvertently made the explanation more difficult to follow and obscured the key message.

235 To improve clarity, we have revised the manuscript so that the main text refers only to the relevant figure without listing detailed values. Additional explanation and context have been moved to Appendix A to support the reader's understanding without disrupting the flow of the main discussion.

RC2-Suggestion8. Line 80-84: The global area statistics can be simplified, by the way, can you provide a comparison with an area general reader know the size, so it will be more intuitive to understand the large numbers. I see you are introducing the fraction to Earth's total land, I think it is not necessary to introduce Earth's land area, besides, you are using a different unit. I would also recommend authors to rephrase this section, it repeated a lot of information that is already provided in the previous sentence.

240

RC2-Response8.

Thank you very much for your helpful comment. Taking your suggestion into account, along with other related comments, we have decided to relocate the relevant content to Appendix A. In addition, we have revised the presentation of the numerical values to make them more visually clear and easier to interpret for readers.

245 **RC2-Suggestion9. Line 85-86: Rephrase is recommended for clearly introducing the two classifications.**

RC2-Response9.

Thank you very much for your comment. Although the wording in the first revised manuscript was based on terminology commonly used in the literature, we recognize that it may have been overly detailed and potentially difficult to follow.

250 To improve clarity and readability, we have simplified the expression. In the first revised manuscript (L41 onward), we wrote: “Tropical peatlands are classified into inland peatlands, which typically form in poorly drained inland areas, and coastal peatlands, which develop in marine clays or mangrove sediments within approximately 80 km of the coast.” In the revised manuscript, we now use the more concise version: “Tropical peatlands, primarily located in Southeast Asia, are categorized into inland and coastal types.” This change breaks the sentence into clearer parts and improves readability for a broader audience.

255 **RC2-Suggestion10. Line 89: (kyBP) is not the right unit here.**

RC2-Response10.

Thank you for your comment. In revising the Introduction, we carefully considered your suggestion and determined that the referenced content was not essential to the overall narrative. Accordingly, we have removed the section from the revised manuscript.

260 **RC2-Suggestion11. Figures: Figure 1: Caption did not explain the squares in different color and labels, and these labelled panels seem not be introduced in the Introduction section. Please add details.**

RC2-Response11.

265 Thank you for your previous comments. In response, we have relocated Figure 1 to Appendix A, where it is now presented as Figure A1. To improve clarity, we have also created a new legend using color-coded and labeled rectangles, and provided an accompanying explanation within Appendix A. We hope this revision improves the figure's readability and supports the overall understanding of the content.

Comments by Polina Shvedko

Notification to the authors:

270 **1. Regarding figure 1(a-c): for the next revision, please check if your figures containing photos require a copyright statement/image credit and add it to the figures (or captions)**

(https://publications.copernicus.org/for_authors/manuscript_preparation.html#figurestables -> Reproduction and

reuse of figures and tables). If these photos were entirely created by the authors, there is no need to add a copyright statement or credit. In that case it is important that you confirm this explicitly by email.

275 2. With the next file upload request, please rename the appendix figure from "Figure B" to "Figure B1".

Response.

1. Figures 1(a–c) consist of photographs taken by the authors during fieldwork.

280 2. Thank you very much for your helpful suggestion. As you indicated, we have made the correction accordingly. In addition, reflecting other referee comments, we have revised the figure1 as Figure G1 in the current version of the manuscript.