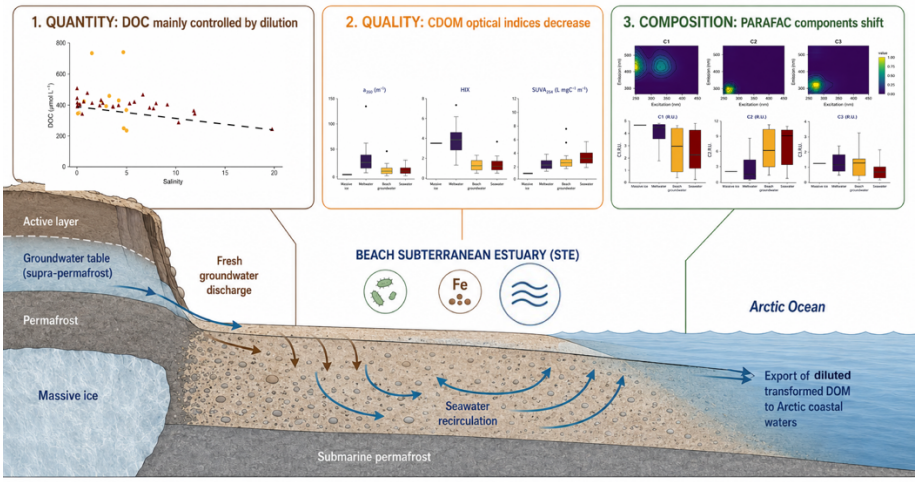
We sincerely thank the Associate Editor, Gabriel Singer, for the careful evaluation of our revised manuscript and for the constructive suggestions that have helped improve its clarity and scientific rigour. The process was long and difficult, but it greatly improved the paper's strength.

We have addressed all of the remaining comments. Specifically, we revised the text to improve clarity and readability by shortening or reformulating several sentences, providing additional details on the interpretation of the mixing relationships, and incorporating all of the requested editorial changes. We also revised Figures 4, 5, 6, and 7 to harmonize axis titles, notation, and units throughout the manuscript, and Figure 5 was redesigned to improve readability by removing the overlap between the inset graphs and the axis labels.

In addition, we took this opportunity to further revise the Acknowledgements to respectfully recognize that this research was conducted in the Inuvialuit Settlement Region and to acknowledge the invaluable support of the Tuktoyaktuk community. This revision reflects our commitment to conducting research that respects Indigenous rights and contributes to more equitable and inclusive scientific practices in partnership with Indigenous Peoples in Canada. We also included a brief description of the children's storybook developed as part of our knowledge mobilization efforts to share the project's findings with younger members of the community.

Finally, in response to the journal's new submission requirements, we prepared a graphical key figure summarizing the main conceptual findings of the study. The conceptual background illustration was initially generated using an artificial intelligence image-generation tool and then substantially modified, corrected, and refined by the authors. The placement of the scientific results, all annotations, the interpretation of the processes, and the final graphical design are entirely our work.




We appreciate the time and effort invested by you and the reviewers throughout this review process. We hope that the revised version is now suitable for publication in *Biogeosciences*.

Detailed comments:

Thank you for this revised version of your manuscript, which I am happy to recommend for publication. Find below a few last technical corrections (my line numbers refer to the tracked changes version):

24-28: Here, "associated with a relative decrease in humic-like and HMW fractions" is a syntax-wise weird appendix to an already fairly long sentence. It is also an repetition. I suggest deletion.

DONE

30: I suggest to replace "highlight the role of" by "suggest". Please tone down as your results may suggest but cannot prove any transformation processes.

DONE

57-62: Sentence feels too long, break into two.

DONE

Now 53-58 :" At the ocean-basin scale, newly mobilized organic matter from Arctic watersheds may enhance emissions of carbon dioxide and other greenhouse gases (Vonk et al., 2015; Kaiser et al., 2017; Tanski et al., 2019; Lapham et al., 2020; Vonk et al., 2025). It may also modify the productivity of primary producers (Thingstad et al., 2008; McMeans et al., 2015; Nguyen et al., 2022), with potential consequences for the Arctic marine food web and the communities that depend on these resources."

71-74: Suggest to include "riverine" or "river-associated" or something similar at an appropriate place to make the contrast clear.

DONE

Now 73-74 : "Therefore, only a small fraction of riverine~~terrestrially~~-derived compounds potentially persists in the ocean over centuries and millennia (Fichot & Benner 2014; Kaiser et al. 2017a)."

84-85: Why paragraph break?

There is no break in the non-tracking-change version.

122: "monitor" suggests repeated measurements over longer time, which was not the case. Suggest to replace by "measure" or similar.

DONE, "monitor" has been changed to "measure".

281-283: Sentence feels weird, maybe because of a tautology between "flow path" and "pathways". Reformulate.

DONE, the sentence has been reformulated as follows:

Line 261-262 :" However, recent studies and conceptual models, mostly developed for lower-latitude regions, suggest that the transport of water and permafrost-derived solutes to the coastal zone is governed by three main hydrological pathways (Walvoord & Kurylyk, 2016): [...]"

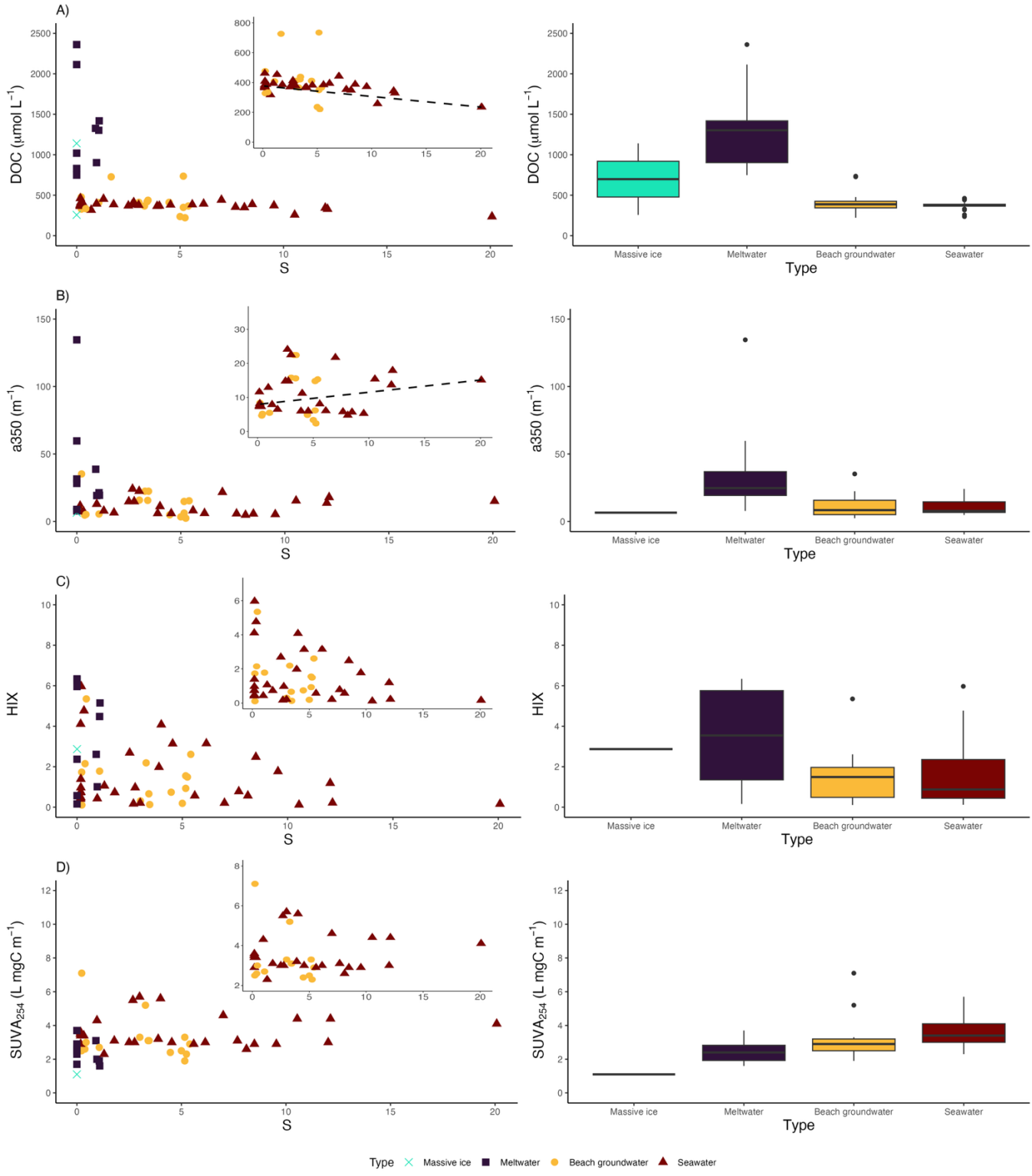
355: Suggest you detail this "deviation from theoretical mixing" and "did not follow simple dilution" with a bit more in-depth information, especially as the next sentence already limits the validity of this finding.

OK, this has been done as follows:

Line 316-339 :" The DOC concentrations dropped from 2,360 µmol $L^{-1}$ in meltwater samples to 236 µmol $L^{-1}$ in the saltiest seawater sample (S = 20; Fig. 5A), with concentrations declining sharply along the supra-permafrost flow path, reaching values below 400 µmol $L^{-1}$ in beach groundwater samples. These differences among sample types were statistically significant (Kruskal-Wallis, $p < 0.001$). Within the beach groundwater–seawater subset, DOC concentrations showed a nearly linear decrease with increasing salinity and clustered closely around the theoretical mixing line connecting the freshest and saltiest endmembers, with only limited scatter around the predicted conservative trend. This mixing line, based on the most enriched and depleted stable isotope signatures in the subset comprising beach groundwater and seawater samples, corresponds to salinity values of 20.08 (N = 1 seawater sample) and 0.18–0.30 (N = 8 beach groundwater samples), respectively. These observations indicate that conservative mixing and dilution become the dominant controls on bulk DOC concentrations once supra-permafrost groundwater enters the beach STE and mixes with recirculating seawater. This interpretation is consistent with the relatively small volumetric contribution of fresh supra-permafrost groundwater compared with recirculating seawater along Arctic coastlines (Section 3.2). Dilution of the high-concentration, low-volume freshwater endmember therefore contributes substantially to the observed decline in bulk DOC concentrations. Absorption coefficients at 350 nm (a350) ranged from 2.0 to a maximum of 134.0 $m^{-1}$, the latter observed in a meltwater sample (Fig. 5B). As with DOC concentrations, the a350 values declined sharply along the flow path, with a median value of 24.0 $m^{-1}$ in meltwater samples and median values of 8.4 and 7.8 $m^{-1}$ in beach groundwater and seawater, respectively. However, unlike DOC, a350 values in beach groundwaters and seawater show substantial scatter around the theoretical mixing line rather than following a simple conservative dilution trend. At comparable salinities, samples exhibited a broad range of a350 values, with deviations occurring on both sides of the predicted mixing relationship. The variability of the endmembers, particularly in beach groundwaters, limits the robustness of a single mixing model and likely contributes to the observed dispersion, pointing to processes in addition to dilution. This interpretation is further supported by the decoupling between DOC and a350 (Fig. 6), as discussed below.[...]"

Fig 5: I am sorry, but I really find it quite unacceptable that insert graphs cover axis labels. This seems to be easy to repair. Alternatively just delete the axis labels anyway for panels A, B, C as these are shared with axis labels of panel D.

In fact, we did have to adjust the scale of Panel D so that we could insert the zoom without covering the axis of Panel C or the points on Panel D. We adjusted the resolution of the figure and reduced the zoom slightly. We took this opportunity to improve details in other figures, notably by adding units in parentheses and subscripts.


A)
DOC (µmol L$^{-1}$)
S
Type
Massive ice
Meltwater
Beach groundwater
Seawater
B)
a350 (m$^{-1}$)
C)
HIX
D)
SUVA$_{254}$ (L mgC m$^{-1}$)
Type Massive ice Meltwater Beach groundwater Seawater