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Dear Editor,

Please find enclosed an electronic version of our manuscript entitled “Fate of dissolved organic matter along the supra-permafrost flow: role of Arctic subterranean estuaries” by Aude Flamand, Jean-François Lapierre and Gwénaëlle Chaillou. The updated paper contains 9 figures and 2 tables. We are grateful to the reviewers for their constructive and insightful comments, which greatly contributed to improving the quality and clarity of our work. We believe we have addressed all concerns raised by both referees.

This revised version incorporates more robust interpretations of our data and additional assurances where needed. We have streamlined the text by removing redundancies and enhancing clarity, resulting in an approximately 5% reduction in overall length. The manuscript has also undergone a thorough revision for English language, improving both readability and precision. In particular, we have addressed the following major points raised by the referees, as detailed below:

1) *Clarification of the paper’s objectives:* We have revised the title to better reflect the scope of the study and explicitly incorporated the concept and terminology of “supra-permafrost” throughout the manuscript to frame our theoretical hydrogeological model. The discussion section has been reorganized to more effectively prioritize our results and reinforce the scientific contributions of the study. In particular, we have strengthened the focus on the diffuse, non-point source nature of supra-permafrost groundwater flow and the fate of its associated DOM as it transits to nearshore coastal waters. To support our conceptual framework, we have incorporated new references on Arctic coastal hydrology. We believe that this revised version now offers a clearer and more cohesive narrative that directly addresses the key questions raised by our study.

2) *Addition of particulate data:* As suggested by the reviewers, we have incorporated complementary data on the particulate phase, including total organic carbon (TOC) content and reactive sedimentary iron, extracted using the citrate-dithionite-bicarbonate (CDB) reduction method. These data are now presented in a newly added Table 2. In addition, we have more explicitly reported total dissolved iron concentrations and DOC:Fe ratios to further support our interpretation of iron–organic matter interactions in the system.

3) *Clarifications of STE* functions: We have added a dedicated section in the Introduction to define Subterranean Estuaries (STEs) and to clarify their biogeochemical functions, particularly their role in modulating the export of dissolved organic matter (DOM) to the coastal ocean. This section incorporates theoretical hydrogeochemical models developed primarily from low-latitude studies, alongside recent references published in the past few months. To support our interpretations and frame the Arctic-specific context of our work, we also introduced a new conceptual figure (Figure 2), which illustrates the water origins and flow paths occurring within Arctic STEs.

4) *Revision of Figures and Captions:* Most of the figures have been revised in accordance with the reviewers' suggestions. Colour schemes were updated to be accessible to color-blind readers, and new zoom-in panels were added to enhance data visualization. Additionally, the graphical abstract has been removed.

Given the substantial revisions made to the English and sentence structure, the "Author's track-changes" file highlights only the most significant modifications. Minor editorial corrections recommended by the referees have been incorporated but are not marked. These revisions, along with the specific comments raised by the reviewers, have been thoroughly addressed in our previously submitted point-by-point response. We hope that the manuscript now meets the standards for publication in Biogeosciences. The data and interpretations presented are original and have not been published or submitted elsewhere. All data supporting this study are available in the PANGAEA repository at the following link: https://doi.pangaea.de/10.1594/PANGAEA.960986.

Sincerely Yours

G. CHAILLOU