We are grateful to you for the time you invested in providing detailed and helpful feedback. Your comments have been invaluable in refining and strengthening our manuscript.

As a general clarification, we updated the station names for Nuup Kangerlua from GF6, GF7, etc., which referenced the Danish name Godthåbsfjord, to NK6, NK7, etc., to more clearly reflect their association with Nuup Kangerlua and enhance consistency throughout the manuscript.

We therefore added:

Line 137: It is important to note that earlier studies (e.g., Mortensen et al., 2011, 2014, 2018; Meire et al., 2015, 2017; Stuart-Lee et al., 2021, 2023) referred to the same stations in Nuup Kangerlua using the prefix "GF", derived from the Danish name *Godthåbsfjord*. In this study, we use the prefix "NK" instead, to reflect the Greenlandic name *Nuup Kangerlua*.

To avoid confusion, we updated this naming (NK) in your comments as well. We also numbered your questions and highlighted them in bold to clearly structure our responses.

Introduction

(1) Line 27 states that fjords OC burial contributes to around 10% of blue carbon burial. The work of Smith et al. (2015) states that fjord OC accumulation is equivalent to 10% of carbon buried in other marine sedimentary systems which does not include blue carbon environments (saltmarsh, seagrass and mangroves).

Thank you for the clarification. You are correct, Smith et al. (2015) compares fjord carbon burial to other marine sedimentary systems, not blue carbon environments. We have accordingly replaced "blue carbon" with "carbon" to reflect this more accurately.

Line 35: Fjord systems play a crucial role in burial and long-term storage of organic carbon (OC), contributing to approximately a tenth of the annual carbon burial (Smith et al., 2015).

In addition, we adjusted the Abstract: line 14: Fjord systems play a crucial role in the burial and long-term storage of organic carbon (OC).

(2) Line 45 – refrain from using "references therein". Cite the relevant studies.

We added references: line 56: Since MTGs terminate in the ocean, this sub-glacial meltwater rises up from the bottom of the glacier within the fjord basin entraining nutrients present in deeper water layers (Meire et al., 2017; Hopwood et al., 2018; 2020; Kanna et al., 2018; Cape et al., 2019; Halbach et al., 2019; Seifert et al., 2019).

(3) Lines 40 – 51 – In this paragraph you discuss how the different types of glaciers enhance or reduce nutrients entering the fjords. Which nutrients?

Following your remark, we adjusted the text and specified the nutrients: line 56 - 60: Since MTGs terminate in the ocean, this sub-glacial meltwater rises up from the bottom of the glacier within the fjord basin entraining nutrients, like nitrate, ammonium and phosphate, present in deeper water layers (Meire et al., 2017; Hopwood et al., 2018; 2020; Kanna et al., 2018; Cape et al., 2019; Halbach et al., 2019; Seifert et al., 2019). This upwelling water mass replenishes essential nutrients for primary production in the surface waters, crucial for sustaining phytoplankton proliferation beyond the initial spring bloom phase.

(4) Line 66 – Throughout the manuscript the term "carbon sequestration" is used. Sequestration is when carbon is removed from the atmospheric pool. Fjords are donor

environments (Middleburg, 2019) which means the receive and store carbon sequestered in other environments (terrestrial or marine). Accumulates or buries are more accurate terms to use when describing these processes.

Thank you for pointing this out. We agree that "carbon sequestration" is not the most accurate term in this context. Following your suggestion, we have replaced 'sequestration' with 'burial' throughout the text.

(5) Lines 81-85 – This line does not add anything to the introduction, please remove.

We removed the last part of the introduction, which was originally: "Therefore, we compared carbon storage and burial in two neighbouring, sub-Arctic fjord systems which both feature a sill at their entrance and are subjected to similar offshore currents and similar geology in their catchments, but have a different glacier influence (MTG-dominated vs. LTG-dominated fjords)." The introduction runs until line 95.

Methodology

(6) Line 104 – is Stuart Lee et al., 2021 correctly referenced.

Regarding line 116: "Being more than twice as shallow compared to the entrance sills in Nuup Kangerlua, the sill restricts inflow of relatively warmer and more saline sub-polar mode water (SPMW), resulting in relatively lower bottom water temperatures of ~0–1°C (spring and summer 2019 data; Stuart Lee et al., 2021)."

Stuart-Lee et al. (2021) states: "A comparison of deep water properties reveals another important difference between these two fjords. Between 50 and 400 m, Ameralik was fresher (by 0.2) and cooler (by **between 0.7 and 1.1°C**) than Godthåbsfjord for each of the studied months (May, July and September). This difference also applied to the water **below 400 m**, as indicated by the gray rectangles in Figure 6. The **difference in deep water properties is related to the sill depth, which determines the inflow of coastal water and differs between the two fjords**." In which Figure 6 shows bottom water temperatures of Ameralik around 0°C and Nuup Kangerlua slightly above 1°C. Given these observations made by Stuart-Lee et al. (2021), we believe that this work fits as a reference. We agree that we also should have referred to our own water temperature measurements during the sampling period. We therefore adjusted the sentence:

Line 116: "Being more than twice as shallow compared to the entrance sills in Nuup Kangerlua, the sill restricts inflow of relatively warmer and more saline sub-polar mode water (SPMW), resulting in bottom water temperatures below 1°C (Stuart- Lee et al., 2021; Table 1).

Table 1 can be found at line 152:

Table 1. Sampling dates, coordinates, water depth, and bottom water temperatures (BWT) of sampled stations in Nuup Kangerlua (NK) and Ameralik (AM).

Station	Date(s) sampled	Longitude (N)	Latitude (W)	Depth (m)	BWT (°C)	
					2021	2022
NK13	31/05/2022	64° 40.8	50° 17.3	476	1.47	1.41
NK12	31/08/2021 20/05/2022	64° 42.9	50° 32.8	531	1.41	1.35
NK10	31/08/2021	64° 36.6	50° 57.5	579	1.32	0.81
NK9	24/05/2022	64° 33.0	51° 0.9	602	1.23	0.67
NK7	01/09/2021 20/05/2022	64° 25.5	51° 3.4	626	1.29	0.64
NK6	30/08/2021	64° 22.0	51° 0.4	630	1.28	0.62
AM10	02/09/2021 18/05/2022	64° 11.0	50° 25.9	350	0.49	0.45
AM8	18/05/2022	64° 10.4	50° 45.3	488	0.59	0.56
AM5	03/09/2021 24/05/2022	64° 05.7	51° 11.3	730	0.56	0.59

(7) 124 – Solid phase – would sediment be a better description. I don't understand the need for this as there is no liquid phase sampling.

We changed the paragraph into: "2.3 Sediment analysis" (line 157). There was originally a liquid phase sampling section, but it was omitted from this paper.

(8) Line 125 – the n=3 and n=1 is not required as you state in the text there were 3 deployments for geochemistry and sedimentology and 1 for dating.

We removed n=3 & n=1.

(9) Line 128 – remove "thick"

We removed "thick".

(10) Line 129 – expand on why the sampling intervals was increased from 1 to 2 cm downcore. Would it not have been more useful to be consistent throughout.

Slices of 2 cm thickness were collected at beyond 10 cm depth to account for the decrease in ^{210}Pb activity with sediment depth, ensuring sufficient material for reliable detection above background levels.

We adjusted the sentence, line 148: "Sediment intended to derive sediment accumulation rates (^{210}Pb analysis) was further sliced beyond 10 cm in intervals of 2 cm until the end of the core (ranging from 10 to 44 cm sediment) ensuring sufficient material for reliable ^{210}Pb activity detection above background levels."

(11) Table 1 – reduce the number of decimals points the BWT is reported to. " decimal points will be suitable.

We adjusted Table 1 (line 152):

Table 1 Sampling dates, coordinates, water depth, and bottom water temperatures (BWT) of sampled stations in Nuup Kangerlua (NK) and Ameralik (AM).

Station	Date(s) sampled	Longitude (N)	Latitude (W)	Depth (m)	BWT (°C)	
					2021	2022
NK13	31/05/2022	64° 40.8	50° 17.3	476	1.47	1.41
NK12	31/08/2021 20/05/2022	64° 42.9	50° 32.8	531	1.41	1.35
NK10	31/08/2021	64° 36.6	50° 57.5	579	1.32	0.81
NK9	24/05/2022	64° 33.0	51° 0.9	602	1.23	0.67
NK7	01/09/2021 20/05/2022	64° 25.5	51° 3.4	626	1.29	0.64
NK6	30/08/2021	64° 22.0	51° 0.4	630	1.28	0.62
AM10	02/09/2021 18/05/2022	64° 11.0	50° 25.9	350	0.49	0.45
AM8	18/05/2022	64° 10.4	50° 45.3	488	0.59	0.56
AM5	03/09/2021 24/05/2022	64° 05.7	51° 11.3	730	0.56	0.59

(12) Line 139 – 153 needs significantly expanded; not enough information is provided to replicate the study and must be supported by references.

We agree that this section was too concise and did not provide sufficient detail for reproducibility. Thank you for highlighting this and for your valuable suggestions in comments 13–17, which have helped guide our revisions. We have substantially expanded the Materials and Methods section and included additional references where appropriate.

(13) Line 139 – How was the sediment prepared for analysis. Was there any preparation such as removal of organics or carbonate using Hydrogen peroxide and HCl. Was any detergent (i.e. Calgon) used to prevent flocculation of the clays?

We adjusted this analysis description to improve clarity: lines 159 – 169: Grain size distribution was determined on oven-dried sediment samples (dried at 60 °C for at least 48 hours). After homogenization, coarse material > 2 mm was removed by sieving. A subsample of 0.1 – 1 g was resuspended in water and analyzed using a Malvern Mastersizer 2000 with the Hydro 2000S module (size range: 0.02 – 2000 µm), which operates based on laser diffraction. The sample is sonicated for 60 s to prevent flocculation of clays before it goes through the laser. No pretreatment to remove organic or inorganic carbon was performed prior to analysis. Grain size fractions were classified according to the Wentworth scale (1922) as clay (< 4 µm), silt (4 – 63 µm), and sand (63 – 500 µm).

(14) Line 140 states Porosity was obtained by dividing the porewater volume by the wet sediment volume. How was the porewater volume calculated?

We elaborated on the porewater analysis: lines 171 – 176: Sediment porosity was estimated gravimetrically using a modified water displacement method. A pre-weighed 10 mL graduated measuring cylinder was filled with 2 – 5 g of homogenized wet sediment. After careful addition of ultrapure water (Milli-Q) to the 10 ml mark (measured by the lower meniscus), the cylinder was weighed again. The sample was then dried at 80 °C for ~48 h and reweighed. Porosity (ϕ) was calculated based on the difference between the wet sediment weight and the dry sediment weight (i.e., the mass of porewater), recalculated to pore water volume through correction for salinity and divided by the estimated volume occupied by the sediment (calculated as 10 ml minus the volume of water added).

(15) Line 141 – What temperature were the samples dried and for how long? + Line 143 states "After decalcification with 37% HCl, total organic carbon (TOC) was also measured" – Was this acid fumigation or direct acidification. I assume it is acid fumigation as 37% conc, HCl would not be used for direct acidification.

Your comments were addressed in the following rewritten lines (lines 179 - 188):

To determine total carbon (TC), total organic carbon (TOC), and total nitrogen (TN), sediment samples were oven-dried at 60 °C for 48 hours ground using mortar and pestle, and homogenized. Between 20 – 35 mg of dried and homogenized sediment was weighed and placed into pre-weighed silver cups. For TC and TN analysis, silver cups were sealed by folding with tweezers into compact spheres to ensure complete combustion. For TOC analysis, carbonate removal was performed by stepwise acidification: 2 – 3 drops of increasing concentrations of HCl (1%, 2%, 5%, and 10%) were added sequentially using a glass pipette. After each addition, samples were dried at 60 °C for 1 to 2 hours. This procedure was repeated over 2 – 3 days until no bubbling was observed and carbonate removal was confirmed. All measurements were conducted using a Flash 2000 NC Sediment Analyzer (Interscience), which quantifies carbon and nitrogen via dynamic flash combustion and chromatographic separation. From these data, the molar C:N ratios were calculated dividing TOC by TN and inorganic carbon (IC) was determined by subtracting TOC from TC**.**

(16) Line 145 – What does "see further" refer to? + Line 146 – for the stable isotope analysis provide a preparation method, I assume the same as the EA.

We specified the section to which we were referring and provided more details on the stable isotope analysis in lines 188 – 191: To investigate the origin of the organic matter (see 2.3.1), stable isotope composition, $\delta^{13}C$ (‰ deviations from V-PDB) and $\delta^{15}N$ (‰ deviations from air), was measured with an elemental analyzer (Thermo Flash EA1112 elementanalyzer) coupled to an isotope ratio mass spectrometer (Thermo Finnigan Delta V, IRMS). Prior to analysis, the same steps were followed as for TOC and TN analysis, except samples were freeze dried.

(17) Line 151 – Briefly expand on the methodology of Wright and Jeffrey (1997), how were the pigments extracted and what tool was used to measure them?

We adjusted the text and provided more information on the pigment analysis in lines 197 - 210: To explore how glacier type affects marine primary productivity and whether and how it is incorporated in the sediment, we additionally measured, for each sediment slice, the content of chlorophyll-a (Chl-a) and of its degradation products (pheophorbide-a, and pheophytin-a, pheophorbide-a like, and pheophytin-a like following Wright and Jeffrey (1997). For pigments extraction, 2 ml acetone (90%) was added to 0.5 g freeze dried sediment under red light conditions preventing pigment degradation. The samples were subsequently sonicated for 30 s and incubated overnight at 4 °C in the dark to aid pigment release.

Afterwards, the samples were centrifuged (10 min, 4000 rpm, 4 °C) and the supernatant was passed through 0.2 µm PTFE filters. Pigment separation was performed using an HPLC system (Agilent 1200 Infinity II, Agilent Technologies) equipped with a cooled auto-sampler, column oven, photodiode array detector, and fluorescence detector, following the method of Van Heukelem and Thomas (2001). Chlorophyll a and its degradation products were identified at 665 nm wavelength. Individual pigment concentrations were determined using the response factors of the respective standards. The ratio of Chl-a to Chloroplastic Pigment Equivalent (CPE, comprising the sum of all aforementioned pigments) was used as a proxy for the "freshness" or lability of photosynthetically produced organic matter (Schubert et al., 2005; Koho et al., 2008).

(18) Line 185 – Both the linear and CRS calculation methods were used to determine the OCAR for a mix of sites. Please state why two different methods were used. I understand the Cs peaks allowed the CRS to be used on some cores, but would it not been useful for comparison to use the linear method on all cores.

In a very dynamic environment such as fjords with mass discharge from glaciers, we suppose that the CRS method offers a higher chance to describe the sedimentation processes. This model gave good geochronology in the cores shown in figure A3, where every ^{210}Pb age is confirmed by ^{137}Cs measurements: the average sedimentation rate calculations in AM5, AM8, NK7 and NK9 are the most robust estimates, as an additional independent tracer (^{137}Cs) could be used.

Vice versa, the absence of a clear ^{137}Cs peak in the other stations did not allow to confirm the CRS dating and, since we needed an estimate of sedimentation rate, we applied the CF:CS model. Based on the available data, we could not get a more accurate dating for stations NK10, NK12, NK13 and AM10. It would be indeed better to emphasize that MAR and SAR values of stations NK10, NK12, NK13 and AM10 based on CF:CS dating are estimates that should be verified in future research. Therefore, we adapted the "2.4.1 Organic carbon burial rate" section in the Materials and Methods section:

Lines 261-272: "Sedimentation rates at stations AM5, AM8, NK7, and NK9 were determined using the constant rate of supply (CRS) model (Appleby, 2001), as a distinct increase in ^{137}Cs was detected at these sites (Fig. A1), supporting the CRS-based chronology. The observed increase in ^{137}Cs activity is attributed to global fallout from atmospheric nuclear weapons testing, which peaked in 1963. In contrast, the CF:CS (constant flux:constant sedimentation) model (Sanchez-Cabeza and Ruiz-Fernández, 2012) was applied to stations NK10, NK12, NK13, and AM10, where the ^{210}Pb$_{ex}$ profiles exhibited approximately exponential trends but lacked a clearly defined ^{137}Cs peak. For these stations, log-transformed ^{210}Pb$_{ex}$ activities were plotted against cumulative dry mass depth (g cm^{-2}) for each station. As a result, the sedimentation rate estimates for these stations should be treated with caution and verified in future studies. Mass accumulation rates (MAR, kg m^{-2} yr^{-1}) were derived from the slope of the linear regression (for CF:CS) or from the CRS model output. Bulk sediment accumulation rates (SAR, mm yr^{-1}) were calculated by dividing MAR by the average bulk density at each station. Organic carbon burial rates (OCBR) were then calculated by multiplying MAR by the TOC content at the 9 – 10 cm sediment layer. …"

(19) Line 187 – State which year you are assigning to the 137Cs peak, Chernobyl or weapons testing?

We agree that this should have been stated in the text. The following sentence was added to the Material and Methods section to clarify that the ^{137}Cs peaks were linked to the nuclear weapons testing:

Line 264: The observed increase in ^{137}Cs activity is attributed to global fallout from atmospheric nuclear weapons testing, which peaked in 1963.

(20) Line 187 states there are clear 137Cs peaks in cores NK9, NK7, AM8 and AM5. From figure A1 that these peaks could be heavily distorted by mixing how confident are you these are unimpacted records.

See joint answer after next comment.

(21) Line 193 states "No bioturbated or mixed upper layer was observed in the profiles". The radionuclide profiles would suggest significant mixing, which the authors later discuss in the text. There suitability of these cores for dating and the quality of the resultant outputs must be discussed.

As you correctly point out, we should have been more clear on why we think bioturbation is limited. The same concern was expressed by another reviewer. Therefore, we added lines 281-288: "We did not apply corrections for bioturbation or mixing processes, as the ^{210}Pb$_{ex}$ profiles do not show evidence of such activity in the upper sediment layers. However, these processes cannot be conclusively ruled out, particularly since some of the ^{137}Cs profiles feature broad activity peaks. Nonetheless, the ^{210}Pb-derived chronology appears to be supported by the ^{137}Cs profiles in AM5, AM8, NK7 and NK9 (Smith, 2001; Barsanti et al., 2020). The broad ^{137}Cs curves or inflections, marking sustained elevation in ^{137}Cs activity after an initial increase followed by a gradual decrease over time, are therefore more likely explained by continued exposure of settling particles to residual ^{137}Cs in the overlying water after 1963. As a result, younger sediment layers also contain measurable amounts of ^{137}Cs, smearing the signal across multiple horizons. This phenomenon has been observed in other marine settings (Tamburrino et al. 2019) and even in lake sediments (Drexler et al., 2018).

Following references were added in the reference list:

Barsanti, M., Garcia-Tenorio, R., Schirone, A., Rozmaric, M., Ruiz-Fernández, A. C., Sanchez-Cabeza, J. A., and Osvath, I.: Challenges and limitations of the ^{210}Pb sediment dating method: Results from an IAEA modelling interlaboratory comparison exercise, Quaternary Geochronology, 59, 101093, https://doi.org/10.1016/j.quageo.2020.101093, 2020.

Drexler, J. Z., Fuller, C. C., and Archfield, S.: The approaching obsolescence of ^{137}Cs dating of wetland soils in North America, Quaternary Science Reviews, 199, 83–96, https://doi.org/10.1016/j.quascirev.2018.08.028, 2018.

Smith, J. N.: Why should we believe ^{210}Pb sediment geochronologies?, Journal of Environmental Radioactivity, 55, 121–123, https://doi.org/10.1016/S0265-931X(01)00110-2, 2001.

Tamburrino, S., Passaro, S., Barsanti, M., Schirone, A., Delbono, I., Conte, F., Delfanti, R., Bonsignore, M., Del Core, M., Gherardi, S., en Sprovieri, M.: Pathways of inorganic and organic contaminants from land to deep sea: The case study of the Gulf of Cagliari (W Tyrrhenian Sea), The Science Of The Total Environment, 647, 334–341, https://doi.org/10.1016/j.scitotenv.2018.07.467, 2018.

Regarding the suitability of the cores for dating, we chose to omit the sedimentation rate estimate of NK6, because (1) it is not a deep profile; only 10 cm deep and (2) ^{210}Pb$_{xs}$ activity is indeed very low. This may be due to erosion conditions at the sill slope where older sediment material (characterized by low ^{210}Pb$_{ex}$ activity) surfaces due to removal of younger sediment or older sediment has been transported to this location, which is also visible in NK7 and 9 profiles. The omission of the low MAR estimate at station NK6 resulted in a slightly higher average organic carbon burial rate for Nuup Kangerlua: 18.0 ± 1.6 g m^{-2} yr^{-1} versus the previously calculated 14.1 ± 1.6 g m^{-2} yr^{-1}.

Results

(22) Line 220 – What is the reason for such shifts in porosity and dry bulk density.

Taking into account your comment, we adjusted the description in the results section: lines 323-327: Porosity and dry density generally fluctuated with sediment depth without a consistent pattern across most stations. In contrast, station NK10 exhibited the expected trend of decreasing porosity and increasing dry density with depth. These variations appeared to be influenced by grain size, although the processes driving the trends at NK10 are less clearly linked to sediment texture.

The related figure can be found further below at question (25).

(23) Line 37 – remove "while"

At line 37, there was no "while" within the sentence, but we removed the redundant "while" in line 344 by splitting the sentence in two: While the $\delta^{13}C$ value fluctuated widely at NK13 ranging from -26.3 to -23.8 ‰, indicating a stronger terrestrial influence and a more heterogeneous mixture of organic matter sources. Notably, $\delta^{15}N$ at this station increased consistently with depth, from 5.7 ‰ to 12.2 ‰.

Figures

(24) Figure 1 – Add site numbers to the map. Change colour of marker for Nuuk it is currently too close to the sampling site symbol. Define the inner, middle and outer sections of the fjord on the maps.

We improved Figure 1 (line 122) based on your comment and the other two reviewers by:

- Adding a legend, depicting stations sampled in Nuup Kangerlua and stations in Ameralik in a different color.
- Adding station labels and adjusting the symbol of Nuuk to differentiate it from the station symbols.
- Situating the outer, mid and inner zone in the (b) panel.
- Enlarging (a) and (b) panel.

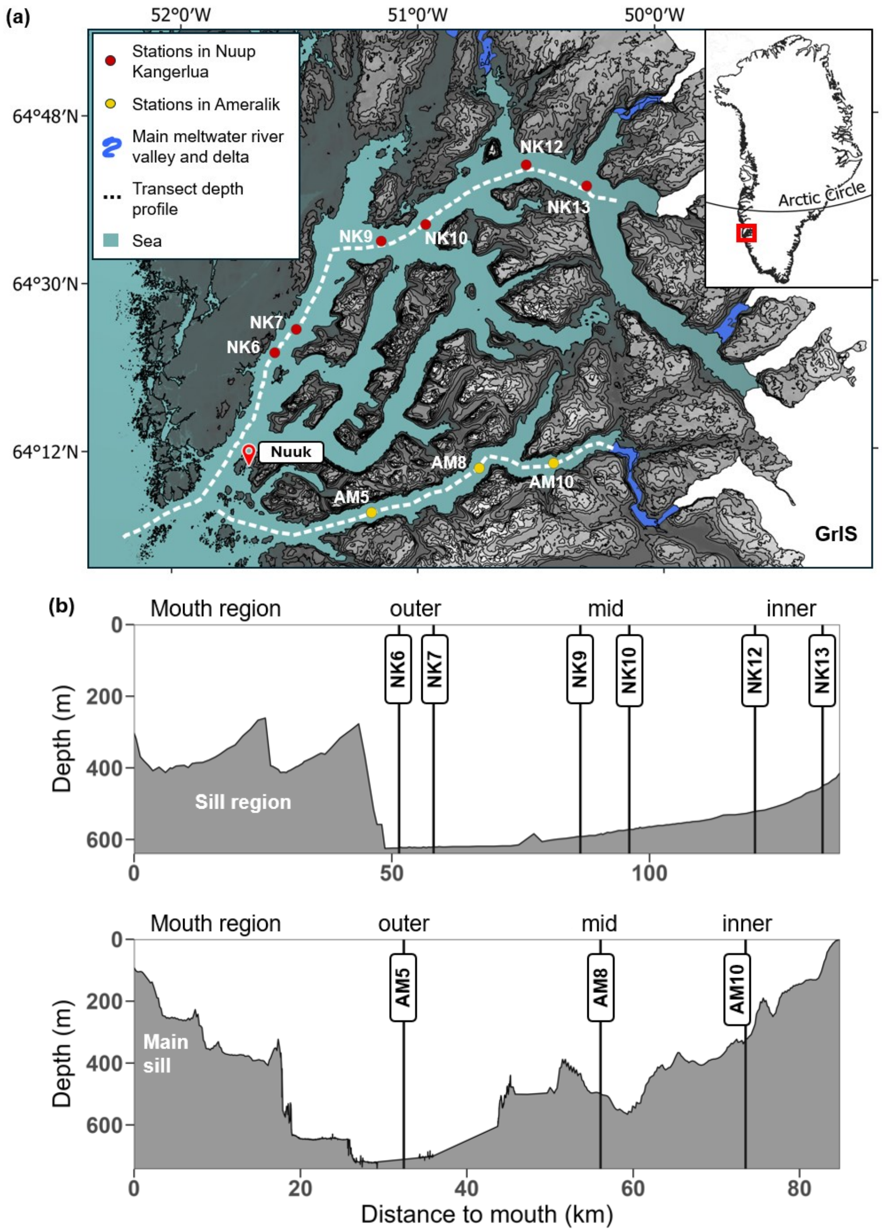

Figure 1. (a) Map showing sampling locations in Nuup Kangerlua (fed by three marine-terminating glaciers and three land-terminating glaciers) and Ameralik (receiving meltwater from a land-terminating glacier). Greenland Ice Sheet (GrIS) is depicted in white. **(b)** Water depth profiles along-axis (white dashed lines) Nuup Kangerlua (top) and Ameralik (bottom). Both fjord basins are divided in an outer, mid and inner section behind the entrance sill(s).

(25) Figure 2 has dry bulk density data. But this is not mentioned in the method section. Lines joining the points would be useful as it is hard to follow some of the downcore data (i.e., NK10).

We added dry density to the M&M section: Line 171: Sediment porosity was estimated gravimetrically using a modified water displacement method. A pre-weighed 10 ml graduated measuring cylinder was filled with 2 – 5 g of homogenized wet sediment. After careful addition of ultrapure water (Milli-Q) to the 10 ml mark (measured by the lower meniscus), the cylinder was weighed again. The sample was then dried at 80 °C for ~48 h and reweighed. Porosity (ϕ) was calculated based on the difference between the wet sediment weight and the dry sediment weight (i.e., the mass of porewater), divided by the estimated volume occupied by the sediment (calculated as 10 ml minus the volume of water added). Dry bulk density was obtained by dividing dry mass by bulk volume.

We added horizontal grid lines to Figures 2 and 3 to enhance visual clarity and support more accurate comparison of values along the y-axis.

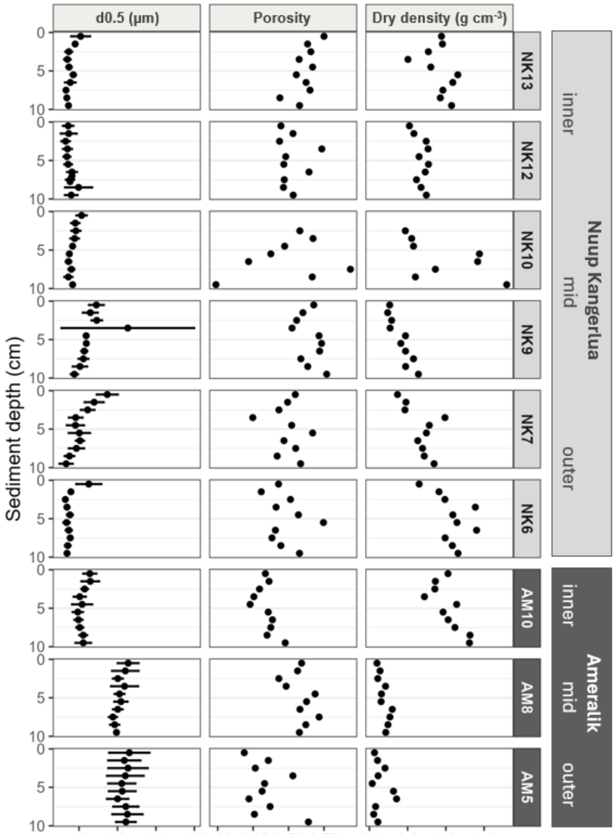

Figure 2. Sediment profiles of median grain size (µm), porosity and dry density (g cm^{-3}) of Nuup Kangerlua (GFNK stations) and Ameralik (AM stations). Error bars represent SD (n = 3 for NK6, NK9, NK13 and AM8 and n = 6 for NK7, NK10, NK12, AM5 and AM10). Only one replicate for porosity and dry density.

(26) Could Figure 2 and 3 be combined.

We understand that all data placed next to each other improves comparison of parameters, but we decided to keep both figures separate as too much different parameters within the same figure decreases clarity.

(27) Figure 4 – add the end-member values used in the study to the plot. Also, it would be useful to plot d^{13}C vs CN

Thank you for this insightful suggestion. We agree that plotting δ^{13}C against C:N ratios adds value, as both are commonly used to distinguish between terrestrial and marine organic carbon sources. We have therefore revised Figure 4 (line 342) including other remarks of other reviewers. We improved this figure by:

- Enlarging all elements of the figure.

- Adding a second panel, displaying δ^{13}C against C:N ratio. We indicated the marine and terrestrial end-member δ^{13}C values used in this study to determine the proportion of marine and terrestrial OC.
- Colors referring to Nuup Kangerlua and Ameralik were adapted to follow the color code of the map (Figure 1; line 122).
- In panel (a), we extended the marine and terrestrial ranges from δ^{13}C -23 ‰ to δ^{13}C -24‰ and from δ^{13}C -25 ‰ to δ^{13}C -21‰ (following Lamb et al., 2006), respectively.

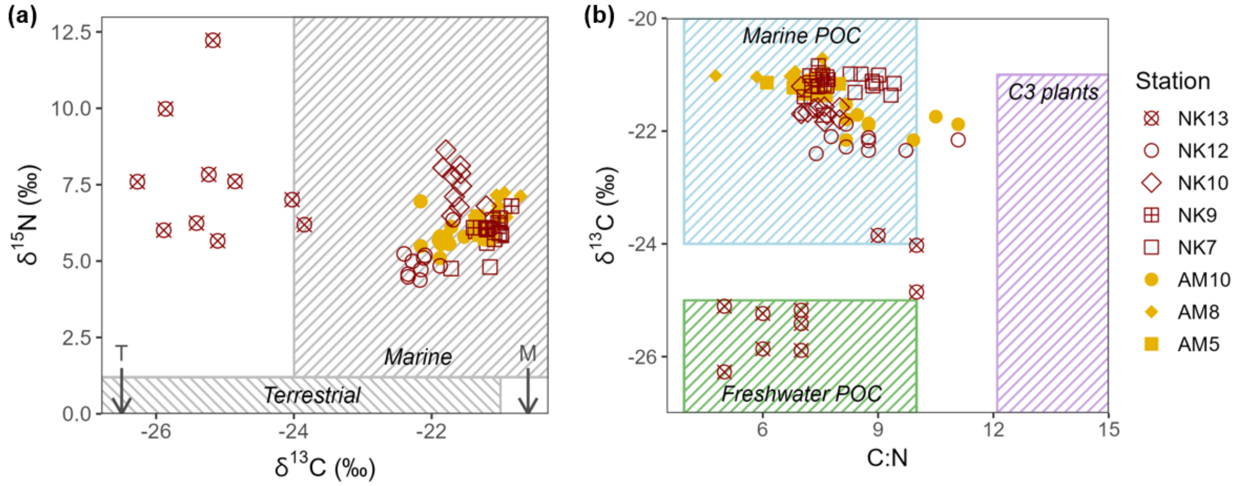

Figure 4. (a) δ^{13}C (‰ deviations from V-PDB) values plotted against δ^{15}N (‰ deviations from air) values of the POM present in the sediment for the different station of Ameralik (filled symbols) and Nuup Kangerlua (open symbols). Typical marine and terrestrial ranges of δ^{13}C (lamb et al., 2006) and δ^{15}N (Zaborska et al., 2018) are indicated with rectangles. (b) δ^{13}C plotted against C:N ratios. Ranges of marine and freshwater POC, and C3 terrestrial plants are displayed as rectangles for reference (values taken from Lamb et al., 2006). Marine (M) and terrestrial (T) δ^{13}C end-members used in this study are indicated with arrows.

In addition we added to the text, section "2.3.1 Calculation of marine organic carbon fraction": lines 212 – 219: Stable isotope composition in addition to C:N ratios of settled organic matter in fjord sediments has been used in multiple studies to estimate the proportion of marine versus terrestrially derived organic matter (St-Onge and Hillaire-Marcel, 2001; Koziorowska et al., 2015; Smeaton & Austin, 2017; Zaborska et al., 2018; Faust and Knies, 2019; Limoges et al., 2020; Placitu et al., 2024). Terrestrial organic matter, primarily derived from vascular plants, tends to have higher C:N ratios (> 12) and more depleted δ^{13}C values (-25 to -30 ‰ δ^{13}C) due to the dominance of lignin-rich, cellulose-based material and the use of C3 photosynthesis pathways (Lamb et al., 2006). In contrast, marine organic matter, originating from phytoplankton and other aquatic organisms, typically shows lower C:N ratios and less negative δ^{13}C values (-18 to -24 ‰ δ^{13}C), reflecting a protein-rich composition and different carbon fixation mechanisms (Lamb et al., 2006).

(28) Table 2 – in the caption state which model was used to determine these rates.

Following your remark, we revised the caption of the table: Line 369: **Table 2.** Mass accumulation rate (MAR), sediment accumulation rate (SAR), and organic carbon burial rate (OCBR) per station. The CRS method was applied at stations NK7, NK9, AM5, and AM8, while the CF:CS method was used for stations NK10, NK12, NK13, and AM10. "NK" denotes Nuup Kangerlua and "AM" Ameralik.

(29) Figure 2A – Colours missing, there should be orange and black according to the caption.

Thank you for noticing our mistake. We changed the figure caption to: "… Grey and black colors represent end of summer 2021 and spring 2022, respectively. Data from the two seasons is available for stations NK12, NK7, AM10 and AM5." (Line 662).

Discussion

(30) I also believe that the discussion needs to be reworked. This section is largely focused on reasons why the results do not match what was predicted. The study goes down multi avenues of enquiry but these are largely subjective as there is no data available. Much of this could be condensed into a single section opposed to being four sub-sections.

Applying your feedback, we reformulated large parts of the discussion and reorganized the discussion to the following structure:

- **4.1 Surface sediment OC content** with a sub-section on **OC origin** (4.2.1), putting more emphasis on what can be derived from our data.
- **4.2 Organic carbon burial rates**, which was set as the 2nd sub section instead of the last paragraph. We also included primary production values from literature.
- We assembled our 3 main hypotheses in sub-sections within **4.3 Pelagic and geomorphological influence on OC burial:**
  - **4.3.1 OC preservation conditions**, which was condensed and more focused on the bottom water temperature differences we measured between the fjords. We removed the hypothesis regarding a difference in OC preservation related to Fe and Mn in both fjords from the discussion due to limited data to support this hypothesis.
  - We condensed section **4.3.2 Transport dynamics.** This section was included to provide a more nuanced view of MTG-induced upwelling, acknowledging that nutrient enrichment may also originate from upwelling at the fjord mouth, potentially influencing the patterns observed in our study
  - We condensed the **4.3.3 Food web OC uptake** section.
- We incorporated the suggestion of Anonymous Referee #1 to add a section on Recommendations for future research.

To avoid an overly long rebuttal letter, we refer the reviewer to our rewritten discussion in the manuscript. (From line 371 onwards).