Dear reviewer,

Re: Manuscript ID: cp-2022-67 and Title: Deglacial records of terrigenous organic matter accumulation off the Yukon and Amur rivers based on lignin phenols and long-chain *n*-alkanes. by Mengli Cao et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2022-67-RC1, 2022

We thank you for your encouraging and helpful comments concerning our manuscript. We have studied these comments carefully and will modify the manuscript according to them. Please find the following detailed responses (blue) to these comments and suggestions.

Major comments:

1. Throughout the introduction there is frequent discussion of long chain n-alkanes and n-alkyl lipids. However, when reading through to the results section it becomes clear that the authors did not extract or analyse n-alkanes themselves, rather just used published data from other studies. However, the authors do seem to have analysed isoGDGT lipids, which are not mentioned in the introduction at all. I strongly recommend re-writing the introduction to ensure that there is not a surprise for the reader when they reach the Methods section.

Response:
We agree with the reviewer's comment regarding the introduction of our manuscript and realize the need to rewrite the introduction and include additional aspects. In particular, we included an explanation of why next to the lignin analyses we considered new and published records of biomarker-based SST and sea-ice reconstructions, and we detail in the introduction and in the methods section which of the records were newly obtained by us.

2. Line 215: "From the polar fractions of the lipid extracts used by Meyer et al"

- *It is not clear whether the authors have re-analysed lipids extracted by Meyer, or re-extracted their sediments. The Meyer paper reports n-alkane concentrations, but the paper mentions adding a C_{46} GDGT at the time of extraction. Did Meyer pre-emptively include a C_{46} GDGT? This needs clarifying, since there seems to be a contradiction.*
- *If the authors re-extracted sediments, how were they stored until this work? If they analysed lipids that had been extracted previously, how were the extracts stored?*

Response:
We realize that our initial description was confusing and re-wrote the methods section to make clear to the reader how and when the analyses were carried out and which methods were used.

- The GDGTs were extracted and analyzed by Vera D. Meyer. The internal standard of GDGTs (C_{46}-GDGT) was put into a vessel together with dry sediment and extract solution (dichloromethane:methanol = 9:1 (vol/vol)). After extraction, neutral compounds (including GDGTs) were extracted with *n*-hexane, and the C_{46}-GDGT will also be extracted with *n*-hexane. We thank the reviewer for this

comment, the description of this paragraph has been revised (lines 287–301, revised manuscript).

- The extraction of *n*-alkanes and GDGTs was carried out together. The data on *n*-alkanes were published by Meyer et al. (2019).

Minor comments:

1. Line 55-56: "Around 70 % of the Yedoma region thawed beneath thermokarst lakes and streams since 14.7 ka BP"

- *It is not clear what is meant here. 70% of the area thawed, or 70% of the area below lakes thawed?*
- *I suggest rephrasing for clarity*

Response:

- It's the thawing of 70% of the Yedoma regions, including deep thermokarst lakes (50%–60%) and streams and rivers (~ 10%–20%) (Walter Anthony et al., 2014).
- The term Yedoma is not used later, so this sentence will be removed from the revised manuscript.

2. Lines 64, 116: "Alnus" "Populus-Salix"

- *For readability by non-experts, it would be useful to include the common names*

Response:

- The common names of these plants will be included in the revised manuscript, such as *Alnus* (alder), *Populus* -*Salix* (cottonwood-willow).

3. Lines 104-106: "The Yukon Basin was mostly unglaciated during the LGM, featuring permafrost and remains mostly so until today."

- *This is an awkward phrasing, that could be clearer. Do you mean "remains mostly so", implying that the basin is still stable, or "remained so until today", implying that the basin has recently started to change?*

Response:

- Thanks for your kind suggestion, this sentence will be changed as follows: The Yukon Basin was mostly unglaciated during the LGM, featuring permafrost (Schirrmeister et al., 2013). Although some permafrost in the Yukon Basin thawed during the last deglaciation (Meyer et al., 2019; Wang et al., 2021), most of it is still covered by permafrost today (Fig. 1).

4. Lines 106-107: "Arctic coasts today often are eroded at high rates of up to several meters per year"

- *This is an awkward sentence that could be rephrased*

Response:

- This sentence will be revised as follows: The rate of Arctic coastal erosion is rapid today, the average rate of erosion for the arctic coasts is 0.5 m $year^{-1}$ (Lantuit et al., 2012; Irrgang et al., 2022), …

5. Line 108: "… suggesting…"

- *It is not immediately clear how the first part of this sentence suggests the second part.*

Response:

- This comment refers to the sentence "Arctic coasts today often are eroded at high rates of up to several meters per year (Lantuit et al., 2012; Couture et al., 2018), suggesting that during past periods of sea-level rise, similar or even stronger erosive forces were at play supplying vast amounts of terrigenous materials to marine sediments." 34% of the coast in the world today is affected by permafrost which is enriched in organic carbon (Hugelius et al., 2014; Schuur et al., 2015). For example, the total flux of organic carbon induced by coastal erosion for the entire Yukon coast (282 km) is 0.036 Tg C $year^{-1}$ (Couture et al., 2018). A high rate of sea level rise occurred at the start of the B/A period, and the global average rise occurs at a rate of ~ 40 mm $year^{-1}$ (Lambeck et al., 2014; Fig. 2, b). Therefore, the contribution of terrigenous organic matter in the marine shelf sediments during past periods of sea-level rise must be very high. We agree with the reviewer that this sentence is not clear, we will change it as follows: The rate of Arctic coastal erosion is rapid today, the average rate of erosion for the arctic coasts is 0.5 m $year^{-1}$ (Lantuit et al., 2012; Irrgang et al., 2022), but it may be slower than the coastal erosion in the B/A and PB periods as reflected by sea level change rate (Lambeck et al., 2014; Fig. 2, b). Coastal erosion causes a large amount of terrigenous organic matter to enter the ocean (Couture et al., 2018; Winterfeld et al., 2018), suggesting that during past periods of sea-level rise, similar or even stronger erosive forces were at play supplying vast amounts of terrigenous materials to marine sediments.

6. Line 199: "8 lignin phenols"

- *The eight phenols are implied in the section above, but not stated explicitly*

Response:

- The eight lignin phenols are introduced in lines 230–248. They can be classified into three groups, vanillyl phenols, syringyl phenols, and cinnamyl phenols. Vanillyl phenols consisting of vanillin (Vl), acetovanillone (Vn) and vanillic acid (Vd). Syringyl phenols, comprising syringealdehyde (Sl), acetosyringone (Sn) and syringic acid (Sd). Cinnamyl phenols that include *p*-coumaric acid (*p*-Cd) and ferulic acid (Fd). Therefore, no changes will be made in the revised manuscript about this comment.

7. Lines 208-210: Choice of HMW n-alkanes

- *Each paper uses different n-alkanes to calculate "HMW Alk". Is it possible to return to the original source data and recalculate so that identical alkanes are used for each basin?*

Response:

- Yes, we will recalculate the HMW Alk of the Okhotsk Sea to bring it in line with that of the Bering Sea (C_{23}, C_{25}, C_{27}, C_{29}, C_{31}, and C_{33}).

8. Line 261: "S/V and C/V ratios"

- *It would be useful to define the various lignin ratios in one place, and explain their uses, before starting to apply them*

Response:

- As a response to the reviewer's comment, brief descriptions of these parameters have been included in the revised results section, in agreement with the first reviewer's comment.

9. Lines 295-296: "The deglacial evolution of the TEX_{86}-derived SST ranging from 4.48 to 10.8℃"

- *This sentence needs re-writing*

Response:

- It will be revised as follows: The deglacial evolution of the TEX_{86}^{L}-derived SST ranging from 4.5 to 10.8 ℃.

10. Line 301: "progressively"

- *"Progressive" does not seem to adequately describe the data shown in the figure. A different adjective would be useful here. A clarification stating the duration over which this temperature drop happens would be helpful*

Response:

- Thanks a lot for the reviewer's comment, and this sentence will be changed as follows: The SST decreased slowly by 1℃ from 10.5 to 9.0 ka BP.

11. Line 381: "PB,"

- *Comma not required here*

Response:

- Changed.

We sincerely hope that these responses have addressed all your comments and suggestions. We really appreciate your efforts in reviewing our manuscript during this unprecedented and challenging time. Your careful review has helped to make our study clearer and more comprehensive.

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