Response to comments by Reviewer 2

The authors appreciate the valuable feedback provided by the anonymous Reviewer 2 on the manuscript. We have thoroughly considered the remarks and will make the required changes to incorporate the suggestions. Our responses are shown in black text.

Reviewer comment:
The paper by Arnaud Nicolas and colleagues titled: "Delivery of aged terrestrial organic matter to the Laptev Sea during the last deglaciation" addresses relevant scientific questions within the scope of CP. It covers a very interesting topic, provides new data, and improves the understanding of the source of terrestrial organic matter in the Arctic during the last deglaciation. The study is based on a single sediment core (PS2458-4) from the Laptev Sea. Notably, while the authors compare their record with other cores in the area, the spatial coverage is limited.

I have, however, a couple of points which I think need to be addressed:
For the GDGT data – are all GDGTs detected assumed to be produced in situ? I am missing here a bit of detailed insight into the methods, especially for the temperature calibration. Why specifically this and no other calibration has been chosen? There is actually a very recent paper/preprint, which I would encourage the authors to read in regards to the GDGT data interpretation and publication (Bijl et al., 2025, https://doi.org/10.5194/egusphere-2025-1467).

Reply: Thank you for raising this important point. With regards to the hydroxylated GDGTs (OH-GDGTs) that were used as a proxy for SST, this class of lipids are known to be produced by planktic Thaumarchaeota and have potential for application as biomarkers for thaumarchaeotal taxonomy (Liu et al., 2012; Sinninghe Damsté et al., 2012). In the open ocean, Thaumarchaeota are widely recognized as the principal producers of isoprenoid GDGTs (isoGDGTs) (Besseling et al., 2020; Zeng et al., 2019), and this is also believed to apply to OH-GDGTs). The strong correlations observed between OH-GDGT concentrations and those of crenarchaeol, which is a biomarker specific to Thaumarchaeota, support the interpretation that both OH-GDGTs and non-hydroxylated isoGDGTs share a common thaumarchaeotal origin in these settings (Bale et al., 2019; Sinninghe Damsté et al., 2002) Taken together, it was assumed that the OH-GDGTs are produced in situ in the open ocean settings.

We used the ring index of hydroxylated tetraethers (RI-OH') and its derived SST (Lü et al., 2015) as we wanted to compare our reconstructed SST values from the Laptev Sea with those from core ARA04C/37 from the Beaufort Sea (Wu et al., 2020). In this latter study, the authors also utilized the same SST proxy, which enabled us to assess and compare variations in reconstructed SSTs across different intervals of the last deglaciation at both locations.

Thank you for suggesting the recent paper from Bijl et al. (2025). We will carefully consider the findings presented in this paper to strengthen our discussion of OH-GDGTs, which we have used as a proxy for SST in this manuscript.

Reviewer comment:
In the discussion: I do not always follow which data are new and which are the legacy data – this also leads to uncertainty if some of the observations are novel, based on the current dataset, or something which was already described by others.

Reply: Thank you for highlighting this issue. To clearly distinguish the novel datasets generated in this study from previously published data, we will add "(this study)" at the end of each relevant figure caption in Figs. 2, 3, 4, and S1. Additionally, we have included the appropriate author names and references at the end of each caption to acknowledge the original sources of previously published data. We will also ensure that these references are properly cited in the Discussion section to fully recognize and credit the prior studies referenced throughout the manuscript.

Reviewer comment:
Also, the discussion sections seems to be a bit randomly organized and very lengthy. I think it would benefit from having each time interval arranged by various shorter subsections, e.g., "rate of MAR", "preservation of OM", or something like that.

Reply:
Thank you for your valuable suggestion regarding the length and organization of the Discussion section. In response, we will incorporate shorter subsections as suggested, corresponding to different time interval to enhance the clarity and readability of this section.

Reviewer comment:
I wonder about the preservation of selected biomarkers analysed here, which can be influenced by several factors, such as sedimentation rate and remobilization?

We thank the reviewer for raising this important point regarding the preservation of the selected biomarkers. As described in the manuscript, the Laptev Sea shelf and slope have experienced significant changes in sedimentation dynamics during the last deglaciation, primarily driven by rapid sea-level rise, which consequently led to coastal erosion. These processes not only control the delivery of terrestrial OM to the marine environment but also influence the preservation potential of terrestrial biomarkers. We calculated MARs for terrigenous biomarkers throughout the core, which allows us to determine enhanced terrigenous OM input and/or preservation. The highest MARs of pre-aged biomarkers coincide with intervals of rapid sea-level rise, suggesting that coastal erosion and subsequent rapid burial favored the preservation of these compounds. On the other hand, during periods of lower sediment accumulation rate like during the Holocene, lower MARs of terrigenous biomarkers may potentially reflect enhanced degradation and thus poorer preservation of these compounds in the sediment record. We will include this aspect in our revised discussion.

Reviewer comment:
The text is overall well written, but section 3, especially 3.2, is difficult to follow.

Reply: We appreciate your insightful comment. We will introduce additional subsections within Section 3 (Materials and Methods), including further subdivisions in Section 3.2, to enhance the clarity and readability of the manuscript.

References

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