The study by Stevenard et al. presents the first high-resolution synthesis of sea surface temperatures (SST) across the final portion of Marine Isotope Stage 10 (MIS 10), Termination IV and MIS 9, incorporating 98 carefully recalibrated and re-dated marine records. By applying a consistent chronological framework (AICC2023), updated SST calibrations, and a Monte Carlo approach to quantify uncertainties from both dating and SST reconstructions, the authors generate global and regional SST stacks that reveal multi-millennial climate dynamics and discuss their potential drivers.

This work is highly relevant in the context of understanding warm climate intervals, particularly as MIS 9e is associated with the highest atmospheric CO_2 and CH_4 concentrations of the past 800 kyr. The study is of significant value to the paleoclimate community, as these SST stacks provide a basis for evaluating the global climate response to natural forcings (global and regional perspectives) and allow meaningful comparisons with other interglacial periods. Furthermore, the authors are transparent about the limitations of their approach and provide thoughtful perspectives on how future work can build upon these findings.

Importantly, the study offers refined estimates of deglacial mean surface temperature (DGMST) for the target period, based on a larger and higher-resolution dataset than previous compilations.

The manuscript is scientifically sound, methodologically robust, and well-structured. Overall, I find the study to be a valuable contribution and worthy of publication following minor revisions as outlined below.

Specific comments

Abstract: homogenize the use of "MIS 9" and "MIS 9e" throughout the abstract for consistency.

We have homogenized the use of MIS 9e throughout the abstract.

The introduction could benefit from improved flow and narrative cohesion. Consider reorganizing some paragraphs or refining transitions between concepts to enhance clarity and better guide the reader through the motivation, context, and objectives of the study.

We have refined transitions between concepts to enhance clarity and better guide the reader.

"[...] rapid sea-level rise. Yet, despite this relevance, our understanding of global or regional temperatures during this period still relies mostly on reconstructions derived from long-term temperature stacks (e.g. Shakun et al., 2015; Snyder, 2016; Friedrich et al., 2016; Clark et al., 2024). For [...]" — Lines 58-59.

"[...] the preceeding Termination IV. Beyond chronological uncertainties, the variety of SST proxy and the improvement in proxy-calibrations over decades challenge a direct comparison between published records. The existing SST [...]" — Lines 76-77.

Lines 76–79: Please provide references for the mentioned sea surface temperature proxies during the target interval.

As described in Table S1, many references can be used to illustrate SST records covering MIS 9e. Rather than adding specific references, we refer the reader to Table S1, which lists all citations. —Line 78.

"[...] a wide range of proxies (see Table S1), [...]"

Table S1: Consider providing more detailed information about the proxies used to estimate SST. For example:

- Specify the foraminifera species used in the Mg/Ca and $\delta^{18}O_p$ records to clarify whether the signal reflects seasonal or annual conditions.
- Consider also indicating the ocean basin or region from which each record originates, even though latitude and longitude are already provided.

We have added two columns "Basin" and "Species" in the Table S1.

Lines 101-103: a more detailed description of the used proxies is needed in the main text. For example:

- How each proxy works
- The type of signal it reflects (seasonal vs. annual)
- Why proxies with seasonal and annual signals are considered, comparable and suitable for joint inclusion in the compilation

We have revised this paragraph and include it in the introduction. Briefly, we have added a more detailed description of the existing SST proxies: how they work and the expected type of SST (annual or seasonal). —Lines 79-95.

"The alkenone unsaturation index ($U_{37}^{K\prime}$) is based on the relative unsaturation of long-chain (C37) alkenones, which decreases with increasing temperature (Prahl et al., 1988). It typically reflects annual SST, but may capture seasonal temperatures at high latitudes (~45°N) or in semi-enclosed basins such as the Mediterranean (Tierney and Tingley, 2018). The Modern Analogue Technique (MAT) estimates SST by comparing fossil planktic assemblages (e.g. foraminifera, radiolarians) with modern datasets using a transfer function, identifying the closest analogues based on species compositions (e.g. Ruddiman et al., 1989). MAT generally reflects seasonal SST. The magnesium-to-calcium (Mg/Ca) ratio of planktic foraminifera reflects a nonlinear increase in magnesium incorporation into calcite shells with rising temperature (Oomori et al., 1987). While often associated with mean annual SST, it may reflect seasonal conditions depending on the foraminifera species and the site's latitude (Tierney et al., 2019). The $\delta^{18}O$ from planktic foraminifera ($\delta^{18}O_p$) is affected by both temperature and the isotopic composition of seawater ($\delta^{18}O_{sw}$) at the time of calcification. Although calibration is complex due to varying relationships derived from culture and plankton tow studies, recent Bayesian approaches (Malevich et al., 2019) allow for SST estimates that incorporate uncertainties in $\delta^{18}O_{sw}$ and can reflect either annual or seasonal SST, depending on species and calcification latitude (Malevich et al., 2019). The TEX_{86} (TetraEther indeX of 86 carbons) proxy is based on the relative distribution of archaeal glycerol dibiphytanyl glycerol tetraether (CDGT) lipids produced by marine archaea (Schouten et al 2002). It can estimate SST through a temperature-dependent change in ring structures, but often reflects subsurface conditions (e.g. Schouten et al 2002; Lopes Dos Santos et al., 2010; Tierney & Tingley, 2014; Rouyer-Denimal et al., 2023), limiting its comparison with surface-based SST reconstructions."

We have added a small sentence at the end of the introduction about the choice of keeping both annual and seasonal signals.

"[...] records. To maximize spatial and temporal coverage, we include both annual and seasonal SST records, while primarily interpreting the results in terms of annual mean temperatures. To ensure [...]"

Line 525: The title of Section 4.1 could better reflect its content by including a reference to Termination IV and MIS 10. For example: *"Limitations associated with our MIS 10–TIV–MIS 9 spatio-temporal SST synthesis"* or simply *"Limitations associated with our spatio-temporal SST synthesis."* This logic could also be applied to the titles of other manuscript sections for improved clarity.

We have modified the title of section 4.1 to "Limitation associated with our spatio-temporal SST synthesis". —Line 391.

Lines 604–608: You describe delayed SST warming in the North Pacific (relative to the North Atlantic and Northern Hemisphere stacks) and compare it to Asian monsoon and insolation records. However, as with the Atlantic, the South Pacific appears to have warmed earlier than the North Pacific. For the Atlantic, you suggest this interhemispheric difference may be linked to intensified Agulhas Leakage during deglaciation. A brief discussion of possible mechanisms explaining the earlier South Pacific warming is currently missing.

We have added a short paragraph to discuss about possible mechanisms explaining the early South Pacific warming after the discussion about the North Pacific. —Lines 479-482.

"[...] high latitude insolation (Cheng et al., 2016). The early warming in the South Pacific compared to the North Pacific would be attributed to the bipolar seesaw mechanism (Stocker & Johnsen, 2003). Its deglacial warming is aligned to the Antarctica air temperature and CO_2 level rises (Jouzel et al., 2007; Bereiter et al., 2015; Nehrbass-Ahles et al., 2020; Fig. 6A), suggesting that radiative forcing could be the main forcing in the South Pacific."

Line 632: Regarding "(~333.5 ka)": consider providing an age interval for the hemispheric heat transfer plateau, rather than a single date. Alternatively, clarify that ~333.5 ka marks the onset of the plateau.

We have clarified and revised the dates of the Hemispheric Heat Transfer records throughout the text. —Line 505.

"[...] strengthened AMOC (Fig. 5D). The onset of the "plateau" in hemispheric [...]"

Line 638: It seems that the most appropriate term in this context is Heinrich Stadial. Since Heinrich Stadial (HS) and Heinrich Event (HE) have distinct definitions, please double-check the use of the term "HE" here and throughout the manuscript to ensure consistency and accuracy.

We have modified the use of HE and named the appropriate period HS throughout the text (also in Figure 6; now Fig. 5 in the revised manuscript).

Line 642: The phrase "In contrast, Pacific DSST changes are less abrupt" is vague. Less abrupt than what? The North Atlantic DSST? The Atlantic as a whole? Please specify.

We have removed this sentence as the new stacks estimates give another point of view.

Lines 656–657: A reference to Figure 6H would be appropriate here.

We have added a reference to the figure 6H in the sentence (now figure 5H). —Line 530.

"A larger obliquity (Fig. 5H) can [...]"

Lines 688–689: *"Indeed, a slowdown of AMOC may have resulted in increased heat storage"* — please clarify: increased heat storage where? In the Southern Ocean? In the deep ocean?

We have clarified this point at the end on the sentence. —Line 563.

"Indeed, a slowdown of AMOC may have resulted in increased heat storage in deep and intermediate ocean (Shackleton et al., 2020; Haeberli et al., 2021)."

Technical corrections

1. When providing time intervals, please list the older date first (i.e., from past to present). For example, use "335 to 300 ka" instead of "300 to 335 ka".

We have "reversed" all time interval throughout the manuscript.

2. Line 12: Correct to "…from the fact that **it** is associated…"

We have modified this sentence. —Line 12.

"[...] from the fact that it is associated with the highest atmospheric CO_2 concentrations [...]"

3. Line 14: Correct to "…of sea surface temperatures (SST) are available…"

We have modified this sentence. —Line 14.

"Numerous reconstructions of sea surface temperatures (SST) cover this time interval [...]"

4. Line 41: Correct to "sometimes exhibiting conditions as warm as…"

We have modified this sentence. —Line 40.

"[...] sometimes exhibiting conditions as warm or [...]"

5. Line 193: Typo — correct to "planktic foraminifera".

We have modified this sentence. —Line 213.

"[...] (i.e. $\delta^{18}O$ of planktic foraminifera after [...]"

6. Line 200: Typo — correct to "Three scenarios".

We have modified this sentence. —Line 221.

" Three scenarios occur: (1) the site [...]"

7. Line 447: Typo — "(i.e. when the global temperature starts to rise sharply)".

We have modified this sentence. —Line 312.

"[...] (i.e. when the global temperature starts to rise sharply)."

8. Figure 5D: The behaviour of the tropical stack during MIS 10 is not clearly visible. Please also check the other figures.

We have modified the figure (now Fig. 4 in the revised manuscript) and the others by putting the median (solid line) of each stack in the foreground.

9. Lines 575–576: Typo — “characterized by a ~2 ka lead in the SH compared to the NH”.

We have modified this sentence. —Lines 443-444.

“[...] characterized by a ~2 ka lead in the SH compared to the NH and identified [...]”

10. Lines 598 and 603: Standardize the formatting of “Heinrich event” throughout the manuscript (choose either “Heinrich Event” or “Heinrich event” and apply consistently).

We have standardized the “Heinrich Event” expression throughout the manuscript.

11. Figure 6: Double-check the y-axis title for panel D.

The y-axis title for panel D is “Hemispheric heat transfer” as desired by the authors. Note that after the submission, we have added a commentary with the new figure without errors.

12. Line 615: Update citation to refer to Figure 6D instead of 6E.

We have modified the citation (now Fig. 5D in the revised manuscript). —Line 489.

“[...] to Northern ones (Fig. 5D).”

13. Standardize the terminology for “greenhouse gases” throughout the manuscript (e.g., use consistently: “GreenHouse gases”, “GHG”, or “greenhouse gas”).

We have standardized by using “GHG” (once defined).