Dear Reviewer,

Thanks for the constructive suggestions and comments. Here, we reply your major concerns (point 1 and 2). We think these two related points form the basis for the review.

We agree with you that Fig. 1c is very central to our argument. There is an offset between the mid-latitude North American west coast and the deep-ocean d18O. This offset indicates that in the mid-latitude North American west coast warming (both in ocean and on land) starts earlier than the NH deglaciation. In the paper, we call it "early warming" in the mid-latitude North American west coast.

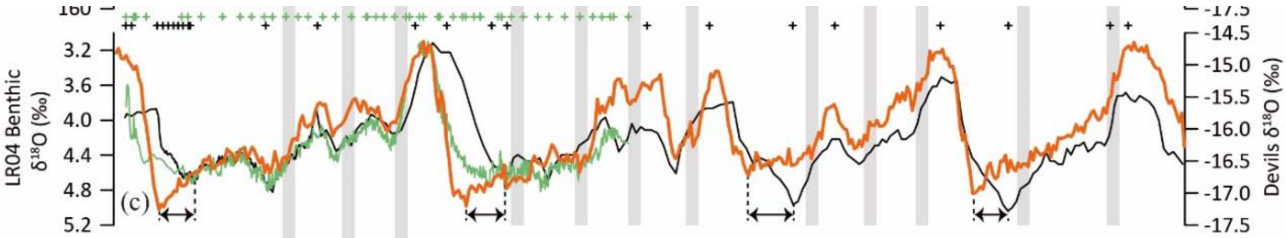
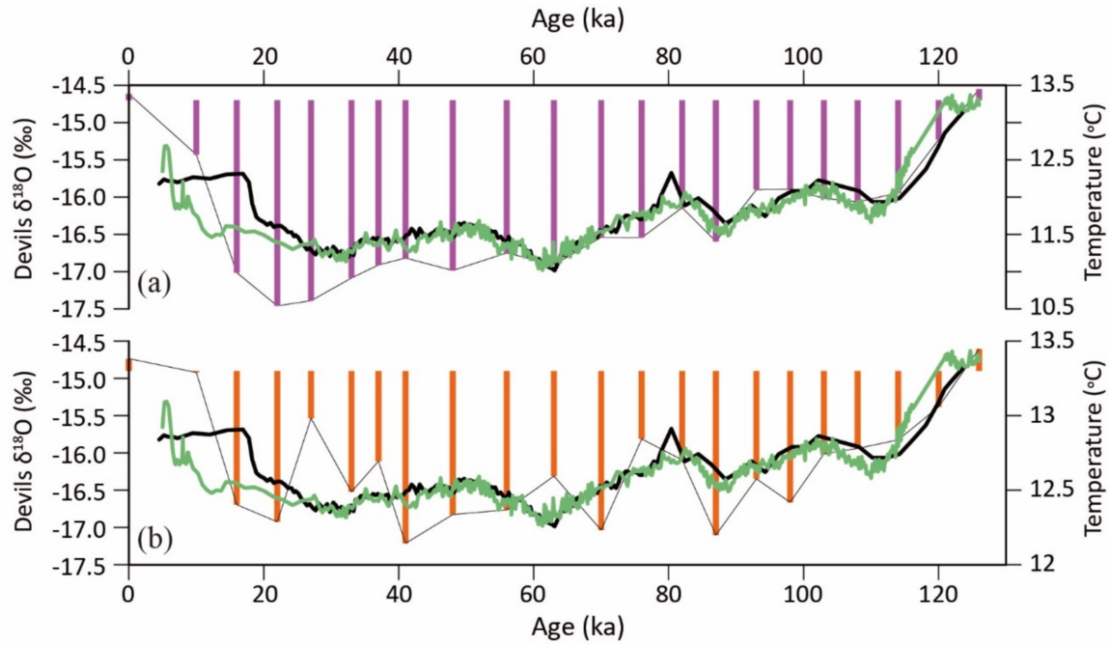


Figure 1c. The LR04 global benthic $\delta^{18}O$ stack (orange line, Lisiecki and Raymo, 2005) and the Devils Hole (DH) $\delta^{18}O$ from the North American west coast (black line for DH-11 and green line for DH2-D, Landwehr et al., 2011; Moseley et al., 2016)

Supplementary Figure 3 is the important evidence to support our argument. We use it to demonstrate which ice sheet scenario, the Laurentide-Eurasian only or the Beringian-involved, can generate the early warming. In this model-data comparison, the trend is the most important.



Supplementary Fig. 3. Simulated SAT evolution in mid-latitude North American west coast during last glacial-interglacial cycle.

When the reconstructed Laurentide-Eurasian only ice sheets are included, please note that the simulated surface temperature (Supplementary Figure 3a) keeps decreasing from 60 ka to 22 ka. In other word, if only the Laurentide-Eurasian ice sheets exist, no early warming occurs in the mid-latitude North American west coast, which conflicts with the climate records. The mechanism behind is revealed in Fig.4a-d in the main texts.

On the contrary, when the simulated Beringian ice sheet is involved, the simulated surface temperature (Supplementary Figure 3b) in the mid-latitude North American west coast show an increasing trend from 40 ka, much earlier than the NH deglaciation. In other word, the Beringian ice sheet allows a successful explanation for the early warming in the mid-latitude North American. The mechanism behind this success is revealed in Fig.4e-h in the main texts.

The mode-data comparisons for the past four glacial-interglacial cycles are shown in Fig. 6d in the main texts. It shows that our experiments successfully simulate the early warming for each glacial-interglacial cycle.

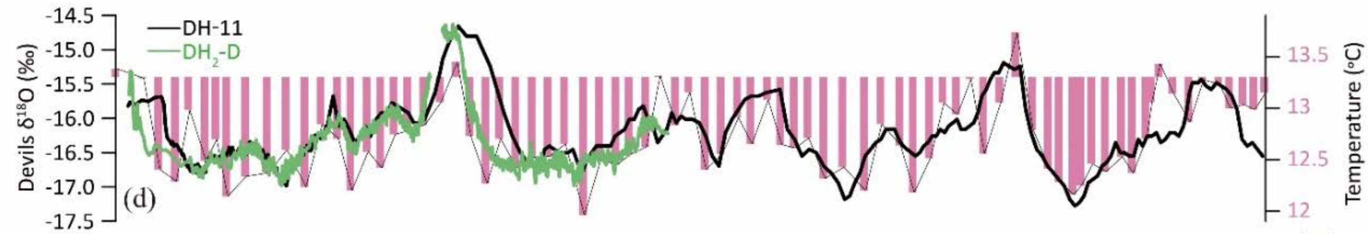


Figure 6d. The simulated SAT (light magenta bars) averaged in the mid-latitude North American west coast (the box 1 marked in Fig. 5) compared to the DH $\delta^{18}O$ (black line for DH-11 and green line for DH2-D, Landwehr et al., 2011; Moseley et al., 2016).

We admit that our simulations underestimate the size of Laurentide ice sheet. This is a weakness in the current study. You ask a good question whether the underestimation makes our simulated TS fit better with the records. Our answer is no. We agree that the size of Laurentide ice sheet will influence the absolute values for simulated temperature in the mid-latitude North American west coast, but not the trend. The cooling effect due to the growth of Laurentide ice sheet must be compensated with a warming effect, otherwise the early warming can not happen.

We agree that it is crucial to understand the interaction between the Laurentide and the Beringian ice sheet. It is a difficult question. We once tried to understand the interaction with equilibrated experiments. Please read our early paper “Instability of Northeast Siberian ice sheet during glacials” https://www.clim-past-discuss.net/cp-2018-79/. The basic mechanism behind this interaction is revealed in the paper. We are going to use high-resolution climate models, as well as increased time steps, to further improve our simulations. This is our future task but with a huge effort, which may need two or three more years.

Moreover, to answer this interaction question also needs modelling intercomparisons with different climate models to constrain modelling uncertainties. Unfortunately, the possibility of a pre-LGM Beringian ice sheet was often neglected and thought to be wrong in the paleoclimate community. We hope our current paper can push the community to reconsider the Beringian ice sheet and re-evaluate the established Laurentide-Eurasian-only concept.

In the minor points, you ask the question how the sediments from Lake El'gygytgyn can be reconciled with an ice sheet over it, since the lake receives continuous sediments during the Quaternary. As we wrote in the main texts, "In Lake El'gygytgyn, the cold sedimentological facies are characterized by laminations, high total organic carbon (TOC), total nitrogen (TN), total sulphur (TS), and very low d13CTOC values. They were interpolated as permanent ice covers due to extreme cold climates, which leads to ceased lake ventilations and anoxic bottom waters in Lake El'gygytgyn." Lake El'gygytgyn could be a subglacial lake when there is an ice sheet on it. It remains possible to explain these sediments in cold periods in a subglacial lake environment. This possibility should be reassessed.

We hope our reply can convince you. If you have any more questions or comments, please let us know.

Best regards

Zhongshi on behalf of all co-authors