From: Dr. Juzhi Hou
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Dec 19, 2023

To: Dr. Qiuzhen Yin
Editor
Climate of the Past

Dear Dr. Yin,

Thank you very much for your comments and suggestion on our manuscript entitled "BrGDGTs-based seasonal paleotemperature reconstruction for the last 15,000 years from a shallow lake on the eastern Tibetan Plateau" (No. cp-2023-32). We have carefully addressed your comments point-to-point below and highlighted in the text. We wish the revised manuscript meets the publication criteria for Climate of the Past.

Comments:

Line 36-38: This sentence is not clear. "a warming trend during the Holocene" is told at the beginning, but "a cooling trend" is said at the end.

Response: Thank you for your suggestion. We have rephrased the sentence, "The existing/available temperature records show complicated patterns of variation, some with general warming trends throughout the Holocene, some with cooling trends, while some with warm middle Holocene".

The abstract is too long and sometimes confusing. I suggest to make it more concise.

Response: Thank you for your suggestion. We have shorten the abstract, please see the revised text.

Line 430-431: Apparently this is not what Fig.6 tells. this sentence needs to be modified.

Response: We appreciate the comment and we have deleted this sentence, which isn't suitable here. Additionally, we have merged the next paragraph with the previous one.

Figure 7: What are the red and blue curves? How is this Jun-Sep insolation calculated and what is the unit? I tried different ways to make the calculation, but I could not get similar result as the authors. What is the Jul insolation and its unit? monthly mean, mid-month daily insolation, total insolation? Why do you need to show both insolation curves?

Response: Thank you very much for your advice and assistance. We have clarified the confusion in Fig. 7. The red curve represents the cumulative insolation from June to September in W/m^2, and the navy blue curve shows the mean insolation during July in W/m^2. Both are shown for comparison with temperature reconstruction in ice-free season (brGDGTs in this study) and in July (pollen in Wang et al., (2022)) at Lake Gahai. The difference in the two temperature records may result from the lags between the insolation in June to September and in July.

The previous solar radiation data was obtained from https://vo.imcce.fr/insola/earth/online/earth/online/index.php. The 34°N July mean insolation and June-September mean insolation calculated in Fig.7 are obtained by dividing the total solar radiation for July 1st to July 31st and June 1st to September 30th, respectively, by the length of these two time periods. The total solar radiation is calculated using the Berger et al. (2010) elliptic integral method.

We have already labeled this in the caption of Fig. 7f, named "Mean insolation during July (W/m2) (navy blue curve) and mean insolation during ice-free months (W/m2) at 34 °N (red curve)". Relevant references have been cited.

References:

Berger, A. and Loutre, M. F.: Insolation values for the climate of the last 10000000 years, Quaternary Science Reviews, 10, 297-317, 10.1016/0277-3791(91)90033-q, 1991.

Berger, A., Loutre, M. F., and Yin, Q.: Total irradiation during any time interval of the year using elliptic integrals, Quaternary Science Reviews, 29, 1968-1982, 10.1016/j.quascirev.2010.05.007, 2010.

Wang, N., Liu, L., Hou, X., Zhang, Y., Wei, H., and Cao, X.: Palynological evidence reveals an arid early Holocene for the northeast Tibetan Plateau, Climate of the Past, 18, 2381-2399, 10.5194/cp-18-2381-2022, 2022.

L447-453: The ice sheets during early Holocene would cool the system directly through their cooling effect, not necessarily through melting water effect. If you suggest melting water effect, you better compare your records with melt water flux. How about the effect of CO_2?
About the effects of astronomical parameters, ice sheets and CO_2 on East Asia climate, I recommend this paper https://doi.org/10.1016/j.quascirev.2022.107689

Response: We thank editor for the meaningful comments and suggestions. We briefly described the impact of CO_2 on temperature changes and rephrased this part in the revision; see lines 450-452 and 458-462 for details.

Line 450-452: "Furthermore, the cooling during the early Holocene followed by the warming trend in the mid-Holocene potentially correlates with significant fluctuations in CO_2 concentrations within these intervals (Fig. 7e) (Monnin et al., 2004)."

Line 458-462: “In essence, temperature, especially seasonal variations like the Gahai ice-freeze temperature in the eastern TP, is influenced by multifaceted factors including astronomical forcing, CO_2, and ice sheets. Temperature exhibits varied sensitivities in response to these factors, while both insolation and CO_2 exert considerable and favorable impacts on summer temperature patterns (Lyu and Yin, 2022).”

References:

Lyu, A. and Yin, Q. Z.: The spatial-temporal patterns of East Asian climate in response to insolation, CO_2 and ice sheets during MIS-5, Quaternary Science Reviews, 293, 10.1016/j.quascirev.2022.107689, 2022.

Monnin, E., Steig, E. J., Siegenthaler, U., Kawamura, K., Schwander, J., Stauffer, B., Stocker, T. F., Morse, D. L., Barnola, J. M., Bellier, B., Raynaud, D., and Fischer, H.: Evidence for substantial accumulation rate variability in Antarctica during the Holocene, through synchronization of CO2 in the Taylor Dome, Dome C and DML ice cores, Earth and Planetary Science Letters, 224, 45-54, 10.1016/j.epsl.2004.05.007, 2004.

I am still wondering why pollen record reflects only July temperature, why not the warm season temperature.

Response: Thank you for your insightful comments. The referenced pollen record from Lake Gahai, as outlined in Wang et al., 2022, explicitly demonstrates the responsiveness of pollen assemblages to the mean temperature of the warmest month (July). A pollen-based transfer function was developed for the eastern TP, utilizing 117 lake surface sediment samples (n = 117) obtained between elevations of 3720 and 5170 meters above sea level (Cao et al., 2021). This function was calibrated with modern climatic data sourced from the Chinese Meteorological Forcing Dataset.

In their study, Wang et al. (2022) specifically selected the mean temperature of July along with elevation (Elev) to explore the relationship between pollen assemblages and July temperature. Ordination analysis highlighted the significance of July temperature as a climatic determinant affecting pollen distribution. Calibration sets, linking pollen data with July temperature, were established to evaluate the predictive power of this dataset. The 'leave-one-out' cross-validation results indicated strong performance, particularly with the first component for July temperature. The original authors therefore regard this reconstruction as reliable.

To assess the potential of the pollen dataset for reconstructing past climates, Weighted Averaging Partial Least Squares Regression (WA-PLS) was employed. Its performance was tested using 'leave-one-out' cross-validation (ter Braak & Juggins, 1993) and evaluated through R^2 (coefficient of determination between observed and predicted values) and RMSEP (root mean square error of prediction Birks, 1998). The number of WA-PLS components used was determined via a randomization t-test (Juggins and Birks, 2012). Climate reconstruction was conducted using R software with the rioja package version 0.7-3 (Juggins, 2012). Prior to reconstruction, the pollen assemblages underwent square-root transformation to minimize noise (Prentice, 1980).

After discussing with the original authors, they believe that the temperature reconstructed for the Gahai region corresponds to the temperature in July.

References:

Cao, X., Tian, F., Li, K., Ni, J., Yu, X., Liu, L. and Wang, N. N.: Lak e surf ace sediment pollen dataset for the alpine meadow vegetation type from the eastern Tibetan Plateau and its potential in past climate reconstructions Earth Syst Sci Data 13, 3525-3537, https://doi.org/ 10.5194/essd 13-3525-2021, 2021.

Juggins, S.: Rioja: analysis of Quaternary Science Data ve rs ion 0.7-3, available at: http://cran.r-project.org/web/packages/rioja/ index.html (last access: June 2020), 2012.

Juggins, S. and Birks, H. J. B.: Quantitative environmental reconstructions from biological data, in: Birks, H. J. B., Lotter, A. F., Juggins, S., and Smol, J. P., Tracking environmental change using lake sediments (vol 5): Data handling and 91 numerical techniques, Springer, Dordrecht, 431-494, 2012.

Prentice, I. C.: Multidimensional scaling as a research tool in Quaternary palynology: a review of theory and methods, Rev. Palaeobot. Palyno., 31, 71–104, https://doi.org/10.1016/0034-6667(80)90023-8, 1980.

ter Braak, J. F., and Juggins, S: Weighted averaging partial least squares regression (WA-PLS): an improved method for reconstructing environmental variables from species assemblages Hydrobiologia 269-270, 485-502 doi: 10.1007/BF00028046, 1993.

Wang, N., Liu, L., Hou, X., Zhang, Y., Wei, H., and Cao, X.: Palynological evidence reveals an arid early Holocene for the northeast Tibetan Plateau, Climate of the Past, 18, 2381-2399, 10.5194/cp-18-2381-2022, 2022.

I draw the authors' attention that Copernicus Publications request depositing data that correspond to journal articles in reliable (public) data repositories. Please see the data policy at https://www.climate-of-the-past.net/policies/data_policy.html.

Response: Thanks for your reminder. We have prepared the data and will submit it as requested.