Reviewer#2:

The authors successfully reconstructed temperatures in Northeast Asia using buried carbonized logs and nearby living trees, and it looks very interesting, providing a data window into our understanding of the temperature before the millennium eruption of the Changbai Mountain volcano. But I still have some concerns. First, the description of the exact dating process of carbonized logs is not complete enough. Secondly, the method of establishing the width chronology needs to be improved. The RES chronology is not as good as the STD chronology in the recording of low-frequency signals. Finally, the teleconnection mechanism discussion simplicity requires more pattern process validation.

[Response]: We thank you very much for the approval of the significance of this work. We also thank you for pointing out the three-aspect shortcomings and for the insightful and constructive comments and suggestions. We have carefully revised/corrected all the questions, which helped us to improve the MS quality significantly. Below you will find our point-to-point response.

1. ***Lines 27~31 The time boundary is confusing, the specific time should be given in the past millennium and the past half century.***

[Response]: Thank you for your suggestion. We have added the specific time of both periods in the revised manuscript as: "…between the periods of 745-946 AD preceding the eruption and 1883-2012."

2. ***Line 39 Why is it pre-industrial.***

[Response]: Thank you for your question. It should be "the industrial period". We have revised the statement in the revised manuscript.

3. ***Line 45 Long-term and historical express the same meaning.***

[Response]: We deleted "historical" from the sentence. Thank you!

4. ***Line 50 Add references.***

[Response]: We supplemented the classical book, "Tree rings and climate" (Fritts, 1976).

5. ***Line 57 Gives the latitude and longitude position.***

[Response]: Done!

6. ***Line 128 unified into English or Arabic numerals.***

[Response]: Thank you for your comment! We spelled small numbers (e.g., numbers less or equal to 10) out, but showed other as Arabic numerals. However, it is little proper to start a sentence with an Arabic numeral. Therefore, we spelled out the starting number "18" (Eighteen) but not spelled out the number "55" within the sentence.

7. ***Lines 129~131 This sentence should specifically describe or list more references to support this method.***

[Response]: This sentence was a bit confusing, which was also pointed out by Reviewer#1. We wanted to express that: "Korean pine was previously successfully used to reconstruct temperature in Changbai Mountain (Zhu et al., 2009). Therefore, Korean pine is suitable to reconstruct temperature in this region. We used the growth-climate response of Korean pine by our samples rather than by Zhu et al. (2009) as the current climate response of the pine in our study."

To avoid this confusion, we deleted the citation in this sentence. We changed the relevant sentences as: "*Prior to performing the climate response analyses, we also sampled modern living Korean pines. Core samples from 27 living Korean pine trees located near site A (see Figure 1a) were collected in 2013 and at 1.3 m height using a Pressler increment borer. We used the 19 carbonized Korean pine cores to reconstruct the climate before the Millennium Eruption (946 AD) using the current climate response of Korean pine growth.*" (Lines 135-140) Thank you for your comments!

8. ***Lines 158-161 What I want to know is the response of the chronology to the mean minimum temperature and mean maximum temperature, but this does not.***

[Response]: Considering your suggestion, we added the analysis of the response of the STD chronology to maximum temperature and minimum temperature in Figure 2. The STD chronology was still most sensitive to April mean temperature among the correlation relationships between the chronology and precipitation, mean temperature, maximum temperature, and minimum temperature.

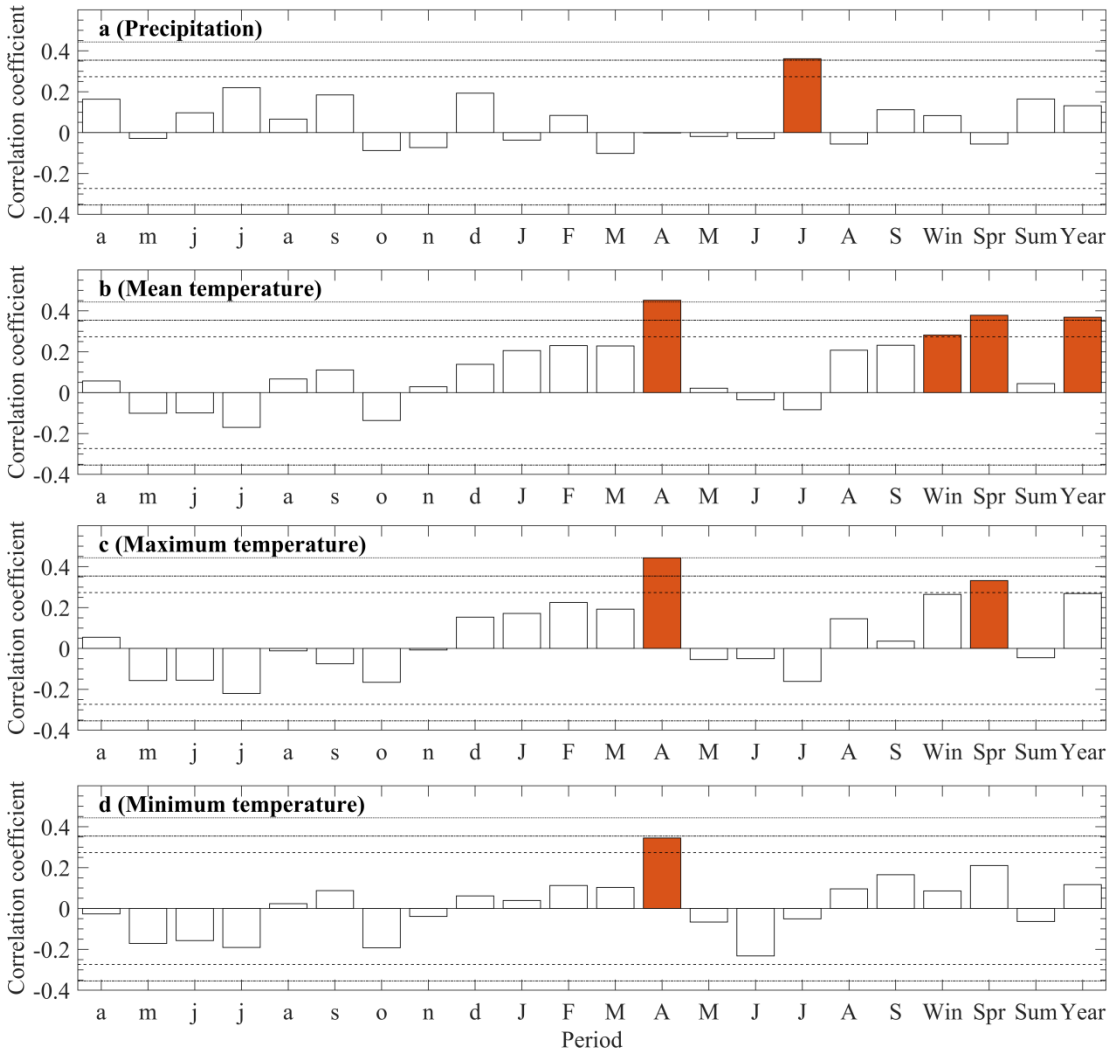

Figure 2.

9. ***Lines 161-162 Why is it from April of the previous year to September of the current year? Is there any relevant explanation?***

[Response]: Climate may show time-lag effects on tree radial growth (Zhou et al., 2022). Moreover, Korean pine is limited by temperature from the month preceding cambial onset onward (Wang et al., 2017; Zhu et al., 2009) and until the end of growing season (September). Therefore, we analyzed the correlations of tree radial growth and climate during the previous April to current September. We have added this information in the revised manuscript (Lines 176-179).

10. ***Lines 164-166 Why does the RES chronology respond better? Is it caused by the different detrending methods used? I want to know about the chronology established by other detrending methods such as spline function or smooth curve. The RES chronology usually suffers from the loss of low-frequency signals, especially for temperature reconstruction, which cannot capture interdecadal signals.***

[Response]: We sincerely thank you for this comment. Maybe because RES chronology emphasizes high-frequency variations in temperatures, which caused higher correlation with short-term temperature (e.g., ~50 years) compared with STD chronology. However, we agree with you that RES chronology usually suffers from the loss of low-frequency signals, especially for temperature reconstruction. Therefore, to capture interdecadal signals, we reconstructed temperature using STD chronology in the revised manuscript, and this revision did not affect the previous main findings.

In the revised manuscript, we used polynomial functions (splines with a period of 67% of series length) to detrend the tree-ring width series. However, results may be sensitive to detrending method (your comments and Peters et al. 2015). Therefore, to ensure robustness of our results to method choice, we also used negative exponential functions to remove non-climatic signals in ring width. The results based on the negative exponential curve (Figure S5) are very similar to the results shown in the main text (Figure 2), which confirms the robustness of our findings. Thank you again!

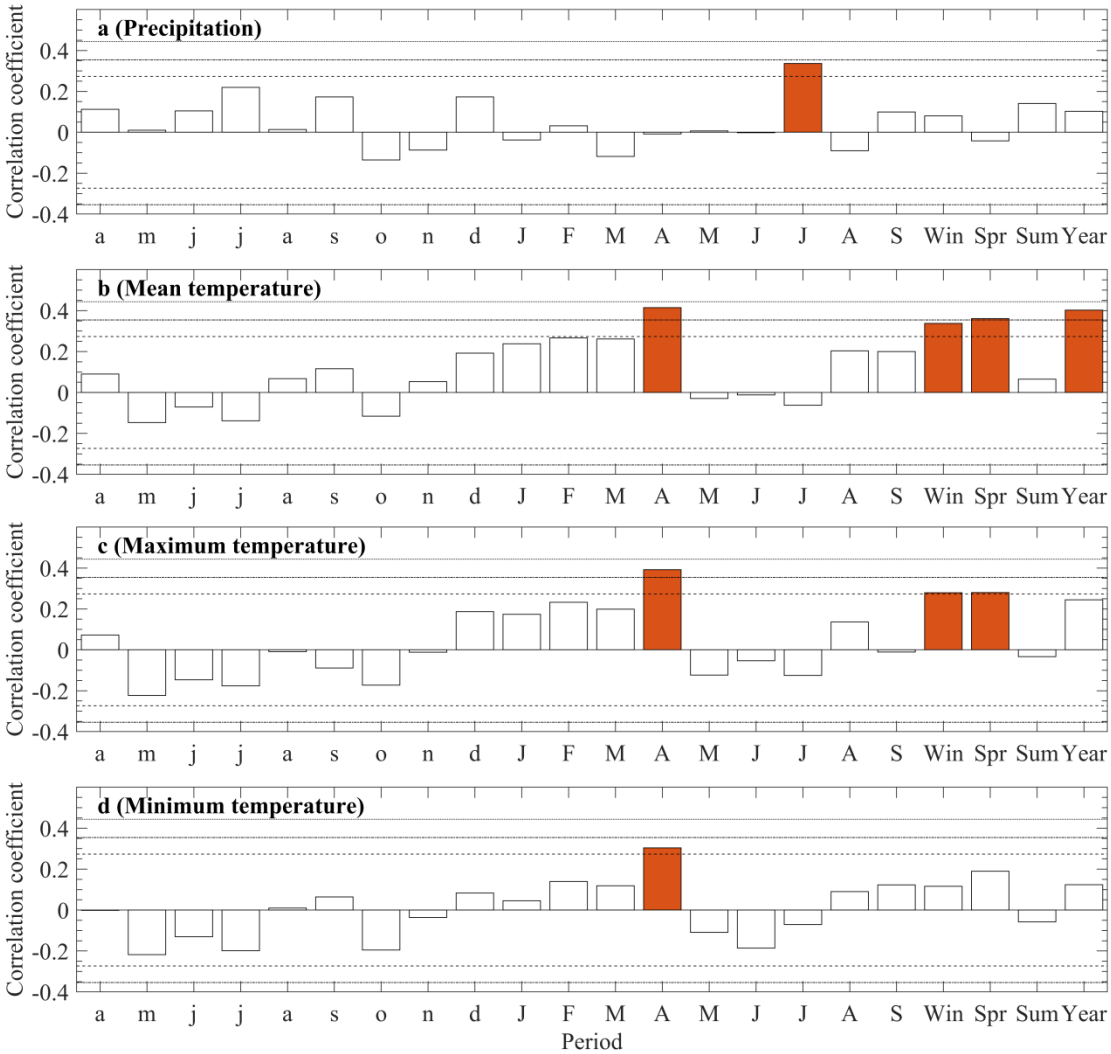

Figure S5. Same as Figure 2, but for the detrending method of negative exponential curves.

11. ***Lines 168-173 Has the author considered using a sliding correlation to test the stability of the temperature or precipitation signal?***

[Response]: Thank you for your comment. We added an analysis of the sliding correlation in the revised version. The results showed that the 30-year moving correlation coefficient between the STD chronology and April mean temperature did not change ($p > 0.01$) during 1961-2012 in the Changbai Mt (Figure S4).

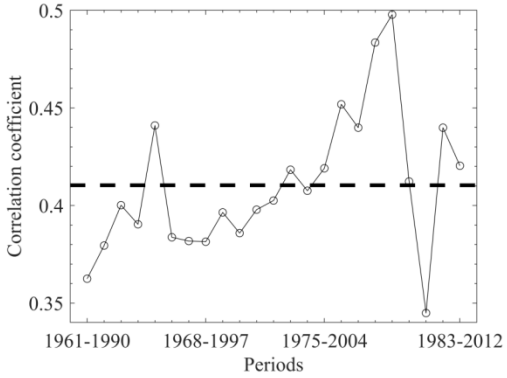

Figure S4. Thirty-year moving correlation coefficient between the STD chronology and April mean temperature during 1961-2012 in the Changbai Mt. The thick dash line shows the average of the moving correlation coefficient.

12. ***Lines 248-250 Has the author done a spatial comparative analysis? e.g., spatial correlation.***

[Response]: We did not calculate the spatial correlation between our temperature reconstructions with other reconstructions. However, we analyzed the correlation and regression relationships between our reconstructed temperature and the observed temperature in the Changbai Mt. (Figure 3).

13. ***Lines 259-275 I suggest that the author add the millennium simulation results in the Earth coupling model (CESM) to increase the accuracy, stability and regional representativeness of the reconstruction results on the basis of the proxy data reconstruction comparison.***

[Response]: We sincerely thank you for this suggestion! We will use the Community Earth System Model 2 to simulate the entire millennial temperature time series based on the two-period reconstructed temperatures. We think that this should be a new work and will further improve our understanding of the changes in regional climate in Northeast Asia at millennial scale. In this study, however, the previously published temperature reconstructions with different space-time scales from the Changbai Mt., China, and Northern Hemisphere were adequate for the comparison with our

temperature reconstructions. Therefore, we want to use your suggestion for another further study based on this study. Thank you very much for this valuable and constructive suggestion!

14. ***Lines 315-323 There are many ways to detect attribution, why didn't the author use it, such as multiple regression to calculate contribution, etc., but rely on simple statistics of increase and decrease.***

[Response]: We agree with you that the multiple regression model is a very useful approach to quantify the (relative) contributions of independent variables on the dependent variable in the model, e.g. by the slope and the R^2 of each normalized independent variable. In this study, however, we cannot get the anthropogenic factors prior to the 946 AD Millennium Eruption, and separately analyzing the regression relationship between temperature and anthropogenic factors exceeds the purpose of this study. Therefore, we used the simple but useful statistics to discuss the differences between the two periods.

15. ***Lines 325-329 Maybe cross wavelet power spectrum XWT analysis is more suitable for the similarities and differences in the periodic changes of the two-time series.***

[Response]: Thank you for this suggestion. The XWT analysis is indeed useful to reveal the correlation and consistency of two different time scales and can reproduce the phase relationship in the time-frequency space. However, this method requires that the two time series must overlap. For example, at least four data available in the common time period are required in the Matlab codes provided by Grinsted (2023). In this study, the two temperature time series have no common time period. Therefore, we used separately the Wavelet analysis for the temperature reconstructions of the two different periods.

However, we supplemented an analysis of the correlation and consistency of the periodicity of the temperature in Changbai Mt. and SST in Eastern Tropical Pacific **based on the XWT**. This is also our response to your next comment below. Thank you for the suggestion again!

16. ***Lines 335-341 The discussion on the SST model is too simple. Has the author verified such a teleconnection mechanism with the reanalysis data (NOAA, ERA)?***

[Response]: Thank you for this comment. We added discussion on the correlation and consistency of the periodicity of the temperature in Changbai Mt. and SST in Eastern

Tropical Pacific based on the XWT to verify the teleconnection mechanism in our study (Lines 363-367; Figure S7). The SST data are from NOAA Extended Reconstructed Sea Surface Temperature (ERSST) Version 5.

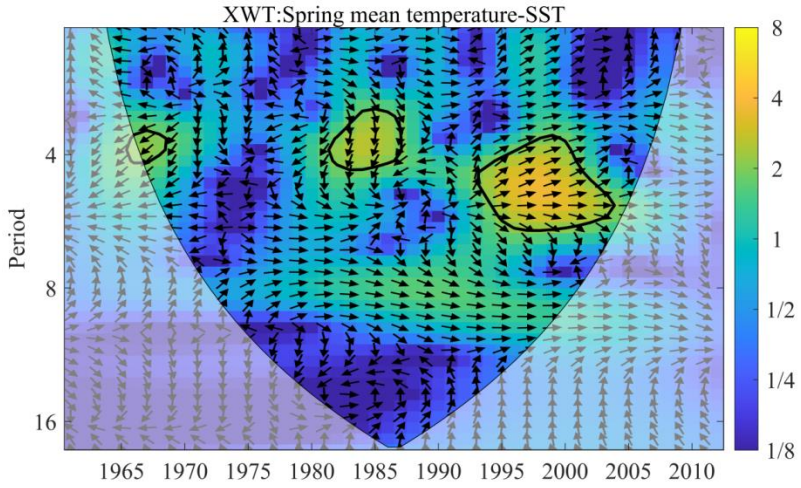

Figure S7. Cross wavelet transform of the spring mean air temperature of Changbai Mountain during 1961-2012 and mean sea surface temperature (SST) of Eastern Tropical Pacific (0 to 10 °South and 90 °West to 80 °West) time series (https://psl.noaa.gov/data/timeseries/monthly/NINO12/). The 5% significance level against red noise is shown as a thick contour. The relative phase relationship is shown as arrows (Grinsted et al., 2004; https://doi.org/10.5194/npg-11-561-2004).

17. ***Figure 4. Needs to separate independent reconstructions and other comparison sequences, it looks very messy and cannot be discerned.***

[Response]: Thank you for this suggestion. We have revised Figure 4 according to your suggestion in the revised manuscript.

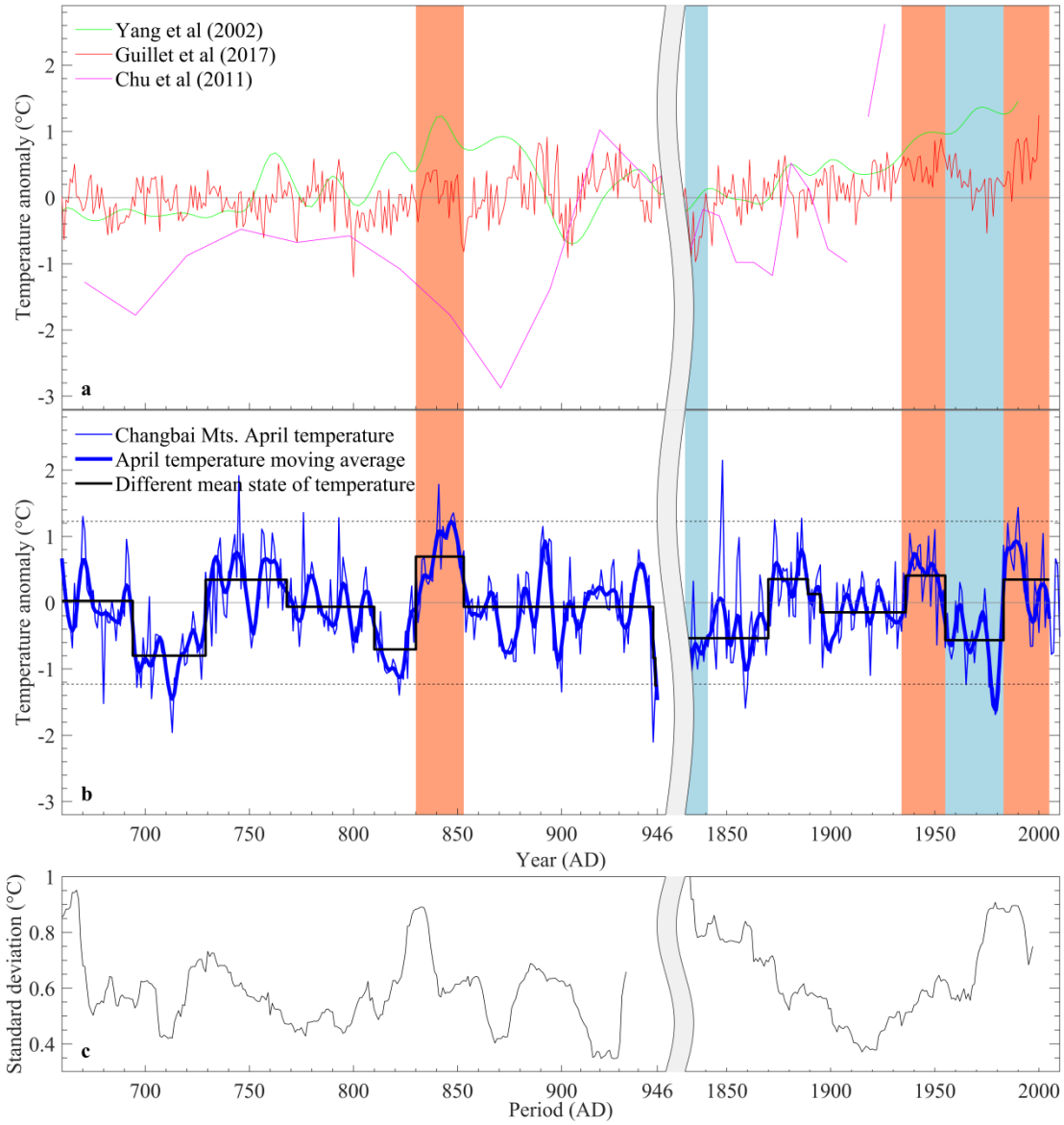

Figure 4.

18. ***Figure 5. Contour lines should be displayed in color to identify significant periods more intuitively.***

[Response]: Thank you! We used bold red contour lines to identify significant periods in the revised Figure 5 and Figure S6.

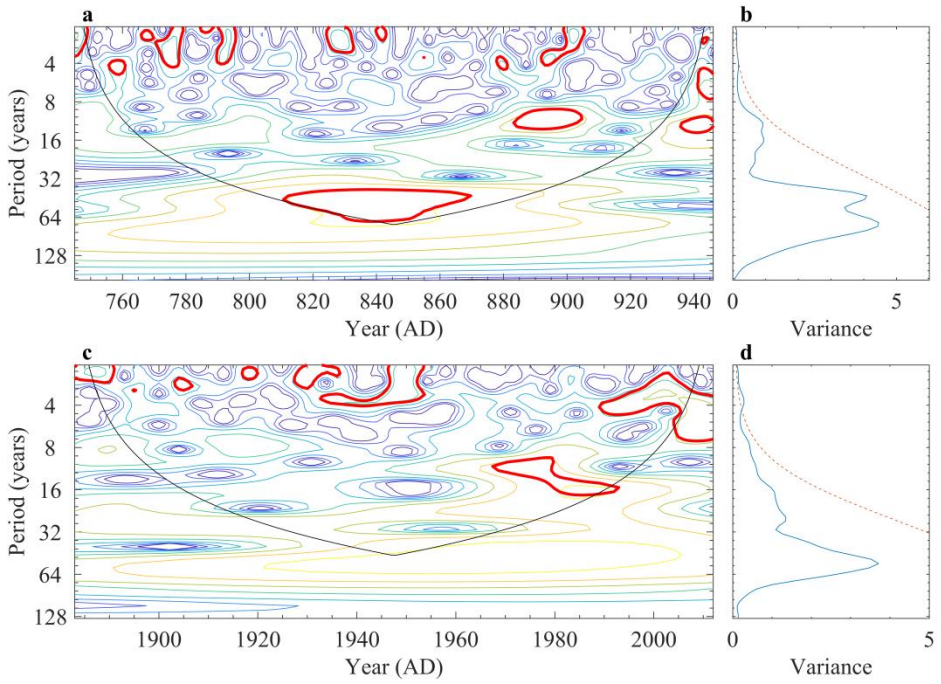

Figure 5.

References:

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