

**Point to point responses on comments of " Temperature changes derived from phenological and natural evidence in South Central China from 1850 to 2008"**

Dear editor and referees,

Thank you very much for your effective works and constructive comments. After read the four reviewers comments, we revised the manuscript carefully. The point to point responses are listed below. Hope you would consider our manuscript can be published on your Climate of the Past journal.

Best wishes,

All authors

**Anonymous Referee #1**

Major comments:

(1) It is suggested to add the comparison between the new temperature reconstruction and the regional temperature derived from CRU (Climatic Research Unit) gridded temperature data in the south central China over the period 1850-2010. The discussion on the advantages and disadvantages between them is beneficial and would strengthen the manuscript. It would be also interesting to compare the new results with the longest observational records (Shanghai, and other longer regional temperature series) in China.

**We agree. The comparison between the reconstruction and regional temperature from CRU has been added in figure4. And long observation in Shanghai have been added too, please see figure 4.**

(2) A spatial correlation map is needed to show the spatial representation of the newly-produced regional temperature series.

**We agree, and please see figure 2.**

(3) Different types of proxy records are used in the regression equation. But the

authors did not state how the proxy series were pre-treated considering their discrepancies in dimensions and length.

**We added in the section of “reconstruction and analysis method”. Line 185-187.**

(4) The method ‘multiple regression’ has some weaknesses. For example, there is multi collinearity and transfer function’s instability with time. It is clear that the tree ring width chronologies used are highly correlated with each other. It would be nice to give some more comments on the related parts in the text.

**We agree, and the weakness of the multiple regression was added in Line 298-300.**

(5) The authors detected Quasi-15-year and quasi-35-year cycles in the temperature reconstruction series, but did not do any discussion. Further insight is needed.

**As suggested in referee 2’s General comments 4, we deleted this part.**

(6) There are spelling errors in the text and tables (Table 1 and Table 2). Please check it carefully and do correction.

**We submitted the manuscript to the English language editor of native speaker, and we also checked the spelling errors.**

(7) A simple section to describe how the tree-ring chronology was produced is needed. The authors should show which detrending method was used, and how the chronology was derived. Also, how the reconstruction uncertainties were estimated need clarification.

**We added the description on the tree-ring chronology production, detrending method in line 156-163, and the method of uncertainties was add in line 189-191.**

**Specific comments:**

(1) In the Title, evidences should be corrected as evidence;

**Yes, revised.**

(2) Abstract: They wrote ‘1893 was the coldest year’. My question is that ‘Is it correct within the uncertainty range’?

**We added the very likely if consider the uncertainty range.**

(3) Page 4079, Materials should be Material;

**Yes, revised.**

(4) Table 1: what are the superscripts [27], [28],[29]? It is difficult to find the reference sources.

**This is a mistake and deleted now.**

(5) Figure 1: the study area is irregular and strange. The Nanchang sub-region should be excluded. Figure caption: central China should be South Central China; There are no proxy records available in west north parts of the study region (see Figure 1). Do the proxy records collected by the authors have good representation for the whole study region? A spatial correlation map is needed.

**About study area division, the proxy data representiveness, we added the introduction in the section of 2.1 instrumental data, line 59-66, and correlation map was plotted in figure 2.**

(6) Page 4082, line 19, the reference could be wrong.

**Changed.**

(7) Page 4084, lines 10-25, many sentences are related to 1892 rather than 1893, but the 1893 is considered as the coldest year.

**Winter of 1892 in the lunar calendar is from December of 1892 to February 1893 in solar calendar, thus the most sentences are related to the 1893 in solar calendar, which is consistent with the coldest year of 1893.**

(8) Page 4085, lines 1-14 is not relevant.

**Deleted.**

**Anonymous Referee #2**

General remarks

1) Plant phenological and snow day documentary evidence can provide very useful information on seasonal temperature variability. Local time series are often impacted by peculiarities at a specific location and show unwanted impacts. The authors of this study construct regionally averaged series from single records. However, the methods are not presented nor basic information about the number of records per year, number

of local time series... Recently, Ge et al (2014 with references therein on methods) and Wang et al (2014) reconstructed two regional plant phenological regional series temperate and subtropical regions in China from local observations. I strongly suggest testing the feasibility of this methodology.

We present all phenological records in Table S1, and add the information about the number of records per year for historical times. The methodology for reconstruction the regional phenological series from single record was added too (Line 91 to 132). About method in Ge et al. (2014) and Wang et al (2014), since there are several pieces of records from same proxy per year, which is not same as that in this manuscript, but we indeed to compare them although their study areas are not completely same, the comparison result was listed from line 125 to 132.

2) One strength of the study is the combination of three different temperature proxies. In the present form, the manuscript does not make clear what the benefit of this combination is and what this means for the model skill and the interpretation of the results. In consequence, it is very hard to understand what the impact of a single record is on the main conclusions of the study. You could also consider a sub-sampling approach to the stability of the reconstruction.

We agree, and the more information on benefit of using combination of three different proxies compare to single proxy has been added in the section “result and discussion” from 304 to 323. In the conclusion part, about accuracy of multi-proxy sentence has been deleted.

3) The study aims at reconstructing mean annual temperatures. Due to the fact that at least two proxy types (plant phenology, tree rings) only store temperature signals of the growing season, it would be desirable to see the differences of model skills with different targets, especially growing season temperature vs annual mean.

We agree, and added the growing season temperature in Figure 4 and made a comparison from line 213-217 and 258-266.

4) I am not sure whether wavelet analysis is really needed here to highlight the changes in temperature. Maybe remove?

**Yes, removed.**

5) Please thoroughly check grammar and spelling when revising the manuscript.

**We submitted the manuscript to the English polish agency by native speaker, and we think grammar and spelling are better now.**

Some detailed remarks on figures and tables.

Table 1: consider exchanging significance level indicators with \*\* and \*\*\* for  $p < 0.01$  and  $p < 0.001$ . Why are there positive correlations of tree ring width with temperatures at four out of five sites? What is the process behind the single site with negative correlations? Why do use “~” in the column duration? Are there dating uncertainties? The same applies for column Location where the altitudes seem to be estimated.

**We agree, and changed; the related negative correlation introduction has been added in the 2.2.3 tree ring data section, Line 171-179 ; “~” changed with “-”; No dating uncertainties existed in tree ring proxy, and the measurement method was added in the 2.2.3 section, see Line 156-163.**

Figure 2: What is the meaning of “0.1 HZFFT smooth”? Please explain. What do you mean with “based on a 95% confidence interval”? Consider making 2 figures with a) in one figure and (b)-(d) in a second figure. The message is not very clear, yet.

**We agree.**

**We explained in Figure 4 caption, which is 0.1Hz FFT filter indicating the 10-year smooth of the reconstruction;**

**“Based on a 95% confidence interval” changed “with a 95% confidence interval, the uncertainties are calculated from the reconstruction equation from the reference of Michaelsen, 1987 with Minitab software.**

**We divided this figure into two figures.**

**Anonymous Referee #3**

1) On page 4079, the authors mentioned “: : :Although these series have become important data to illustrate regional temperature changes in China in the last century(Tang et al. 2009), several flaws remain in the data: : :” What are the flaws? The authors should at least explain the flaws by one or two sentences.

**We agree and added, please see line 39-46.**

2) Since this work applied multi-types of proxies, and the authors also believe that the new reconstructed temperature anomalies have lower uncertainties, it would be helpful if the authors make a detailed comparison between the new reconstructed time series and the time series reconstructed by (Wang et al., 1998).

**We agree, and the text for comparison was added from Line 324-331 in the last**

### **paragraph of result and discussion section**

3) On page 4086, “our annual temperature series has a higher explaining variance(more than 56%) on the temperature observation” How is the explaining variance 56%calculated? It will be helpful if the authors show a figure here, or explain by some sentences on the explaining variance.

**We agree. The explain variance was calculated by the ratio between observed temperature and predicted temperature. And the figure has been added in Figure 3.**

4) On page 4086 and 4087, the authors claim that the maximum error is only 0.35oC. How did the error bar calculated?

**It is 95% confidence level, i.e. 2-times standard error of prediction. which has been added from line 189 to 191.**

### **Anonymous Referee #4**

1) The authors conclude that they improved the accuracy of reconstruction by using multiple proxy types compared to using a single type of proxy. However, some obvious differences exist between the different proxies (e.g., resolution and trend). How did the authors treat these differences when performed the reconstructions, especially for the different trend existing in the five tree-ring width chronologies owing to different detrending methods were used by different researchers?

**We agree. And the stepwise regression was used to perform the reconstruction. And the equation with higher explanation variance was used for every year. Please see table 2 for detailed information.**

2) The locations of proxies used in the study mainly distributed in the southeastern part of the studying region, but less in the northwestern part.

**We agree, since no available proxy data can be found in the northwestern part, but we analyzed temperature coefficient between the regional and grid point, the result was not influenced by the proxy distribution.**

3) I agree on the point of the referee #1: comparison of the reconstruction with CRU grid dataset or meteorological record in Shanghai station is necessary to validate further the reliability of the reconstruction.

**We agree, and added, please see Figure 4 and text line 279-283.**

4) The authors present the calibration equations (Table 2), but not present the statistics of the leave-one-out validation of the regression model.

**We agree and added in table 2, including Root mean square error for calibration, and Root mean square error for cross-validation.**

5) Except for the earlier extension and the improved accuracy of this reconstruction than the Wang's reconstruction, are there other differences between the two reconstructions? For example, some different cold or warm periods.

**Yes, we added, please see the part from line 324-331.**