We would like first to thank the three referees very much for their careful reading and their constructive comments that help us to improve the quality and the explicity of our MS.

Anonymous Referee #1

1. The number of illustrative figures is sufficient, although Figure 4 seems reproduced too small. The map (Figure 1) is not very appealing; some topographic features instead of a plain grey background would give a better impression of the area.

Reply: According to the recommendations, we have reproduced Figure 1 and Figure 5 (we added a figure 2 for the illustration of the local climate character). The elevation information was added on the map (Figure 1) to show the topographic features.

2. The methods are clearly described, although it is not completely clear if the fixed 180-year spline used to detrend the original data is applicable for all trees collected. As shown in Table 1, median segment length of the trees is at least 180 years, so some tree-ring series are shorter.

Reply: The fixed 180-year spline can successfully fit the long-term growth trend for the shorter (<180 years) series (Figure a).

3. It would be helpful to give more information about the regional climate (winter temperature, seasonal distribution of precipitation) to demonstrate the monsoonal character of the local climate.

Reply: We have added the descriptions of the regional climate in the text and a new figure (Figure 2). The descriptions are as below: "The study area is located in the Changbai Mountain, a volcano in Northeast China, where the climate is affected by the East Asian monsoon (Fig. 1). At the meteorological station in Dunhua (43°22′N, 128°12′E, 523 m a.s.l.), January (mean temperature of -16.9℃) and July (19.9℃) are the coldest and the warmest month, respectively (Fig. 2). The multi-year mean of annual precipitation amounts to 630 mm, with 88.4% of the annual precipitation falling during the growing season approximately from April to September."

4. The positive tree-ring response to winter temperature is a widely found reaction at high-altitude tree-ring sites, although explanations about the effect are often speculative, though reasonable from the common ecological knowledge. There are also a number of tree-ring papers mentioning an influence of winter temperature on the Tibetan plateau which have not been addressed. Therefore, a more thorough discussion about the effect of February-April temperature on tree growth is needed.

Reply: According to the referee's suggestion, we have provided a more thorough discussion about the effect of February-April temperature on tree growth. The discussion is as following: "The positive effect of winter temperature on tree growth was also reported for other temperate coniferous forests, such as central Japan and Hudson River Valley (Pederson et al., 2004; Yonenobu and Eckstein, 2006), and the timberline forests on the east and northeast Tibetan Plateau (Brauning, 2001; Liu et al., 2007; Zhu et al., 2008). The warm winter may mean less damage to the roots and positive carbon gains for conifer trees when their leaves are not frozen (Brauning, 2001; Chabot and Hicks, 1982; Havranek and Tranquillini, 1995; Pederson et al., 2004)"

5. The usage of English is generally good, despite some wrong usage of the particle 'the' which should be checked by a native English speaker. Some detailed suggestions for language corrections are given below. p. 1217, l. 2f: The purpose of this study is to reconstruct winter temperature based on tree-ring widths of Korean Pines from the Changbai (also known as Baekdu) Mountain area in Northeast China (Fig. 1). This reconstruction may also be useful for studying the long-term behavior of the EAWM. p. 1217, l. 21: CB is considered to be reliable from 1750 AD, when the sample depth is 20 series, although the EPS is 0.80, slightly lower than the commonly used level of 0.85. p. 1218, l. 18: The ring width series shows has significantly ($p<0.01$) positive correlations with the temperatures in previous October, current February to April, and September. p. 1220, l. 15: A former reconstruction of January–April maximum temperature for the Changbai area was based mainly on Larix olgensis and Picea jeozoensis (Shao and Wu, 1997). However, due to the removal of persistence in their original tree-ring data by autoregressive modeling (Cook and Kairiukstis, 1990), little low-frequency variations were retained in that record that would allow a comparison with the current reconstruction. p. 1221, l. 17: The SH is the source area of EAWM, and its intensity is significantly positively correlated with. . . p. 1221, l. 17: Moreover, D'Arrigo et al. (2005) have developed a difference index between the normalized SH index and North Pacific index based on the tree-ring records from broad regions of Eurasia and northwest America.

Reply: We corrected the language according to the suggestion.

Anonymous Referee #2

1. Although long climate records are hardly available in China, I am worried that the calibration span is very short. It is highly informative if the same analysis could be performed using the CRU gridded temperature dataset (5x5), which includes a temperature record from 1909 (Oct. '43 to Dec. '48 missing).

Reply: We agreed with the referee's worry about the short calibration span, but there are really too few continuous meteorological records before 1950. Yanji and Mudanjiang, the nearest two stations to Dunhua, have earlier records during 1914-1928 (with 1922 missing) and 1909-1928, respectively. We had correlated the Feb-Apr temperature data of both stations with our reconstructed records. The correlations are 0.40 (with Yanji, p=0.15) and 0.31 (with Mudanjiang, p=0.19). These correlations may be of little statistical meaning, because there are too few samples, and the meteorological data may also be of poor quality due to the political turbulences and wars in China back then.

According to the referee's suggestion, we performed moving correlation analysis between our reconstructed data (TCBM) and the CRU gridded temperature dataset (0.5*0.5) with a 40-year window. The 0.5*0.5 dataset is similar to CRU 5*5 dataset, butss has higher spatial resolution. We selected the nearest grid (128.25E, 43.25N) to Dunhua station for the analysis. The correlations are not stable through the time (Figure b and Figure c). They are much lower during the pre-1953 period than after 1953. The low correlations may be caused by the scarcity and the poor quality of the earlier meteorological data which are used to derive the gridded data. As the CRU dataset is constructed using surface station data, we think that the earlier CRU gridded data provide no more extra information about our reconstruction, and therefore we did not add the analysis in the text.

2. The manuscript can be shortened by deleting the biological explanation (p. 1219, l. 17–28) for the correlation function. Such implication is not relevant to the purpose of the study. If the authors think the information is useful for readers of CP, this should be discussed also using response function analysis (PCA).

Reply: The purpose of this study is to present a temperature reconstruction based on tree-ring records. The biological relationships are the basis of the reconstruction. So we assume that the possible explanations for the relationship between tree growth and climate need to be reserved.

We did the analysis with response function according to the referee's suggestion. The result (Figure d) is similar with the correlation analysis. So we did not add it in the text.

3. Leave-one-out cross-validation (LOOCV) does not provide any useful information when a single calibration model is presented. Nothing will be different even if the result is given using ordinary least square regression. See Hughes et al. (TRR, 2005, pp. 59–72) for example. They used LOOCV to heuristically choose explanatory variables.

Reply: According to the referee's suggestion, we performed LOOCV for choosing of seasonal combination to be reconstructed. The season from February to April still acquired the highest variance predicted (Table a). We changed the description of the methods in the text (p. 1218, l. 9-15.)

"The leave-one-out cross-validation method (Michaelsen, 1987) was used to choose the most successful season, since the instrumental data set from 1953–2002 was too short to be divided into two subsets for independent calibration and verification tests. The testing statistics include variance explained, adjusted variance explained, sign test of the first difference (SN1), sign test of the raw data (SN2), the reduction of error (RE) and Pearson's correlation coefficient (Fritts, 1976; Cook and Kairiukstis, 1990)."

And p. 1218, l. 22-p. 1219, l. 4:

“The transfer function between February-April temperature and tree-ring chronologies (t and t+1) acquired the best calibration and cross-validation statistics (Table 2). The final calibration model (Tem = -10.9 + $0.00235CB_t$ + $0.00412CB_{t+1}$) explained 46.2% of the total variance of the instrumental records during 1953-2002 (Fig. 3), and 37.1% in the leave-one-out cross validation. The positive RE indicates good predictive skill of the regression model. The lower SN1 and highest SN2 suggest that the strength of the calibration lies more in the lower-frequency agreement between the reconstruction and the instrumental records.”

4. I am concerned that the correlation coefficients are used for smoothed time series (e.g., p. 1220, l. 25–26; p. 1221, l. 16) to infer the association between the reconstruction and other proxies without significance testing. The degrees of freedom should be adjusted to account for the first order autocorrelation in the smoothed series.

Reply: We had calculated the effective sample size (by formula: $N`=N*(1-r_{1,x}r_{2,y}) / (1+r_{1,x}r_{1,y})$ of the smoothed series. However, due to their high first-order autocorrelation (r>0.95), the effective sample size (ESS) is very low. For example, the ESS is only 1.88 for the correlation between the smoothed TCBM and EAWMI during 1951-2000, and is 5.55 during 1874-2000. It is too low to have a significance test. So we deleted the description of the correlations between the smoothed time series.

5. I do not see clear shifts in the reconstruction shown in Fig. 4(a). The variation seems rather continuous. It would be highly informative to insert horizontal lines showing mean states of the temperature variation. In addition, what about if the same calculation is performed for the EAWMI. Do those two show the similar epoch?

Reply: According to the suggestion, we insert horizontal lines showing mean states of the temperature variation in Fig. 5(a). The EAWMI show the similar shift at 1988/1989 when we perform the same calculation for it.

Specific comments (incl. typos)

1. P. 1219, l. 7: Change ‘event’ to ‘period’. P. 1219, l. 14: It is not wise to use the term ‘regime shift’ for the local temperature reconstruction. Regime shift is usually used to describe changes in mean state of a large-scale climate system (PDO, EAWMI, etc). Please reword. P. 1220, l. 15: Change ‘jezoen’ to ‘jezoensis’.

Reply: We have followed the referee’s suggestion to change ‘event’ to ‘period’, ‘jezoen’ to ‘jezoensis. The term ‘regime shift’ was replaced with ‘shift’.

2. Fig. 1: I agree with the comment by Referee #1. It is more informative if the grid for the EAWMI and a map scale could be presented. Fig. 4: The current figure is not appealing. The panels should be enlarged. The warm/cold periods (W1, C1, _ _ _) should be presented more explicitly. With respect to the shifts, see the above comment.

Reply: As suggested by the referee, Figures 1 and 5 have been modified. We labeled the major cold/warm periods and the shifts on the figure.

Anonymous Referee #3

1. The authors presented only cold and warm periods in low frequency trend. I suggest to add some interpretation on extreme years, i.e., very cold and very warm. For example, the year 1840 and 1841 is extremely cold years in central Korea (Choi et al. 1994). Choi et al. (1994) also used the same species, Korean pine.

Reply: As suggested by the referee, we added discussion on extreme years. "In addition, the present reconstruction indicates that 1837-1839 were the coldest winters in the northeast China during the past 250 year. In Japan, the winters were also cold in 1838-1839 (Yonenobu and Eckstein, 2006), and the occurrence frequencies of the winter monsoon weather patterns are high (Hirano and Mikami, 2008). Tree-ring records in central Korea indicate that it was cool in early summer during 1835-1844, with the lowest temperatures occurring in 1841-1842 (Choi et al. 1994). The consistency implies that there may be synchronous occurrence of extremely cold winters or even cool summers in EA."

2. The authors did not discuss about warming trend in last few decades in their reconstruction. It will be useful to compare this warming trend with the ones shown in other reconstructions, particularly in Asian region as well as East Asia.

Reply: According to the referee's suggestion, we added discussion about the warming trend in the recent decades. 'Our winter temperature reconstruction captures warming trend in the recent decades in northeast China. The warming trend in winter was also recorded by tree growth on the Tibetan Plateau (Liu et al., 2007; Zhu et al., 2008; Shao and Fan, 1999). However, a study based on tree-ring width in central Japan (Yonenobu and Eckstein, 2006) did not track such warming trend due to the anthropogenic SO_2 emission. In addition, the warming summer temperature was also recorded by tree growth in other areas of EA, such as Mongolia (D'Arrigo et al., 2000), central Korea (Choi et al., 1994) and Tibetan Plateau (Liang et al., 2008). Unlike apparent loss of temperature sensitivity in some northern forests (D'Arrigo et al., 2008; Briffa et al., 1998), there appears to be no such shift in response at Changbai Mountain, indicating the trees' continued response to temperature.'

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Tables and Figures

Table a. The calibration and verification statistics of different seasonal temperature models. The leave-one-out method was used for verification during the period of 1953-2001

	Calibration		Verification			
Season	R^2	R_a^2	SN1	SN2	RE	r
P10C4	0.331	0.301	27	34*	0.226	0.475*
P10C9	0.392	0.365	24	35*	0.308	0.555*
C2C4	0.457	0.439	30	41*	0.376	0.613*
C2C3	0.374	0.360	31	36*	0.312	0.558*
C2	0.393	0.380	35*	34*	0.326	0.571*

* Significant ($p < 0.01$).

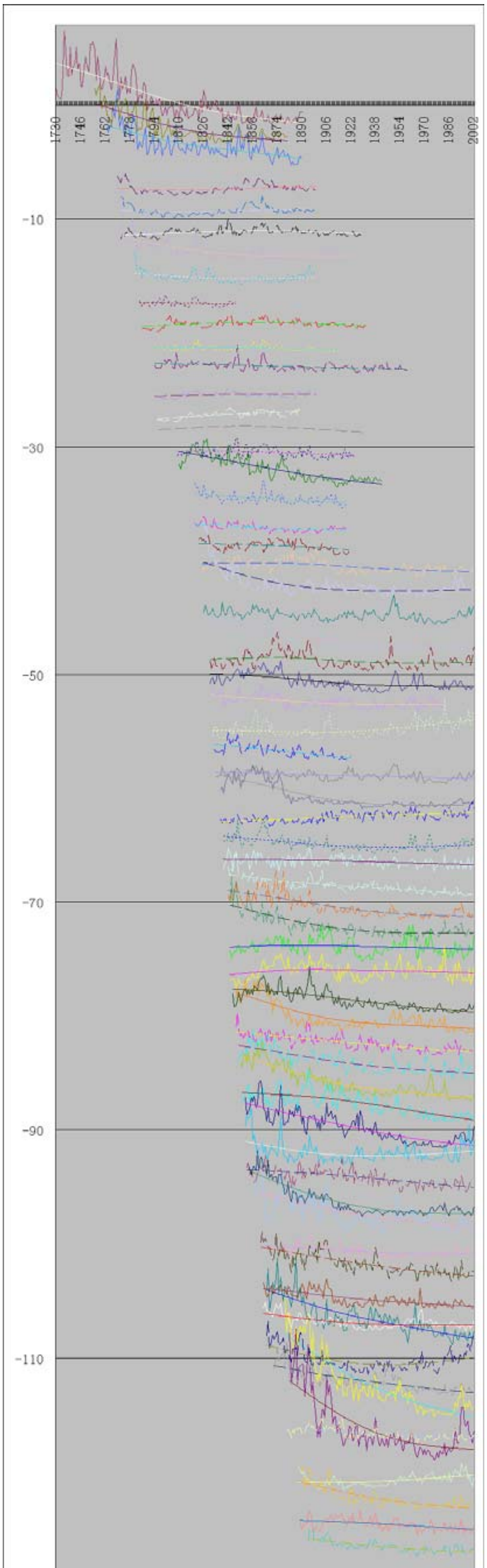

Figure a. the fit of 180-year spline on the raw ring-width series shorter than 180 years.

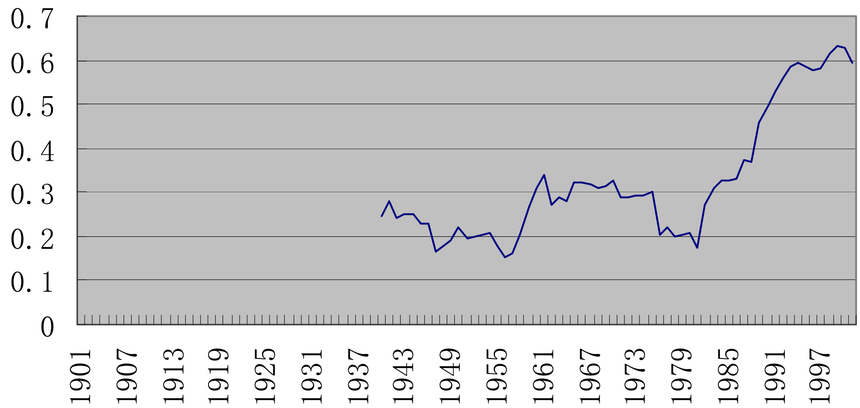

Figure b. Moving correlations between the reconstructed February-April temperature of Dunhua station and the CRU gridded data (128.25E, 43.25N). The correlation span is 40 years.

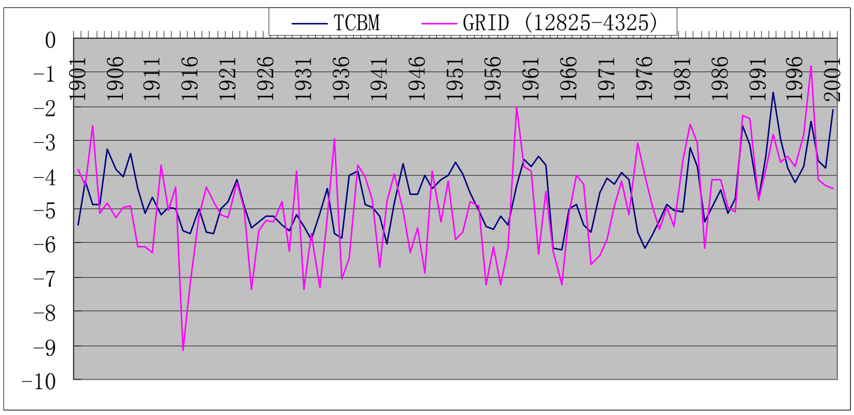

Figure c. Comparison of the reconstructed February-April temperature of Dunhua station and the CRU gridded data (128.25E, 43.25N).

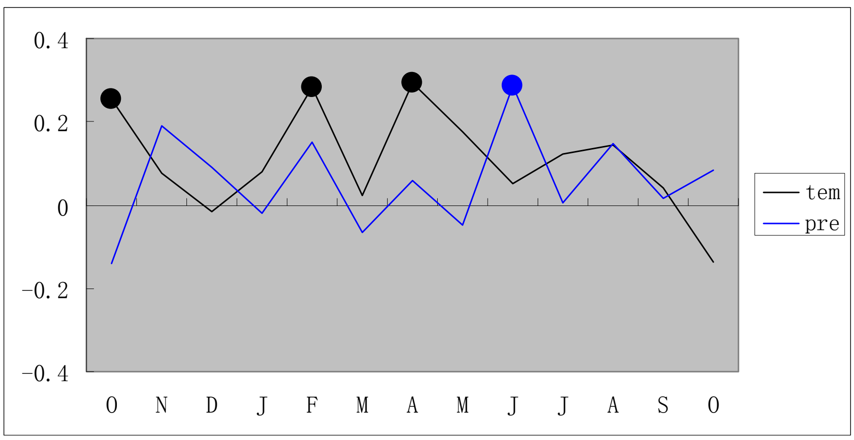

Figure d. the regression coefficients of the response function between tree-ring indices and the monthly mean temperature and precipitation at Dunhua station. The solid circle represents the significance level of 0.05.