

Interactive comment on “A 413-year tree-ring based April-July minimum temperature reconstruction and its implications on the extreme climate events, northeast China” by S. Lyu et al.

Anonymous Referee #3

Received and published: 23 June 2016

The manuscript from Lyu et al., presents a 413-year-long Korean pine (*Pinus koraiensis*) tree-ring chronology for the Laobai Mountain (northeast China). Despite the fact that the paper provides valuable information to understand past changes in temperature in this region, I have several major concerns that prevent me to give a positive assessment of the draft for publication in climate of the past. Hereafter the major points:

Major concerns. 1. It is strange for me to see that radial tree-growth was only correlated to minimum temperature for the period from April to July. I would expect to test a wider period from e.g April to August or April to September for the reconstruction. 2. I do not understand the use of a non linear model to reconstruct the April-July MMT. What is the added-value of this model? Most of the dendroclimatological studies are

C1

based on linear models. To my knowledge logarithmic transfer function are not used for climate reconstruction. The authors should explain in detail the reasons why they chose this type of transfer function and the "biological reality" supported by this model. 3. The comparison between the newly developed reconstruction and other regional and hemispheric reconstructions is not sufficient and only concerns the last decades (p6, L7-23). This weakness does not allow to have a clear idea about the reliability of the new reconstruction. 4. The sections 3.4 and 3.5 respectively dedicated to frost disaster events and to the analysis of periodicities in the newly developed reconstruction are too weak and failed to prove (i) that trees properly recorded extreme events and (ii) to properly demonstrate the impacts of solar cycles on temperatures fluctuations in north-eastern China. 5. I would recommend a strong revision of the results and discussion section as several statements remain insufficiently demonstrated (see comments below). In addition, I would also recommend a careful revision of the language by a native speaker.

Minor concerns. 1. P2. L19-22. It would be very valuable for the paper, and especially for readers that are not familiar with recent tree-ring developments, to add a map with the location of the study sites as well as other available chronologies for China. 2. P2. L18-19. "However, tree-ring series were rarely used to reconstruct past climate (especially temperature) in this area because of the exceptional hydrothermal conditions." Could you assess the impact of hydrothermal conditions on radial growth in this region? 3. P2. L20-25. In my opinion, the necessity for a new reconstruction in this area is insufficiently explained. Please consider rephrasing this section. 4. P2. "Therefore, our new temperature record not only furthers the tree-ring series in northeastern China and provides new evidence for regional impacts of past climate variability and changes". This sentence is not clear, please consider rephrasing. 5. P2. L25-26 "it is important to understand the longitudinal impacts of the climate change on forest ecosystems and human production activities in northeastern China." This sentence is very confusing. 6. P3. L3. I strongly recommend to add a location map for the study sites. 7. P3. L20. "Tree-ring samples were obtained from the south slope of

C2

Laobai Mountains along an elevational gradient from 950 to 1050 m". It is strange to find temperature-sensitive trees at low altitude, far from the timberline, especially on a south-facing slope. Please provide more detail here to explain how minimal temperatures could be a limiting factor at such altitude for tree-growth. 8. P3. L31-32. "A standard chronology, which preserves more low frequency signals than other chronologies, was used in the subsequent analyses". Accounting for the detrending method used in this study, the negative exponential curve, it is difficult to understand why this detrended chronology would preserve more low frequency. 9. P4. L2-3 I am really surprised that EPS could exceed 0.85 with a sample depth of only 5 trees. 10. P4. L17-18 "and the reduction of error test (RE), and product means test (PMT) are the tools used to verify the results". Please provide the coefficient of efficiency (CE) which is usually used to indicate the significance of the model skill on the verification period. 11. P4. L24-25. "Climate-growth response function analysis showed that the standard chronology was positively correlated with the mean minimum temperatures from January to December in current year". Why did you test such a long period as the growing season is probably limited to April to September? 12. P4. L25-26. "This means that cool or warm conditions are favored for the Korean Pine growth in this area." This sentence is not clear please consider rephrasing. 13. P5. L2-3. "Second, a crucial growth period of the Korean pine is from April to July." Why only April-July and not April-August or April-September, the periods usually used for reconstructions in these regions? did you test all the possible combinations of regressors? In this case, could you please provide an additional table with these analyses? These analyses are even more crucial as the authors state that " the photosynthesis still occurred during autumn, when it is generally the end of growing season; the lower mean minimum temperature reduced the tree respiration, allowing for more photosynthetic products to be stored, thus creating favorable conditions for subsequent tree growth". 14. P5. L25-28. "The longest cold period lasted from 1605 to 1681 AD (77 years), with an average temperature of 1.04 °C below the mean value". During most of this period, $EPS < 0.85$, it is thus difficult to consider the reconstruction as reliable during the first part of the 17th century. 15.

C3

P5. L31. "were also consistent with other results of the tree-ring reconstructions in northeastern China (Shao and Wu, 1997; Yin et al., 2009; Wang et al., 2012)". Please provide a figure in order to highlight this consistency between reconstructions. 16. P5. L33. "In addition, the two cold periods of 1605-1681 and 1684-1690 were fully consistent with the Maunder minimum (1620-1710), an interval of decreased solar irradiance (Bard et al., 2000)". The Maunder minimum is usually defined as the coldest period of the LIA that extends from ~1645 to 1715. 17. P6. L4-6 "The Little Ice Age in the 17th century and the rapid warming during the mid-19th and late 20th century in northeastern China had been well recorded in this series, suggesting that this series had a good regional representativeness of temperature variations in northeastern China". This is insufficiently demonstrated, please provide more details here. 18. P6. L12-16. "All of the temperature series exhibited significantly low temperatures during the 1950s-1970s, which coincided with a slight decrease in sun activity from AD 1940-1970 (Beer et al., 2000) (Fig. 5). Another notable feature was that all of the curves showed a sharp increase from 1980, and the peak values appeared in the late 1990s and early 2000s, 15 which was consistent with the reports from the Intergovernmental Panel on Climate Change (IPCC, 2007)" Why did the authors only focus on comparisons for the last decades ? I would expect comparisons between reconstructions for the last 400 hundred years. 19. P6. L18-20. "Additionally, three northeastern temperature reconstruction series showed that some cold/warm years were not analogous due to the differences in the reconstruction parameters (e.g., temperature subdivisions into average temperature, minimum temperature, maximum temperature, etc.) and habitat conditions in different sampling areas". Neither these chronologies nor their relations with climatic variables are presented here. In this context, we should only trust the authors. . . 20. P6. L27-28 "The evidence from historical documents shows that cold damage or frost disaster events have been occurring in Heilongjiang Province since 1675 (Sun et al., 2007)." Here again, I would expect a year-by-year comparison between historical archives and the tree-ring reconstruction, at least for the extreme years detected in both dataset in order to demonstrate unambiguously that tree-rings

C4

from Korean pines properly recorded past climatic extremes.

Interactive comment on Clim. Past Discuss., doi:10.5194/cp-2016-38, 2016.