

## ***Interactive comment on “An underestimated record breaking event: why summer 1540 was very likely warmer than 2003” by O. Wetter and C. Pfister***

**Anonymous Referee #2**

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This is a very interesting, and generally well-written, article that is definitely worth to be published in Climate of the Past after some improvements and clarifications. Articles that compare different types of proxies, for instance historical documentary records and tree-ring maximum latewood density data, are very important. All proxies have their strengths and limitations and only if we can find a similar signal in different types of proxies can a robust assessment of past temperature variability be made. Hence, an article that addresses disagreements between historical documentary data and tree-ring data is highly relevant.

Major comments:

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I would like to see the authors discuss their results in the light of other tree-ring temperature reconstructions than Büntgen et al. (2006). A number of other tree-ring width or density reconstructions from continental Europe are now available including, but not limited to, Büntgen et al. (2011), Büntgen et al. (2012), Corona et al. (2011), Dorado Liñán et al. (2012), Popa and Kern (2009), and Seim et al. (2012).

A more in-depth discussion of the relationship between precipitation/drought versus temperature during the summer season in Central Europe would improve the article. I would like to see a discussion of what the different available precipitation reconstructions can tell us about the extreme summer of 1540 and of other hot summers with regard to precipitation. The reconstructions by Büntgen et al. (2010), Büntgen et al. (2011), Pauling et al. (2006), and Wilson et al. (2005) should at the very least be discussed in this context.

I would like to see a somewhat more detailed presentation of the calibration/verification process and the calibration/verification statistics so that other scholars more easily can reproduce the results. Some discussion about the likely deflated amplitude of the reconstructed temperature variability resulting from the regression method would also be of interest. A useful discussion of this is found in Christiansen et al. (2009) and the references there-in.

Even if it is not of relevance for Central Europe, a brief discussion of the extreme heat wave in Eastern Europe/Russia in 2010 would be of interest in relationship to the extreme heat wave in Western and Central Europe in 2003. Both heat waves are often discussed in relationship to each other as a “proof” of a higher frequency of extreme heat waves in Europe as a result of anthropogenic greenhouse gas warming. The authors might consider citing Barriopedro et al. (2011) here. Other papers of general interest for the topic the authors address are Rahmstorf and Coumou (2011) and Zorita et al. (2008) that ought to be cited.

I would prefer if the authors changed their reference period to AD 1961–1990. This is

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the common climate reference period and makes the results much easier to compare with other studies than if the reference period AD 1901–2000 is used. This is, admittedly, only a technical issue but consistency in this respect is rather important in my view.

In order to make this study useful to other scholars, especially in a multi-proxy context, the temperature reconstruction presented by the authors must be made publically available after the article is published in its final form. This could preferably be done by archiving the data at NOAA Paleoclimatology at National Climatic Data Center (<http://www.ncdc.noaa.gov/paleo/paleo.html>) and/or as a supplement to the article. Since the winter grain harvest temperature reconstruction by Wetter and Pfister (2011) is discussed so much in the article, it would be preferable if the data for this temperature reconstruction is also made publically available.

I would also like to take the opportunity to congratulate the authors that they likely have been able to preserve a larger amount of low-frequency variability than is often the case with summer temperature reconstructions based on historical documentary data. A clear maximum long-term Little Ice Age cooling is seen during the 17th century consistent with other types of proxy data such as glacier data and lake sediment data. This makes their reconstruction useful, not only for assessing year-to-year variability, but also for assessing long-term trends and allow for the reconstruction to be compared to e.g. lake sediment temperature reconstructions.

Minor comments:

Page 2695, line 4: It is a little unclear what is meant by “extreme warm anomaly” here. It would be better to write something like “the warmest summer”.

Page 2695, line 4: Exchange “have” with “present” or something similar.

Page 2696, line 19: The tree-ring maximum latewood density record by Büntgen et al. (2006) starts in AD 755 and not AD 735. (It covers the period AD 755–2004.)

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Page 2697, lines 20–21: Please expand this section. More information about the calibration/verification process is needed.

Page 2706, line 28. The authors must mean the fourth place instead of the third place.

One paper of Wetter et al., “European Mega drought of 1540 – an evidence based Worst Case Scenario” is cited as “in preparation” and is hence not available to the reviewer(s). In principle, I think it is problematic to cite papers that are work in progress and not available.

Page 2707, line 22: Is it really correct that the correlation coefficient should be negative here?

Page 2708: In order to make the comparison between the tree-ring maximum latewood density record by Büntgen et al. (2006) and the grape harvest date temperature reconstruction useful, it would be useful to investigate and discuss the correlation in the instrumental temperature record between the June to September mean temperature (used for the tree-ring maximum latewood density record) and the April to July mean temperature (used for the grape harvest date temperature reconstruction). A simple correlation value between the two periods, as well as the standard deviation of the variability for each period, would be of interest.

Page 2709, lines 1–3: This sentence could be formulated in a better and clearer way.

Page 2711, line 4: The tree-ring maximum latewood density record by Büntgen et al. (2006) is not only 750 years long. It extends back to AD 755.

Page 2717, line 24: The surname Zorita is misspelled (as Zorito).

Page 2717, line 27: The surname Söderberg should be written with “ö”.

Page 2727: Figure 6 is rather hard to follow and the text legend to the figure is very small.

Page 2728: The legend to the Figure 7 is also very small and hard to read.

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