Reply to the RC of the anonymous referee # 2

Oliver Wetter and Christian Pfister

Thank you for your constructive comments (RC2) which are very helpful to improve our paper.

Major comments:

RC1: *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).*

Reply: We think that such a comparison indeed is a very interesting task and thus already planned to do it in the next paper in which we are going to reconstruct precipitation of the extreme drought in 1540 on a European scale. We prefer to do it there because we think that it is quite problematic to compare tree ring temperature reconstruction with our GHD based reconstruction, because they base on different temperature periods (AMJJ vs. JJAS). Tree rings on the other hand may give valid information about the precipitation in 1540 as well. A comparison between temperature and especially precipitation between documentary- and tree ring data thus will be of much more interest in the paper in progress.

RC2: *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.*

Reply: See reply to RC1. We will do such an in-depth discussion in the next paper which is already in preparation.

RC3: *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.*

Reply: Thank you for the additional literature. We are going to include a short discussion about the likely deflated amplitude of our temperature reconstruction in the final paper version. As this point was already brought up by the anonymous referee #1, we in meantime already improved the description of our data-, statistics- and methodology parts.

RC4: *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.*

Reply: Thank you again for the additional literature! We are going to discuss both droughts in our next paper (see reply to RC1-RC3). We decided to exclude the temperature reconstruction from this coming paper due to complexity reduction reasons. The 1540 mega drought will be discussed mainly in terms of temperature (this article; Wetter and Pfister, 2012), precipitation (next article in preparation; Wetter et al.) and societal impacts (Pfister, accepted). To be able to understand the complexity of the 1540 phenomenon, we choose the strategy to discuss it more in depth in three different articles, relating to each other.

RC5: *I would prefer if the authors changed their reference period to AD 1961–1990. This is 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.*

Reply: We prefer to use the same reference period as was used by HISTALP as the calibration of our GHD bases on the HISTALP temperature anomalies. Using different reference periods would unnecessarily complicate the calibration-verification procedure. Everyone is free to use another reference period, as our data is published online and will be made available on NOAA Paleoclimatology at National Climatic Data Center as soon as the CP Paper will finally be published.

RC6: *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.*

Reply: We are going to publish our GHD as well as WGHD in the supplement to the article and at NOAA. (See reply to RC5).

RC7:   *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.*

Reply: Thank you very much! I am not an expert in this low-frequency variability problematic, but I think that this problem generally appears if temperature- or precipitation reconstructions base on indexed documentary data (e.g. $\pm$ 3). Temperature reconstructions basing on GHD are not indexed, so that most if not all GHD based temperature reconstruction should show good low-frequency variability results.

Minor Comments:

RC8:   *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".*

Reply: Thank you. We will replace "warm anomaly" with warmest "spring-summer" temperatures.

RC9:   *Page 2695, line 4: Exchange "have" with "present" or something similar.*

Reply: Thank you. We will exchange "have" with "present".

RC10:   *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.)*

Reply: We will correct this mistake in the final version.

RC11:   *Page 2697, lines 20–21: Please expand this section. More information about the calibration/ verification process is needed.*

Reply: We will do so (see also our reply to RC3).

RC12:   *Page 2706, line 28. The authors must mean the fourth place instead of the third place.*

Reply: We will correct this mistake in the final version.

RC13:   *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.*

Reply: In our opinion it is quite common to cite papers that are work in progress. We could show you numerous articles or Journals where this is common praxis. As we are going to publish three articles dealing with the 1540 drought problem that relate on each other we would like to be allowed to cite our work in progress.

RC14: Page 2707, line 22: Is it really correct that the correlation coefficient should be negative here?

Reply: Yes this is correct. We correlated the Swiss GHD series (which are DOY) with the accumulated AMJJ temperature index from Dobrovolny et al. (2010). High DOY values correlate with low index values, which explain the negative correlation coefficient.

RC15: 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.

Reply: Thank you. We will include this point in the new version. As mentioned before, comparisons between different temperature proxies basing on different temperature periods are quite tricky and it is no wonder that correlation between our reconstructions are not very good. (see also reply to RC 1)

RC16: Page 2709, lines 1–3: This sentence could be formulated in a better and clearer way.

Reply: We are going to formulate it in two instead of one sentence.
"31-year moving correlations with the uncorrected Dijon GHD compilation series (red curve) clearly reveal that the low correlation is due to the period 1516 to 1555, where the values drop to 0.14. This is a consequence of wrong values in 1522 and 1523 and the questionable value for 1540 (Fig. 7)."

RC17: 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.

Reply: Thank you. We are going to correct this mistake in the final version.

RC18: Page 2717, line 24: The surname Zorita is misspelled (as Zorito).
RC19: Page 2717, line 27: The surname Söderberg should be written with "ö".

Reply: We are going to correct these mistakes in the final version.

RC20: Page 2727: Figure 6 is rather hard to follow and the text legend to the figure is very small.
RC21: Page 2728: The legend to the Figure 7 is also very small and hard to read.

Reply: We are going to redo all figures according to the instructions given by the anonymous referee #1. If CP allows us a second 31-yr moving correlation figure (for free) readability indeed would be increased.