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Climate of the Past Discussions

Interactive comment on "A 560 yr summer temperature reconstruction for the Western Mediterranean basin based on stable carbon isotopes from *Pinus nigra* ssp. *laricio* (Corsica/France)" *by* S. Szymczak et al.

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We acknowledge the constructive comments of the Referees and suggest to revise the manuscript as follows:

Comments Referee 1:

"A solution is to correct data using McCarroll et al. (2009) as it does not rely upon optimising the correlation."

Both Referees recommend the application of the pin correction of McCarroll et al.

(2009) instead of the correction models from Kürschner (1996) or Feng & Epstein (1995) developed for correction of physiological responses to changes in atmospheric CO2. In our manuscript, we stated that the pin correction cannot be used on pooled series. We agree that this statement is not correct since pooled pin corrected carbon isotope series have been published in 2012. We applied the pin correction to our data series and calculated the correlations with climate parameters. The pin corrrection affects the carbon isotope values differently at the sites. For example, the pin corrected series at the site Asco is similar to the atmospheric corrected series while the pin corrected series at site Capanelle is similar to the Feng & Epstein corrected series. This indicates that trees growing at different sites respond differently to the increase in CO2 level. The climate correlations of pin corrected series are of comparable magnitude and occur in the same months as for the Kürschner or Feng & Epstein corrected series. The highest correlations occur at sites Asinao, Ballone and a mean value of these both sites. We therefore decided to use a mean of the Asinao and Ballone carbon isotope chronologies and not the mean of all 4 sites as suggested by Referee 2 for the summer temperature reconstruction. Correlations with temperature are lower for an averaged chronology from all 4 sites and not valuable for a reliable reconstruction. Since Asinao and Ballone are located in the south and north of the island with different exposure, we assume that they are good representatives for the whole Corsican mountain range. These both sites are more extreme (concerning slope and water holding capacity) and drier than the two other sites and trees from the extreme sites are more sensitive to change of climate parameters. The resulting August-September-temperature reconstruction using the pin correction is rather similar to the reconstruction presented in the paper, i.e. a reconstruction based on only one site and with a Feng & Epstein corrected series. However, concerning the statistical parameters the reconstruction based on Feng & Epstein corrected series is more reliable.

In a revised version of the manuscript we intend to present both, the pin and Feng & Epstein reconstructions in order to demonstrate the influence of different correction factors on climate reconstructions derived from Pinus nigra on Corsica and validate the

reconstruction derived from the “tuned” data series.

"Section 4.3 describes the mean difference calculated between series corrected with the different correction factors as being equivalent to 0.8 C in AD1497. This is unclear and requires a little further clarification. Is this the same series corrected with a range of incremental corrections?"

Figure 3 presents the maximum difference between temperature reconstructions derived from the carbon isotope series from site Asinao corrected with correction factors ranging from 0.012 to 0.020 ppm-1 CO2. The figure was designed to illustrate that the different correction factors have only minor influence on the resulting reconstruction.

In a revised version, this point will be made more clear.

"Table 1 showing the mean 13C for both corrected datasets requires clarification in the legend. Is this value calculated just over the instrumental period, the full record or the industrial period of correction?"

The mean values are calculated over the common time period AD 1582-2008 for all sites. The intention is to identify differences between the series with respect to altitude, latitude and site characteristics. Altitude and latitude values are given in the table.

We agree that differences in site characteristics can be discussed in more detail in section 4.1.

"I am uneasy about using both a mean record of 4 sites to reconstruct cloud and a constituent single site being used to reconstruct temperature – you are using the same data to reconstruct two things within the same study."

We agree that this is a critical point. In order to account for this criticism, we calculated a cloud coverage reconstruction from the mean of only the three sites not included in the temperature reconstruction (i.e. Asco, Ballone and Capannelle). The resulting reconstruction is similar to the one presented in the manuscript.

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However, based on the comment of Referee 2 that the temperature reconstruction should be based on more than one site, we will exclude the cloud coverage reconstruction in a revised version. The cloud coverage reconstruction (also based on Feng & Epstein corrected data series) has been regarded as an addition to support the reliablitiy of the temperature reconstruction.

"It would also be useful to calculate the expressed population signal on the 4 sites (pre-industrial period and corrected full record?) to determine the common signal."

The calculation of the expressed population signal (EPS) leads to the following results: EPS pre-industrial period (AD 1582-1844): 0.71 EPS uncorrected series (AD 1582-2008): 0.90 EPS Kürschner corrected series (AD 1582-2008): 0.66 EPS Feng & Epstein corrected series (AD 1582-2008): 0.76 EPS pin corrected series (AD 1582-2008): 0.72 A strong common signal among the four sites becomes apparent.

The EPS values will be included in a revised version.

Minor comments

We agree with all the minor comments and will consider them in a revised version. Concerning the cellulose extraction method, we will refer to the method of Boettger et al. (2007). The Referee is correct by saying that it should actually be a 17% sodium hydroxide (NaOH) solution instead of a 17% sodium chlorite solution as stated in the reference cited.

Risk of juvenile timbers being included in the pooled records. We did not include the oldest 50 years of each tree in the sample in order to avoid potential juvenile effects.

"What is the causal link here between the Maunder minimum and the climate of the Mediterranean? Is there firm evidence for a strong solar control throughout the reocrd?" We could not found a strong solar control on the carbon isotope records.

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"Among others, the approach consisting on tuning the isotopic data by applying different correction factors in order to obtain the highest correlations with climate parameters appears to me scientifically hazardous. Authors should have selected and applied the appropriate correction considering the context of their study (the pin-correction of McCarroll et al., 2009, seems the best in that case) and then worked with this single data set to reconstruct climate variables."

See comment of Referee 1. Since Referee 2 stated that our study "explores several central aspects of the dendroisotopic apporach, notably the correction of isotopic values related to changes in atmospheric CO2 concentration" we are convinced that it is worthwhile to present Kürschner, Feng & Epstein as well as pin corrected series in a final version of the paper and not only to present pin corrected series. With a comparison of different corrected series, we can document that the Feng & Epstein correction factors are a rather good estimation of necessary plant physiological corrections for Pinus nigra on Corsica. As already mentioned in the manuscript, this result is not very surprising since the correction factors are derived from old living tree species in rather similar mountain environments. By comparing the reconstructions derived from Feng & Epstein corrected series and pin corrected series, we will avoid the tuning of the isotope series to obtain the "best" climate signal since the pin correction does not rely upon optimising the correlation (after Referee 1).

"How can authors justify their choice of using the Italian climate data instead of the Corsican ones since the usable part of both series covers the same period?"

We assume that the Italian climate data is a better estimation of Corsican mountain climate than the Corsican coastal stations because coastal and mountain climate on Corsica may be quite different. Unfortunately, data series from Corsican mountains are too short to allow a reliable calculation of the climate-isotope relationship and hence a robust climate reconstruction. We compared the Italian data set with data from available Corsican stations and found that mean annual precipitation and annual temperature is more comparable for mountain than for coastal stations with correlations between

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Italian climate data and Corsican mountain stations being strong.

This point will be further elaborated in a revised version.

"If the objective of the study is really to reconstruct summer temperature for the Western Mediterranean (at least a regional scale), isotopic values from all 4 sites should be considered in regression model even if the temperature signal in the mean series is a little bit lower."

See comment 1, Referee 1.

"Authors should explain why they decided to analyse only one cor per tree." We agree with the Referee 2 that in case of a species with a high circumferential variability as for Pinus nigra trees, it would be more convenient to use two or even more cores per tree in a pooled chronology. However, in the scope of our project we already needed several cores per tree for the analysis of different tree-ring parameters. The preparation of cores, e.g. for image analysis, precluded the following use for isotope measurements.

Interactive comment on Clim. Past Discuss., 8, 2111, 2012.