Clim. Past Discuss., 4, C819–C822, 2010
www.clim-past-discuss.net/4/C819/2010/

Climate of the Past Discussions

Interactive comment on "Millennium-long summer temperature variations in the European Alps as reconstructed from tree rings" *by* C. Corona et al.

C. Corona et al.

christophe.corona@gmail.com

Received and published: 27 April 2010

What is the added value of this paper from the authors' point of view? Büntgen et al. have already published a European Alpine reconstruction covering past millennial summer temperature variability. Guiot et al. 2005 published a millennial long Western-European summer temperature reconstruction. You state your findings to be significantly similar with other alpine reconstructions. But what is new? This question is of particular importance looking at the data used in the study.

The new findings of our study have been highlighted in the introduction. We may summarize the innovations in this paper as follows: 1. the use of new unpublished series widely distributed in the Alpine arc has been highlighted in the introduction: "Unlike previous reconstruction, our reconstruction is built from series widely distributed in the

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

Alpine arc, and, in particular, series from Western Alps are incorporated in the dataset." 2. As this study was performed to best preserve inter-annual to multi-centennial scale summer temperature variations, we use a refined version of the well-established RCS technique for tree-ring detrending (as highlighted in the original introduction) 3. We use an analogue-based method preserving the variance of the temperature and are thus able to work on unequal proxy series lengths; the interest of this method has been detailed in section 3.2.

A closer look reveals that most of the 36 (or 38?) series are shorter than 1000 years. Before 1400 AD there are actually only 10 series available, before 1200 AD only 5 series. Is that correct? Thus looking at Figure 2: Can you provide the percentage of missing values of each series considering your reconstruction period (1000 to 2000) as 100%. Where are the critical limits to fill in missing values (the thresholds) in your analogue technique? What is the maximal accepted amount of missing values in your technique?

The number percentage of missing values has been added in table 3. The percentage of available series compare to the full reconstruction is precisely stated in the paragraph 4.1, "chronology characteristics": The percentage of missing values, considering the reconstruction (AD 1000-2000) as 100% varies between 0 and 68% with a mean of 49%. Only 8 chronologies are available before AD 1400 and only 5 before AD 1200 (fig. 3a, f).

Interestingly, with artificial neural networks a different method than used predominantly for climate reconstruction at the European and NH scale has been used. The authors compare their approach to the nested (due to decreasing number of proxies back in time), regression-based techniques of e.g. Mann et al. and Luterbacher et al. used in the past. However, the methodological discussions have developed considerably. Schneider et al. 2001, Rutherford 2005 and Mann et al. 2007 introduced with RegEM a technique, which also imputes/ infills missing values, thus allowing for missing values in the input data. Your methodological argument seems therefore rather obsolete. How do you further motivate the choice of your method? How do you bed in your approach into the methodological discussion on summer temperature reconstruction?

A paragraph concerning the comparison between RegEM and analogue techniques has been introduced in section 3.2. We explain that the analogue technique relies on the Euclidian distance and is not based of the correlation between variables but between the years. This method does not have the same weakeness as the other methods, as the number of predictors is maintained constant in time. It conserves the spatial variability of the original dataset and maintains the variance back in time.

Moreover, such methods do not account for missing values within proxy series. An alternative more and more frequently used is the regularized expectation maximization (REGEM), which imputes missing values on the basis of the regression between variables (Schneider et al. 2001), in a manner that make optimal use of spatial and temporal information in the dataset. Here, infilling of missing data is done using an analogue technique introduced by Guiot et al. (2005). This technique has not the same weakness as REGEM, as the number of predictors is maintained constant in time. In order to replace a missing year for any given tree ring series, we compared the existing vector of data with all other series available during this time on the basis of the Euclidian distance and not on the basis of the correlation between variables, as most of the methods do.

Results will show below that the method has an interesting characteristic as compared with the regression based methods: the correlations between estimated series are not better than those of the observed series as the estimation process is not based on the similarity between variables but between the years. The method is then conservative for the observed spatial variability. Moreover, it has been demonstrated that variance is well maintained independent of the number of predictors (Nicault et al. 2008b).

My final question addresses the part of the interpretation. The authors state a proper match with multi-decadal to centennial variations and solar forcings as well as the

CPD
4, C819–C822, 2010

relation to volcanic eruptions. How have these findings been investigated methodologically?

The correlations between the solar activity and the reconstruction have been calculated for periods of 100 years. Correlations between the low-frequency solar activity and the 20 year-smoothed temperature reconstruction are 0.21 over their common period respectively. Even though, the correlation is not significant at $p<0.05$ level, records share high values (0.41) during the twelfth and thirteenth centuries (great solar maximum; Eddy 1976) a prolonged depression during 1300– 1600 (0.21) and and increasing values toward the twentieth century (0.31). The prominent interdecadal solar minima, Oort, Wolf, Spörer, Maunder, Dalton, and Damon as well as the corresponding maxima are superimposed upon this secular trend.

Interactive comment on Clim. Past Discuss., 4, 1159, 2008.