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Discussions

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Interactive comment on "Large scale climate signals of a European oxygen isotope network from tree-rings – predominantly caused by ENSO teleconnections?" *by* Daniel F. Balting et al.

Anonymous Referee #2

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Review of 'Large scale climate signals of a European oxygen isotope network from tree-rings - predominantly caused by ENSO teleconnections¿ by Balting et al.

Summary

The authors investigate delta18O tree ring records of 26 site distributed over Europe for the last 400 years. They claim that they were able to identify a connection of the leading mode of variability of this data to El Nino Southern Oscillation. They speculate that this connection is only found in the last 130 years and thus the connection is not stable in time. The second mode of the data is suggested to reconstruct regional summer atmospheric circulation. Finally, the author team claim that delta18O tree ring records

can be used to reconstruct atmospheric circulation.

General comments

The topic would certainly be of high interests. However, the authors fail to convincingly show evidence for their main claims listed in the summary. Therefore, I recommend to reject the manuscript.

Major comments

1. At several places in the manuscript the authors claim that their analysis suggests "the relationship between ENSO and the European climate may not stable over time". The connection is only found for the instrumental period after 1850 CE. I think the first order interpretation is that the reconstruction of ENSO might be not perfect, as normally the reconstruction methods are trained in the last 100 to 150 years. So differences between the training periods and the period before are a hint that the reconstruction might be not successful. So, from your analysis you cannot conclude that you have identified non stationarity of teleconnections.

2. The conclusion that the analysis shows that "We infer that the investigation of large-scale atmospheric circulation patterns and related teleconnections far beyond instrumental records can be done with oxygen isotopic signature derived from tree rings. " is not convincingly demonstrated. There is only 2 line in the introduction which gives a hint why this should be possible, i.e., fractionation happens during the transport from source to sink areas. Most of the studies however try to reconstruct temperature and precipitation when using delta18O as delta18O is first order temperature dependent. The authors also nicely discuss that fractionation processes are also relevant within the tree. Then, at the different sites the water can be transported form different source regions during the seasonal cycle, e.g., North Atlantic versus Mediterranean, or long distance transport versus local water recycling. Moreover, seasonality plays an important role, so mostly tree ring records are interpreted to record growing season signals and not winter signals. So given all these uncertainties how can the transport aspect

(which is related to the atmospheric circulation) survive?

3. For the first EOF I have a different interpretation, which takes into account the fact that temperature play the dominant role in delta18O. What we see is a monopole structure. The authors claim to see a link to ENSO. I hypothesize that the link is simply due to the fact that ENSO has a global impact on the global mean temperature. So, due to an El Nino event, the Earth warms and thus also the North Atlantic and the Mediterranean (visible in the composite plots). Warmer source regions affect the fractionation of delta18O without any change of the circulation we see in the sink regions (at the tree sites) a uniform signal.

4. There are problems with the data (see comment below Section 2.2, L132-140, L145) ignored which might be influential to the analysis

Minor comments

L18: What is meant by "reflects a multi-seasonal climatic signal."? ENSO works on timescales of 3 to 7 years.

L20: "out of phase variability": I would interpret this in the time and not in space as the authors. Just say the 2. EOF is a dipole pattern with centers over northwestern and southeastern Europe.

L47-50: Hard to read.

L53: please change to "leaf water clearly affects"

L55: I disagree with this statement, see major comments 2 and 3.

L56: What is meant by "resulting long-term perspective"? Where does it result from?

L84: Created -> generated

L88: Please include a space between number and unit throughout the manuscript.

L91: What is SMOW?

Section 2.1: Which method is used to get the delta18O samples from trees. This is relevant as studies show that the method (pooling or not pooling) makes a huge difference

Hangartner et al. Methods to merge overlapping tree-ring isotope series to generate multi-centennial chronologies CHEMICAL GEOLOGY Volume: âĂŔ 294 Pages: âĂŔ 127-134 Published: âĂŔ FEB 10 2012

Section 2.2: Again if is unclear what the authors are using. Is it the ensemble mean of 20CR or an individual ensemble member. Please note that the 20CR is only constraint with sea level pressure (SLP) data so no sea surface temperatures (SST) are used which are relevant for ENSO. My guess is that the authors use the ensemble mean. This is problematic as in the early part of the reanalysis the constraint (via SLP) is rather weak leading variance deflation and thus can have a strong impact on the analysis (so it is normally recommended to use all individual ensemble members). As said, the other problem is that ENSO might not be realistically included in the first part of the reanalysis.

Section 2.3: too short and not clear why the simulations are used and how the simulations are generated. The reader needs to understand which model is used and how, just references is not enough.

Section 2.4: It reads like EOF and PCA are different analysis, but actually they are not. The method of empirical orthogonal function (EOF) analysis is a decomposition of a data set in terms of orthogonal basis functions determined from this data. Thus it is the same as geographically weighted PCAs.

L132-140: How many tree ring records cover the entire period with no gaps? How sensitive it the analysis to filling the gaps? How many cycles are needed to reach convergence? What if you use only the tree ring records which cover the entire period?

L142: This is certainly not extreme.

L145: I would say that the authors misuse the composite analysis by focusing on the linear response. If they would like to analyze the linear response, a simple correlation analysis is enough. The beauty of the composite analysis is that you can easily show non-linear effects, but only if you make the difference between the mean above the threshold with the long term mean and in a second plot the mean below the negative threshold and the long term mean. This was done by Fraedrich 1992 mentioned in the manuscript. He highlighted the nonlinearity of the ENSO response over Europe and thus is in contradiction to the linear relationship suggested here.

L150: Event Coincidence Analysis needs to be explained.

L177-179: If this is the case one could speculate that EOF2 showing a North South patterns just resemble this latitudinal effect.

L195: I do not see this is there a typo and the authors mean PC1?

L200-210: Avoid using the bracket with e.g. (cold). This makes the text unreadable. Just say what you show in Fig. 4.

L208: I do not see a AO pattern, again the reference to Fraedrich are incorrect as they claim that ENSO has a nonlinear response behavior over Europe.

L225: Why drought we see a positive precipitation anomaly? Section3.4: What do we learn from this? What is shown and why? This section is unclear and to my feeling can be removed.

L250: section 3.5

L251-252: This sentence is a repetition.

L260 -263: You need to show this with more proxies. Note that dry conditions are not droughts!

L263-265: Given your study you cannot conclude this. The authors study certainly is inadequate to reconstruct blocking so this statement is not supported by the authors

analysis.

L269-70: Please change to ". . . signal still dominates".

Figures: Statistical significance is not tested (or not shown).