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Climate of the Past Discussions

Interactive comment on "The origin of the 1500-year climate cycles in Holocene North-Atlantic records" *by* M. Debret et al.

M. Debret et al.

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Reviewer 2: Annette Witt

Major comments

1. The software/technique used for doing Fourier or wavelet analysis is not or not sufficiently cited.

Yes, we correct it.

2. The authors describe and refer to a wavelet analysis technique that can be applied to evenly sampled data. They do not explain how to deal with (likely to be) unevenly timesampled records. So, it remains unclear how they produced their results. I am familiar with two approaches to overcome this problem (but there might be more): (A) There are wavelet analysis techniques for unevenly sampled data (for instance Foster

1996, and updated versions). Foster's technique has been applied to Holocene climate records already (Witt & Schumann, 2005) where millennial scale climate cycles in different records of the GISP2 ice core have been discussed. (B) Alternatively, the data can be interpolated with different techniques to make them evenly sampled. Then the authors have to test (may be simulatively) how the applied interpolation technique influences on the significance of identified periodicities.

Blanks/gaps in the data were filled up/interpolated using a cubic spline interpolant (passes exactly through each data point). Although we did not use the weighted wavelet Z-transform algorithm, the cubic spline interpolation we used for handling unevenly-spaced data would not imply significant changes in the results of spectral/continuous wavelet analysis: for instance as shown in figure 1, a Lomb periodogram performed on the initial data of the most heterogeneously sampled series leads to the same results as a FFT of the interpolated time series (here interpolated to 4 times the length of the initial series).

IMPOSSIBLE to post Lomb Periodogram

3. Unlike the presented Fourier analysis, the wavelet analysis comes without any statistical test to evaluate the significance of the findings/ the presence of the cycles. This is not acceptable.

Yes we correct it. For all local wavelet spectra, Monte Carlo simulation was used to assess the statistical significance of peaks. Background noise for each signal was estimated and separated using singular spectrum analysis. Autoregressive modelling was then used for each noise time series to determine the AR(1) stochastic process against which the initial time series was to be tested. AR(1) background noise could be either white (AR(1)=0) or red noise (AR(1)$>$0).

4. I am wondering if wavelet analysis of a non-trivial record with less than one hundred data points (as the IRD, grain size and the diatom concentration record have) can lead to a proper identification of periodic cycles.

CPD
3, S470–S472, 2007

EGU

All series were zero padded to twice their initial length to minimize wraparound effects (which are as greater as the series is short). Subsequent edge effects were assessed by the cone of influence. According to this, we see no reason why it would not be possible to perform a wavelet spectrum of series of about a hundred points (see for instance Labat D., 2005 - Oscillations in land surface hydrological cycle. Earth and Planetary Science Letters, volume 242, issue 1-2, pages 143-154).

Minor comments:

5. The six panels of Figure 3 would benefit from larger y-axis notations and from horizontal bars indicating the three considered cycles. "Time" in the x-axis title should be replaced by "Age".

Yes, we correct it on the figure 3.

Interactive comment on Clim. Past Discuss., 3, 679, 2007.