

Interactive comment on “Sub-millennial climate variability during MIS 11 revealed by high resolution EPICA Dome C isotopic data – a comparison with the Holocene” by K. Pol et al.

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Very interesting manuscript: new EDC dD data enabling a comparison of centennial-to-millennial-scale variability during MIS 11 with that during MIS 1 (Holocene), generally very well written. But: timescale errors not sufficiently taken into account.

Major criticism.

(1) Holocene timescale errors are not taken into account. Although these should be clearly smaller than MIS 11 timescale errors, they are certainly larger than zero and

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should be analysed.

(2) MIS 11 (and Holocene) timescale errors not sufficiently taken into account. Analysing just two alternative scales (called test 1 and test 2) is not enough. You should construct a statistical age-depth model, and then perform n_{sim} simulations: for each simulation, (i) draw a random timescale and (ii) draw random AR(1) values, (iii) combine timescale and AR(1) values, (iv) calculate wavelet spectrum on combined simulated AR(1) series. Then, after the simulations, you take an upper percentile of the simulated wavelet power at each point in the "wavelet domain"; you should take test multiplicity into account by selecting a high enough percentile (see Lemmen's citation of Thomson 1990 or consult Mudelsee 2010: Chapter 5 therein). (If a test is performed multiple times, it becomes more likely to find a significant single result.) Usage of higher percentiles requires higher n_{sim} ; a typical value may be $n_{\text{sim}} = 10000$. A paper on spectrum estimation (Lomb-Scargle for unevenly spaced series) with timescale errors taken into account is Mudelsee et al. (2009). The wavelet peaks (calculated on the EDC data) above that upper percentile may then be a reliable result and worth of climatic interpretation.

Minor criticism.

The number of minor errors is indeed less than what I normally see in other papers I have to review, but it is still large enough to let me think: "These authors wish the reviewer to do that tedious job" or "Who guarantees that their measurements, data processing or software development are not corrupted by a similar amount of errors?" Let me give a few examples.

Example 1: Affiliation 4 should be "Niels Bohr Institute" and not "Niels Bohr Institue".

Example 2: "Siegenthaler" is the first author of the EPICA CO₂ (late interval) paper and not "Siengenthaler".

Example 3: You define "MIS" on page 1779, line 3-4 as "Marine Isotopic Stage" and

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on the same page, line 25, as "Marine Isotope Stage".

Example 4: You cite (page 1785, line 4-5) a QSR paper for detailing the "mathematical formalization" of wavelet analysis, instead of consulting original mathematical sources (for such, see e.g. Mudelsee 2010: page 217-218 therein).

A short comment on Lemmen's review comment:

Section 3.1 (dataset publication): agreement.

Section 3.2 (time axis): no agreement, it is paleoclimatic convention to plot time from right to left.

Section 3.3 (figure quality): agreement.

Section 3.5 (reanalysis): this is not sufficient because timescale errors have not been taken adequately into account (see major criticism 2 above).

References:

Mudelsee M, Scholz D, Röthlisberger R, Fleitmann D, Mangini A, Wolff EW (2009) Climate spectrum estimation in the presence of timescale errors. *Nonlinear Processes in Geophysics* 16:43–56.

Mudelsee M (2010) *Climate Time Series Analysis: Classical Statistical and Bootstrap Methods*. Springer, Dordrecht, xxxiv + 474 pp [www.manfredmudelsee.com/book]

Interactive comment on *Clim. Past Discuss.*, 6, 1777, 2010.