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Climate of the Past Discussions

Interactive comment on "Exploring errors in paleoclimate proxy reconstructions using Monte Carlo simulations: paleotemperature from mollusk and coral geochemistry" *by* M. Carré et al.

Anonymous Referee #2

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Review of Carre et al (2011), submitted to Climate of the Past

General comments. The authors present an explicit means to explore uncertainties which are known but not well-accounted for in the paleoproxy literature, in particular for proxy measurements made in corals and molluscs. To improve the impact of the paper I suggest (1) inclusion of chronological error in the algorithm; (2) additional sensitivity experiments involving more of the proxy calibration parameters; (3) discussion of the results in the context of existing proxy reconstruction uncertainty estimates and interpretations; (4) overall revision for clarity and focus; (5) correction and revision of the code for use in an open source computing environment.

Specific comments.

1. Revise the abstract to focus solely on the results and conclusions of the study; give specific results and conclusions from the exercises performed in support of the manuscript.

2. Revise the introduction (section 1) to clearly identify the novelty and scope of the study. I think this is the development of an code to estimate standard error, systematic error and potential systematic error, via Monte Carlo algorithm, for the high resolution aragonitic paleoproxy archives: corals and molluscs. Alternatively the authors might want to consider making both the algorithm and illustrations more generalized to a broader range of proxy data taken from marine sediments, tree rings, ice cores, and lake sediments.

3. Structure section 2.1 to better categorize all the potential sources of uncertainty in the interpretation of paleoclimatic data. Given (1) and (2) it may be clearer to revise this section and the introduction to focus more narrowly on the targeted proxy archive (corals and molluscs), rather than the more general question for all categories of proxy data. The authors can then discuss the extension of their approach to other proxies with similar and additional sources of uncertainty.

4. Revise the code (section 2.3) to operate in an open-source environment such as Octave (www.octave.org), rather than Matlab, a commercial product. This is easy to do and improves the accessibility of the software to those without Matlab access. On my system MoCo runs a lot slower in Octave than in Matlab, but not impractically so.

5. Revise the MoCo implementation to permit random and systematic chronological uncertainty, for instance in radiometric ("absolute") dating by Th/U or radiocarbon; relative dating from density banding, x-ray fluorescence, cyclical isotopic or minor element chemistry; age model interpolation between tie-points, etc. For the latter, see Chapter 3 of: Ault, Toby R. 2011. The continuum of drought in western North America. Ph.D. Dissertation (191 p), University of Arizona, Dept. of Geosciences. I think including age

uncertainty would be a great and novel addition to this tool. Or can such chronological uncertainties be simulated vis-a-vis the existing parameters in MoCo?

6. In section 3.1, the algorithm requires a long realistic target time series, and suggests that this be derived from climate models. Discuss the extent to which the results might be biased if the relevant properties of the real climate are different from that of the climate model time series.

7. Section 4: It would be good to have results and discussion of additional sensitivity experiments that explored the proxy calibration parameters, particularly in Alpha and Beta via R, sigma_T, and sigma_P.

8. Some comparison and discussion of the resulting uncertainty simulations, relative to those commonly cited in the literature and mentioned in section 1, would be useful. For example, how much different are the MoCo error bars relative to those, say, from the Cole et al (Science, 1993) Tarawa coral oxygen isotope record? How do those revised uncertainties affect interpretation of that record?

Technical corrections.

1. Abstract: The first four sentences are introductory and can be deleted.

2. Give results of preliminary experiments and tests in the abstract.

3. p. 2480, l 25-6: for an example at the paleoreconstruction stage, see Gergis et al, 2011, Clim. Dyn. in press, available here: http://climatehistory.com.au/publications/

4. Section 6.4: Some examples of forward modeling of coral oxygen isotopic composition as a function of temperature and salinity are: Brown et al (JGR, 2006), Thompson et al (GRL, 2011).

5. The code has some errors (line 8, after line 98) and does not run out-of-the-box in Matlab 7. It can be corrected/revised for use in Matlab 7 or Octave 3.2 (www.octave.org), as follows: (1) line 7: a=load('MoCo_timeseries.txt'); (2) line 8:

a=a(:,1); (3) after line 98 and before line 99, add the loop:

if length(find(∼isnan(ts)))<1,

error('The timeseries values are beyond biological limits');

end

Interactive comment on Clim. Past Discuss., 7, 2477, 2011.