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A simplified methodology to approach the complexity of foraminiferal calcite oxygen-isotope data – model comparison

Didier Roche (1,2) and Claire Waelbroeck (1)

(1) Laboratoire des Sciences du Climat et de l'Environnement, LSCE/IPSL, CEA-CNRS-UVSQ, Université Paris-Saclay, F-91191 Gif-sur-Yvette, France, (2) Earth and Climate Cluster, Faculty of Earth and Life Sciences, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands

Since the pioneering work of Epstein (Epstein et al., 1953), numerous calcite isotopic records from the ocean have been used to attempt reconstructing paleoclimatic information. Additional to the well known complexity brought by the fact that foraminiferal calcite records both temperature and isotopic composition of the surrounding oceanic waters, an additional effect for surface – dwelling foraminifers is the fact that two different species do not have the same habitat and may thus record different signals. This is obvious when comparing paleoclimatic records where different species have been measured for the isotopic composition of the calcite. The difference in habitat produces a three dimensional spatial complexity (a foraminifera living in preferred climatic conditions at a specific location, but also at a specific depth, sometimes far from the surface) but also a temporal uncertainty (foraminifers generally live for only a few weeks and their growth season may be evolving through time with climate change). While the different species habitats potentially contain a wealth of information that could be used to better understand the sequences of climate change, this has seldom been used in modeling studies, most models deriving calcite isotopic signal from surface and annual mean conditions (e.g. Roche et al., 2014).

In the present work, we propose a reduced complexity approach to compute the calcite for several planktonic foraminifers from climate model simulations under pre-industrial conditions. We base our approach on simple functions describing the temperature dependence of the different species growth rates (Lombard et al., 2009) and on probability of presence based on the physical variables computed in the climate model. We present a comparison to available sediment traps and core tops data as a validation of the methodology, focusing on the possibility for future applicability towards inversion of the signal measured in oceanic sediment cores.

References

Epstein, S., R. Buchsbaum, H. A. Lowenstam, and H. C. Urey (1953), Revised carbonate-water isotopic temperature scale, Geological Society of America Bulletin, 64, 1315-1325.

Lombard, F., L. Labeyrie, E. Michel, H. J. Spero, and D. W. Lea (2009), Modelling the temperature dependent growth rates of planktic foraminifera, Marine Micropaleontology, 70, 1-7.

Roche, D.,M., D. Paillard, T. Caley, C. Waelbroeck, LGM hosing approach to Heinrich event 1: results and perspective from data – model integration using water isotopes, Quaternary Science Reviews 106 (2014) 247–261. doi:10.1016/j.quascirev.2014.07.020.