Geophysical Research Abstracts
Vol. 14, EGU2012-13508, 2012
EGU General Assembly 2012

Consequences of the mismatch between the depth at which planktonic foraminifera live and the calibration depth of SST transfer functions

R.J. Telford (1,2) and M. Kucera (3)

(1) Uni Bergen, Department of Biology, Bergen, Norway (richard.telford@bio.uib.no), (2) Bjerknes Centre for Climate Change, Bergen, Norway, (3) Department of Geosciences, University of Tübingen, Germany (michal.kucera@uni-tuebingen.de)

Although many palaeoceanographic proxies are described as sea-surface temperature (SST) proxies, there is a growing realisation that the seasonal and depth sensitivity of proxies may differ substantially. Exploiting information on the seasonal and depth sensitivity of proxies can give new insights into palaeoceanographic processes, and deliver more precise reconstructions.

Transfer functions for quantitatively reconstructing past sea surface temperatures from planktonic foraminifera assemblages are typically calibrated against temperatures at 10m water depth. However, planktonic foraminifera are not usually most abundant at 10m depth, but have a geographically variable peak in abundance often near or even below the thermocline. This discrepancy between the depth at which foraminifera live, and the depth against they are calibrated may bias SST reconstructions.

With a collation of 18 North Atlantic foraminifera records that cover the time since the Last Glacial Maximum, we make reconstructions of summer and winter temperatures for each standard depth in the World Ocean Atlas down to 500m using the modern analogue technique. We test how much of the variance in the fossil data is explained by each reconstruction, and whether each reconstruction explains more than expected under the null hypothesis that temperature did not influence assemblage composition. We find that changes in North Atlantic foraminifera assemblages since the Last Glacial Maximum are, for most records, better explained by variability near the thermocline than at the surface, and that reconstructions of summer temperatures within the seasonal thermocline are often poor.

If the thermal structure of the water column has changed over time, such that the relationship between 10m temperature and the temperature at the depth which most affects foraminifera assemblages is not constant, then reconstructions of SST calibrated to 10m temperature may be biased. This bias will propagate into, for example, estimates of global cooling during the Last Glacial Maximum that are being used to constrain estimates of the Earth's sensitivity to carbon dioxide concentrations.