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Re-evaluating tropical LGM planktonic foraminifera assemblage-based sea-surface temperature reconstructions

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A large fraction of the estimates of LGM sea-surface temperatures is based on planktonic foraminifera assemblages and calculated using transfer functions. Despite the broad depth distribution of planktonic foraminifera in the upper ocean, transfer functions for foraminifera assemblages are usually calibrated against 10 m SST. We show [1] that calibrating foraminifera assemblages against different depths can yield markedly different reconstructions in the tropics, and that 10 m reconstructions are rarely the most plausible as they typically do not explain the most variance in a time series of fossil data. The tropics also have many LGM assemblages without good modern analogues, and the thermal profile of tropical CMIP5 LGM grid boxes lacks analogues in the CMIP5 PI ocean.

In view of these issues, we recalibrate the MARGO planktonic foraminifera calibration sets against different depths and reconstruct LGM temperatures for each ocean. There is evidence of substantial regional biases, for example, the direction of east-west gradient in tropical Atlantic LGM temperature anomalies is dependent on the calibration depth. If the most applicable calibration depths are deeper in the western tropical Atlantic than the eastern, as suggested by analysis of time series, we can reconstruct uniform cooling in the tropical Atlantic greater than that previously reconstructed. We compare our new reconstructions with CMIP5 LGM temperatures.

1) Telford, RJ, Li, C & Kucera, M: Mismatch between the depth habitat of planktonic foraminifera and the calibration depth of SST transfer functions may bias reconstructions, Clim. Past, 9, 859-870, doi:10.5194/cp-9-859-2013, 2013.