



Proxy surrogate reconstructions of Common Era Atlantic meridional overturning circulation

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Centennial-timescale variations in Atlantic meridional overturning circulation (AMOC), and their effects on climate, are poorly constrained by brief observational records and low resolution marine paleoclimate datasets, adding uncertainty to the interpretation of modern trends and climate change projections. Here we seek to extend the instrumental record of AMOC by generating quantitative reconstructions of its variation during the Common Era. We develop proxy surrogate reconstructions (PSRs) that combine information from coupled ocean-atmosphere general circulation model (AOGCM) simulations, paleoclimatic proxy system models, and the observations themselves. Specifically, we use Common Era Mg/Ca and oxygen isotope records, compiled as part of the PAGES Ocean2K and PAGES2k v2.0 databases, to reorder isotope-enabled, realistically forced AOGCM simulations which have been observationally mapped via marine carbonate proxy system modeling, minimizing spatiotemporally local misfit to the paleoclimate observations. We evaluate the uncertainties in the PSR results that arise from methodological choices, data type, observing network, and observational error, in part through pseudoproxy experiments. PSR ensembles with significant calibration and validation skill will be compared with independent estimates of past North Atlantic Circulation change. The results will be used to diagnose AMOC variations and develop a baseline for interpreting modern AMOC observations on timescales comparable to those over which projected changes are expected in the next several centuries.