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Pronounced interannual variability in tropical Pacific temperatures at the end of the last glacial

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The response of interannual climate variability in the tropical Pacific Ocean to future greenhouse warming plays a crucial role in climate model simulations. However, the dominant mode of Pacific atmosphere-ocean variability on interannual timescales, the El Niño-Southern Oscillation (ENSO), is poorly understood with respect to its behaviour under boundary conditions different from today. For last glacial conditions, model simulations and rare proxy records of interannual climate variability in the Pacific are contradictory. Here we present a monthly resolved reconstruction of tropical South Pacific climate from 15,000 years ago, providing the closest to full glacial conditions proxy record of interannual variability available from the Pacific Ocean. This period was characterized by substantial cooling in the North Atlantic Ocean and a near or complete shut-down of the Atlantic Meridional Overturning Circulation (AMOC). Our Sr/Ca palaeotemperature record constructed from a fossil coral recovered by Integrated Ocean Drilling Program (IODP) Expedition 310 to Tahiti indicates pronounced interannual variability at ENSO periods, even though the site is only weakly influenced by ENSO today. The results suggest that interannual ENSO variability in the tropical South Pacific was strong at the end of the last glacial, consistent with recent climate model simulations suggesting that a weakening of the AMOC can lead, via atmospheric teleconnections, to an intensification of ENSO variability. The coral Sr/Ca palaeothermometer indicates that mean sea surface temperatures in the tropical South Pacific were lower by not more than 3.5 °C relative to today at 15,000 years ago (by about 2-3 °C when seawater Sr/Ca changes are considered), with no change in seasonality. Our results suggest that strong interannual ENSO variability is characteristic for periods of reduced AMOC and probably for glacials in general.