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Paleoenvironmental changes in the Western Tropical Atlantic and adjacent Brazil linked to North Atlantic Heinrich and Dansgaard/Oeschger events during the last 60,000 years

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Linkage mechanisms between high and low latitudes play an important role in abrupt global climate change. Due to few tropical paleoclimate records providing sub-millennial resolution, however, these mechanisms are still largely unknown. We address this issue by presenting centennial-resolution paleoclimatic and paleoenvironmental records of the western tropical Atlantic and adjacent Brazil for the last 60,500 years, retrieved from a combined analysis of terrigenous and marine compounds of marine sediment core GeoB 3910-2. The results give new insight into linkage mechanisms between Greenland, Antarctic and western tropical Atlantic climate. Additionally, we analyze the response of terrestrial precipitation and vegetation on western tropical Atlantic climate shifts.

Western tropical Atlantic sea surface temperature and salinity records combined with a deep sea circulation record strongly suggest coupling of millennial-timescale variations in Greenland temperature and western tropical Atlantic surface and deep ocean conditions. This was probably induced by rapid changes in the Atlantic thermohaline circulation associated with Dansgaard/Oeschger and Heinrich events. Greenland

cooling during Heinrich events corresponds to western tropical Atlantic cooling and salinity decrease during the glacial, but to warming and salinity increase during the deglacial. This is probably related to rising Antarctic influence on Atlantic circulation during the deglacial, which we suggest to have shifted the axis of the Atlantic interhemispheric seesaw northward, limiting Heinrich event cooling to more northern parts of the Atlantic. Deglacial western tropical Atlantic warming correlates to Antarctic warming, suggesting linkage on glacial-interglacial timescales.

Northeast Brazilian millennial-scale precipitation and vegetations changes are inferred from marine and terrestrial archives. These changes were caused by shifts in the position of the Intertropical Convergence Zone associated with changes in the Atlantic thermohaline circulation. Precipitation rate instantly responds to Intertropical Convergence Zone shifts, but vegetation lags precipitation rate change by 1000-2000 years, probably reflecting slower change in seasonality of precipitation.