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Millennial scale precipitation changes over Easter Island (Southern Pacific) during MIS 3: Inter-hemispheric connections during North Atlantic abrupt cold events

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Marine Isotope Stage (MIS) 3 climate has been globally characterized by the occurrence of millennial-scale climate variations defined over North Atlantic as Dansgaard-Oeschger and Heinrich events. Despite climate variability has been broadly explored over North Atlantic records, the response of the tropical and subtropical latitudes, especially in the Southern Hemisphere, still remains as a matter of debate. Rano Aroi peat record (Easter Island, Chile, 27ºS) provides a unique opportunity to understand Southern Pacific atmospheric and oceanic changes during these stadial-interstadial transitions because of its exceptional location on the interplay of the South Pacific Convergence Zone (SPCZ), the Intertropical Convergence Zone (ITCZ), the South Pacific Anticyclone (SPA) and the Southern Westerlies (SW).

Rano Aroi record contains 8 main enhanced precipitation events between 70 and 40 kyr BP that can be correlated with the timing of Heinrich events 5, 5a and 6 as well as other cold stadials. These humid events are also present in other Southern Hemisphere continental sites and correspond to dry periods on Northern Hemisphere records. This opposite hydrologic trend has been explained by the latitudinal migration of ITCZ and has been supported by several climatic models. As Easter Island precipitation is mainly dependent on SPCZ storm track belt activity, we suggest that the southern migration of the ITCZ is associated to an expansion of SPCZ to the east. This process should be intimately related to a weakening of the Walker circulation, which is further supported by an estimation of d18Osw gradient along the equator for the same time period. Consequently, atmospheric and oceanic responses during these cold stadials and Heinrich events might lead to a configuration that resembles the warm ENSO state over Southern Pacific, as previously suggested by some global climatic models.

Rano Aroi record clearly points out that shifts in hydrological cycle in tropical Southern Hemisphere have been abrupt in response to the MIS 3 climate variability, a pattern which is in contrast to the typical gradual changes shown by several southern hemisphere records. This points to a very rapid atmospheric reorganization at low and medium latitudes in front to a more progressive oceanic heat redistribution lead by the bipolar seesaw.