New insights about millennial-scale positive precipitation anomalies over tropical South America

Albuquerque, A. L.; **Campos, M. D. C.**; **Chiessi, C. M.**; **Prange, M.**; **Mulitza, S.**; **Kuhnert, H.**; **Paul, A.**; **Venancio, I.**; **Cruz, F. W., Sr.**; **Bahr, A.**

Heinrich Stadials (HS) are cold Northern Hemisphere abrupt millennial-scale events frequently related to decreases in the strength of the Atlantic meridional overturning circulation (AMOC). Model simulations and paleoclimate records indicate that the reduction in oceanic heat transport to the Northern Hemisphere during periods of weak AMOC cools down the North Atlantic and warms up the South Atlantic. This perturbation in the cross-equatorial heat transport would in turn affect tropical rainfall. Indeed, South American hydroclimate records indicate marked precipitation anomalies during HS of the last glacial period. However, the scarcity of high-resolution marine records off South America, especially between 7 and 20°S, hampers a mechanistic understanding of tropical South American hydroclimate responses to HS. Here we investigate piston core M125-95-3 collected at 10.95°S from a site influenced by the terrigenous discharge of the São Francisco River, eastern South America, for the last ca. 70,000 years. In order to reconstruct changes in precipitation over the São Francisco River drainage basin we determined the major elemental composition along the piston core. To gain mechanistic insights into tropical South American hydroclimate changes we analyzed a HS-simulation with a high-resolution version of the atmosphere-ocean general circulation model CCSM3. Our new elemental record shows marked increases in São Francisco River sediment discharge to the eastern South Atlantic during HS. It is the southernmost marine paleoclimate record off eastern South America that unequivocally records the HS of the last glacial period. Additionally, our high-resolution model output allows new insights into the drivers of changes in South American hydroclimate during HS.

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