EGU2020-16361, updated on 30 Oct 2020
https://doi.org/10.5194/egusphere-egu2020-16361
EGU General Assembly 2020

South American climatic response to changes in the tropical South Atlantic Ocean hydrography during Termination 1

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Rapid climatic reorganizations during the last Termination (i.e. Heinrich Stadials 0-1) had major impacts on the Atlantic Meridional Overturning Circulation (AMOC) strength and on global atmospheric circulation patterns. However, if and how this high-latitude forcing affected low-latitude climate variability is still poorly constrained. Here we present a high-resolution multi-proxy record from marine sediment core M125-3-35 recovered in the western tropical South Atlantic combining foraminiferal Mg/Ca, Ba/Ca ratios, stable oxygen isotope measurements and organic biomarker-based sea surface temperature (SST) proxies (TEX86 and UK'37). The near-shore core position of M125-3-35 off the Paraíba do Sul river mouth in southeastern Brazil and the means of foraminiferal Ba/Ca ratios, which depends on the quantity of continental freshwater input, enables us to investigate direct coupling of continental hydroclimate and oceanographic changes.

The data show a complex interplay of oceanic and atmospheric forcing dominating the tropical South American climate, which is mainly controlled by the strength and position of the Intertropical Convergence Zone (ITCZ) and South Atlantic Convergence Zone (SACZ). During times of weakest AMOC in Heinrich Stadial 1 (HS1) , a distinct SST peak in the tropical South Atlantic points to an enhanced Brazil Current and strong recirculation of heat within the southern hemisphere. Further, wet conditions prevailed during this time in tropical South America caused by a maximum southward shift of the ITCZ. This happened in coincidence with a temperature drop and weakening of the North Brazil Current (NBC) in the tropical North Atlantic (Bahr et al., 2018) as result of maximum AMOC slowdown. Therefore, for the first time, we reveal a clear seesaw-like pattern of the NBC and BC during times of abrupt AMOC variability.

While HS1 is generally characterized by a warm and wet anomaly in our record, Ba/Ca ratios and SST show a distinct centennial-scale alternation between warmer (colder) and wetter (drier) phases indicating a distinct climate instability during this climatic phase. A distinct offset exists between SST reconstructed using Mg/Ca, TEX86, and UK'37 which points to strong seasonal differences in the oceanographic settings and/or changes in the terrestrial input from the south

American continent. These findings illustrate the strong sensitivity of hydroclimate variability in tropical South America to oceanic forcing as expected also during future climate change, in line with recent studies that showed a severe impact on modern South American climate by changes in (tropical) South Atlantic SSTs (Rodrigues et al., 2019, Utida et al., 2018).

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