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Relative timing of precipitation and ocean circulation changes in the western equatorial Atlantic over the last 45 ky

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Documenting the precise timing and sequence of last glacial millennial climate events is a prerequisite for deciphering the climate mechanisms at play in these rapid climate transitions. Here, we examine climate and ocean circulation records in a pair of neighboring marine sediment cores from the North Brazilian margin, ideally located to capture both Atlantic meridional overturning circulation (AMOC) changes and precipitation events over tropical South America.
We were able to establish very precise chronologies thanks to the simultaneous recording of South American precipitation events in both U-Th dated terrestrial speleothems and our marine sediment cores. Also, because the various time series we have studied are records from the same marine core, or from two marine cores retrieved from the same location and precisely aligned through high-resolution XRF signals, the relative phasing of one time series with respect to the other could be assessed with minimal uncertainty.
We quantify and discuss the relative phases between overturning reduction above 2300 m water depth (recorded by sedimentary Pa/Th), decreases in water ventilation at the core sites (recorded by Cibicides δ13C), and increases in precipitation on the adjacent continent (recorded by sediment Ti/Ca).
Given the non-stationary character of the climatic signals over the last 45 ky, we show that significant relative phases between the studied proxy records can be determined using cross-wavelet transforms, in contrast to stationary cross-correlation.