Insights into changes in precipitation patterns in Brazil from oxygen isotope ratios on speleothems

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Variations in tropical precipitation on millennial and orbital time scales can reflect a Hadley-cell-related anti- phasing between the Northern and Southern hemispheres due to the influence of insolation on the global summer monsoons. A new δ18O speleothem record from northeastern Brazil shows that insolation- driven changes in monsoon intensity are capable of producing a similar, zonally oriented anti-phasing within the same hemisphere. Comparison of our speleothem record with other precipitation-sensitive proxies from the central Andes and southeastern Brazil shows that precipitation in Northeastern Brazil has been out of phase with insolation and rainfall in the rest of tropical South America south of the equator since the Last Glacial Maximum. Northeastern Brazil experienced humid conditions when summer insolation was reduced and arid conditions when insolation was high. While previous interpretations of past climate change in NE South America have commonly invoked meridional displacements in ITCZ location as the main mechanism for changes in precipitation on millennial time scales, our results suggest that remote monsoon forcing is responsible for much of the observed precipitation changes on orbital time scales during the Holocene. These results demonstrate that orbitally driven out-of-phase relationships in precipitation are not limited to interhemispheric anti-phasing as demonstrated previously, but may well occur within the same hemisphere. Speleothem records also indicate contrasting climatic conditions around the Last Glacial Maximum in Brazil, characterized by marked dry and wet climates in the Nordeste and in southeastern Brazil, respectively. It is likely, however, that these regional differences primarily reflect more distant extratropical teleconnections from the Atlantic Ocean and high northern latitude changes during glacial conditions.

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