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The speleothem perspective on past African hydroclimates: a SISAL contribution

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Understanding the past variability in African hydroclimates is important in studies into the earth's climate system, paleoanthropology and future climate change. Speleothems provide one of the highest-resolution, precisely-dated archives of past hydroclimate change. The Past Global Changes (PAGES) working group Speleothem Isotopes Synthesis and AnaLysis (SISAL) brings speleothem records together in a single easily accessible database. The database can be used to analyse multiple datasets together rather than in isolation. This big data approach allows for better spatial analysis of past hydroclimate variability and better integration with climate models. Here we detail the progress of the Africa working group, highlighting the spatial and temporal coverage provided by the SISAL database, and providing initial analysis into past speleothem isotope variability across the continent.

Speleothem deposition at the southern and northern extremities of the present day ITCZ migration appears to be more common during late Pleistocene interglacials than during glacial phases suggesting an overall increased latitudinal range of ITCZ migration or a widening of the tropical rainfall belt during interglacials. During glacial phases speleothem deposition is recorded mainly in the hemisphere that has higher summer insolation. In northwestern and southern Africa precession and eccentricity influence speleothem growth, largely through changing synoptic storm activity. Comparison of recent speleothem stable isotopes with modern isoscapes suggest speleothem d18O and d13C approximate modern precipitation d18O and vegetation d13C. We assess the spatial variability of speleothem d18O over the last 12,000 years as an example of database use. Due to restrictive bedrock geology and dry climate African speleothem records are spatially and temporally flashy, but hotspots of cave records still provide great insight into regional climatology. Continued research should combine the high-resolution snapshots they provide with other longer term, low resolution hydroclimate records already available, such as sediment cores from lakes and near shore marine environments.