

Drying in NE Mexico in response to Heinrich Events inferred from a multi-proxy speleothem record

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Variations in the length and extent of droughts in Mexico can have powerful impacts on agriculture, industry and ecosystems in the region, however, it is uncertain how regional hydroclimate will be affected by climate change in the future. Climate simulations demonstrate the response of precipitation in northeast Mexico is highly sensitive to North Atlantic SST's and changes in the Atlantic Meridional Overturning Circulation (AMOC), however, there are no paleoclimate records in the region to confirm. Here, a multiproxy ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$ and trace elements) U-Th dated speleothem record from Tamaulipas, Mexico demonstrates the response of regional precipitation between 7,900 and 75,000 years BP.

Over 1600 stable isotope measurements yielding multi-decadal temporal resolution, demonstrate a synchronous response during the Younger Dryas and Heinrich stadials with shifts as large as +3‰ and +5‰ in speleothem $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$, respectively. These shifts indicate regional drying, consistent with other Northern Hemisphere paleoclimate records. Speleothem stable isotopes have been verified as robust proxies for regional rainfall through an active cave monitoring program, a nearby precipitation collection program, a suite of climate and air-trajectory model output analysis, and co-variation in a preliminary analysis of speleothem trace element ratios (Mg, Sr, Ba with respect to Ca). Regional drying during Heinrich stadials is likely directly driven by a southward shift and/or weakening of the Caribbean Low-Level Jet through an anomalous tropical Atlantic warm pool and a southward shift in the Intertropical Convergence Zone, consistent with decreased AMOC strength.