Evaluating Southern Portuguese Hydroclimate from Highly Resolved Speleothem Records

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Anthropogenic climate change is expected to alter global hydrological regimes in the near future, resulting in significant changes to water availability. However, the magnitude of such changes will vary regionally. The Iberian Peninsula, and specifically Portugal, has been identified by climate model projections as an area where climate change will increase drought frequency and severity. Climate in the Iberian Peninsula is impacted by both internal and external climate modes, potentially producing different precipitation patterns within a small geographic region. Thus, the development of regional highly resolved paleoclimate records from Portugal is critical for improving the predictive capability of regional climate models under future warming scenarios and to determine the extent to which different teleconnection patterns are influencing hydroclimate. Here we present a near annually resolved stable carbon isotope ($\delta^{13}C$) and oxygen ($\delta^{18}O$) isotope time-series from three stalagmites from the Algarve region of southern Portugal from two caves within 2.3 km of each other. U/Th dating indicates that our composite record spans the last millennia continuously through 2019 CE. Two stalagmites (GIA-19-1 and C-18-1) stopped growing around 1550 CE, during a dry interval, and sample GIA-19-2 grew continuously since the 17th century. GIA-19-2, with sub-annual resolution, is compared to modern instrumental records to evaluate the influence of specific environmental controls, including temperature and precipitation amounts. Isotope data from all three stalagmites exhibit substantial multidecadal variability indicating relatively wet and dry intervals. Based on our initial results, it is likely that both temperature and precipitation amount effects are the dominant controls on isotopic variability in these stalagmites. Comparison of the GIA-19-2 oxygen isotope time-series with the instrumental record and reconstructed index of the East Atlantic (EA) pattern (1650 CE to present) shows strong coherence with a reconstructed EA index (1650-2018 CE) and an instrumental EA index (1950 to present). Hence, variability in Southern Portuguese hydroclimate associated with the EA mode should also be considered by policy makers planners as they prepare for future warming and associated water stresses.