THE RESPONSE OF CENTRAL TEXAS CAVE DRIP SITES TO EXTREME EVENTS: IMPLICATIONS FOR PALEOCLIMATOLOGY

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ABSTRACT

As global climate changes, and extreme events are hypothesized to become more frequent and extreme, understanding the geographic range, intensity, and frequency of extreme events in the past becomes ever more important. Speleothems have the potential to record these events. This study investigates the response of central Texas cave drip sites to short-term extreme climatic events. From the resulting observations, it was hypothesized how such events may be preserved in a speleothem record, if at all. To determine this, drip rate, growth rate, and oxygen isotope responses of eleven central Texas sites over eight years were analyzed. The study period includes three extreme events; a historic drought, a hurricane, and a historically wet multi-month period. This study shows that these short-term events are only likely to be preserved in sites with little mixing of older waters, and that events that take place in the summer, a regional period of slow to no growth, are less likely to be preserved. As would be expected, those events that last longer, or have a longer recovery time, are more likely to be preserved. The most likely preservation styles of the studied events, based on the extremity and duration of the drip water response, are as follows: 1) droughts show longer-than-average periods of low to no growth with no isotopic response; 2) tropical storms show an abrupt historic isotopic low (drip water depleted in $\delta^{18}O$) followed by a multi-month return to baseline isotopic values with no growth rate response; and 3) abnormally wet periods a combined isotopic low and growth rate increase. It is clear that in paleoclimatology studies investigating extreme climatic events, deep-cave temperate speleothems chosen should be those that are fed by more direct drip sites and have higher growth rates. Monitoring studies of cave drip sites can be very useful in identifying sites that fit these criteria and thus may be useful in paleoclimate studies.

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