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Mesoamerican monsoon failure during the last Interglacial

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We present a new precisely-dated, replicated and high-resolution Mesoamerican monsoon reconstruction from Juxtlahuaca Cave, Mexico, that extends to 105 ka. While speleothem-based monsoon records have become available in many global monsoon regions, ours provides a strong counterpoint to the prevailing hypothesis of a millennial-scale forcing via variations in Intertropical Convergence Zone (ITCZ) position. Our record is dominated by an orbital character, but with abrupt transitions between wet and dry intervals. Prominently, we observe an abrupt monsoon collapse between 85 and 90 ka that coincides with Marine Isotope Stage 5b and a strong minimum in September local insolation. In contrast to the weak monsoon intervals during Heinrich stadial 1 and the Younger Dryas, the MIS 5b monsoon collapse was associated with low ice volume, limited northern hemisphere ice sheet extent, and a strong Atlantic Meridional Overturning Circulation (AMOC) in the subtropical North Atlantic. These observations suggest that monsoon strength is strongly coupled to local late summer insolation, and that monsoon collapses may happen during interglacial periods when AMOC is strong. Further, we see no clear evidence for the prominent millennial-scale stadial and interstadial events evident in Greenland and elsewhere in the North Atlantic Ocean during Marine Isotope Stages 3 to 5, despite our close proximity to the North Atlantic Ocean. Nor is there a monsoon weakening coincident with the Toba eruption. These observations suggest that the Mesoamerican Monsoon over southwestern Mexico is largely uncoupled from millennial ITCZ displacements evident elsewhere. Instead, we show that our monsoon record is paced by orbital insolation (September 21 at 15ºN) during the Pacific tropical cyclone season, which implicates an orbital control on tropical storm occurrence and/or intensity. Synchronization of this response across the tropical Pacific Ocean could be related to the Walker circulation and its response to ENSO-like behavior on orbital timescales. We conclude that the Mesoamerican monsoon operates as a coherent plateau monsoon with threshold behavior on orbital time scales driven by ocean-to-land temperature gradients. The simplistic interpretation of Neotropical monsoon variation as a response to extratropical forcing of meridional shifts in the ITCZ is unsupported for our area.