Holocene precipitation changes in the deep tropics recorded by Speleothems (Invited)

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We have obtained a high-resolution oxygen isotope (δ18O) record of cave calcite from Paraiso Cave, eastern Amazon, which covers most of the Holocene. Its chronology was determined by U-Th ages from three column-shaped stalagmites. Their δ18O profiles replicate among their contemporaneous growth periods. Therefore, the samples were likely precipitated under equilibrium conditions and their oxygen isotopic variations are primarily caused by climate change. We find that the δ18O decreases steadily from ~11.0 to 5.0 thousand years ago, with a growth gap between ~8.4 to 6.3 thousand years ago, and then gradually increases until the present. The large amplitude of the δ18O change (up to 4 per mil) suggests that the variation in δ18O value is dominated by meteoric precipitation change at this equatorial site. In order to investigate the interactions between the Intertropical Convergence Zone (ITCZ), monsoons and El Niño-Southern Oscillation (ENSO) activity during the Holocene, we compare the Paraiso record to speleothem records from other locations in the deep tropics, namely, cave sites from Flores, Borneo and Peru. We find that all these speleothem records are consistent, with a progressive δ18O decrease (rainfall increase) during the early Holocene, probably in response to the southward retreat of the ITCZ from its northernmost location in the early Holocene. This is evident from the strong anti-correlation between the speleothem monsoonal records from China and southern Brazil. However, our record is distinct from the others during the last 4 thousand years, when it switches to a continuous δ18O increase (rainfall decrease) trend, while the others flatten out. We propose that, during the late Holocene, the strengthened South American Summer Monsoon may override the ENSO influence and cause the discrepancy in precipitation between eastern Amazon and other deep tropical cave sites.

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