Variations in Indo-China Hydroclimate over the last two millennia

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The Southeast Asian Monsoon (SEAM), a sub-component of the Asian Monsoon (AM) system, dominates the hydroclimate of mainland Southeast Asian and provides the rainfall necessary to sustain agriculture and food production for millions of people. Meridional migrations of the intertropical convergence zone (ITCZ) coupled with zonal shifts in the Pacific Walker Circulation (PWC) govern variations in hydroclimate across the AM region. However, the impacts of these internal climate variations on Indo-China hydroclimate remains poorly understood, partly due to the scarce paleoclimate records available from this region. Here, we present 2,000-year, high-resolution, absolute-dated stalagmite $\delta^{18}O$ and $\delta^{13}C$ records from Tham Mai cave in northern Laos, which document changes in monsoon strength and local hydrological conditions, respectively. The moderate correlation between our $\delta^{18}O$ and $\delta^{13}C$ records suggests a potential linkage between large-scale monsoon circulation and upstream rainout with locally wet (or dry) conditions. The two records share broadly similar patterns from 1200 CE to 1800 CE, which suggest that decreased monsoon intensity and subsequent decreased upstream rainfall correspond with drier conditions in northern Laos. A positive $\delta^{13}C$ excursion, interpreted as reflecting dry conditions, at ~1300 CE coincides with the approximate transition from the Medieval Climate Anomaly (MCA; 950-1250 CE) into the Little Ice Age (LIA; 1400-1800 CE). Our records suggest multi-decadal drought conditions especially during the 14th and 15th centuries, which are consistent with Vietnamese tree-ring records and the timing of Late Medieval droughts in Cambodia. Our record, however, contradicts the relatively wet conditions in the South China Sea during the LIA revealed in grain sizes of lake sediment and ostracode shells from Dongdao Island.