This research suggests that temperature can be a significant control on the speleothem oxygen isotope glacial records due to the thermal decoupling between surface and cave atmospheres, especially, but not exclusively in deep caves located in mountainous areas.

Asynchronous Holocene Optimum in East Asia monsoon region recorded by stalagmites and its underlying climate dynamics

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Reconstructions of Holocene Optimum (HO) in East Asian summer monsoon (EASM) regime from speleothem versus other proxy records have yielded divergent phase relationships with the EASM and local precipitation. This apparent discrepancy has been partly attributed to the uncertainties in the climatic representation of Chinese speleothem oxygen isotope ($\delta^{18}O$) records. Here we conducted a data-model comparison along with a water moisture budget analysis to assess the role of thermodynamic and dynamic components in controlling mid-summer and spring rainfall during early and mid-Holocene, and to compare with the precipitation changes referred by the stalagmite $\delta^{18}O$ records. Our results show that 1) a marked southward shift of the HO period from 10500~6500 yr BP in North China (NC) to 9000~5000 yr BP in Yangtze river valley (YRV). During the Holocene, the variation of the summer precipitation is dominated by precession in NC, ice sheet in YRV. 2) An incoherent orbital-scale speleothem $\delta^{18}O$ variability in EASM regime indicate that speleothem $\delta^{18}O$ is largely controlled by the large-scale circulation and concomitant latitude shifts of monsoon rain belt.3) The intensified hydroclimate in YRV in mid-Holocene was contributed to excessive rainfall in spring, especially for increasing the large-scale/total precipitation ratio, which leads to the lightest speleothem $\delta^{18}O$ during the mid-Holocene. The excessive rainfall in spring is mainly from the enhancement of horizontal monsoonal moisture transport that is caused by the anticyclone over Western North Pacific.