What are Asian speleothem $\delta^{18}O$ telling us? Insights from an isotope-enabled model

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Asian speleothem records have been widely used to investigate hydroclimate variability on timescales going from decadal to orbital [1]. However, the interpretation of Asian speleothem $\delta^{18}O$ is still contentious, with many possible interpretations such as monsoon intensity, moisture source regions and transport, and convective activity [2-4]. Thus it is necessary to quantify the relative contributions of each factor to better interpret speleothem $\delta^{18}O$. While the spatiotemporal distribution of available instrumental observations is limited, isotope-enabled models provide a physically-consistent framework to explore the interpretation of precipitation $\delta^{18}O$.

iCAM5 is a state-of-the-art isotope-enabled model which simulates the variability of precipitation $\delta^{18}O$ with high fidelity [5]. Here we leverage a 150y-long simulation of iCAM5 from an AMIP-style experiment. The contributions of local and remote rainfall amount, air temperature, water vapor transport, convective activity to the precipitation $\delta^{18}O$ over Asian speleothem sites at monthly scales are estimated via linear regression. Precipitation $\delta^{18}O$ over Chinese caves is strongly influenced by upstream precipitation and convection. Also, precipitation $\delta^{18}O$ over Borneo (home to many influential records) and India is more influenced by local convective activity, as previously established [4].

The results imply that, while the variability of Asian precipitation $\delta^{18}O$ occurs at continental scale, different processes matter locally. Thus the interpretation of precipitation $\delta^{18}O$ is very site-dependent and requires careful analysis. We will investigate the role of karst processes in transducing precipitation $\delta^{18}O$ variability to speleothems $\delta^{18}O$, by coupling speleothem forward models [6]. Our study will shed new light on the interpretation of speleothem $\delta^{18}O$ records and their use in paleoclimatology.

[1] Cheng *et al*. (2016) *Nature* **534**, 640-646. [2] Wang *et al*. (2001) *Science* **294**, 2345-2348. [3] Pausata *et al*. (2011) *Nat. Geosci*. **4**, 474-480. [4] Moerman *et al*. (2013) *EPSL* **369**, 108-119. [5] Nusbaumer *et al*. (2017) *J. Adv. Model. Earth Syst*. **9**, 949-977. [6] Baker & Bradley (2009) *Global Planet. Change* **71**, 201-206.