

What controls oxygen isotopes in stalagmites? Answers from a daily resolved precipitation record from peninsular Thailand

Stable oxygen isotopes in terrestrial archives such as e.g. speleothems or tree rings are commonly used to reconstruct past variations in precipitation. However, although rainfall on historical time scales appears to show a reasonable correlation to yearly averaged stable oxygen isotope values, the actual mechanisms behind this correlation are complex. To improve our understanding of the climatic and meteorological processes controlling $\delta^{18}\text{O}$ in the precipitation over peninsular Thailand, daily rain water samples were collected at the Krabi Airport Meteorological Station. For daily $\delta^{18}\text{O}$ values, only a very weak correlation with rain amount was detected, indicating that the amount effect (*sensu stricto*) does not play a major role on the isotopic composition of the rain water. Comparison to outgoing long wave radiation, a proxy for local convection, shows that short term variability in $\delta^{18}\text{O}$ is best explained by variations in local convection. In contrast, monthly amount weighted isotope values show a weak, but significant, correlation to monthly precipitation amount, indicating that moisture source, mixing processes, and rainout history play a more important role in controlling long term variations in $\delta^{18}\text{O}$. More importantly, there is a rather strong seasonal pattern in the isotopes of the rain water, suggesting that the source regions of winter and summer monsoon play an important role in controlling the isotopic values in precipitation. Consequently, shifts in stalagmite oxygen isotopes are more likely reflecting changes in the relative importance of the different monsoon systems than absolute rain amounts. Moreover, in a short pilot study, two months of daily drip water were collected from a cave in the Krabi province and compared to the rain water data. Even though short, the time series suggests that cave waters were close to yearly average and that extreme rain events may be recorded, although strongly muted, with a lag of a couple of weeks.

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