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Speleothem records of interannual variability in the tropics during the Holocene

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Reconstruction of changes in interannual variability through the Holocene period can provide valuable insight into the sensitivity of internal modes of variability (e.g. ENSO, PDO) to external forcing. Coral and bivalve records are widely used to examine past changes in short-term variability, however, far fewer reconstructions exist in the terrestrial realm. Here, we use the SISAL (Speleothem Isotopes Synthesis and Analysis) database to examine changes in the amplitude of interannual/short-term variability across the monsoon regions, recorded by speleothem $\delta^{18}\text{O}$ standard deviation ($\delta^{18}\text{O}$ s.d.). First, we identified and corrected for any confounding factors that may obscure interannual climate signals in the speleothem records, such as variable growth rate. We used a multiple linear regression model to constrain relationships between $\delta^{18}\text{O}$ s.d. and growth rate and mean climate (represented by mean $\delta^{18}\text{O}$), then used these relationships to apply a correction. Second, corrected $\delta^{18}\text{O}$ s.d. trends were combined into regional monsoon composites, representing changes in short-term variability across the Holocene. Trends are very similar between raw and corrected $\delta^{18}\text{O}$ s.d., suggesting that confounding factors have a minimal effect. Trends differ amongst regions: the Indian monsoon shows gradually increasing $\delta^{18}\text{O}$ s.d. through the Holocene, whilst the East Asian monsoon shows no significant changes through this period. The Indonesian-Australian monsoon shows higher than present $\delta^{18}\text{O}$ s.d. during the mid- to early Holocene and the South American monsoon shows multi-centennial scale fluctuations between higher and lower $\delta^{18}\text{O}$ s.d.