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Speleothem Evidence for Temporal-Spatial Variation in East Asian Summer Monsoon since Medieval Warm Period

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Published annual-to-decadal resolution stalagmite δ18O records since AD 900 from six caves (Dongge, Furong, Heshang, Buddha, Shihua and Wanxiang) in China were analyzed to detect temporal and spatial variability of the East Asian Summer Monsoon strength which strongly affects wet/dry conditions in eastern China. The empirical mode decomposition method (Huang et al., 1998) was used to obtain trends of the six cave records. After the base trend was determined, δ18O anomalies of each record were computed by subtracting the base trend. Mean δ18O anomaly values of the detrended time series for each cave record were calculated for four periods: (1) medieval warm period (MWD, AD 900 – 1250), (2) little ice age phase-1 (LIA-1, AD 1250 –1550), (3) little ice age phase-2 (LIA-2, AD 1550 – 1850), and (4) modern period (MD-1, AD 1850 – 2000). From these anomalies, the temporal and spatial variability of wet/dry conditions has been identified. Positive values of the mean δ18O anomalies indicating drier conditions appeared in lower Yangtze River Drainage Area and Southeast Coast Area during MD-1, LIA-1 and MWD, whereas negative values existed in North, South and Yangtze areas of the eastern China. The results agree with Dryness/Wetness index reconstructed by Chinese historic records in general. These results illustrate that wet and dry conditions in different regions of the eastern China could be opposite under the monsoon influence, so that no single speleothem δ18O record could represent monsoonal climate in this vast region. The climatic patterns in the monsoonal region can either warm/wet (cold/dry) or cold/wet (warm/dry) on annual-to-centennial scales. A 128-yr periodic cycle exists in all six cave records, whereas 64-yr and 42-yr periodicities appear in the Shihua, Heshang and Dongge records. These cycles may reflect the influence of the solar activity on the East Asian Summer Monsoon.