Variations of the Asian monsoon on inter-annual and inter-decadal timescales in the past 1000 years: A $\delta^{18}O$ record of an annually-laminated stalagmite from Heshang cave, Central China

MENGYU WANG[1] CHAOYONG HU[1] YUHUI LIU[1] LIANLIAN LI[1]

[1]School of Geography and Information Engineering, China University of Geosciences, Wuhan, 430078, China(wmywmytctctc@outlook.com)

Chinese stalagmite $\delta^{18}O$ have been reported to reveal the variations of the Asian monsoon on inter-annual to orbital time scales. However, published annual $\delta^{18}O$ records are still rare. In this study, according to the lamination characteristics of stalagmite HS4, powder samples on annual resolution in recent 1000 years (1000~2000 A.D.) have been obtained for the measurement of the $\delta^{18}O$. Based on the analysis of $\delta^{18}O$ of HS4, the variations and the driving mechanism of the East Asian Monsoon in recent 1000 years have been discussed. The results demonstrate that the $\delta^{18}O$ values of HS4 range from -9.38 to -6.97‰ with an average value of -9.38‰ and an amplitude of 2.41‰. During the Medieval Warm Period (MWP), the $\delta^{18}O$ values show a gradual decreasing trend with relatively small fluctuations, indicating a strengthening summer monsoon. In the Little Ice Age (LIA), $\delta^{18}O$ values reached a minimum of -9.38‰ around 1551 A.D. After that, there is an increasing trend with fierce fluctuations, indicating a weakening summer monsoon. During the Current Warm Period (CWP), the $\delta^{18}O$ values generally decrease again, indicating the summer monsoon becomes weak. Compared with other $\delta^{18}O$ records from Lianhua Cave and Dongge Cave, a generally similar trend could be observed among them with a relative high value during the LIA, a relative low value during the MWP, and a decreasing tend in the CWP, which suggests Chinese stalagmite $\delta^{18}O$ records do reveal the variations of the Asian monsoon. A power spectrum analysis of the $\delta^{18}O$ of HS4 in the past 1000 years demonstrates significant periodicities of 2-7 years, 13-15 years, 40 years and 110 years (90% confidence levels), which are in coincidence with the cycles of El Niño–Southern Oscillation (ENSO), Pacific Decadal Oscillation(PDO), and solar activity respectively, suggesting both external forcing and internal variability influence the Asian monsoon on inter-annual and inter-decadal timescales