

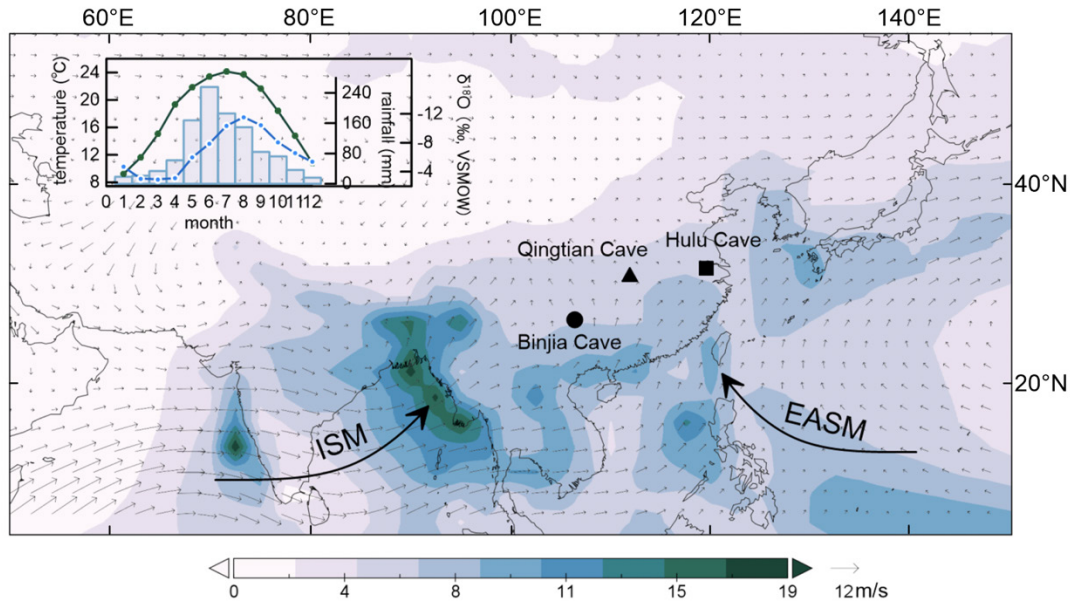


Figure S1. Regional climatology and cave sites. NCEP/NCAR May to August (MJJA) daily precipitation (mm/day) and 850 hPa wind vectors (m/s) averaged from 1983 to 2012. Inset shows mean monthly rainfall (bar) and temperature (green line) at Wangmo station and monthly simulated precipitation $\delta^{18}\text{O}$ (blue line) [1]. Arrows indicate the directions of the Indian Summer Monsoon (ISM) and the East Asian Summer Monsoon (EASM). Cave sites are indicated as follows: rectangle—Hulu Cave [2,3], triangle—Qingtian Cave [3], and circle—Binjia Cave (this study).

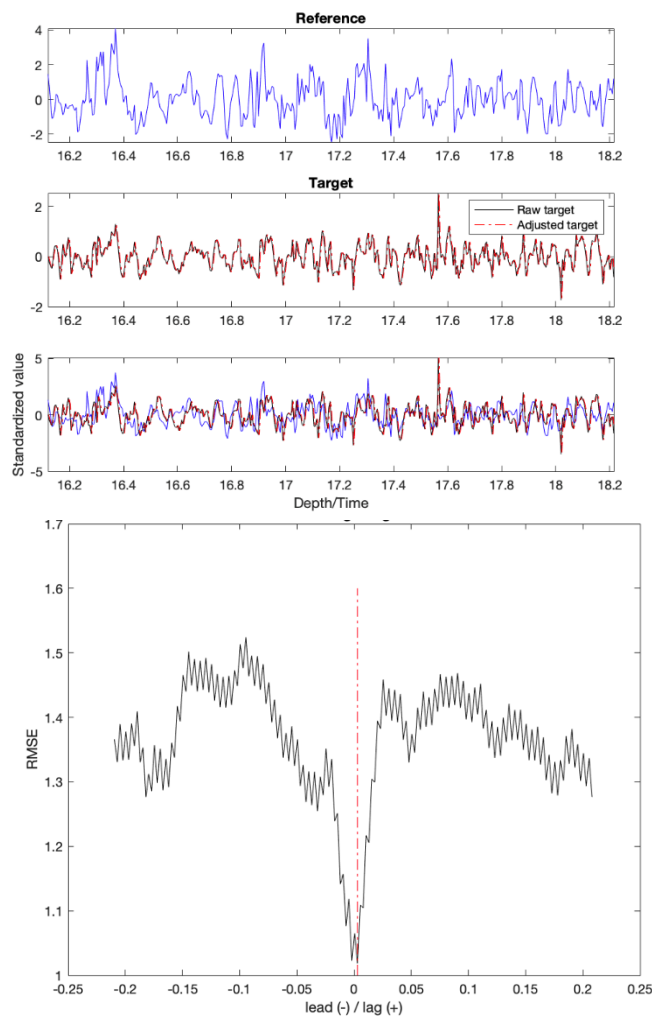


Figure S2. Lead-lag test for $\delta^{18}\text{O}_d$ (target) and $\delta^{13}\text{C}_d$ (reference) records of sample BJ7. Results show that the two records are almost coeval and are in-phased related. The test was performed using Acycle software [28].

Table S1. ^{230}Th dating results for sample BJ7 ^{230}Th dating results for BJ7.

Sample	^{238}U	^{232}Th	$^{230}\text{Th} / ^{232}\text{Th}$	$\delta^{234}\text{U}^*$	$^{230}\text{Th} / ^{238}\text{U}$	^{230}Th Age (ka BP)	^{230}Th Age (ka BP)	$\delta^{234}\text{U}_{\text{initial}}^{**}$
Number	(ppb)	(ppt)	(atomic $\times 10^{-6}$)	(measured)	(activity)	(uncorrected)	(corrected)	(corrected)
BJ7-35	26.30 ± 0.04	444.59 ± 10.05	199.7 ± 4.8	454.39 ± 4.21	0.2047 ± 0.002	16.34 ± 0.16	16.01 ± 0.23	475.38 ± 4.41
BJ7-81	17.57 ± 0.03	93.41 ± 9.90	630.4 ± 67.1	450.68 ± 5.47	0.2032 ± 0.002	16.26 ± 0.20	16.15 ± 0.21	471.70 ± 5.73
BJ7-321	26.82 ± 0.04	594.79 ± 10.10	164.9 ± 3.1	454.22 ± 4.11	0.2217 ± 0.002	17.81 ± 0.16	17.38 ± 0.27	477.05 ± 4.33
BJ7-691	30.17 ± 0.04	921.17 ± 10.18	128.1 ± 1.7	475.26 ± 3.83	0.2372 ± 0.002	18.87 ± 0.16	18.27 ± 0.34	500.41 ± 4.06
BJ7-750	26.11 ± 0.04	1203.58 ± 10.35	88.5 ± 1.0	509.82 ± 4.12	0.2474 ± 0.002	19.25 ± 0.15	18.37 ± 0.46	536.96 ± 4.39

U decay constants: $\lambda_{238} = 1.55125 \times 10^{-10} \text{ yr}^{-1}$ [4] and $\lambda_{234} = 2.82206 \times 10^{-6} \text{ yr}^{-1}$ [5]. Th decay constant: $\lambda_{230} = 9.1705 \times 10^{-6} \text{ yr}^{-1}$ [5].

$\delta^{234}\text{U} = ([^{234}\text{U}/^{238}\text{U}]_{\text{activity}} - 1) \times 1000$. * $\delta^{234}\text{U}_{\text{initial}}$ was calculated based on ^{230}Th age (T), i.e. $\delta^{234}\text{U}_{\text{initial}} = \delta^{234}\text{U}_{\text{measured}} \times e^{\lambda_{234}T}$.

** Corrected ^{230}Th ages assume the initial $^{230}\text{Th}/^{232}\text{Th}$ atomic ratio of $(4.4 \pm 2.2) \times 10^{-6}$. Those are the values for a material at secular equilibrium, with the bulk earth $^{232}\text{Th}/^{238}\text{U}$ value of 3.8. Errors are 2σ analytical errors. B.P. stands for “Before Present” where the “Present” is defined as the year 1950 A.D.

References

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