**Supplementary** **Figures**

Precisely constrained 134-ka strong monsoon event in the Penultimate Deglaciation by an annually laminated speleothem from the Asian monsoon domain

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**Figure**

**Fig. S1. The cave site, meteorology station, and cave monitoring.**

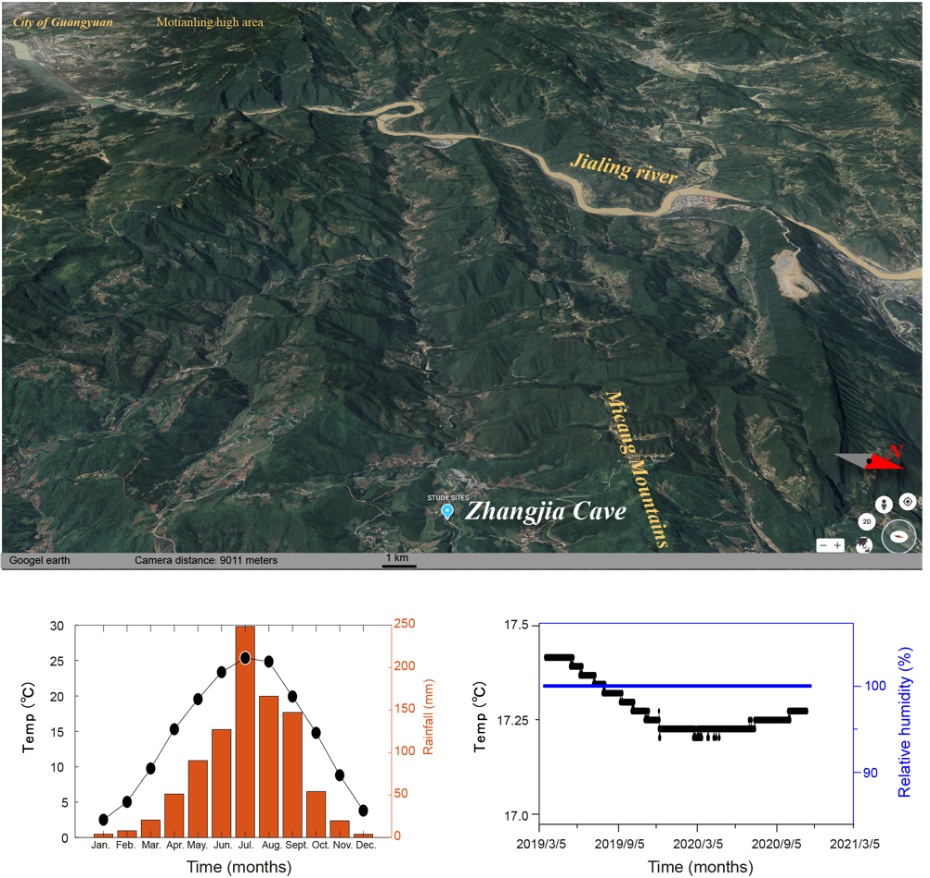
**Fig. S2. Oxygen isotope** **simulations of isoGSM (A-C) and iCESM (D-F)**

**Fig. S3. Comparison of stalagmite records from north and south China**

**Fig. S4. Global paleo-records comparison from 20 to 5 ka**

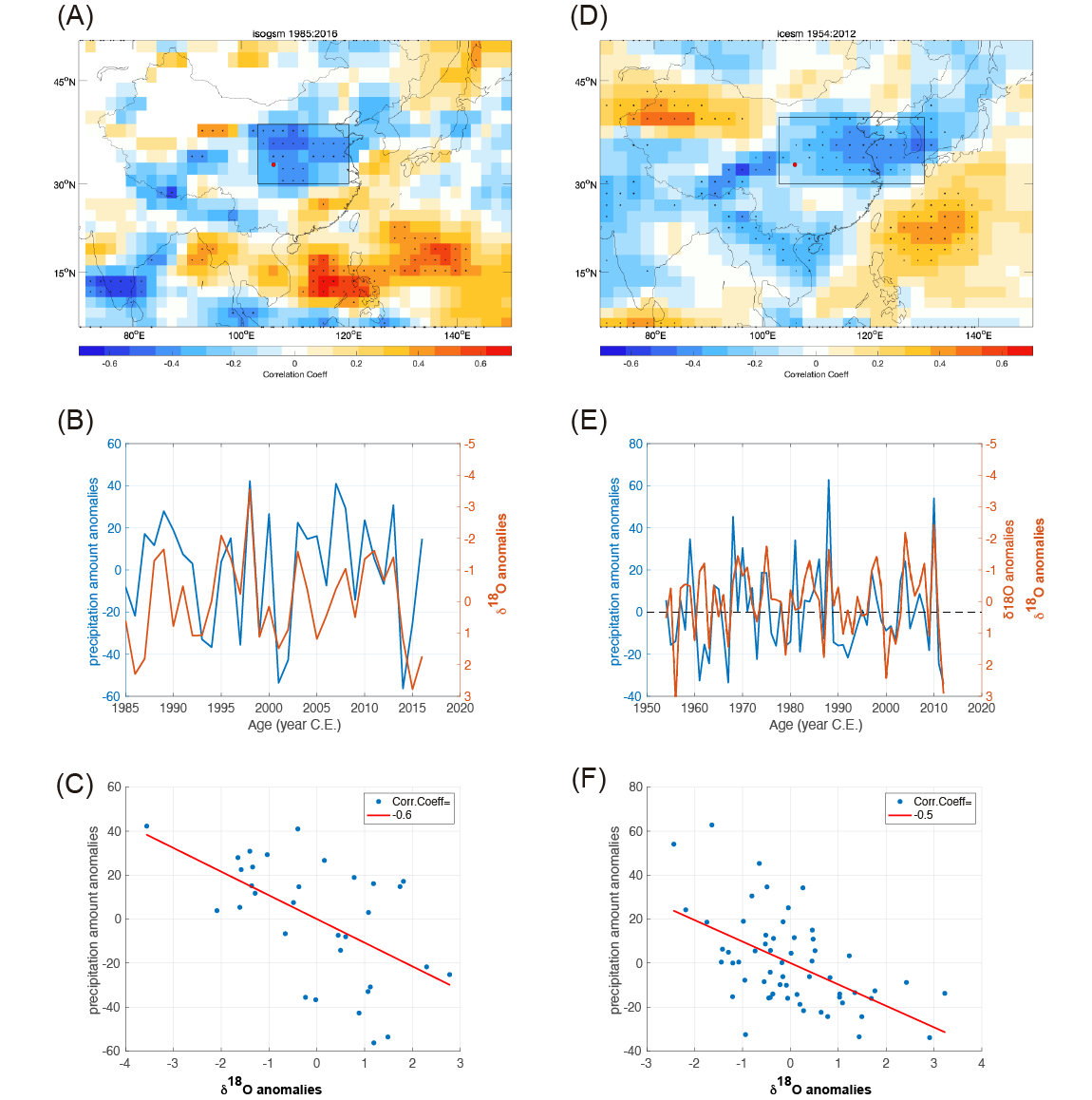
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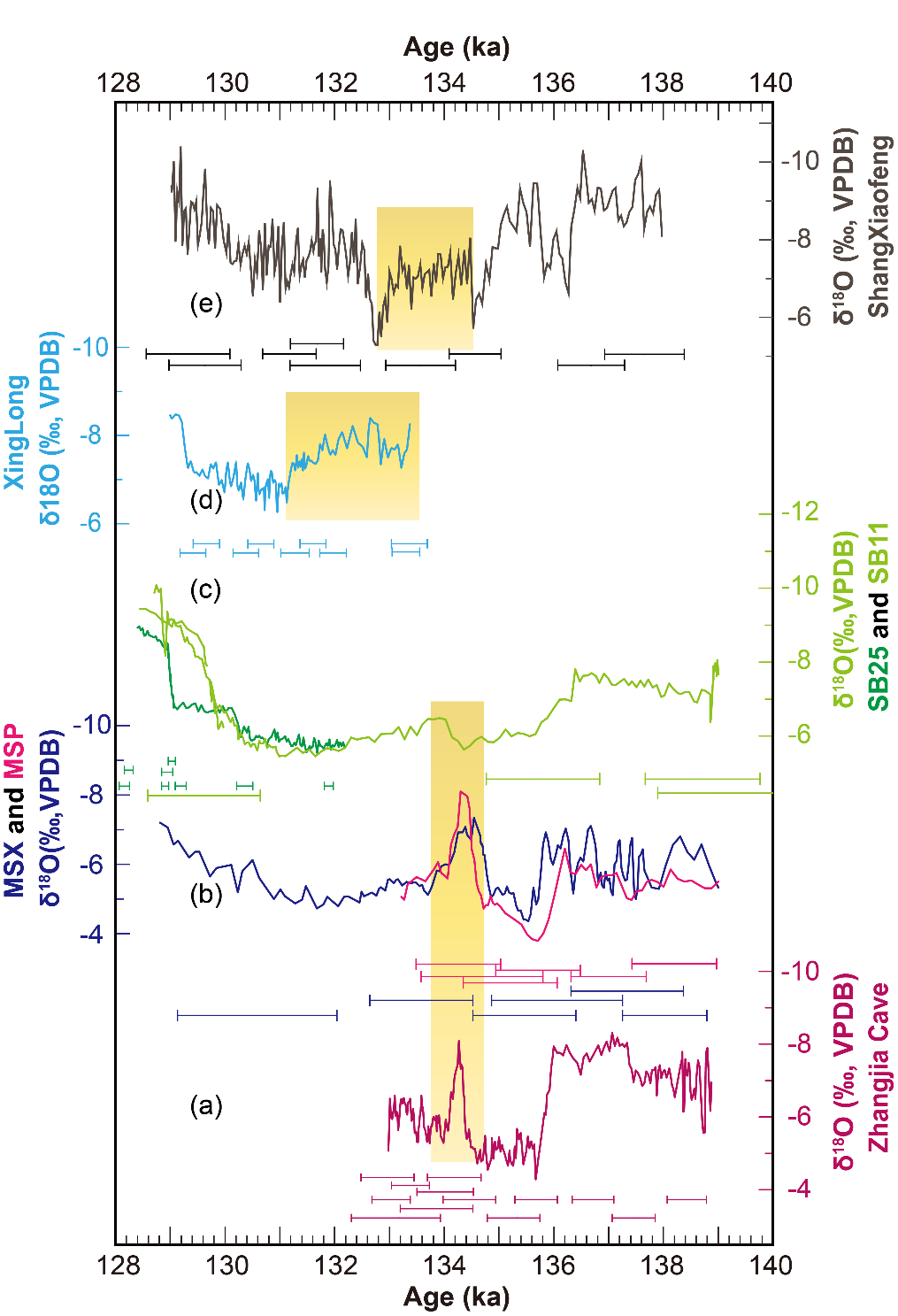


**Fig S1. The cave site, meteorology station, and cave monitoring.**

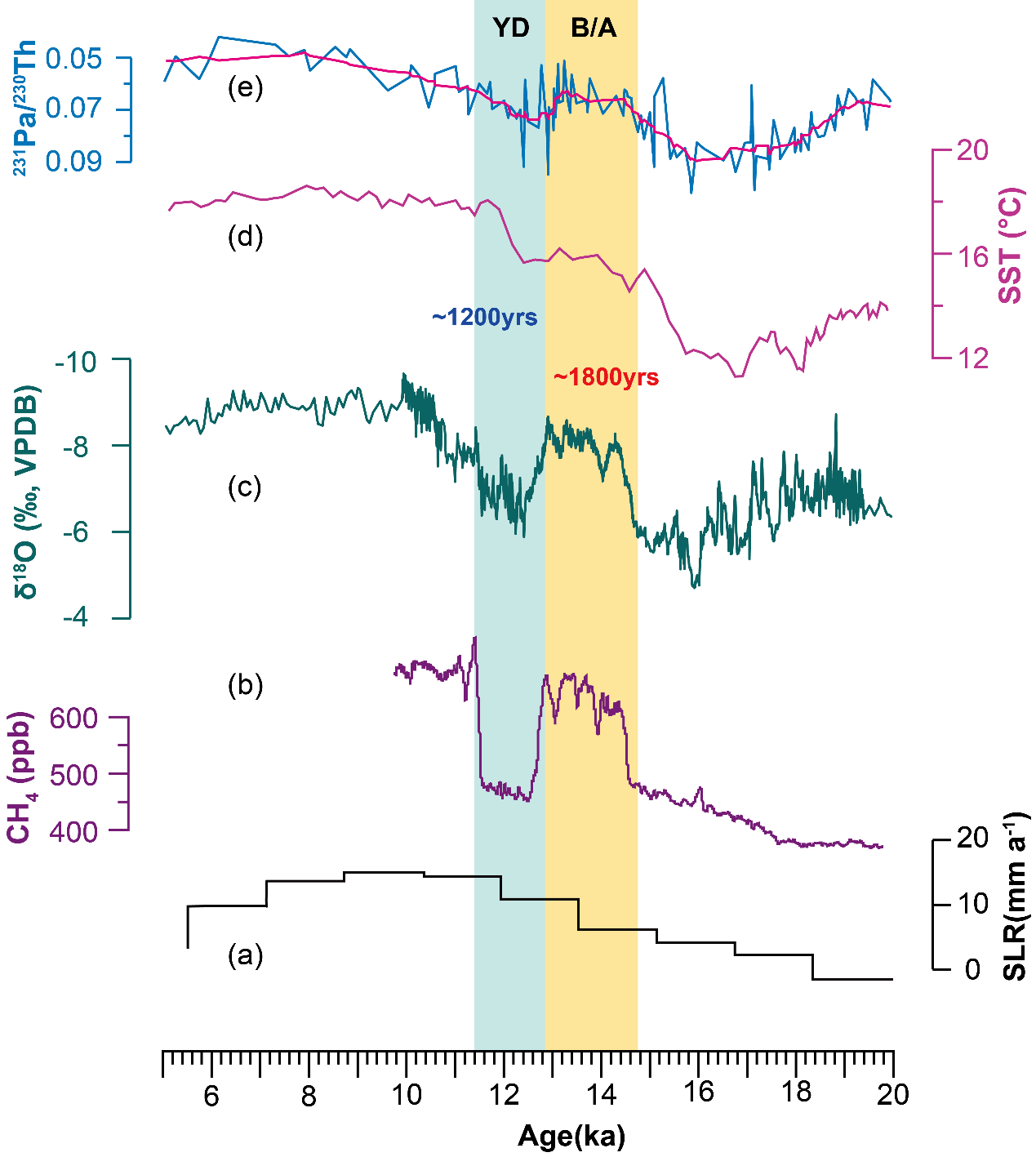
The figure above shows the location of the Zhangjiadong Cave, the figure on the lower left shows the local average monthly temperature and precipitation, and the figure on the lower right shows the changes in temperature and relative humidity monitored in the cave from March 5, 2019 to March 5, 2021.



**Fig S2. Oxygen isotope simulations between precipitation (mm) and** **δ18O in isoGSM**([Yoshimura et al., 2008](#_ENREF_16))**(A-C) and iCESM** ([Hurrell et al., 2013](#_ENREF_5))**(D-F).** **(A-C): (A)** Correlations between June and September (JJAS) IsoGSM simulated δ18O and precipitation amount at each grid cell. The black rectangle demarcates the region from where precipitation amount was extracted for time-series comparisons in panel **(B)**. **(B)** Z-score transformed time-series comparisons between the JJAS precipitation amount (black), δ18Op (red) for 1985–2016. Timeseries for all two variables represent averaged values extracted from a rectangular-shaped region over the China marked in panels **(A)**. **(C)** Correlation between the IsoGSM simulated δ18O and precipitation amount. **(D-F):** **(D)** Same as **(A)** but by the iCESM for 1954–2012. **(E)** Z-score transformed time-series comparisons between the JJAS precipitation amount (black), δ18Op (red). Timeseries for all two variables represent averaged values extracted from a rectangular-shaped region over the China marked by rectangles in panels **(D)**. **(F)** Correlation between the iCESM simulated δ18O and precipitation amount.



**Figure S3. Comparison of stalagmite records from north and south China.** From bottom to top**: (a)** The speleothem δ18O record from Zhangjia Cave (this study). **(b)** The speleothem MSP (pink), and MSP (navy blue) δ18O records from Hulu Cave (Cheng et al., 2006; Wang et al.,2018). **(c)** The speleothem SB-25(dark green) and SB-11(light green) δ18O records from Sanbao Cave (Cheng et al., 2009). **(d)** The speleothem δ18O record from Xinglong Cave (Duan et al., 2019). **(e)** The speleothem δ18O record from Shangxiaofeng Cave (Xue et al., 2020). The 230Th dates with uncertainties (±2σ) is shown in each error bars. The yellow bars indicate 134ka-event.



**Figure S4. Global paleo-records comparison from 20 to 5 ka.** From bottom to top**: (a)** Global sea level rates from benthic (Stoll et al., 2022). **(b)** WAIS Divide ice core methane concentrations (Rhodes et al., 2015). **(c)** East Asian monsoon intensity speleothem-derived record (Cheng et al., 2016). **(d)** Iberian margin SST reconstructions at sediment cores MD01-2444 (Martrat ef al., 2007). **(e)** North Atlantic marine sedimeni 231Pa/230Th ratios reflecting AMOC intensity (red line: 9-point moving average) (Henry et al., 2016; Ng et al.,2018). The yellow bars indicate B/A event.

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