



## **Precessional cycles and millennial-scale climate variability of East Asian monsoon over the past 225,000 years**

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As the previously reported climatic data from Hulu and Dongge caves [Wang et al., 2001; Yuan et al, 2004; Wang et al., 2005], knowledge of the precise timing of Asian monsoon climate variability provides a crucial test of the orbital forcing theory and physical models of abrupt climate events. Here we further report data of nine stalagmites from Sanbao Cave, central China, a 1000km distance to the west of Hulu Cave. Spliced and partially duplicated with the Hulu Cave record, Sanbao Cave oxygen isotope data provide a precise-dated high-resolution climate record of East Asian monsoon for the past 225,000 years. The most striking feature of East Asian monsoon over the past 225,000 years is coherent and in phase with northern summer insolation at precessional band, indicating a direct control of East Asian monsoon climate by insolation. During the last glacial period, timing of 25 Dansgaard-Oeschger (D/O) events in the monsoon record agrees well with a more recently published age scale for Greenland Ice Sheet Project (GRIP) [Johnsen,2001] except for D/O 19 and 20 younger than the GRIP chronology by about 1000 years. For the earlier glacial period, between 129,000 and 225,000 years ago, the millennial-scale variability of East Asian monsoon, although less pronounced, bears a high similarity to the pattern of the last glacial, suggesting that such D/O episodic behavior is a fundamental aspect of Pleistocene glacial cycles. Our result supports global linkages of Asian monsoon variability on millennial time scale throughout the entire record by self-sustained oscillations of large-scale oceanic-atmospheric circulation.