



Holocene climate variability over Southeast Asia - The East Asian winter monsoon and the Chinese civilization

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The Asian-Australian monsoon is a major component of the Earth's climate system that influences the societal and economic activities of roughly half of the world's population. Instrumental and historical records reaching back several centuries show considerable interannual to decadal variability in monsoonal strength. While El Nino warm events tend to weaken the summer rainfall in both the Indian and East Asian monsoons, the instrumental data do not reveal a straightforward relationship among these major climate elements. Paleoclimate records can provide additional insights into monsoon dynamics, as the past includes larger amplitudes of climate change that may reveal more robust linkages among climate components.

In the sediments of Lake Huguang Maar in coastal southeast China, titanium content and redox-sensitive magnetic properties record the strength of winter monsoon winds at subdecadal resolution over the last 16 thousand years. The record indicates a stronger winter monsoon prior to the Bølling-Allerød warming, during the Younger Dryas, and during the middle and late Holocene, when cave stalagmite oxygen isotope data indicate a weaker summer monsoon.

Our record of East Asian monsoon dynamics raises the possibility that climate change was a catalyst of profound societal change in China during the last 4 millennia. The Huguang Maar data suggest that major changes in Chinese dynasties occurred when the winter monsoon was strong. Extending the relation with the oxygen isotope data to the early Holocene supports the assertion that dynastic changes took place when the

summer monsoon was weak and thus rainfall was reduced. Dynastic changes in China often involved popular uprisings during phases of crop failure and famine, consistent with a linkage to reduced rainfall. In contrast, the 'golden ages' of Chinese civilization, such as the short Qin dynasty (206-221 BC) and parts of the Han (202 BC-220 AD) and Tang (220-907 AD) dynasties, occurred during phases of relatively wet and stable monsoonal conditions.