Geophysical Research Abstracts, Vol. 7, 05604, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05604

A precisely dated, high-resolution record of Holocene East Asian Monsoon intensity: Comparison with millennial changes in the Indian monsoon and elsewhere

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The Asian monsoon is one of Earth's largest climate systems. It is commonly considered as two related systems: the Indian Monsoon and the East Asian Monsoon, separated by Indonesia (which divides the source of water vapour)) and the Himalayans (which represents a major atmospheric boundary). Paleo-climate records have demonstrated that both these monsoon systems are strongly linked to Northern Hemisphere processes with monsoon intensity, for example, being significantly weakened during the Younger Dryas and MIS 3 cold periods (Wang et al. 2001). For the Holocene, high-resolution records have also demonstrated the presence of sub-orbital changes in the Indian monsoon (Fleitmann et al. 2003) including the presence of an event close to 8.3 kyr and changes apparently caused by solar forcing. Here we present a high-resolution record of East Asian monsoon intensity for the Holocene. This record allows a comparison of the two Asian monsoon systems, and an assessment of the spatial extent of millennial and solar-frequency climate change.

U/Th analyses provide a higher precision chronology for two speleothems from Hesghang Cave in the middle Yangtse Valley (30.44 N, 110.42 E). More than 30 dates, with typical (95% confidence) precision of $<$50 years, indicate that one stalagmite grew more than 2 meters continuously during the last 8.8 kyr, while the second grew through the last deglaciation. A high-resolution stable-isotope record indicates, as in previous studies, a decrease in monsoon intensity during the Younger Dryas and other cold periods of the last 20 kyr. Significant structure is also observed during the Holocene. A long-term decrease in monsoon strength broadly mirrors that seen in the

Indian monsoon. Superimposed on this are millennial events, particularly one at ≈8.3 kyr which is, again, similar to that seen in the Indian monsoon. Other millennial variability is not shared between the two systems with, for instance, the mid-Holocene decrease of monsoon intensity occurring later in East Asian than in India. And the absence of an increase of monsoon intensity at ≈1.5 kyr in East Asia, despite such strengthening in India. These results demonstrate that, although the orbital history of the two monsoon systems is similar, millennial variability is not generally shared. The notable exception, at 8.3ka, implies a significant role for the North Atlantic in causing larger millennial monsoon events.

Continuing work is increasing the resolution of the record, and duplicating it in a nearby stalagmite. The complete dataset will allow accurate assessment of the presence/absence of solar-related climate changes, and provide further information about the teleconnections linking the Asian monsoon to climate systems around the Earth.

.Fleitmann, D. et al., 2003. Holocene forcing of the Indian Monsoon recorded in a Stalagmite from Southern Oman. Science, 300: 1737-1739.

Wang, Y.L. et al., 2001. A high-resolution absolute-dated late Pleistocene monsoon record from Hulu Cave, China. Science, 294: 2345-2348.