



The impacts of northern hemisphere high-latitude climate on northeastern Australian summer monsoon evolution during the Holocene

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Influenced by the northern hemisphere high-latitudes, many of the millennial-centennial scale climate changes originating in the North Atlantic have been detected even in southern hemisphere. However, the linkage between hemispheres on orbital-suborbital time scales has not been firmly examined due to the absence of records from the Southern Hemisphere. Here we present such a record from Bromfield Swamp in tropical northeastern Australia. The Australian Summer Monsoon index (AuSMI) of the last 13.5 ka was reconstructed based on the principal component analysis (PCA) of five proxies, the Rb/Sr, Ti/Ca, Al/Ca, mean grain size and organic content. The results reflected a weak AuSM influence during the Bolling-Allerod event and with a somewhat stronger influence during the YD event. During the Holocene, there was a decreasing AuSM before ~7.8 cal kyr BP, and then it enhanced from middle to late Holocene. The AuSM change was out of phase/ in phase with the East Asian summer monsoon/ East Asian winter monsoon during the Holocene, and all of them changed parallel with the northern-southern hemisphere temperature gradient. This implied the dominance of interhemispheric thermal contrast to the highly coupled East Asian-Australian monsoon changes, by modulating the Intertropical Convergence Zone migration, which was influenced by the retreat of northern hemisphere ice sheet from early to middle Holocene and the local summer insolation changes during the late Holocene. The study highlights the likelihood that high latitude northern hemisphere played a major role in the evolution of the northeastern Australian summer monsoon.