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Position and orientation of the Westerly jet determined Holocene rainfall patterns in China

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Proxy-based reconstructions and modelling of Holocene spatio-temporal precipitation patterns for China and Mongolia have hitherto yielded contradictory results, indicating that the basic mechanisms behind the East Asian Summer Monsoon and, in particular, its interaction with the westerly jet stream, remain poorly understood. Here we present quantitative reconstructions of Holocene precipitation derived from 101 fossil pollen records which show similar trends and anomalies as simulations of a minimal numerical model. We infer a south-westerly to north-easterly orientation for the westerly jet stream axis during the early Holocene, in contrast to its east-west orientation since the middle Holocene. Our results also suggest that the westerly jet stream axis shifted gradually southward since the middle Holocene. This re-orientation and shifting of the westerly jet stream was tracked by the main summer monsoon rain band, resulting in an early Holocene precipitation maximum over most of western China, a mid-Holocene maximum in north-central and north-eastern China, and a late Holocene maximum in south-eastern China. Our results indicate that, irrespective of the time-scale or the forcing mechanisms invoked, correct simulation of the orientation and position of the westerly jet stream is crucial to reliable prediction of precipitation patterns in China and Mongolia.