

Tectonically controlled establishment of modern-like precipitation patterns in East and Central Asia during the early Late Miocene

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摘要: Deciphering how modern precipitation patterns became established in the monsoon-dominated East Asia and the arid interior Asia is crucial for predicting future precipitation trends under accelerated global warming and increased climate extremes. However, this effort is hindered by a scarcity of quantitative paleo-precipitation data in this region. Here we reconstruct the pattern of Middle to Late Miocene paleo-precipitation across an east-to-west transect from the summer monsoon-dominated East Asian region through the transition zone and into interior Asia. Our work is based on a newly established precipitation calculation equation and quantitative pollen-based precipitation conversion. Analysis indicates a common trend of precipitation across the studied region prior to ca. 11 Ma, followed by a clear bifurcation of precipitation variations between East and Central Asia since at least 11-9 Ma. This bifurcation is characterized by increasing precipitation in East Asia, but a coeval decrease in rainfall in the transition zone and Central Asia. The timing of this precipitation bifurcation was contemporaneous with intense tectonic activity in the northern Tibetan Plateau, which differentially affected the efficacy of water vapour transport into East and Central Asia. Modeling work using different topographic settings corroborates this tectonic influence. Our study demonstrates the early establishment of modern-like precipitation patterns in East- Central Asia in the early Late Miocene, and their subsequent precipitation patterns may be upgraded versions related to global warming events.

关键词: Tectonic、Modern-like precipitation patterns、~10Ma