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Spatially inhomogeneous response of Asian monsoon rainfall to orbital forcing

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The remarkable correlation between oxygen isotope abundance in Chinese speleothems and Northern Hemisphere (NH) summer insolation indicates that Asian monsoon dynamics is strongly controlled by orbital-scale forcing from solar heating. However, rainfall proxies from the Chinese loess plateau - despite its close proximity to caves - are more correlated with the global ice volume and sea-level with a weaker signal in NH summer insolation. This raises questions of how changes in solar radiation and extratropical climate affect regional monsoon systems as well as their reflections in paleo-climate records. To help understand, why records from nearby locations can have different orbital sensitivities and to better understand the spatial characteristics of East Asian monsoon rainfall, we perform a comprehensive analysis of precipitation and oxygen isotope data over Asia using a variety of observational and modeling datasets ranging from interannual to orbital time scales. At the orbital scale, transient climate simulations with the LOVECLIM and CESM earth system models reveal that the precipitation amount and its phase relative to the orbital forcing are spatially highly variable over Asia. Our analysis offers new insights into the mechanisms generating regional differences in the orbitally-forced East Asian monsoon system.