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Climate–carbon-cycle interactions and spatial heterogeneity of the Carnian Pluvial Episode (Late Triassic)

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Understanding climate–carbon-cycle interactions and tempo of past warming events is essential to accurately project the consequences of anthropogenic carbon emissions. The Carnian Pluvial Episode (CPE; 234–232 million years ago) is an iconic but poorly understood hyperthermal event marked by a dramatic widespread increase in humidity and temperature. Here, we present an integrated high-resolution (~2–10 kyr) multi-proxy record from a Carnian lacustrine succession of the Junggar Basin of northwestern China. We find that the rapid CPE onset (~15.8 kyr) could have been the result of volcanism and subsequent surface carbon-cycle feedbacks. The CPE terrestrial carbon cycling, at a scale of ±1‰ ($d^{13}C_{org}$), displays an in-phase relationship with the 405-kyr-long-eccentricity parameter, paralleling the climate–carbon cycle interactions throughout the Oligo–Miocene. The CPE hydrological cycle was typified by increased aridification in continental interiors and multiple precipitation centres at low-latitude eastern regions of Pangea and at the poles. The mechanistic origin and carbon and hydrological cycle changes of the CPE include features reminiscent of other warm events suggesting they may share key characteristics and hold important clues to Earth system functioning.