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Recycling of sediments from the last 300 kyr in the modern sediment flux during transfer across the north Tian Shan alluvial piedmont.

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Climatic changes can force a fast-paced increase or decrease in erosion rates and sediment production (relative to geological times) and can modify the transport rate and mixing of these sediments from source to sink. To decipher the tectonic and climatic history recorded in sedimentary sequences we need to constrain the sensitivity of sediment fluxes to climatic variations. We set here to investigate quantitatively how climatic forcing at a glacial cycle scale affects the evolution of a mountain piedmont with field work, and in which way this cyclic forcing controls the flux and nature of sediments into the basin with a sediment mixing model. We choose the depositional fold-and-thrust belt in the northern piedmont of the Northeast Tian Shan (Xinjiang, China) as a case study for its well-constrained tectonics and climate. The piedmont experienced several important cycles of incision and aggradation in the Pleistocene. New OSL dating of terrace abandonment and fan aggradation suggests a broad correlation between glacial cycles and incision-aggradation on the alluvial piedmont. As a consequence, a significant fraction of sediments produced in that period is temporarily deposited in the piedmont before a later incision phase can deliver it to the basin, illustrating a stepwise progression of coarse material towards the basin to the beat of climate cycles. We build a sediment mixing model informed by field dating and propose that the modern sediment flux entering the basin contains recycled material as old as 300 ka that can significantly skew geochemical or provenance studies if ignored.