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Millennial scale climatic oscillation recorded by the Ili aeolian loess during the last glaciation in Central Asia

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The westerlies-dominated area of arid Central Asia is the furthest dust source from the oceans and plays an important role in global change. Central Asia is also one of the most significant loess regions on Earth, located between the well-studied European loess sequences to the west and the extensive Chinese Loess Plateau to the east. This enables researchers to carry out interregional paleoclimatic investigations along a west-east transect across the entire Eurasian loess belt of the Northern Hemisphere. However, there are few reports of climatic change during the last glacial period in arid Central Asia. Widely distributed loess in the Tianshan mountains in Central Asia has provided us with the opportunity to verify the last glacial climatic instability in Central Asia. The Ili basin is surrounded by the Tianshan mountains, and loess is widely distributed on the terraces and piedmonts. Previous studies in the Ili basin have also identified climatic events; however, due to geochronological limitations and a lack of reliable proxies from this region, the amplitude and frequency of climatic change and its possible driving mechanisms remain poorly understood. Here, based on an updated geochronology, grain size and mineralogy, we present a new loess section to determine the timing and characteristics of abrupt climatic events during the last glacial period. The results indicated that most of the abrupt climatic events (such as Dansgaard-Oeschger events and Heinrich events) were imprinted in this loess section, although their amplitudes and ages showed some differences. Compared with the millennial oscillations recoded in loess and stalagmites in East Asia, the arid Central Asia responded more sensitively to the warming events than to the cooling events. The shifting trajectory of westerlies across Central Asia played an important role in dust deposition during the stadials. The North Atlantic climatic signals may have been transmitted from Central Asia to the East Asian monsoon regions via the westerlies.