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Different orbital rhythms in loess grain-size records across the Chinese Loess Plateau

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The thick loess-paleosol sequences on the Chinese Loess Plateau (CLP) are among the best terrestrial archives for the understanding of the global paleoenvironment and East Asian monsoon changes. In particular, orbital-scale variations characterized by major periodicities of ~100 kyr, ~40 kyr and ~20 kyr are recorded by various proxies in the loess, which is often suggested to reflect the orbital control on East Asian climate. However, whether these climate periods could be affected by the signals from the dust source areas remains unknown. Here we present the spectrum results of grain size records from the Baoji loess section spanning the past 400 ka in the southeastern part of the CLP, and compare with the previous results in the western CLP (to the west of the Liupanshan Mts.), including Gulang, Menyuan, Lanzhou, Linxia, Jingyuan loess sections, and loess sections in the eastern CLP (to the east of the Liupanshan Mts.), including Luochuan, Xifeng, Lantian, and Weinan sections. The results show that the dominant periods in different sections are spatially different, and the ~20-kyr precession cycle from the western CLP is significantly stronger than that in eastern CLP. Albeit dust accumulation rates in the Jingbian loess section from the eastern CLP are very high, the lack of precession signal suggests that high sedimentation rate is not the main factor for occurrence of precession cycle in grain size records. The results also suggest that the dust source areas for the eastern and western CLP are different, specifically, the loess deposits in western CLP were mainly sourced from the NE Tibetan Plateau, while the loess deposits in eastern CLP were significantly fed by the deserts to the north CLP (including deserts in Northern China and Southern Mongolia). As the dust production and transportation in NE Tibetan Plateau and the deserts to the north CLP were significantly driven by the ~20-kyr local summer insolation and the ~100-kyr ice age cycle, respectively, we argue that the climate cycle in loess grain size of the CLP indeed reflects the climate signals of their source areas, rather than the deposition areas. Our results suggest that caution should be taken when

explaining the meaning of the loess grain size records.