**Supplementary Information:**

Spatial variation of East Asian winter monsoon evolution between northern and southern China since the Last Glacial Maximum

Qin Li1, 2, Haibin Wu2, 3, 4, Jun Cheng5, Shuya Zhu2, Chunxia Zhang2, Jianyu Wu2, Yating Lin2, Pei Li2, Xiangbin Ren2, Deai Zhao2, Yan Zhang2

*1. School of Geography, Liaoning Normal University, Dalian 116029, China*

*2. Key Laboratory of Cenozoic Geology and Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China*

*3. CAS Center for Excellence in Life and Paleoenvironment, Beijing, 100044, China*

*4. University of Chinese Academy of Sciences, Beijing 100049, China*

*5. College of Oceanography, Nanjing University of Information Science and Technology, Nanjing 210044, China*

**Comparison with the nearby Weinan-1 sections on SR and MAR**

The grain size of the loess, i.e the eolian dust, reflects the strength of the wind, whereas the accumulation rate (g/cm2.ka) is an approximate of the eolian dust flux, which suggests the strength of wind filed and the aridity of source area as well as the frequency of the dust storm events and dust fall event, so the distribution of the grain size and the dust flux can be approximately used to reconstructed the strength field of the wind and the average climatic condition from source area to deposition area (Liu, 1985; An and Xiao, 1990; An et al., 1991; Ding et al., 2001; Kohfeld and Harrison, 2001; Sun and An, 2005).

The mass accumulation rates (MARs) of eolian deposits on the Chinese Loess Plateau (CLP) are reconstructed from measured bulk sediment densities combined with sedimentation rates (Sun and An, 2005; An and Xaio, 1990). MAR can be calculated according to:

MAR=feolian×SR×BD

where feolian is the fraction of eolian dust in the deposit, SR (cm/kyr) is the dust accumulation rate, and BD (g/cm3) is the bulk density. As loess and red clay deposits are assumed to be entirely eolian in origin (Pye, 1987; Kohfeld and Harrison, 2001, 2003), feolian = 1 is often assumed when

estimating the MAR of eolian deposits in the CLP.

It should be noted that the bulk densities of loess deposits have rarely been measured in practice, and most previous MAR estimates have been based on the assumption that the average BD value is 1.6 g/cm3 or 1.65 g/cm3 as suggested by Liu (1985) and Pye (1987) in Loess deposits. Considering lack of measured bulk density at Weinan profile in this study, the MAR estimates was calculated based on the bulk density measured in Weinan-1 profile by Kang et al., (2013). The MAR calculated in this study has been compared with that from Kang et al., (2013), which was shown in Fig. S1.



Fig. S1 Mean SR (sediment rate) of S0, L1LL1, and L1SS1 unit at Weinan (a) and Weinan-1 (Kang et al., 2013) (b); Mean MAR of S0, L1LL1, and L1SS1 unit at Weinan (c) and Weinan-1 (Kang et al., 2013) (d)

The comparison of our MAR estimates and SR with those from Kang et al., (2013) do display some similar change. For example, the MAR show a decline first, followed by an increase in both sections. The above comparison further supported the two nearby eolian sequence are under a very similar climatic environment, making it possible to develop a time scale for this sequence by correlating to the Weinan-1 in Kang et al., (2013).

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