MILLENNIAL-SCALE OSCILLATIONS OF THE EAST-ASIAN SUMMER AND WINTER MONSOONS OVER THE LAST CLIMATIC CYCLES

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The loess-soil sequence in northern China is a near continuous climate record of the last 2.5 Ma. The climate in this region is mainly under the control of two seasonally alternating monsoon circulations: the East-Asian summer monsoon originating from the South and East China Seas which brings rainfall to the Loess Plateau, and the dry/cold northwesterly winter monsoon associated with the Siberia High and which transports dust from the northern and northwestern deserts to the Loess Plateau. In this study, high-resolution paleoweathering records and grain-size timeseries of the loess-soil sequences covering the last two climatic cycles have been generated, which are interpreted as proxies of the summer and winter monsoons, respectively. Over the last two glacial periods, the strength of the winter monsoon as indicated by the grain-size variations has experienced clear millennial changes. As for the summer monsoon, as indicated by the loess weathering records, a general agreement can be observed compared with the GRIP ice d18O record for the last glacial period. However, the summer monsoon seems to have been rather stable for the older portion. In combining the weathering data and the grain-size data, we interpret that instability is a common feature for the winter monsoon over the last two glacial periods while large amplitude millennial oscillations of the summer monsoon seem to be only characteristic for the last glacial period. Both the summer and winter monsoon proxies show a rather stable pattern for the Eemian Interglacial period (marine d18O stage 5e) although small fluctuations can be observed. At least, the three warm peaks and the two cold peaks shown in the GRIP data cannot be clearly defined in our weathering and grain-size records. This interpretation seems to be supported by the well-developed Luvisol within the S1 soil complex in the eastern and southern Loess Plateau, which would have been formed under relatively stable warm-humid conditions.