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Holocene moisture variations in western arid central Asia inferred from loess records from NE Iran

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Holocene variations in precipitation in central and eastern arid central Asia (ACA) have been widely investigated, but the pattern in western ACA remains unclear. We present records of the stable carbon isotope composition of bulk organic matter ($\delta^{13}C_{org}$), magnetic parameters, and sediment color, from five loess-paleosol sequences in NE Iran, in western ACA, with the aim of reconstructing Holocene precipitation. The Yellibadragh (YE) section (the thickest among the five sequences) was selected for OSL dating of the coarse-grained quartz (63-90 μm) fraction, and its $\delta^{13}C_{org}$ record was used to quantitatively reconstruct mean annual precipitation (MAP). The record indicates a dry early Holocene (~11.8-7.4 ka), with nearly constant MAP (~93 mm), followed by a wetting trend from the mid-Holocene (~7.4 ka) onwards, with the wettest period in the late Holocene (~4.0-0.0 ka, ~390 mm). The stratigraphic observations and environmental proxies support the reconstruction. The other loess profiles show stratigraphic features and trends of environmental proxies which are similar to those of the YE profile. A dry early Holocene and wetting trend since the mid-Holocene, with the wettest climate in the late Holocene in NE Iran, are both consistent with records from sand dunes and lake sediments from adjacent areas, and with loess records from central and eastern ACA. Comparison with loess records from monsoonal Asia supports the interpretation of a “westerlies-dominated climatic regime” (WDCR) which was proposed mainly on the basis of lake sediment records from the region. Changes in solar insolation may have been responsible for the persistent wetting trend during the Holocene in western ACA.