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Dansgaard-Oeschger millennial oscillations are not restricted to the last climate cycle

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We have demonstrated a strong correlation between millennial variations of loess accumulation rates in Europe, and the North Atlantic climate oscillations known as Dansgaard-Oeschger (DO) interstadial –stadial cycles that punctuated the last climate cycle (Moine et al., 2017). Stadials are cold and dusty glacial conditions; they are even colder when associated with the huge iceberg discharges from the Northern Hemisphere ice sheets known as Heinrich events (Rousseau et al., 2017a). DO interstadials are warm phases, with reduced dust concentration in the atmosphere, following abrupt temperature increases in the North Atlantic (by more than 10°C in Greenland in less than 100 years). These interstadials correspond to paleosols found in European loess series (Antoine et al. 2015), whose type depends on the interstadial duration. Longer interstadials correspond to more mature paleosols (Rousseau et al., 2017b). In parallel, a recent model (Boers et al., 2018) was shown to replicate the observed characteristics in δ180 variations, such as the sawtooth shape of the DO cycles, with abrupt warming and slower cooling to glacial conditions, as well as the time intervals between successive DO events over the past 130,000 years, and also the opposite phasing of the observed climate signal in the Greenland ice cores and in Antarctica: when Greenland warmed, Antarctica cooled and conversely. This model has provided, moreover, a unified framework to explain the major characteristics of millennial climate variability, including both DO cycles and Heinrich events during the glacial intervals of the last climatic cycle (Boers et al., 2018). New investigations of European loess records from MIS 6 reveal the occurrence of alternating loess intervals and paleosols (Antoine et al., 2019, Lomax et al., 2019), similar to those from the last climatic cycle. The paleosols are correlated with interstadials described in various Northern Hemisphere records, including GLt_syn, the synthetic 800 kyr record of Greenland δ180 due to Baker et al. (2011). Therefore, referring to the interstadials described in the record of the last climate cycle in European loess sequences, the MIS 6 interstadials can confidently be interpreted as DO-like events of the penultimate climate cycle. If this interpretation is correct, DO events and DO cycles are not restricted to the last climate cycle. Our most recent results herein clearly indicate that these millennial oscillations are solely due to mechanisms intrinsic to the climate system, and imply that their understanding requires further investigations that need to encompass at least the last two climate cycle.

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