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Paleodust cycle in Europe during the last climate cycle

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The Last Climate Cycle (LCC, 130-15kyr) has shown cold, dusty (GS) and warmer, non-dusty (GI) intervals, when the atmosphere was 2-20 times more loaded with dust than today. The alternations between GS and GI occurred on millennial time scales, involving climate forcings other than orbital. The transition between GS and GI lasted on average 50 yrs, resulting from a complete climate reorganization that is not presently understood. A data-model project has acquired and investigated European loess sequences to get high-resolution and well-dated paleodust records of the LCC showing Europe experienced millennial paleodust variations through paleosol-loess unit alternations. These alternations correspond to the millennial climate variability as expressed in the Greenland ice cores, with the paleosol developments occurring during GIs, and loess deposition during GSs. Although evidenced for the last climate cycle along a 50°N transect from Brittany to Ukraine, such system prevailed at least also during the penultimate climate cycle with evidence of similar millennial climate variability during the past 192-130 ka interval, equivalent to marine isotope stage 6. Earth System Models contribute i) to characterize the source regions of the paleodust and ii) to reproduce past variations in dust deposition for key paleoclimate scenarios.

A key component of our investigation analyses loess samples dated from the last glacial maximum to detect the origin of the deposited material. A first study on the bulk sediment demonstrates that the paleodust deposited over Europe along a long longitudinal transect (about 2000 km) indicates a short distance transport implying local to regional source. Targeting the <2 microns and 2-20 microns grain size fractions and comparing with the previous results from the bulk samples, preliminary results indicate a local to regional origin for the coarse (2-20 microns and bulk) material and a more distant source for the finer fraction (<2 microns), involving longer transport in relation to general atmospheric circulation, for the finer particles. This is a critical new research question because it implies potentially important order of magnitude regional variations

in dust radiative forcing that have never been accounted for in simulations of abrupt events.