Geophysical Research Abstracts
Vol. 20, EGU2018-2704, 2018
EGU General Assembly 2018

Millennial eolian dynamics during the last climate cycle and associated large-scale patterns of atmospheric circulation.

Denis-Didier Rousseau (1,2), Adriana Sima (3), Youbin Sun (4), and Pierre Antoine (5)

(1) Laboratoire de Météorologie Dynamique, Ecole Normale Supérieure, 24 rue Lhomond, 75231 Paris, France (denis.rousseau@lmd.ens.fr), (2) Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY 10964, USA, (3) Laboratoire de Météorologie Dynamique, Sorbonne Universités, Campus Pierre et Marie Curie, 4 place Jussieu 75005 Paris (adriana.sima@gmail.com), (4) State Key Laboratory of Loess and Quaternary Geology, Institute of Earth Environment, Chinese Academy of Science, Xi'an 710061, China (sunyb@ieecas.cn), (5) Laboratoire de Géographie Physique, Environnements quaternaires et actuels, CNRS, 1 place A. Briand, 92195 Meudon Cedex, France (pierre.antoine@lgp.cnrs.fr)

Europe has been strongly impacted by the millennial climate changes related to variations in the sea-ice extent and therefore also affected the moisture sources of precipitation on the Greenland ice sheet. These variations in the extent of the sea ice during the last climatic cycle (LCC, about 130-15 kyr) impacted the westerlies and the position of the polar jet stream, and consequently storm track trajectories. Furthermore, the presence of ice sheets and ice caps over Great Britain, Scandinavia and the Alps enhanced the zonal circulation, as recorded by the European paleodust deposits located along the 50°N parallel, and as supported by numerical experiments. Loess units are interpreted to correspond to coarse paleodust transported at rather low elevations, in the active layer of the atmosphere (about 300 to maximum 3000 m) at regional to local scales, while finer paleodust deposited at high latitudes seems transported at much higher elevations.

Loess sequences are well developed all over Europe, but especially in the so-called loess belt between 48° and 52°N. Such intensive deposition of paleodust over Europe has been favored by the reduced arboreal cover (even practically absent in NW Europe during both GS and GIs, by sea-level lowering, exposing large areas of the continental shelves to eolian erosion, and by strong increases in fluvial transport and sedimentation by periglacial braided rivers. Extensive investigations of European loess series along a longitudinal transect at 50°N reveal that the millennial-scale climate variations observed in the North-Atlantic marine and Greenland ice-core records are well preserved in loess sequences. Among them, the Nussloch loess site yields an important record of the LCC.

The Nussloch paleosol-loess unit couplet succession is not unique, but observed with a variable thickness and a diverse nature of the paleosols in sequences ranging from Western Europe eastward to Ukraine over more than 1800 km. The uncertainties concerning the duration of the soil formation are fundamental questioning the definition of a correct time scale to be used for further model-data comparisons. A recent study raised the problem in correctly estimating the sedimentation (SR) and mass accumulation (MAR) rates of the sequences for comparison with model estimates, which cannot be estimated by just taking into account the whole thickness of the considered deposits as classically performed. Similar calculations are extended to other European loess key sequences for comparison. Eastwards, millennial variations are described from sequences from the Chinese loess Plateau, but without any paleosol identified in the LCC, through grain size variations where GS correspond to unit with coarse material contrary to GI characterized by finer material, all originated from northern Chinese deserts. SR and MAR from Chinese key sequences are also estimated through the same methodology than used in Europe. The comparison of SR and MAR from European and Chinese loess sequences allow proposing atmospheric mechanisms linking the millennial deposits at both ends of Eurasia.

Rousseau, D.-D. et al.: Eurasian contribution to the last glacial dust cycle: how are loess sequences built?, Clim. Past, 13, 1181-1197, https://doi.org/10.5194/cp-13-1181-2017, 2017.