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Eurasian Loess Reloaded - Inter-hemispheric Linkages and Teleconnections of Past Atmospheric Circulation and Aeolian Dust Dynamics

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The distribution of Eurasian loess deposits allows interregional palaeoclimatic investigations along a west-east transect across the entire Eurasian loess belt of the Northern Hemisphere, offering the potential to reconstruct Pleistocene atmospheric circulation patterns and aeolian dust dynamics on a wide spatial scale.

High resolution proxy data from several loess sequences across Eurasia (Serbia, Romania, Uzbekistan, Kazakhstan) provide a detailed signal of glacial-interglacial atmospheric dynamics and long term, semi-continuous trends in the aeolian dust record since marine isotope stage 10. In consideration of the modern synoptic atmospheric circulation patterns and aeolian dust transport across the Eurasian landmass, we propose that the observed data reflect oscillations superimposed on a long term signal of seasonality, triggered by changes in duration and permanency of the seasonal shift of the Eurasian polar front during the middle to late Pleistocene. As the activity of the polar front jet is intimately connected with the high level planetary frontal zone (HPFZ), the Eurasian loess archives may also serve as a recorder of inter-hemispheric climate connections in past atmospheric circulation.

Although there are large scale similarities in the dust transport record from numerous sites across Eurasia, the data reveal distinct differences in climate variability along the studied transect from SE Europe to Central Asia. For example, the occurrence and configuration of the last glacial maximum (MIS 2 / MIS 4) varies along the transect. This suggests that the record contains distinct background signals of aeolian dust dynamics, such as a decreasing influence of western Atlantic teleconnection influence from the west to the east, as well as temporal variation in the onset of the last glacial cooling and its associated increase of aeolian dust activity.