EGU22-4663
https://doi.org/10.5194/egusphere-egu22-4663
EGU General Assembly 2022

Modelling the relative effect of different climate factors, vegetation and dust deposition on the MIS-13 and MIS-11 paleosol development on the Chinese Loess Plateau

Keerthika Nirmani Ranathunga[1,2], Peter Finke[1], Qiuzhen Yin[2], and Zhipeng Wu[2]
[1]Faculty of Bioscience Engineering, Department of Environment, Ghent University, Ghent, Belgium
(keerthikanirmani.ranathunga@ugent.be)
[2]Earth and Life Institute, Université Catholique de Louvain, Louvain-la-Neuve, Belgium

The Chinese loess-paleosol sequences provide valuable records of the Quaternary climate changes. However, the relative contributions of the Quaternary paleoclimate (e.g. precipitation, temperature, evapotranspiration, vegetation and dust addition) on interglacial paleosol development, and which factor plays a key role are inadequately studied in the Chinese Loess Plateau (CLP). Here, we examine the relative contributions of these factors on paleosol development on the CLP by a sensitivity analysis. For this, we simulate paleosol development using the climate-soil model LOVECLIM-SoilGen2.

The sensitivity analysis was done during two interglacials, MIS11 and MIS13, where MIS11 shows quite contrasting climate forcing with MIS-13. Several simulations were run; in each simulation, one parameter is allowed to change at a time (e.g. precipitation), and others are kept constant (as in reference). A reference simulation is included 100-year average values of the end of Holocene simulation mimicking the Pre-Industrial climate. Additionally, combined effects of climatic parameters (e.g. precipitation and evapotranspiration) were investigated, and mean absolute error was calculated between each of the sensitivity simulation and the actual simulation (combination of all soil forming factors).

Our results show that precipitation has the largest influence on the depth redistribution of soil properties (calcite and clay) in MIS11 and MIS13 and dust addition is the dominant factor affecting the amount of simulated calcite and clay. Our results indicate that potential evapotranspiration has a pronounced impact during MIS13. Unlike the simulated MIS11 paleosol, which is explained by precipitation plus dust addition, the MIS13 paleosol development is better explained when potential evapotranspiration is also taken into account during this extreme interglacial.