

Paleo-Pedo-Climatology: Modeling the paleosol formation on the Chinese Loess Plateau during the Quaternary interglacials

Keerthika Nirmani Ranathunga, Peter Finke, Qiuzhen Yin, Zhipeng Wu

The loess-paleosols sequences in the Chinese Loess Plateau (CLP) are the most comprehensive terrestrial palaeoenvironmental records for paleoclimates, reflecting global scale climatic oscillations, glacial-interglacial phases. Environmental conditions over the Quaternary period have resulted in continuous loess deposits during glacials (cold-dry), which nevertheless interrupted by paleosols during interglacials (warm-humid) in the CLP. However, paleosols in there are least well understood in response to relative contributions of various soil forming factors, including climate conditions during interglacials (e.g. precipitation, evapotranspiration), duration of soil formation, dust deposition etc. Therefore, the overall theme of this research is to better understand paleosol formation in the CLP, particularly through quantitatively assessing paleosol responses to interglacial climates and ultimately to evaluate soil functioning in terms of soil-based ecosystem services.

To achieve this we combine a dynamic process-based climate and –soil model (LOVECLIM1.3-SoilGen2) to identify important drivers for paleosol development over the past 500 kyr. The structure of this PhD research is described below. First, we calibrate the soil model for various soil process parameters by confronting simulated and measured soil properties for interglacial soils formed in the CLP and test the effect of reconstructed dust addition patterns on soil development in the loess plateau. Second, we apply the calibrated model to assess the relative contributions of precipitation, temperature, evapotranspiration, vegetation and dust addition on paleosol formation. For the first time, we investigate paleosol response to the precessional and ice volume changes. Finally, the research highlights the potential of using SoilGen2 with LOVECLIM1.3 for quantifying soil-based ecosystem services.

Affiliations:

- Keerthika Nirmani Ranathunga
- Peter Finke
- Qiuzhen Yin
- Zhipeng Wu