Challenges of loess formation models for the Carpathian Basin

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The general pattern of loess-paleosol sequences for the last several glacial-interglacial cycles in South-eastern Europe is becoming more established through an increasing amount of available data. However, the paleoclimatic mechanisms leading to these patterns are much less understood, especially the deviations from northern hemisphere patterns. Here we use relatively simple models to determine the effect of insolation forcing and global climate, as represented by benthic $d^{18}O$ data, onto loess-paleosol sequences.

Multiple linear regression models are rather simple models which may be used for the estimation of factors influencing dust deposition resulting in loess-paleosol formation, including pedogenesis in loess. We demonstrate that such models consistently fail to reach a baseline as observed in proxy data for soil formation in loess. This is due to the lack of such baselines in input data, requiring more sophisticated models clipping input data at least at its base.

Applying regression models including an optimisation of fit adjusting base levels, estimates for the forcing mechanisms behind loess-paleosol sequence formation are discussed. Results from such models show clear discrepancies to proxy data, more in the timing of events than in magnitude and patterns, suggesting that models may be used for iterative time scale adjustment. Such approaches, however, should be treated with caution and need to be supported by fully independent age control to avoid circular reasoning. Here we present and discuss an updated time scale for a loess-paleosol sequence by iterative model adjustment.

Future work should focus on the effects of (a) time scale inaccuracy, (b) phase lags of input data, (c) comparison of several proxy data and (d) investigations and interpretations of residual from models.