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Loess-paleosol grain size populations: what are the causes of complex grain size distribution curves?

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Grain size distributions (GSDs) of aeolian dust deposits obtained by laser diffraction can be characterized by polymodal curves, in general. As grain size proxies have widely been applied in loess-related paleoenvironmental studies, it has to be emphasized that (1) complex GSDs cannot be regarded as indicators of single one environmental factor; (2) simple statistical descriptors are not suitable to represent composite distributions; (3) falsely applied optical settings of laser diffraction measurements could result additional artificial modes in the fine-grained fractions.
More complex mathematical deconvolution algorithms are needed to decipher deeper sedimentary meanings from the measured grain size results. In this paper, results of parametric curve fitting; end-member modelling and hierarchical cluster-analysis were compared by using sedimentary data of 304 collected samples of loess-paleosol series from Dunaszekcső, Hungary exposing the last glacial-interglacial sedimentary units with a thickness of 14.57 m.
Differences of decomposition methods arise from their different scope and approach. Calculated end-members are the results based on the covariance structure of the whole grain size database, while the input for the parametric curve fitting is only one GSD. The end-members are polymodal, complex GSDs, the simple probability density functions of parametric curve fitting are unimodal. The end-members' GSDs cannot be regarded as the representation of a single dust transportation and/or sedimentation process; these can be assessed by the curve-fitting results. The end-members are results of more simultaneous sedimentation mechanisms dominant in a specific period (e.g. seasonal dust signal: spring dust storms connected to the arrival of cold fronts). Results of cluster analysis represent similar grouping conditions as end-member modelling with a reduced sedimentary and genetically meaning. To develop a full granulometric picture joint application of parametric curve-fitting and end-member modelling is suggested. Parametric deconvolution of the fix and stable end-members the process related seasonal aeolian sedimentary dynamics could be recognized.
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