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# Scale factors to quantify and predict the field scale variability of heavy metal sorption in soil

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Many studies report the close relationship between heavy metal sorption in soil and physicochemical soil properties. Since 1980s pedotransfer functions (PTF) were developed to predict the heavy metal sorption in soil, based on the Freundlich sorption isotherm with parameters K and n, and physicochemical soil properties. An important application of PTFs is to predict sorption behavior at larger scales (e.g. soil units) from easily measurable soil properties, but PTFs were also applied to predict the spatial variability of sorption at the field scale. A new method to quantify the spatial variability of heavy metal sorption in soils at the field scale is the calculation of scale factors (SF). This method reduces the broad spread of the sorption isotherms into an average relation, but saves the variation through the scale factors. For physicochemical soil properties scale factors can also be calculated. Scale factors from sorption isotherms and physicochemical soil properties are correlated. SF of isotherms are indirectly related to the Freundlich parameters K and n, but PTF directly and solely predict K. That is the reason, why SF in contrast to PTF were found in an earlier study with an acidic sandy soil under forest to increase the accuracy of model predictions.
The two prediction methods, SF and PTF, were both evaluated for an agricultural field on a more or less homogeneous Luvisol developed in loess near Hannover, Germany. Samples were taken from the A and B horizon (each 50 samples) along a 250 m transect. Sorption isotherms for heavy metals (Cd, Cu, Pb and Zn) and soil properties as pH, CEC, organic carbon content, texture were measured, and scale factors were calculated.
In our contribution we will present results on (1) the accuracy of PTF and SF to predict the field average sorption behavior of the soil, (2) a comparative numerical simulation of field scale heavy metal transport with spatially variable sorption behavior in unsaturated soil described by both prediction methods (SF and PTF).