



Aquifer Heterogeneity Estimation using Cone Penetration Tests (CPT)

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The intensive growth of industrial and agricultural activity causes an increase of polluted areas. In order to predict the spreading of near-surface contamination it is essential to be familiar with the hydrogeological parameters of the investigated earth. The cone penetration technology is capable to resolve the structure of the subsurface in detail and logs various physical parameters during soil penetration. Cone penetration tests (CPT) were performed at the Krauthausen test site to investigate the aquifer's heterogeneity in detail.

In order to obtain the aquifers heterogeneity with highly resolved measurements CPT were carried out at 77 locations in an investigation area of 30x20 m with 10 cm resolution in vertical direction. This survey provided a data set of approximately 10000 single measurements of physical parameters, e.g. cone pressure, natural gamma activity, bulk density and water pore volume. Using adequate interpolation we obtain the three dimensional heterogeneous structure of physical soil properties (e.g. porosity, shear strength, etc.).

In addition we linked these physical parameters from CPT to prior measurements of grain size distribution at approx. 300 single locations using multiple linear regression analysis. This enabled the prediction of the 20th percentile of the grain size distribution within an accuracy of factor 2. Thereafter we used the empirical relationship from regression analysis to predict the hydraulic conductivity within the investigation area. Based on the estimated hydraulic conductivities we examined the spatial heterogeneity, i.e. the correlation lengths depending on depth and direction, using variogram analyses. A layer-wise analysis showed strong variations in correlation length and horizontal anisotropy.