Geophysical Research Abstracts
Vol. 14, EGU2012-8143, 2012
EGU General Assembly 2012
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Spatial variability of specific surface area of arable soils in Poland

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Evaluation of soil spatial variability is an important issue in agrophysics and in environmental research. Knowledge of spatial variability of physico-chemical properties enables a better understanding of several processes that take place in soils. In particular, it is well known that mineralogical, organic, as well as particle-size compositions of soils vary in a wide range.
Specific surface area of soils is one of the most significant characteristics of soils. It can be not only related to the type of soil, mainly to the content of clay, but also largely determines several physical and chemical properties of soils and is often used as a controlling factor in numerous biological processes. Knowledge of the specific surface area is necessary in calculating certain basic soil characteristics, such as the dielectric permeability of soil, water retention curve, water transport in the soil, cation exchange capacity and pesticide adsorption.
The aim of the present study is two-fold. First, we carry out recognition of soil total specific surface area patterns in the territory of Poland and perform the investigation of features of its spatial variability. Next, semivariograms and fractal analysis are used to characterize and compare the spatial variability of soil specific surface area in two soil horizons (A and B).
Specific surface area of about 1000 samples was determined by analyzing water vapor adsorption isotherms via the BET method. The collected data of the values of specific surface area of mineral soil representatives for the territory of Poland were then used to describe its spatial variability by employing geostatistical techniques and fractal theory. Using the data calculated for some selected points within the entire territory and along selected directions, the values of semivariance were determined. The slope of the regression line of the log-log plot of semi-variance versus the distance was used to estimate the fractal dimension, D. Specific surface area in A and B horizons was space-dependent, with the range of spatial dependence of about 2.5°. Variogram surfaces showed anisotropy of the specific surface area in both horizons with a trend toward the W to E directions. The smallest fractal dimensions were obtained for W to E directions and the highest values - for S to N directions.

* The work was financially supported in part by the ESA Programme for European Cooperating States (PECS), No.98084 „SWEX-R, Soil Water and Energy Exchange/Research", $AO_3$275.