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Spatial distribution of topsoil moisture in various scales

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Measurements of soil moisture in the scale of field and greater areas (for example community) require knowledge of soil texture and its spatial distribution to properly select calibration curve of measuring instrument in a given point and avoid error during measurements. Field TDR measuring systems are commonly calibrated for mineral and organic soils. The calibrations are performed for averaged values of dielectric constant of solids, bulk density of soil at temperature of 20ºC. Therefore, to be sure of measurement results the TDR results should be compared with those of a standard gravimetric method. Because it is not possible to perform infinitive number of measurements, the point measurements are usually referred to the whole investigated area. On the way of conducting measurements, distribution and number of measuring points as well as methods of data analysis depend whether the results are representative or not for given area.

The aim of this work was to recognize distributions of soil moisture in the scale of field and community and to determine parameters describing its spatial variability. The measurements were conducted on cultivated fields of total area 140 km^2 in community Trzebieszow (Lublin region, Poland). Soil moisture, temperature and electrical conductivity were measured in topsoil layer (0-10 cm) using TDR (Easy Test, Lublin, Poland) measuring instrument just before sampling of 100 cm^3 soil cores for determining gravimetric moisture content. Distribution of measuring points in the scale of field and community was regular (distances between knots from 6 to 25 m) and irregular (from 0.1 to 3 km), respectively. Regular grid and reference points in the scale of the field were established using a measuring tape and GPS, respectively. Geographical co-ordinates of measuring and reference points in the scale of community were determined using Trimble's GPS GeoExplorer 3 with accuracy of 1 to 5 m. To analyse and visualise the results in 3D maps, Surfer 8 (Golden Software, Inc.) and GS+7 (Gamma Design Software) software were used. Distribution of soil moisture was spatially dependent in the scale of field and community. The range of the spatial dependence was associated with the scale of the investigated objects. Geo-statistic analysis of the measured and detrended soil moisture data showed that spatial distributions of soil moisture measured by both methods were similar. The type of spatial dependence was associated with the size of the fields. The longer field was characterized by exponential, and the shorter by spherical semivariograms. In the scale of community exponential semivariogram was obtained. The agreement between measured and calculated soil moisture, as shown by kriging method, depends not only on the semivariogram parameters but also on the deterministic component of the data.