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Spatial analysis of water infiltration in urban soils. Case study of Iasi municipality (Romania)

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The post-communist period (after 1989) caused important changes in the functional structure of Iasi municipality. The partly dismantling of the industrial area, the urban sprawl against the periurban and agricultural space, the new infrastructure works, all these determined important changes of soils' physical and morphological properties (e.g. porosity, density, compaction, infiltration rate etc., in the first case, and changes in soil horizons, in the second case etc.).
This study aims to prove the variability of physical properties through the combination of statistical and geostatistical methods intended for a correct spatial representation. Water infiltration in urban soils was analyzed in relation to land use and the age of parental materials. Field investigations consisted in measurements of the water infiltration (by the means of Turf Tech infiltrometer), resistance to penetration (penetrologger), moisture deficit (Theta Probe) and resistivity (EC) for 70 equally distanced points (750 m x 750 m) placed in a grid covering more than 33 km2. In the laboratory, there were determined several parameters as density, porosity (air pycnometer), gravimetric moisture and other hydrophysical indicators.
Filed investigations results are very heterogeneous, because of the human intervention on soils.
The curves of variation for the rate water infiltration in soils indicate a downward trend, from high values in first time interval (one minute), between 5000 and 60 mm/h-1, gradually decreasing to the interval of 5-10 minutes (between 30 and 1000 mm/ h-1 to a general trend of flattening after a large time interval (in the timeframe of 50-60 minutes, the infiltration rate ranges between 4 and 142 mm•h-1). The highest frequency ($\geq$65%) caracterizes the infiltration rates between 20 and 65 mm•h-1. For each analyzed sector (residential areas, industrial areas, degraded lands, recreational areas - parks and botanical gardens, forests heterogeneous agricultural lands), the variation curve of the infiltration rates is different depending on the land use and the importance of soil horizon transformation. Significant changes of the variation curve were observed within the areas occupied by degraded lands (with initial infitration rate below 1200 mm•h-1 and final values below 35 mm•h-1) and by recreational spaces, with initial infiltration rates above 1800 mm•h-1 and final rates with more than 40 mm•h-1. The mean values of the final water infiltration rate in soil range from less than 35 mm•h-1 in the case of degraded lands and more then 65 mm•h-1 for industrial areas, with recent changes of soil horizons. The liniear correlations allowed to establish some connections between the soil physical parameters and the infiltration rates, one of the most important factor that influence the infiltration rate being the resistance to penetration r=0.553-0.998, p<0.001).
The results were spatialized using the facilities of ArcGis 9.3 software, through different interpolation methods (IDW, krigging). It can be noticed that IDW has lower accuracy because of the large variability of data and some field correction of the grid.