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Experimental evaluation of the degree of soil erosion caused by agricultural activities in a small area near Sofia (Bulgaria) using magnetic methods

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Magnetic mineralogy and magnetic grain size distribution along depth of soil profiles and on a lateral scale reflect in a very sensitive way changes in micro-environmental conditions like soil texture, clay content, soil reaction, Eh – pE conditions, etc. Magnetic measurements of field magnetic susceptibility and laboratory measurements of various magnetic parameters are used to evaluate soil loss, based on the knowledge of the behavior of these characteristics along depth of representative soil column for this soil type. Detailed field and laboratory study on small 8.4ha test site of agricultural land near Sofia (Bulgaria) have been carried out. The particular point in our study is the fact that parent material shows strong magnetic signal due to the high content of magnetic minerals in weathered material from the C-horizon. Field measurements of magnetic susceptibility were carried out with grid size of 6m, resulting in 258 data points. Bulk soil material was gathered from 78 grid points. Cores of 30cm length were sampled in several grid points in order to study depth variations of magnetic mineralogy and other magnetic characteristics. Natural, non-disturbed soil section was sampled near the agricultural field for reference profile of complete undisturbed soil. Surface susceptibility measurements reveal well defined maxima down slope, which however cannot be assigned directly to a certain depth interval, corresponding with susceptibilities along the non-disturbed soil profile. This is caused by the presence of high magnetic susceptibility of structural B- and C-horizons, which have similar or higher susceptibilities than that of the plough horizon. Non-uniqueness is resolved by using another magnetic parameter – the ratio of Saturation Remanent Magnetization (SIRM) and magnetic susceptibility (X) (SIRM/X). This ratio shows increased values in C-horizon of undisturbed soil profile, which corresponds to certain part of the studied area. Soil loss is estimated using an empirical relationship.
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