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# Magnetism of soils applied for estimation of erosion at an agricultural land

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A detailed field study on small test site of agricultural land situated in loess region in Southern Moravia (Czech Republic), followed by laboratory analyses, has been carried out in order to test the applicability of magnetic methods in soil erosion estimation. The approach is based on the well-established differentiation in magnetic signature of topsoil from subsoil horizons as a result of "in situ" formation of strongly magnetic iron oxides e.g. (Maher 1986). Introducing a simple tillage homogenization model for predicting magnetic signal after uniform mixing of soil material as a result of tillage and subsequent erosion, Royall (2001) showed that magnetic susceptibility and its frequency dependence can be used to estimate soil loss.

Haplic Chernozem is an original dominant soil unit in the wider area, nowadays progressively transformed into different soil units along with intensive soil erosion. The site was characterized by a flat upper part while the middle part, formed by a substantive side valley, is steeper (up to 15°). The side valley represented a major line of concentrated runoff emptying into a colluvial fan (Zadorova et al., 2011; Jaksik et al., 2011). Field measurements of magnetic susceptibility were carried out on regular grid, resulting in 101 data points.

Bulk soil material for laboratory investigation was gathered from all grid points. Mass specific magnetic susceptibility $\chi$ and its frequency dependence kFD was used to estimate the significance of SP ferrimagnetic particles of pedogenic origin. Thermomagnetic analyses, hysteresis measurement and SEM were used in order to determine dominant ferrimagnetic carriers in top-soil and sub-soil layers.

Strong correlation was found between the volume magnetic susceptibility (field measurement) and mass specific magnetic susceptibility measured in the laboratory (R2 = 0.80). At the same time, no correlations were found between the values of kFD and mass specific susceptibility.

Values of organic carbon content, pHKCl and magnetic susceptibly are spatially distributed depending on terrain position. Higher values of magnetic susceptibly and organic carbon content were measured at the flat upper part (where the original top horizon remained). The lowest values of organic carbon content and magnetic susceptibly were obtained on the steep valley sides. Here the original topsoil was eroded and mixed by tillage with the soil substrate (loess). Regression analysis showed positive correlation between the organic carbon content and volume magnetic susceptibility (R2= 0.89).

Vertical distribution of magnetic susceptibility along the selected transect was measured using SM400 soil kappameter (Petrovský et al., 2004). Differences between susceptibility values in undisturbed soil profiles and magnetic signal after uniform mixing of soil material as a result of tillage and erosion are fundamental for estimation of soil loss in studied test field.

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