



Mapping of soil erosion and redistribution on two agricultural areas in Czech Republic by using of magnetic parameters.

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Soil erosion is one of the major concerns in sustainability of agricultural systems in different areas. Therefore there is a need to develop suitable innovative indirect methods of soil survey. One of this methods is based on well established differentiation in magnetic signature with depth in soil profile. Magnetic method can be applied in the field as well as in the laboratory on collected soil samples.

The aim of this study is to evaluate suitability of magnetic method to assess soil degradation and construct maps of cumulative soil loss due to erosion at two morphologically diverse areas with different soil types. Dominant soil unit in the first locality (Brumovice) is chernozem, which is gradually degraded on slopes to regosols. In the second site (Vidim), the dominant soil unit is luvisol, gradually transformed to regosol due to erosion.

Field measurements of magnetic susceptibility were carried out on regular grid, resulting in 101 data points in Brumovice and 65 in Vidim locality. Mass specific magnetic susceptibility χ and its frequency dependence χ_{FD} was used to estimate the significance of SP ferrimagnetic particles of pedogenic origin in top soil horizons. Strong correlation was found between the volume magnetic susceptibility (field measurement) and mass-specific magnetic susceptibility measured in the laboratory (Kapicka et al 2013). Values of magnetic susceptibility are spatially distributed depending on terrain position. Higher values were measured at the flat parts (where the original topsoil horizon remained). The lowest values magnetic susceptibility were obtained on the steep valley sides. Here the original topsoil was eroded and mixed by tillage with the soil substrate (loess). Positive correlation between the organic carbon content and volume magnetic susceptibility ($R^2= 0.89$) was found for chernozem area. The differences between the values of susceptibility in the undisturbed soil profile and the magnetic signal after uniform mixing of the soil material as a result of tillage and erosion are fundamental for the estimation of soil loss in the studied test field (Royall 2001). The map of soil erosion shows maximum removal of soil material in the steepest parts of the testing localities. The magnetic method is very well suitable for mapping at the chernozem locality (Brumovice) and measurement of soil magnetic susceptibility is in this case a useful and fast technique for quantitative estimation of soil loss caused by erosion and tillage. However, it is less suitable (probably due to high terrain heterogeneity) for mapping in areas with luvisol as dominant soil unit.

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References :

- Royall, D. (2001). Use of mineral magnetic measurements to investigate soil erosion and sediment delivery in small agricultural catchment in limestone terrain. *Catena*, 46, 15-34.
- Kapicka, A., Dlouha, S., Grison, H., Jaksik, O., Kodesova, R., Petrovsky, E. (2013) Magnetism of soils applied for estimation of erosion at an agricultural land. *Geophys Res Abstr* Vol. 15, EGU2013-4774.