Geophysical Research Abstracts
Vol. 13, EGU2011-3134-1, 2011
EGU General Assembly 2011

Spatial soil material redistribution due to soil erosion studied using magnetic susceptibility mapping

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Study is focused on a magnetic susceptibility mapping and its application for estimating soil properties within the area affected by soil erosion. The study was situated in loess region in Southern Moravia in the Czech Republic. The region has been under uninterrupted agricultural use since the middle of the Holocene. Haplic Chernozem is an original dominant soil unit in the wider area, nowadays progressively transformed into different soil units along with intensive soil erosion. An extremely diversified soil cover structure resulted from the erosion. Detailed research of soil types was carried out on one study plot (strip part of an agricultural parcel, area of 6 ha) in Brumovice cadastre (Zadorova et al., 2010). The site was characterized by a flat upper part (slope 0-0.5°) 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. Soil samples for analysis were taken from 104 points in representative terrain and soil cover positions at the same study plot. Organic carbon content, pH_H2O, pH_KCl, soil particle density, and mass specific magnetic susceptibility were measured in the laboratory.
Regression analysis showed that organic carbon content was negatively correlated with pH_KCl (R2 = 0.666) and soil particle density (R2 = 0.607). Similarly the mass specific magnetic susceptibility was negatively correlated with pH_KCl (R2 = 0.729) and soil particle density (R2 = 0.629). The positive correlation was therefore found between the organic carbon content and magnetic susceptibility (R2= 0.899). No significant correlation of pH_H2O with the other measured soil properties was found. Values of organic carbon content, pH_KCl, magnetic susceptibly and particle density are spatially distributed depending on terrain position. Greater values of organic carbon content and magnetic susceptibly, and lower values of pH_KCl and particle density were measured at the flat upper part and at colluvial fan. The lowest values of organic carbon content and magnetic susceptibly, and higher values of pH_KCl and particle density were obtained on the steep valley sides. However, poor correlation between measured soil properties and terrain attributes were found.

Acknowledgement: Authors acknowledge the financial support of the Grant Agency of the Czech Republic (grant No. GA CR 526/08/0434) and the Ministry of Education, Youth and Sports of the Czech Republic (grant No. MSM 6046070901).

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