Geophysical Research Abstracts
Vol. 15, EGU2013-7924, 2013
EGU General Assembly 2013

Soil hydraulic properties of topsoil along two elevation transects affected by soil erosion

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This study is focused on the comparison of soil hydraulic properties of topsoil that is affected by erosion processes. Studied area is characterized by a relatively flat upper part, a tributary valley in the middle and a colluvial fan at the bottom. Haplic Chernozem reminded at the flat upper part of the area. Regosols were formed at steep parts of the valley. Colluvial Chernozem and Colluvial soils were formed at the bottom parts of the valley and at the bottom part of the studied field. Two transects and five sampling sites along each one were selected. The soil-water retention curves measured on the undisturbed 100-cm3 soil samples taken after the tillage and sowing of winter wheat (October 2010) were highly variable and no differences between sampling sites within the each transect were detected. Variability of soil-water retention curves obtained on soil samples taken after the wheat harvest (August 2011) considerably deceased. The parts of the retention curves, which characterized the soil matrix, were very similar. The main differences between the soil-water retention curves were found in parts, which corresponded to larger capillary pores. The fractions of the large capillary pores (and also saturated soil water-contents) were larger after the harvest (soil structure reestablishment) than that after the tillage and sawing (soil structure disturbance). Greater amount of capillary pores was observed in soils with better developed soil structure documented on the micromorphological images.
The saturated hydraulic conductivities (Ks) and unsaturated hydraulic conductivities (K) for the pressure head of -2 cm of topsoil were also measured after the wheat harvest using Guelph permeameter and Minidisk tensiometer, respectively. The highest Ks values were obtained at the steepest parts of the elevation transects, that have been the most eroded. The Ks values at the bottom parts decreased due to the sedimentation processes of eroded soil particles. The change of the K values along transects didn't show similar trends. However, the variability of values within both transects was low.
The undisturbed soil samples (3200 cm3) were also taken at 3 sampling sites and ponding infiltration experiment was performed in the laboratory. Cumulative inflow and outflow, and pressure heads at depths of 6.5, 11 a 15.5 cm were measured. Numerical inversion of measured data using HYDRUS-1D was performed to obtain parameters of van Genuchten hydraulic function. Data obtain from previous tests were used to characterize development of dual permeability system along the studied transects.

Acknowledgment: Authors acknowledge the financial support of the Ministry of Agriculture of the Czech Republic (QJ1230319).