



Spatial and temporal variability of soil hydraulic properties of topsoil affected by soil erosion

Antonin Nikodem, Radka Kodesova, Ondrej Jaksik, Veronika Jirku, Ales Klement, and Miroslav Fer
University of Life Sciences Prague, Dept. of Soil Science and Soil Protection, Prague, Czech Republic

This study is focused on the comparison of soil hydraulic properties of topsoil that is affected by erosion processes. In order to include variable morphological and soil properties along the slope three sites - Brumovice, Vidim and Sedlčany were selected. Two transects (A, B) and five sampling sites along each one were chosen. Soil samples were taken in Brumovice after the tillage and sowing of winter wheat in October 2010 and after the wheat harvest in August 2011. At locality Vidim and Sedlčany samples were collected in May and August 2012.

Soil hydraulic properties were studied in the laboratory on the undisturbed 100-cm³ soil samples placed in Tempe cells using the multi-step outflow test. Soil water retention data points were obtained by calculating water balance in the soil sample at each pressure head step of the experiment. The single-porosity model in HYDRUS-1D was applied to analyze the multi-step outflow and to obtain the parameters of soil hydraulic properties using the numerical inversion. The saturated hydraulic conductivities (Ks) and unsaturated hydraulic conductivities (Kw) for the pressure head of -2 cm of topsoil were also measured after the harvest using Guelph permeameter and Minidisk tensiometer, respectively.

In general soil water retention curves measured before and after vegetation period apparently differed, which indicated soil material consolidation and soil-porous system rearrangement. Soil water retention curves obtained on the soil samples and hydraulic conductivities measured in the field reflected the position at the elevation transect and the effect of erosion/accumulation processes on soil structure and consequently on the soil hydraulic properties. The highest Ks values in Brumovice 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 of eroded soil particles. The change of the Kw values along transects didn't show similar trends. However, the variability of values within both transects was low. Higher values were obtained in transect B, where the soil was more affected by erosion. The highest values of Ks as well as the value of Kw were also obtained in the steepest part of transect A in Vidim. This trend was not observed in transect B. The results corresponded with measured retention curves. Two different trends were shown in Sedlčany. While the highest values of Ks and Kw were found in the upper part of transect A, in the case of transect B the highest values were measured at the bottom of transect. Differences observed at both localities were caused by the different terrain attributes of both transects and extent of soil erosion.

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