Geophysical Research Abstracts
Vol. 13, EGU2011-13632, 2011
EGU General Assembly 2011

Experimental research and modelling macropore flow in soils

Constance Bornkampf (1) and Jürgen Schmidt (2)

(1) Technical University Bergakademie Freiberg, Soil and Water Conservation Unit, Agricolastraße 22, 09599 Freiberg, Constance.Bornkampf@tbt.tu-freiberg.de , (2) Technical University Bergakademie Freiberg, Soil and Water Conservation Unit, Agricolastraße 22, 09599 Freiberg, jschmidt@tu-freiberg.de

1 Introduction

Water retention and infiltration capacities of soils are crucial parameter for run-off formation and soil erosion during a rain-storm event. Macropores made by earthworms may effect the water transport in the soil dramatically. The aim of this study is to quantify these effects of earthworm burrows on infiltration in the field and lab experiments and to account macropore flow in a mathematical infiltration model.

2 Methods

The field investigation sites differed in their tillage system. So it was possible to compare water infiltration rates, amount of macropores and soil physical properties. The quantification of macropores was leant to the system of Ehlers (1975). We also made dye tracer experiments to visualize preferential flow paths.
The soil column experiments in the laboratory were divided into three groups; reference columns free of macropores, columns with natural macropores and those with artificial macropores. The columns are 50cm high and have a diameter about 24cm. For the experiment a mixed silty soil was used with a constant water content of 21%. Six columns were settled with 3 adult individuals of L. terrestris in order to produce natural macropores. These columns were stored in a cool and dark place for six weeks. The artificial macropores were made using plastic pipes (diameter 6mm). The pipes were installed bevore filling the column with soil and then removed. For all the different set-ups the saturated hydraulic conductivity was determined with a hood infiltrometer.
The physically based simulation model EROSION 3D has been developed as an instrument for estimation soil loss and deposition processes. Macropore flow could not be simulated directly. However, the model can be adapted by calibrate the hydraulic conductivity using the so called skin-factor. A value greater than 1 means positive correction of conductivity (e.g. macropore flow) and a value less than 1 negative (e.g. soil compaction).

3 Results

The highest saturated hydraulic conductivity was measured in the soil columns with artifical macropores, the lowest in the reference columns. These data were compared with the saturated hydraulic conductivity measured in the field. The no-till field sites shows the highest number of macropores and the highest infiltration rates. There is also a significant correlation between saturated hydraulic conductivty and number of macropores per m^2. The dye tracer experiments show most continous macropores on no-till system. Next step is the correlation of macropores per m^2 and the skin-factor in order to adapt the EROSION-3D model.