Geophysical Research Abstracts
Vol. 12, EGU2010-12639, 2010
EGU General Assembly 2010

Noninvasive investigation of fluid dynamics on undisturbed soil samples

Vladimira Jelinkova (1), Michal Snehota (1), Andreas Pohlmeier (2), Dagmar van Dusschoten (2), and Milena Cislerova (1)

(1) Czech Technical University in Prague, Faculty of Civil Engineering, Czech Republic (vladimira.jelinkova@fsv.cvut.cz), (2) Forschungszentrum Jülich, Germany

Magnetic resonance (MR) imaging and MR relaxometry measurement techniques were used to study the process of infiltration in two undisturbed soil samples of coarse sandy loam and loamy sand taken into the plexiglas cylinders (dia. 6.0 cm × h. 12 cm). For coarse sandy loam sample the repeated ponded infiltration (RPI) experiment was carried out, the first infiltration was conducted into a relatively dry sample and the repeated infiltration into the gravitationally drained sample. The RPI method for this sample was performed in order to assess the changes in entrapped air distribution and its impact on steady state flow rates. A single infiltration run was carried out for loamy sand. An automatic setup continuously monitoring fluxes and pressure head in one tensiometer was constructed for these experiments. The main stages of each experiment run – wetting, steady state flow, drainaige – were monitored by multi-echo multi-slice (MEMS) MR sequence. Multiple vertical slices at a spatial resolution of $0.53 \times 2 \times 5$ mm covered the whole soil core to obtain 3D image. During steady state flow, axial slices at spatial resolution of $1 \times 1 \times 5$ mm of T1 maps were acquired. Later the nickel nitrate pulse was injected with the aim to visualise the solute breakthrough. Effluent from the sample was collected into a fraction collector and breakthrough curve of the nitrate was developed. Soil samples were scanned with computed tomography (CT) at a spatial resolution of $0.2 \times 0.2 \times 0.6$ mm. The CT images were obtained before and after magnetic resonance investigation.
The novelty of this approach is the 3D monitoring of infiltration process in natural soil samples. It reveals its potential to study the complex flow dynamics.
The research has been supported by GAČR 103/08/1552 and SP/2E7/229/07.