Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02563, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02563
EGU General Assembly 2008

Water detection in soil with X-ray technology

U. Weller, H.-J. Vogel, S. Trenkel

Department of Soil Physics, Helmholtz Centre for Environmental Research - UFZ, Theodor-Lieser-Str. 4, 06120 Halle (Saale), Germany

The detection and quantification of water movement in soil is important for detailed process understanding. X-ray technology was used for this purpose, but had strong technical limitations. Nowadays, with the new detector panels the spatial, temporal and dynamic resolution was highly increased. An improved contrast in X-ray absorption allows for detecting structural elements of different densities as well as soil water content. In coarse pore systems, water can be detected directly by its characteristic attenuation, thus, the three phases (solid, liquid and gas) can be separated in x-ray tomographies. Here we analyse the spatial distribution and arrangement. For finer textured materials the different phases can not be separated. We use differential techniques to determine the change in density between dry and wet samples. With this approach it is possible to quantify water dynamics during infiltration using radiographs with a high spatial and temporal resolution.

At equilibrium stages the differential radiographs can be used for 3D tomographic reconstruction of the water distribution. Together with measurements of the soil water potential, localised water retention characteristics can be obtained for detailed 3-D modelling of water dynamics.

The detection of water brings the x-ray technology to its limits. The small density differences between wet and dry samples versus the much higher density gradients in soil make it necessary to exploit the full dynamic range of current detectors. Combined images with different beam intensities (analogous to the HDR photography) can improve the resolution. The main advantages of using x-ray technology are the combined study of soil structure and soil water dynamics, the high spatial and temporal resolution and the moderate costs in comparison to NMR or Neutrontomography.