Geophysical Research Abstracts, Vol. 8, 09909, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09909

Combining Image Processing and Displacement Experiments to study Solute Transport in an Andosol

B. Prado (1), C. Duwig (1), P. Delmas (2), K. Müller (3), J. Li (2) and M. Esteves (4)

(1) IRD/Colegio de Postgraduados, Montecillo, Mexico, (2) The University of Auckland, New Zealand, (3) AgResearch Ltd., Hamilton, New Zealand, (4) IRD/LTHE, Grenoble, France (blanca.prado@hmg.inpg.fr / Phone: +52 595 95 20 200)

Agrochemicals applied to the soil surface may leach and cause groundwater contamination. The inherent heterogeneity of physical and chemical soil properties significantly affects reactive solute transport. In this work we evaluated the effect of the porous structure of a volcanic soil on water flux and solute transport. The movement of a water tracer ($H_2^{18}O$) was studied in intact soil cores of 50 mm diameter and 150 mm long, sampled at different depths (from 5 to 110 cm) of an agricultural soil profile. Its breakthrough curves were analyzed with the model CXTFIT and parameters such as the mobile water fraction and the rate of solute exchange between mobile and immobile liquid phase were obtained. At the end of the displacement experiments the cores were impregnated with resin and cut at selected depths. The thin section layers were further scanned onto 5000 by 4000 pixels image of 11 μm resolution. The generated color images were segmented using classical mean shift algorithm. Using mathematical morphology techniques, a set of parameters describing the porous network was derived, such as the total macro- and meso-porosity, pore size distribution, and pore orientation. Results show that the structure of the topsoil that is affected by plowing had a reduced and homogeneous pore size distribution leading to symmetrical ^{18}O breakthrough curves. With depth, macro-porosity increased, and asymmetrical breakthrough curves were observed with advanced peak fronts representative of physical non-equilibrium transport. Soil plowing destroys natural preferential flow paths and pore connectivity. The next step is to use the parameters directly obtained by thin section analysis to predict water and solute transport. A direct and independent method to characterize porous media geometry with effective transport parameters will help to better predict contaminants' fate through unsaturated soil.