



## **Effects of hysteresis on flow and transport in a heterogeneous sand structure: experimental results and numerical simulations.**

**M. Rossi** (1), O. Ippisch(2), N. Ursino(3), P. Lehmann (1) and H. Flüßler (1)

(1) Institute of Terrestrial Ecology, ETHZ, Zurich, Switzerland, (2) Interdisciplinary Center for Scientific Computing, Ruprecht-Karls-University of Heidelberg, Heidelberg, Germany, (3) Engineering Department I.MA.GE. University of Padua, Padua, Italy

We present the results of a two-dimensional simulation of a tracer experiment run on a highly heterogeneous sand structure. The structure consists of more than 1000 layers of three quartz sand types arranged randomly with an inclination of 45° respect to the applied water gradient. Experimentally we applied to this structure a series of increasing stationary flow rates (imbibition) and then a series of decreasing stationary flow rates (drainage). The flow field and the transport process were characterized by monitoring several plumes of a fairly mobile fluorescent tracer.

Numerically we were able to solve the flow field and the transport and to simulate the flow rates tested experimentally. Hysteresis was taken in account in the choice of the hydraulic parameters of each sand type.

Our purpose was to observe how hysteresis influences flow and transport on a scale larger than the scale of a single layer. At the larger scale hysteresis affects the exchange of water and solutes at the textural boundaries and is the result of the combination of the hysteresis of each sand type and of the geometrical arrangement of the layers.