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Solute transport in subsurface drained soil: Numerical modelling and laboratory experimental approach comparison.

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Artificial drainage has been subject to widespread criticism because of its impact on water quality. In particular, observations converge to show drainage is suspected to accelerate pollutants transfer through soil. However, there are some unknowns about the actual mechanisms for such observations. The present work aims at describing and understanding the processes of bi-dimensional solute transfer in subsurface drained soil, using tracer monitoring in a metric size experimental laboratory model (MASHYNS: Model of Hydraulic Simulation in Shallow Water Table) followed by the modelling of the system using CDE approach and a simple "particle tracking" method in HYDRUS-2D.

In all experiments, water flow through the profile was maintained on a steady state regime by adding a water solution on the soil surface. The actual hydraulics were rather well known thanks to preliminary measurements of soil water characteristics and through 46 tensiometers installed throughout the profile. Chloride was used to trace solute leaching through the soil. Two types of experiments were conducted corresponding to two different initial tracer concentrations in the soil: pulse or resident. Spatial repartition of the chemical tracer in the profile was estimated through EC measurements monitored by specially designed and installed 26 four-electrode EC probes.

Our experiments and simulations highlight the particular consequences of the bi-dimensional character of water flow and the influence of the hydrodynamics at the interfacial saturated/unsaturated zone. Preferential flows can be explained by the heterogeneity of the velocity fields, due to the seepage boundary condition of buried tile pipe. Distribution of the pollutant in the soil profile at the beginning of the leaching period and cumulative drained water are the two major parameters for the understanding

and quantification of leaching processes.