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An experimental setup in Avignon (South of France) for the multiscale study of preferential flow in soil and of groundwater recharge processes

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Preferential flow in soil is of major importance for the dynamic of groundwater recharge, on a quantitative and qualitative point of view. This is particularly the case in Mediterranean regions where this phenomenon is increased due to flood irrigation, high intensity rainfall events and seasonal soil water deficit leading to soil shrinkage and cracking.

A large scale experimental setup devoted to a multiscale study of preferential flow in soil and of groundwater recharge processes has been set up in Avignon, South of France in 2002. It is composed of a large scale undisturbed lysimeter associated to a 0.7 ha field. Agricultural practices are the same on both plots. The field plot is equipped with piezometers, groundwater level probes working at a fine time step, water balance sites and porous cups for soil water sampling. The lysimeter is equipped with soil moisture probes and tensiometers, and with an automatic device for measuring drainage flow at the bottom of the lysimeter. Physical and hydrodynamic properties of the field plot and lysimeter have been measured using geophysical devices (electrical tomography and electromagnetic prospection) and the kinematic wave theory for preferential flow. Local hydrodynamic properties of the aquifer are also known.

We present some results concerning (i) rainfall simulation on the lysimeter and on the field using chemical tracers and water stable isotopes, (ii) drainage hydrographs obtained at the bottom of the lysimeter under natural rains, (iii) groundwater level variations. This is an original experimental device, combining tracers experiments, geophysical and physical monitoring of soil water and groundwater dynamics, for studying in situ bypass flow in soil and rapid groundwater recharge at the field scale.

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