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Preferential pathways for subsurface and overland flow on a sloped farmland: field evaluation

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It has been shown that contaminant transport to river systems is dominated by various types of fast flow and solute transport, which can be attributed to macropore flow in tile-drained fields and surface runoff in sloped areas, but also due to point sources including urban drainage, effluents of waste water treatment plants, and inappropriate agricultural practices. Our study focuses on quantitatively identifying fast flow processes through different preferential pathways in an agricultural soil towards a neighbouring river. In October 2009, field plots at three locations along a representative hillslope of an agriculture-dominated remote watershed at Nil-Saint-Martin in Belgium were setup to continuously monitor surface runoff, soil moisture and water potential, and solute concentrations. Runoff tipping bucket equipment, TDR probes, tensiometers, drop counting glassfibre wick samplers and a meteorological station were connected to a fully automated solar-powered datalogging system with wireless communication to a lab-based PC. Hydrus-3D was used to optimize the setup of wick samplers, which were designed specifically for collecting soil pore water in the shallow (0-45 cm) vadose zone for both flux quantification and chemical analysis. First results show that macropore flow may well play an important role in the topsoil, as indicated by the quick response of subsurface flow upon rain events. Lateral subsurface fast flow and transport occurred above the compacted layer (at depth of 30-35 cm) after several heavy rain events and ceased when the rain intensity and duration reduced. The role of subsurface and overland flow on the spatial distribution of soil moisture appeared to be dependent on the spatial variations in soil hydraulic properties across the slope.