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Identification of hydrologic transport processes and diffuse nutrient input pathways with natural and applied tracers

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This experimental tracer study is focussing on runoff generation, flow and transport issues in headwater catchments. The objectives were (i) to identify the dominating runoff generation processes, (ii) to quantify preferential flow contribution to discharge using natural and applied tracers, and (iii) to assess nutrient fluxes (Phosphorus, P) into the river during storm events.

Shallow subsurface hydrologic transport processes in the unsaturated zone and in the temporary saturated zone are playing a key role in transfering rainfall into runoff and nutrients/agrochemicals from land into surface water bodies. Soil heterogeneity and preferential flow paths have substantial impacts on flow time distributions, break through curves and event driven nutrient fluxes.

An innovative combination of natural and applied tracers under artificial and natural rainfall conditions in conjunction with high resolution sampling strategies offered detailed insights in the processes of runoff generation and non-reactive transport from land to water. Natural isotopic (18-O) and geogenic (SiO2) tracers were monitored synchron with sampling of applied non-reactive (2-H, flurescine) and reactive tracers (P). The applied methods made it possible (i) to quantify event water/pre-event water ratio (ii) to quantify groundwater contribution (iii) to identify the dominating preferential flow paths, and (iv) to check the influence of these quick flow paths on delivery mechanisms of nutrients on a event orientated basis.

Close cooperation with farmers allowed conducting these management related ex-

periments on entire fields (field scale). The spatial dimension of these experiments is therefore more in agreement with the scale of natural phenomenon of intrest than plot- or lab-experiments. This makes the results more valueable for the catchment scale and consequently for watershed management issues (e.g. Water Framework Directive).