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Overland flow and sediment transport in an agricultural lowland catchments: a focus on tile drain export

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Rural landscapes have been extensively modified by human activities in Western Europe since the beginning of the 20th century in order to intensify agricultural production. Cultivated areas often expanded at the expense of grassland and wetlands located in lowland areas (de Groot et al., 2002). Therefore, large modifications were made to the agricultural landscapes: stream redesign, land consolidation, removal of hedges, and installation of tile drainage networks to drain the hydromorphic soils. These changes modified sediment processes and resulted in large morphological alterations (e.g. channel bed incision, deposition of fine sediment, channel bank erosion). Accordingly, these alterations threaten water quality and prevent to meet the requirements of the European directives. Improving water quality requires a clear understanding of the hydrosedimentary dynamics in these lowland cultivated catchments. However, few studies were conducted in drained environments. To fill this research gap, a pilot study was started in cultivated catchment of the Loire River basin, France, where tile drain densities are very high (> 1.5 km/km^2).

Six hydro-sedimentary monitoring stations were installed in the Louroux catchment (24 km^2). One of them was specifically dedicated to measuring water/sediment fluxes from tile drains. Water level and turbidity were continuously monitored and sediments were sampled during floods and low stage periods. Samples were measured for particle size distribution, and sediment tracing studies are currently being developed to quantify the contribution of potential sources (e.g. surface vs subsurface, lithologies) to river sediment.

Hydro-sedimentary fluxes were quantified and modelled for some selected events. The catchment hydrosedimentary fluxes and their properties were shown to be impacted by tile drain sediment transport, especially regarding particle size distribution, with the dominant export of very fine particles (< 2 μm) from tile drains. This study demonstrates that tile drain transport should be included when developing and running hydro-sedimentary models in catchments, and particularly in lowland/wetland environments.