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Quantification of suspended sediment transfers in a lowland agricultural catchment

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Lowland agricultural landscapes underwent important changes since the second half of the XXth century such as hedges removal, implementation of drainage systems, stream redesign and land reallocation. It resulted in changes in sediment transfer processes, and in widespread morphological alterations of water bodies. However, little is known about the sediment dynamics in these environments.

The Louroux catchment (25 km²) is located in central France. It is a typical intensively cultivated and tile drained lowland catchment. The Xth century pond located at its outlet (52 ha) is undergoing large siltation, with a current sedimentation rate 60 fold higher than the pre-1950 period. Five monitoring stations, measuring water levels and turbidity at high frequency (15 mn and 1 mn respectively), combined with automatic samplers, were implemented in 2013. Three stations are located at the main tributaries outlets of the pond, one in a sub-catchment, and one at a tile drain outlet.

45 floods were observed during the three studied hydrological years. They occurred mostly between December and March (33 floods) and in May-June (8 floods). Specific sediment yields ranged from 0.02 to 0.38 t.ha⁻¹.yr⁻¹ depending on the monitoring site and the considered year. The vast majority of suspended sediment transfers occur during the winter floods. While large water volumes were also measured during spring floods, the sediment yields remained low.

Suspended sediment yields present large inter-annual (ratio ranging between 2 and 6 depending on the monitoring station) and spatial variations, due to significant differences in total rainfall amounts during the winter season and variations in land use, respectively.

The processes related to sediment transfers are most likely linked to soil saturation during winter despite the presence of a tile drainage network, with transfers occurring both at the soil surface and through the drainage system. While sediment transfer rates can be considered as low regarding values measured in other environments, they are sufficient to cause, in conjunction with eutrophication processes, a filling of the pond that should be complete in 50 to 100 years. Although lowlands show very limited morphogenic activity, it is crucial to determine appropriate management strategies to limit these sediment transfers to water bodies.