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Physically based numerical modelling of sediment production and transfers in an agricultural watershed with TELEMAC-MASCARET

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In the context of optimizing electricity production and preserving the ecological system, understanding the sediment sources at the Loire River basin scale (France) and their transfer to the hydrographic network is an important issue. The Louroux watershed, a sub-catchment of the Loire basin, has been studied and instrumented in order to analyse the erosion dynamics and the sediment transfer processes from hillslopes to the hydrographic network.

The objective of this study is to evaluate a 2D physically-based model (TELEMAC-MASCARET) for simulating the sediment transfers between the drained parcels and the hydrographic network. Two rain events from different seasons are simulated on the Masniers sub-catchment (2 km^2). The model has been calibrated by comparing results to discharge and suspended sediment concentration data measured at the outlet of the Masniers catchment.

By testing different formulas for erosion processes on parcels or in the hydrographic network, this work identified different erosion behaviour depending on the season. For the summer event, the comparison of the different erosion formulas shows that erosion occurs mainly in the hydrographic networks, which is coherent with the rich vegetation we can find on parcels at this season. For the winter event, the model shows that the main source of sediment comes from erosion of the parcels due to the rainfall. This work gives very promising perspectives on the use of a physically based model as TELEMAC-MASCARET to better understand relationships between sediment production and sediment transfers at the catchment scale.