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Combining multitracing and 2D-modelling to identify the dynamic of heavy metals during flooding.

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Recent years have seen a growing awareness of the wider environmental significance of the sediment loads transported by rivers and streams. This includes the importance of suspended sediment in transporting heavy metals and the potential for these trace elements to be desorbed from the particles to the solution. That threaten the water quality and can cause severe impacts in downstream areas like wetlands and floodplains. Contemporary data on the sediment loads of rivers provide clear evidence of significant recent changes in the sediment fluxes and of several rivers in response to human activities. For instance, Trace elements (including heavy metals) that are currently considered to be undisturbed by human activities and used as tracers of continental crust derived material have become more and more involved in industrial processes. Mathematical models validated by in situ experimentations are the only available tool to predict the consequences of natural as well as man-induced environmental changes and impacts on sediment dynamics. They are approximate representations of complex natural systems and the evaluation of a model with respect to its ability to reproduce multiple criteria and behaviour of a real system is still problematic. Interactions between modellers and experimentalists improve significantly the interpretation of the modelling output and led to formulate more realistic assumptions on the behaviour of natural systems. The geochemical information, which appeared to be non-correlated with the hydrological standard parameters, provides new information and contributes to give an “orthogonal view” on the hydrologic system behaviour. Regarding the recent development in geochemical tracer applications in models, the multi-tracer approach (natural vs anthropogenic; elemental concentration-isotopic signature-radionuclide activity) may be a necessity to decrease significantly the uncertainties in sediment transport modelling.
The objective of this study is to assess the risk of floodplain contamination in heavy metal due to river sediment deposition and to heavy metal partitioning between particulate and dissolved phases. We focus on a multi-disciplinary approach combining environmental geochemistry (multitracing) and hydraulic modelling (using TELEMAC-2D). One important single flood event was selected to illustrate this innovative approach. During the entire flood, the river water was sampled every hour in order to collect the particulate and the dissolved fractions. All the tracers were analyzed in both fractions. An important set of hydrological and sedimentological data are used to reach a more efficient calibration of the TELEMAC modelling system. In addition to standard techniques of hydrochemistry, new approaches of in situ suspended sediment transport monitoring will help getting new insights on the hydraulic system behaviour.