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First flush effect of hazardous substances during a flash autumn flood in an intermittent Mediterranean river.

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First flush effects are most of the time addressed in urban hydrology, however they are often more accurate for intermittent rivers, even in rural contexts.
In the Mediterranean area, catchments are subject to long-duration dry periods interrupted by intense rainfall events that explain the intermittence of the rivers. In karstic context, the dynamics of karstic springs enhance the intermittent behaviour of the river.
During the dry periods, the karstic springs dry up. The riverbed dries up too; however some pools remain downstream from direct anthropogenic inputs. In-situ experiments, focusing on organic matter, nutrients and some hazardous substances as organotins, raised interesting results in terms of rates of accumulation in the bed sediments in these pools. At the same time, lab experiments, in microcosms, showed long-term persistence of contaminants (i.e. organotins). So, it was demonstrated that pollutants and hazardous substances are stored in the riverbed, downstream from the direct inputs, during the dry periods, creating reservoirs of contaminants.
The intense rainfall events generate short-response floods, due to runoff on impervious catchment areas; but these floods may last for several days if karstic springs are triggered. Sampling of such floods showed high concentrations of most of particulate contaminants during the rising period of the flood; concentrations decrease then after the peak flow. The rewetting of the river course flushed particulate material from the riverbed and the attached contaminants; the dilution effect by karstic waters is obvious after the peak flow. A significant part of the accumulated contaminants is remobilized from the riverbed reservoir and flushed away during the first period of the flood. So it was demonstrated that floods of intermittent rivers show significant first flush effects.
Since dilution and self-purifying processes are not able to take place in intermittent rivers during dry periods, permanent anthropogenic inputs are accumulated and transformed in riverbeds. This explains the first flush effects during the floods, as it will be demonstrated on the example of the Vène river (South France).