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Nutrient loads during first autumn floods in an intermittent river

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In the Mediterranean basin, many small rivers are characterized by the alternation of long dry periods cut by short flush flood events. In summer, the riverbed falls almost completely dry, except in some sections where human inputs contribute to feed the river. Therefore, nutrients and other pollutants are stored in the riverbed, downstream the inputs. During the first autumn floods, a significant part of the stored nutrients is remobilized and flushed away in some hours. Very few studies have been carried on this topic, while these first autumn floods could have a harmful effect on the downstream ecosystems.

This study addresses the temporal variations of nutrient loads during first autumn floods at three gauging stations along the Vène River (catchment area of 67km^2; South of France). The Vène catchment is characterized by three sharply contrasting geology and land use zones: urban zones (3%), agricultural areas (vineyards -21% and permanent crops -13%) and karstic scrubland areas (63%). The three gauging stations (V: 67km^2; S: 35km^2; K: 1.4km^2) are equipped with automatic level and conductivity loggers, coupled with an automatic water sampler. Two first floods were observed the 22nd of September 2003 and the 13th of September 2004. Water quality was evaluated through the determination of nutrients (NO2+NO3, NH4, NTK, SRP, TP) and suspended solids concentrations on hourly samples.

These floods showed low runoff coefficients (lower than 3%): they are mainly generated by urban runoff and then lasted less than one day. At the outlet, the discharge increased from 20L/s to 13m3/s and 20m3/s (respectively in 2003 and 2004) in less than three hours. The flood dynamics showed significant differences among the three gauging stations due to their hydraulics and hydrological specificities. In 2003, the

flood had a karstic component that increased its duration.

Concentration dynamics followed quite well the flow dynamics. Suspended solid concentrations varied from 200 to 2000mg.L-1 at S; from 30 to 3000mg.L-1 at V in 2003. The maximum values were lower in 2004, probably due to a dilution effect. Total nitrogen concentrations were higher at the beginning of the flood event and then showed a quick decrease, after the peak flow. Nitrogen was essentially under organic forms (dissolved and particulate) at the beginning of the floods (over 70%); nitrates and ammonium showed concentrations lower than 1500μgN.L-1. Total phosphorus, essentially particulate (over 80%) during rising and peak flow, showed the same dynamics as total nitrogen, with higher concentrations at the beginning of the flood.

At the outlet, the volume of the flood was about 350000m3 in 2004, while it was 180000m3 in 2003. Nevertheless the floods flowed away similar loads of total nitrogen (about 650kg). The total phosphorus loads were only half more in 2004 (220kg and 310kg respectively in 2003 and 2004). The nitrogen loads brought by domestic inputs during the floods were about 20kg. Rainfall contributed to about one third of total nitrogen loads at the outlet, while agricultural areas had a smaller contribution. The phosphorus loads brought by the domestic inputs during the floods were about 5kg, while it is the main source of phosphorus in regular conditions. The contribution of agricultural areas can not explain these differences. Remobilisation processes of nutrients stored in the riverbed during summer must be considered as a potential source of nutrients during first autumn floods.