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Hydrological behaviour and nutrient loads in an intermittent Mediterranean river

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In the Mediterranean basin, many small rivers are characterized by long low flow periods cut by floods events of short duration. Very few studies concerning the combined effect of hydrological and hydrochemical behaviours have been carried out at catchment scale, while it is of main interest for the application of the European water framework directive in such environment.

In this context, this study addresses the hydrological behaviour and the nutrient loads of the Vène River (catchment area of 67 km^2; South of France). The catchment is characterized by three zones with sharply contrasted geology and land uses: urban zones (3%), vineyards and permanent crops (34%) and karstic scrubland areas (63%). The river is fed by two karstic springs. Three nested basins are gauged: K station gauges the upstream karstic spring plus 1.4-km^2 catchment; S station (35 km^2) cuts the river down the middle; V station is located at the outlet. Each station is equipped with automatic water level and conductivity loggers. Three automatic rainfall stations are located on the catchment area. Data are available since August 2002. Water quality is evaluated through in situ measurements (temperature, pH, conductivity, Eh and dissolved oxygen) and the determination of nutrients (NO2+NO3, NH4, Kjeldahl nitrogen, SRP, total phosphorus) and suspended solids concentrations. These data are available at a bi-monthly time step for long term period and at an hourly time step during flood events.

At catchment scale, diffuse and point sources of nutrients are ranked for hydrological conditions and their associated hydrological processes. During the dry period, which duration varies from 2 to 6 months, the riverbed falls almost dry, except in some sections where anthropogenic inputs contribute to feed the river. Downstream from the

inputs, nutrients and other pollutants are accumulated in the riverbed when there is no flow to flush them away. So bed sediments must be considered as a specific source of nutrient during floods. During the rainfall period, two kinds of floods are observed: - flash floods of less than 2-day duration. These floods present runoff coefficients lower than 3% and the peak discharge reaches 20 m3/s. Flow is essentially generated by surface runoff on urban zones. Rainfall contributes to about one third of total nitrogen loads, while the contribution of agricultural zones and domestic inputs are not significant for both nitrogen and phosphorus. - major floods of more than 2-week duration. These floods present a significant external contribution of the karstic springs and a maximum discharge of 25 m3/s. Two third of NO2+NO3 have here an agricultural origin and one third of total phosphorus and Kjeldahl nitrogen are due to anthropogenic inputs. For both kind of floods, the rest of NO2+NO3 loads comes from the karst and the rest of total phosphorus and Kjeldahl nitrogen comes from the riverbed nutrient pool.

Out of the flood periods, agricultural areas do not impact the water quality of the river. But during major flood events, NO2+NO3 are mainly brought by these areas. During recession periods, NO2+NO3 loads are mainly brought by the karstic springs that bring the main part of the discharge at the outlet. But the whole part of total phosphorus and Kjeldahl nitrogen are due to the sewage treatment works that only bring 10 % of the discharge at the outlet.