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Interactions between the hydrology and hydrochemistry of an intermittent southern Mediterranean River– Oued Fez (Morocco)

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Mediterranean catchments are often characterized by highly variable rainfall inputs and intermittent flows. In comparison to the existing knowledge on their hydrological behaviour, the interactions between flow conditions and pollution levels remain less documented. This study aims at filling that gap through a case study on Oued Fez (Morocco).

Oued Fez is an intermittent river located in central-eastern Morocco. It has a 615 km^2 catchment 10% of which corresponds to the city of Fez, the 3rd biggest in the kingdom (1.2 M inhabitants). Oued Fes is a tributary of the Sebou River, a major body of great economical importance used for irrigation and freshwater supply.

A coupled water quality-water quantity monitoring scheme has been implemented on Oued Fez since 2008. In addition to basic hydrological data, water quality samples are collected at regular intervals at 8 locations where discharge is simultaneously measured using an Acoustic Doppler Current Profiler (ADCP). Water samples are analysed for different forms of nitrogen (nitrates, nitrites, ammonium and total nitrogen) and phosphorus (soluble reactive phosphorus and total phosphorus) using a photospectrometer (Hach Lange DR 2800 VIS-photometer (Germany).

The results of the study indicate that, despite variations in annual rainfall, the catchment's hydrological response is controlled by the urban impervious zones during floods. The rural areas contribute mostly to baseflow during the wet period while non-treated anthropogenic inputs constitute most of the flow during the dry period. This in turn affects the water quality results. Indeed:

- during low flow conditions the pollution levels are very high and total nitrogen and total phosphorus concentrations reach 45 mg/l N and 6.5 mg/l P respectively at the most polluted sites.
- during average and high flow conditions the pollution levels decrease due to dilution. Total nitrogen and total phosphorus concentrations reach 32 mg/l N and 3.5 mg/l P respectively with minimum values lower than 20 mgN.L-1 and 2 mgP.L-1 during the flood of March 2010.

The hydrological conditions also impact the distribution of the relative part of the different forms of nitrogen (NH4 and Norg) which varies significantly in time and clearly evolves with temperature. The NH4/Norg ratios vary between 0.25 in winter and 2 in summer because of ammonification processes.

Despite of the variations in flow conditions, nitrogen and phosphorus fluxes remain quite stable at the sites directly influenced by waste water inputs (more than 500 kg/hour of nitrogen and 60 kg/hour of phosphorus). However, in low flow conditions, a significant fraction of the particulate forms of these pollutants is stored in the downstream riverbed sediments, and can be remobilized during high flow conditions.

The study highlights the importance of coupled monitoring schemes on intermittent rivers.