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Relathionship beteween hydrological conditions and Escherichia coli contamination in a karstic rural watershed

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Among aquatic environments, karst aquifers represent one of the most important freshwater resources supplying water of 25% of the global population and 40% of the French population. In karstic aquifers, anthropogenic pressure exerted on the watershed and hydrological conditions are linked with water's fecal bacterial contamination, mainly by Escherichia coli (E.coli). In order to assess the vulnerability of a rural karstic hydrosystem this study combine hydrogeology, and environmental microbiology to propose a hydrological indicator (Iv) suited to predict contamination by fecal bacteria (E.coli) of surface and groundwater.

We focused on a well-characterized chalk karstic hydrosystem (Norville, France) vulnerable to microbiological pollution, of the French national observatory network on karst (INSU/CNRS).
Temperature and hydrological time series (pluviometry, turbidity and electrical conductivity) over the past 5 years were analysed in order to correlate hydrological condition leading to run-off on the watershed and E.coli contamination of the hydrosystem. That would be used for determining periods more subject to soil bacteria leaching and input in the hydrosystem.

Twelve sampling campaigns of water and biofilms were carried out in different hydrological conditions, on the surficial watershed (i.e. the upstream part of the system) and at the spring (in water and biofilms) downstream. Finally, relationships between abundance and genetic diversity (phylogroup distribution) of E.coli population in the hydrosystem waters and the hydrological indicator (Iv) were investigated.

A hydrological indicator (Iv) based on the analysis of pluviometry, electrical conductivity, turbidity and temperature time series has been constructed to assess the vulnerability of such karstic hydrosystem to E.coli contamination according to hydrological conditions. Iv values up to 0.2 mm are correlated with E.coli concentration of 5,3$\pm$3,7 10^2 UFC/100mL at the sinkhole (surface water) and 1,1$\pm$2,3 10^2 UFC/100mL at the spring (groundwater). Moreover, genetic diversity of the E.coli population show that highest E.coli abundance was significantly correlated with highest abundance of B1 phylogroup indicating a bovine origin of the contamination.