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Groundwater circulation, connection between aquifers and relation with surface water in a karstified and faulted watershed: Constraint by Sr isotopes in the upper Sèvre-Niortaise basin (western France)

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The Sevre-Niortaise watershed, upstream of the Niort City and the Poitevine Marsh ("Green Venice", France) is under strong anthropogenic pressure, especially with diffuse pollution from agricultural activities, this watershed being representative of the problem of nitrate contamination on a large scale. This led to exemptions for the drinking water supply for many catchments. Nitrate concentrations can vary greatly over the yearly hydrological cycle, but following mechanisms that are still poorly understood, given the very complex structure in terms of hydrogeological and hydrological exchanges between groundwater and surface network. This results in a close relationship between the quality of the groundwaters and that of the rivers also used for drinking water supply. The specificity of this area also consists in a multilayer limestone aquifers mainly composed of the Infra-Toarcian and Dogger layers, partly karstified, and isolated by a pseudo-impermeable layer, the Toarcian marls, and crossed by numerous faults.

One of the objectives of the project, in addition to tracking the sources of nitrate contamination, consists in understanding of the watershed functioning in terms of (1) relations between aquifer layers all along the hydrological cycle, (2) relations between surface and groundwaters both spatially and temporarily. For that purpose, Sr isotopes (87Sr/86Sr) are used as a tracer of water-rock interaction and are studied together with major element chemistry and selected trace elements (Rb, Sr). Two spatial sampling campaigns were conducted in low and high flow periods (oct-2009 and march-2010) where 26 spring samples emerging from the two main aquifers (Dogger and Infra-Toarcian) were sampled, as well as the main river (Sèvre-Niortaise) draining the area. In addition to these snapshots, 6 representative springs and the river were monthly sampled over one hydrological cycle (13 months, from oct-2009 to oct-2010). In this study we present the Sr isotopic composition variation all along the hydrological cycle for each spring replaced in the general context of the studied area as defined by the two snapshots campaigns.