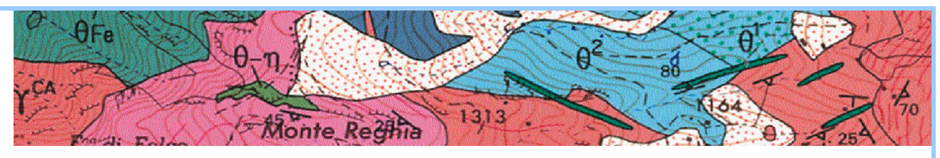

Géosciences pour une Terre durable

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$\delta^{18}O/\delta^{2}H$ and $^{87}Sr/^{86}Sr$ in supporting understanding a complex karstic system linked to surface water – The Loiret system, France

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Introduction

The Loiret River, begins at the Bouillon spring and end, 13 kms later, in the Loire River. This short river has a basin of 500 km and is of main interest for the residents enjoying the proximity to this crystalline river but facing drought, flood and algae invasion. The Loiret system is directly linked to the Loire River (Binet et al., 2017) and groundwater. The CENARI-O project, funded by the Center & Val de Loire Region, aimed at better understanding the surface water – groundwater relations for a better management of this fluvio-karstic system using multiple tools.

Method

Two sampling campaigns were implemented for chemical and isotopes at similar hydrological conditions, in 2020 and 2021 including the Loire River, the Loiret River at 9 sites, the two main local and regional aquifers, five of the main springs linked to the Loiret River. At the same time in situ measurements (conductivity, T°, pH, dissolved O_2) were taken from a boat along the 13kms of the Loiret River (Figure 1).

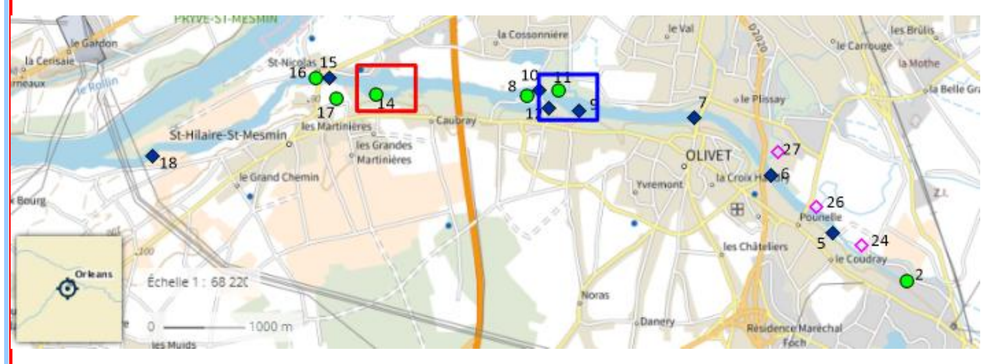

Fig.1 : Location of Loiret River and Springs sampling points

Results

The Loiret system is composed of different parts from the origin of the Loiret River (Bouillon spring 2 up to the confluence with the Loire River (18):

Bouillon (2): mixing of groundwater (4 and 3) and Loire River (1).
Form the Bouillon to upstream Loiret (5) : influence of one main affluent (Dhuy, not shown in fig.2)

From upstream Loiret (5) to first basin area (blue in fig. 1): increasing contribution of groundwater through various springs reflected by a clear decrease of the $\delta^{18}O$/ $\delta^{2}H$ and $^{87}Sr/^{86}Sr$.

First basin area : biotic and abiotic/physical processes (photosynthesis, evaporation) with an important impact on chemistry (calcium precipitation leading to a decrease of conductivity) and stable isotopes (evaporation).

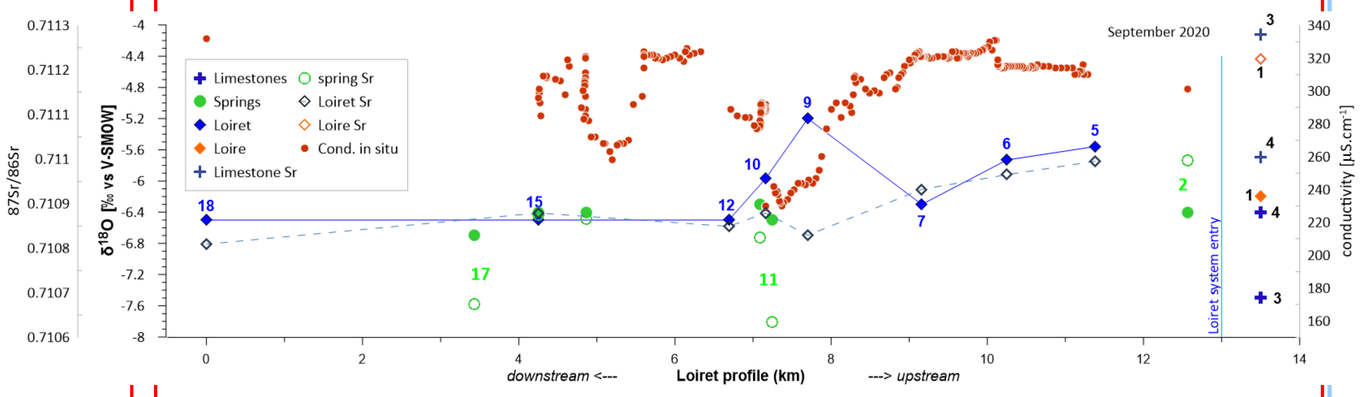

Fig.2: Evolution of $\delta^{18}O$ and conductivity along the Loiret River in Sep. 2020

Loiret downstream: Major contribution of groundwater. Similar biotic processes reflected in conductivity in the second basin area (red in fig.1).

The Loiret remained quite different than the deepest regional aquifer (4) confirming the important part of surface water influence in this area.

Two springs (17,11) have a different isotopic signal indicating other mixing or origin of groundwater.

Conclusions

The results of two sampling campaigns are demonstrating that even using various tools (pumping tests, chemistry, isotopes, artificial tracers, temperature,…) the Loiret system functioning is difficult to delimit due to a complex hydro(geo)logical functioning linked to short and long-term influence of surface water.

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