Secondment Report

INSPIRATION Innovative Training Network

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Work Package 2

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1. Introduction

General information:

- Start date: 8th of May 2017
- Accomplished: 28th of January 2019
- Total length (months): 3 months
- Host organization: The University of Liège, Belgium
- Topic of the secondment: Monitoring of N dynamics in agricultural catchments using stable isotope techniques.
- Topic of the PhD project**:** Integrative isotope techniques for quantifying nutrient fate and transport across agricultural landscapes.

The main objectives of the secondments were:

- designing the monitoring strategy for the selected study site
- performing one year monitoring programme in the selected study site including precipitation and surface water samples collection

This report summarizes the main activities performed during the secondment, including the design of monitoring strategy (chapter 2), precipitation monitoring (chapter 3.1), and surface water monitoring (chapter 3.2).

2. Field site and sampling design

The Geer River catchment has been selected as a field site for this study. The Geer River is 65km long, it is located in eastern Belgium and flows through three regions and two countries (Belgium, Netherlands). The catchment extends over 474 km^2 and it is mostly dominated by agriculture (65%), pasture (15%), urban (13%) and forests (7%) (Fig.1) (Hakoun et al. 2017).

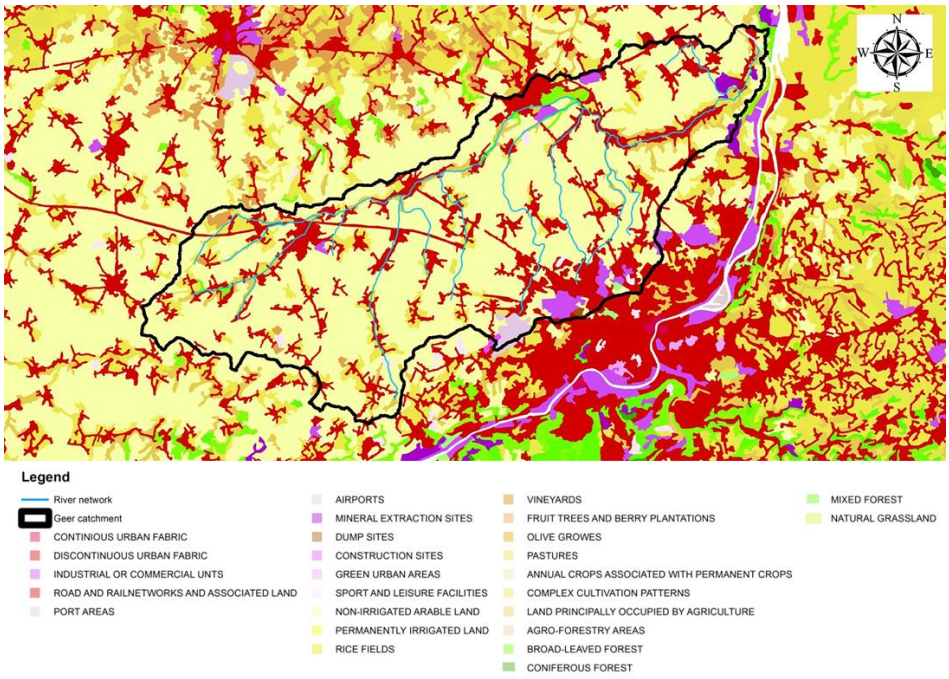

Fig.1. Land use in Geer catchment (EEA, Copenhagen, 2014)

The Geer River provides the water to the Liège and surroundings, where around 600 000 people live and the water consumption is about 30 million m3 per year (Brouyere et al. 2004). The topography is relatively flat, the altitude ranges between 80 m and 206 m (Batlle Aguilar et al. 2007).

The water quality of the Geer River is considered poor due to the excessive amounts of phosphates and nitrogen, which are still lower than the drinking water limit of 50 mg/L (Batlle Aguilar et al. 2007). In the 70s of the 20th century, the Geer River was declared 'dead' due to law biodiversity. Since that time, several restoration projects have run in order to improve the water quality, which is still far from the European standards (AQUADRA 2013).

With the help of The University of Liege monitoring strategy was designed for the Geer River catchment. Figure 2 shows the locations selected for precipitation and surface water monitoring.

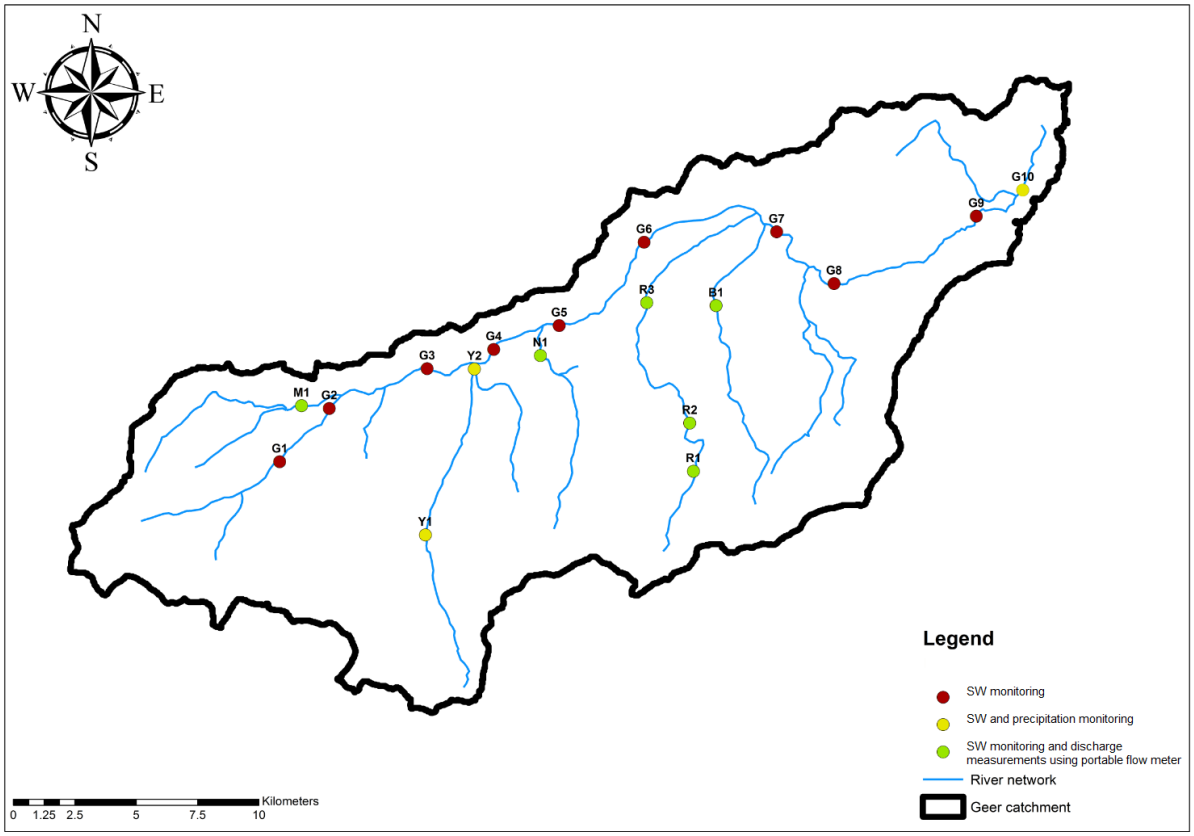

Figure 2 Monitored sampling locations in the Geer River catchment

Figure 3 Agricultural landscapes in the Geer River catchment

3. Field training

3.1. Precipitation monitoring

Major goals: Quantitative and qualitative precipitation monitoring. Determination of nitrate sources in the study catchment and their isotopic composition.

Main activities:

- selection of proper locations for precipitation monitoring
- assembly and disassembly of the rain gauges
- maintenance of the rain gauges
- usage and maintenance of data loggers for quantitative precipitation monitoring
- contact with owners of the properties on which the rain gauges were assembled

Instrumentation of the rain gauges:

- precipitation collectors (tube-dip-in-water collector type)
- data loggers (temperature, relative humidity, rain amount)
- rain collectors with tipping buckets (for the measurement of rain amount)
- solar radiation shield

Measured parameters:

- in-field measurements: rain amount, air temperature, relative humidity
- laboratory analysis of precipitation samples: stable isotopes of nitrate and water ($\delta^{15}N/NO_3^-$, $\delta^{18}O/NO_3^-$, $\delta^{2}H/H_2O$, and $\delta^{18}O/H_2O$), and major ions (depending on the precipitation amount)

Figure 4 Precipitation collector

Figure 5 Maintenance of the rain gauges

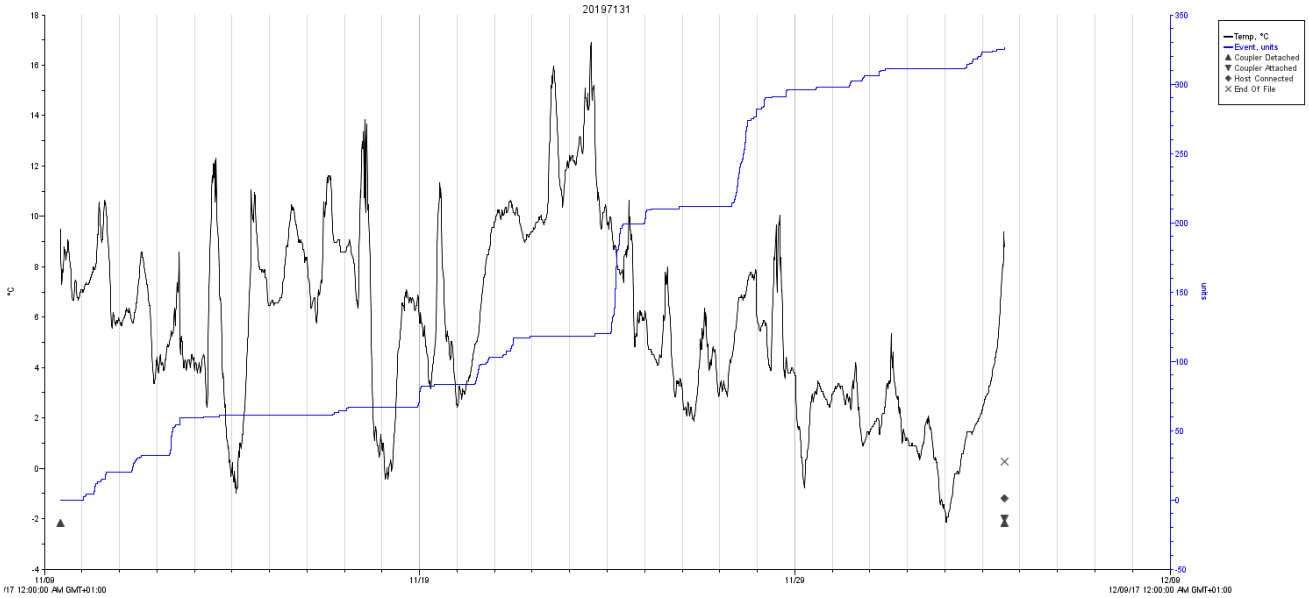

Figure 6 Plot with exemplary data obtained from the rain gauge

3.2. Surface water monitoring

Major goals: Quantitative and qualitative monitoring of surface water. Determination of nitrate sources in the study catchment and their isotopic composition.

Main activities:

- selection of proper locations for surface water monitoring
- long term and event-based monitoring
- surface water sample collection (grab samples, snap-shot sampling, in-field filtration)
- river discharge measurements (portable flow meter)
- measurement of basic physicochemical properties of water

Measured parameters:

- in-field measurements: pH, EC, Eh, T, DO, alkalinity
- laboratory analysis of surface water samples:
    - stable isotopes of $\delta^{34}S/SO_4^{2-}$, $\delta^{18}O/ SO_4^{2-}$, $\delta^{15}N/NO_3^-$, $\delta^{18}O/NO_3^-$, δ^2H/H_2O, and $\delta^{18}O/H_2O$, $\delta^{15}N/TNb$, $\delta^{15}N/NH_4^+$
    - concentrations of DOC, anions (Cl^-, NO_3^-, SO_4^{2-} , PO_4^{3-}), cations (Na^+, Mg^{2+}, Ca^{2+}, K^+, NH_4^+)

Figure 7 Discharge measurements conducted in close cooperation with The University of Liège

Figure 8 Taking notes (left) and water samples filtering (right) in an agricultural catchment

Figure 9 Field site was visited during different seasons and hydrological conditions, e.g. winter (left), drought in 2018 (middle), and autumn (right)

Figure 10 Field equipment: portable flow meter (right), and multi-meter for measurements of basic physicochemical parameters of water (left)

Figure 11 One of the minor lessons learned: how to fit all the equipment into one car

4. Summary

Overall, the secondment was a beneficial experience. The secondment was helpful for me to achieve the objectives of my project within the INSPIRATION ITN. I acquired additional meaningful data and relevant field insights on the studied catchment for my PhD research. Moreover, it provided me with new skills and collaborative opportunities.

5. References

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