Université de Neuchâtel
Centre d'hydrogéologie et géothermie

MSc in Hydrogeology and Geothermics
Thesis topic proposal 2023

HYDROGEOLOGICAL CONTROLS ON THE BIOGEOCHEMICAL FUNCTIONING OF AN ALPINE PEATLAND

Context and objectives

Alpine peatlands and organic soils are important ecosystems for the regulation of the global carbon cycle. They behave as major carbon sink reservoirs resulting from imbalance between intake from photosynthesis and release from organic matter decomposition. However, alpine peatlands are highly sensitive to the impact of changing climate. Specifically, changing in precipitation and evapotranspiration regimes may result in a decrease of the groundwater table in the peatland which in turn lead a release of carbon back to the atmosphere. Understanding the feedback mechanisms between groundwater dynamics and carbon fluxes in alpine peatlands remains a major challenge.

This Msc project aims at investigating these feedbacks on a unique alpine catchment observatory located on the Lasset catchment in the heart of the Massif du Saint-Barthélémy nature reserve (Pyrénées, France). The student will participate in leading field investigations to: 1) characterize the geometry of the peatland, the soil properties and its connection with basin scale groundwater fluxes; 2) define the origin of the waters involved in the different compartment (soil, bedrock, vegetation); and 3) evaluate the relationship between groundwater and CO2 fluxes. Ultimately, the student will draw a detailed conceptual model of the peatland to summarize the main hydrogeological and biochemical processes involved that will serve as bases for the development of a future numerical modelling experiment.

Methodology

The student will participate to a 3-weeks field mission during summer 2023 co-organized with the local team of Réserve Naturelle du Massif du Saint-Bathélémy. This mission will include: 1) detailed description of the soil types using standard pedological classification and laboratory analysis for carbon content and isotopes; 2) characterization of peatland depth and heterogeneity using geophysical investigations; 3) water sampling for stable isotopes, major chemistry, traces, dissolved inorganic and organic carbon as well as dissolved gases (including CO2, O2, He, and Ar); and 4) the measurement of CO2 fluxes across the peatland using air chamber system. In addition to the field investigations, the student will be trained in advanced laboratory technics for chemical analysis as well as to the processing of joint chemical and hydrological dataset. Future publication(s) with the MSc student as co-author are foreseen.

Supervision and collaboration

Supervision by Clément Roques, Daniel Hunkeler, Clémence Berguerand (UniNE) and Laurent Servière (Réserve Naturelle du St-Barthélémy, ANA-CEN)
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Figure 1: Overview picture of the investigation site where preferential groundwater seepage from the hillslope modifies locally the peatland ecosystem.