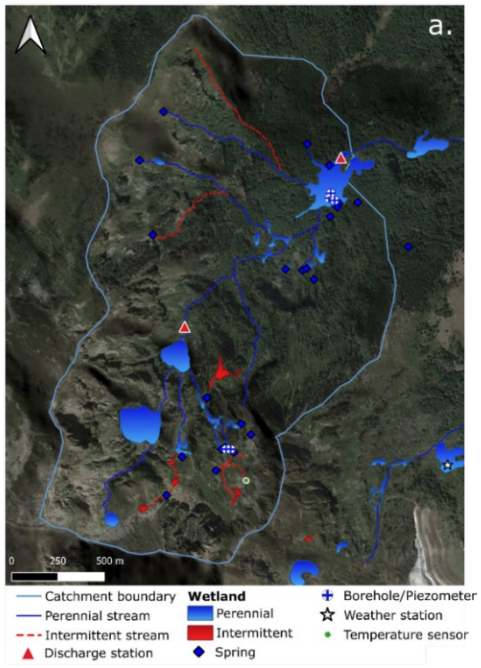
Université de Neuchâtel
Centre d'hydrogéologie et géothermie

MSc in Hydrogeology and Geothermics
Thesis topic proposal 2023

IMPACT OF CHANGING CLIMATE ON THE CONNECTIVITY AND RESILIENCE OF WETLANDS IN THE ALPINE CATCHMENT OF LASSET

Context and objectives



Alpine streams and wetlands are key ecosystems hosting rich biodiversity and playing a major role in the global water and solute cycle. However, they are among the most threatened ecosystems by climate change. Increasing frequency of winters with low snowpack and increasing duration of free-rain periods during summer are driving the sharp modification of alpine aquatic ecosystems. Besides increasing reports of their degradation, the mechanisms controlling the resilience of alpine aquatic ecosystems and their services to climate change remain poorly known. Deep groundwater flow and storage are important processes controlling the resilience of alpine ecosystems. However, their representation in catchment- to regional-scale hydrological models is currently overlooked, often limited to a simplified homogeneous and shallow layer with effective hydraulic properties.

This master project aims at exploring the role of geological heterogeneity in controlling groundwater-surface water interactions under changing climate. The research will be developed at 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 and be trained in advanced groundwater-surface water modelling. Specifically, the goals of this project are: a) mapping the main geological and geomorphological features to inform an existing groundwater flow model, b) analysing the different climate scenarios available for the area, c) predicting the evolution of wetlands connectivity and resilience under changing climate.

Methodology

The student will compile available geological information that will be further completed by specific in-situ investigations including: 1) geological, geomorphological and hydrological field mapping helped by drone-based high-resolution imagery technics, and, 2) surface electrical or seismic geophysical investigations. 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. The geological features will be integrated in a 3D model which will be used to calibrate the distribution of hydraulic properties. Finally, the student will test possible scenarios of future evolution of the wetland network using an existing Modflow model considering the last generation of climate scenarios (CMIP6), on previously validated geological models.

Supervision and collaboration

Supervision by Clément Roques, Ronan Abhervé, Philip Brunner (UniNE) and Laurent Servière (Réserve Naturelle du St-Barthélémy, ANA-CEN). Further information is available from Clément Roques, clement.roques@unine.ch