Université de Neuchâtel
Centre d'hydrogéologie
et géothermie

MSc in Hydrogeology and Geothermics

Thesis topic proposal 2024

Monitoring the active layer of rock glaciers using gravimetric surveys

Context and objectives

Rock glaciers are complex and threatened components of many alpine landscapes. Rock glaciers go through an annual cycle of thaw and freezing during which the active layer acts as a subsurface water reservoir and source. Measuring the thickness and melt dynamics of rock glaciers is challenging as direct measurement of ice thickness is often impossible. Non-invasive geophysical techniques have been successfully deployed to investigate the internal structure of rock glaciers, but there remains a lack of techniques for measurement of active layer depletion. Time-lapse gravimetry involves measurements of changes in the Earth's gravitational field caused by subsurface mass changes. The application of this approach to measure the loss of ice volume during the melt period is therefore highly novel and promising.

The project

This project will employ gravimetry to measure changes in subsurface ice volume at two active rock glaciers located in Grisons canton. The Canfinal rock glacier (Valposchiavo) and the well-documented Murtèl rock glacier (St-Moritz) will serve as our field sites. The student will be responsible for carrying out differential gravimetric surveys on these rock glaciers at the beginning and end of the snow-free period. He or she will analyse the gravimetric data alongside meteorological, hydrological, geodetic, and geomorphological data in order to understand seasonal variations in rock glacier interstitial ice mass. The student will develop models of early- and late-season ice extent to aid in data interpretation. Investigations at the Poschiavo site will benefit from recent and ongoing research and monitoring led by the CHYN, while those at the Murtèl rock glacier will be supported by previous published research. In order to obtain the required data for this project, field work in early Summer and Autumn 2024 is required.

Supervision and collaboration

The project will be supervised by Dr. Landon Halloran and Dr. Clément Roques in collaboration with PhD student Ronny Figueroa (CHYN) and colleagues at other universities in Switzerland. Collaboration with other MSc and PhD projects focusing on the Poschiavo site and/or on gravimetry is foreseen. Given satisfactory results, co-authorship of a journal article is possible.

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