Université de Neuchâtel
Centre d'hydrogéologie
et géothermie

MSc in Hydrogeology and Geothermics

Thesis topic proposal 2023

Gravimetry as a groundwater monitoring solution: Combining hydrological and gravimetric measurements to understand a pre-alpine alluvial aquifer (Project 2)

Context and objectives

Groundwater fluxes are generally the most uncertain quantities in hydrological models. Direct piezometric measurements give us information on the state of groundwater; however, the value of this information is often limited, especially when the hydraulic properties of the subsurface are very heterogeneous, such as in alpine and subalpine catchments.

Gravity is a fundamental physical force that can be used to measure changes in mass. The value of *g* is not constant across the Earth's surface and is not constant in time. By measuring these temporal changes in gravity, the method "time-lapse gravimetry" (TLG) can be applied to measure groundwater fluxes indirectly. Two big advantages of the method are that *a)* it is independent of subsurface hydraulic properties and *b)* it is sensitive to all changes in water storage. Gravimetry is a well-established technique, with relative accuracies on the order of a few parts per billion (~5 x 10^{-9} *g*); however, the use of time-lapse gravimetry to inform hydrogeological models is highly novel and still requires much research.

The project

Several MSc projects are available within the context of the SNSF-funded RADMOGG project.

In this project, we will investigate changes in groundwater storage in the Röthenbach catchment (Bern Canton) using traditional hydrological measurements combined with novel TLG measurements. We will install hydrological and meteorological monitoring equipment in the catchment and will also carry out regular single-day gravimetric surveys. We will analyse these data to understand correlations between variations in surface water, groundwater, and gravity. The data will be prepared for integration into numerical models within the broader RADMOGG project.

Further field work is possible at the secondary project site, the Vallon de Réchy (VS), in collaboration with Project 3.

Given satisfactory results, the publication of a journal article, co-authored by the student, is possible.

Supervision and collaboration

The project will be supervised by Dr. Landon Halloran in collaboration with PhD Student Nazanin Mohammadi. We will collaborate with partners at METAS and CREALP.

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