Université de Neuchâtel
Centre d'hydrogéologie et géothermie

MSc in Hydrogeology and Geothermics

Thesis topic proposal 2024

Hydrogravimetric monitoring of a pre-alpine alluvial aquifer system

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 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 carry out monthly single-day gravimetric surveys and regularly process data from existing surface and groundwater measurement installations. We will analyse these data to understand correlations between variations in surface water, groundwater, and gravity. The data will be integrated into models to constrain hydraulic properties and indirectly measure changes in groundwater storage.

Supervision and collaboration

The project will be supervised by Dr. Landon Halloran in collaboration with Nazanin Mohammadi (CHYN) and the rest of the RADMOGG team. The student will benefit from synergies with other relevant MSc and PhD projects. Given satisfactory results, eventual publication of a journal article, co-authored by the student, is possible.

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