Université de Neuchâtel
Centre d'hydrogéologie
et géothermie

MSc in Hydrogeology and Geothermics

Thesis topic proposal 2026

Electrical conductivity of karst springs

Context and objectives

Electrical conductivity (EC) is one of the most measured parameters. In karst environments it is a good indicator of the type of karst (salt/gypsum/limestone). In limestone karst, EC represents mostly calco-carbonate dissolution, which is strongly controlled by pCO_2 in soils covering the catchment area feeding the spring. Therefore, the elevation of the catchment area seems to be a strong controlling factor.

Using EC as an indicator of the elevation of the catchment area is surprisingly not usual in karst hydrogeology. The aim of the work is to assess how far this approach is liable and applicable in practice.

As EC varies depending of the flow conditions, a second objective of the study is to synthesize the range of observed variations and present models found in the literature. A good understanding of average values of EC is possible only if variations are understood at least to a certain degree.

Methodology

The objective of the master is to collect and analyze data from a wide range of karst springs with known catchment areas, and to establish how precisely EC measured at the spring is related to the elevation of the catchment area and/or to the characteristics of the soil and vegetation cover. Ideally data from 30 catchments would be welcome, but at least from 12. Most systems considered will be in Switzerland, but data from abroad could also be used for comparison.

Ideally, a comparison with stable isotopes (18O / 3H) would be welcome.

ISSKA can provide data from ~10 catchments and the candidate will have to look for further data, what should not be very difficult (from CHYN, papers and data repositories).

The student will have to develop a statistical approach for linking parameters of the catchment areas to EC measured at the spring, including a review of uncertainties. The main focus of the work is to test if characteristics of the catchment area can be derived from one or a few EC values, if yes, with what uncertainty.

An analysis of EC time-series is also expected first and mainly to assess the variance of values around the average, but possibly also in order to interpret the shape of the EC-variations.

Hydrochemical modelling (PhreeqC) and hydrogeological modelling could be used for the validation of some ideas.

This work should therefore link field work, data analysis and modelling.

Supervision and collaboration

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