Université de Neuchâtel
Centre d'hydrogéologie
et géothermie

MSc in Hydrogeology and Geothermics
Thesis topic proposal 2024

The effect of using different potential evaporation methods on the estimation recharge and groundwater levels

Context and objectives

A good understanding of groundwater system dynamics is of great importance to ensure the sustainable use of groundwater resources. To estimate how much groundwater can sustainably be used for human purposes, a good estimate of groundwater recharge is required. Time series analysis is a relatively new method to better understand groundwater dynamics and has recently been tested to obtain estimates of recharge (Collenteur et al., 2021) The recharge flux is often computed from precipitation and potential evaporation fluxes. Where the latter is typically measured using rain gauges, potential evaporation must be estimated from other meteorological variables. A wide variety of methods for potential evaporation exists, ranging from simple temperature-based methods to more complex methods with higher input data requirements.

The goal of this thesis work is to investigate the effect of using different methods to estimate potential evaporation on the estimation of groundwater recharge and the simulation of groundwater levels.

Methodology

The student will use different methods to estimate potential evaporation (PyEt, https://github.com/pyet-org/pyet/) and use this as input into time series models (Pastas, https://github.com/pastas/pastas) to estimate recharge and simulate groundwater levels. The results will be structurally analyzed to better understand the effect of using different input data on the output variables, similar to the study of Oudin et al. (2005). Depending on the progress, we will also investigate the added value of satellite-based evaporation estimates. The entire analysis will be performed in Python, and support for programming problems is available with the supervisors. The results of this study will be written in a report and presented to colleagues.

Supervision and collaboration

Supervision by Raoul Collenteur, Dr. (Eawag), Matevz Vremec Dr. (Uni Graz)

In collaboration with Mario Schirmer (Univ. Neuchâtel / Eawag).

Required knowledge: Hydrogeology, Python programming

References

Oudin, L., Hervieu, F., Michel, C., Perrin, C., Andréassian, V., Anctil, F., & Loumagne, C. (2005). Which potential evapotranspiration input for a lumped rainfall–runoff model?: Part 2—towards a simple and efficient potential evapotranspiration model for rainfall– runoff modelling. Journal of Hydrology, 303(1), 290–306.

Collenteur, R. A., Bakker, M., Klammler, G., and Birk, S.: Estimation of groundwater recharge from groundwater levels using nonlinear transfer function noise models and comparison to lysimeter data, Hydrol. Earth Syst. Sci., 25, 2931–2949.