Modelling pesticide distribution and transport in a karst aquifer in the Swiss Jura

Context and objectives

In Switzerland, approximately 18 % of drinking water is produced from karst aquifers. Besides the porous and fractured matrix, conduits are widely present in karst which leads to a heterogeneous aquifer structure. Pollutants such as agro-chemicals can be transported fast through preferential flow paths and hence break through at karstic springs during precipitation events. Due to the complexity, there is only limited knowledge on how pesticides are stored and transported through karst aquifers after their application. Therefore, based on previous measurements of temporally highly resolved time series of pesticide concentrations and additional physicochemical parameters at one site, a mechanistic multiple compartment model will be developed in order to deepen our understanding how pesticides are stored and transported in karst.

Methodology

The data set which will be used for this project was recorded mainly in 2021 and 2022 and comprises of time series of several pesticides, counts of bacteria, discharge, electrical conductivity, nitrate, pH, temperature, turbidity, precipitation and application data of pesticides. Moreover, land-use data for 2021, as well as geologic and soil data is available. For some physicochemical parameters, more data for previous years might be available upon request from cantonal authorities. In order to gain a thorough understanding and amend the data set already present, the project might include analyzing pore water concentrations of pesticides in soil samples from the catchment. Additionally, tracer tests might be necessary in order to identify further flow paths. Lumped-parameter models will be used to investigate how transport through soil, rock matrix and conduits, and reactive processes in these compartments, influence the pesticide dynamics.

Supervision and collaboration

The project will be carried out in collaboration with the cantonal environmental agency and the Swiss federal office of the environment that supports the project. In addition, the student might interact with farmers in the catchment to obtain soil and pore water samples. The project will be supervised by Daniel Hunkeler. Further, Johannes Schorr (Eawag, ETHZ) who generated the data set during his PhD project will be available for consultation on the data set or any other questions the student might have.

Contact : Daniel.Hunkeler, Daniel Hunkeler@unine.ch; Johannes Schorr, johannes.schorr@eawag.ch
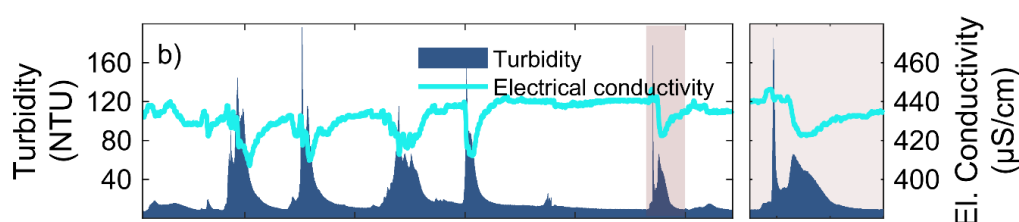

Figure 1: Time series of water quality parameters at the spring.