Master Theses in Engineering Geology/Hydrogeology, 2010
Supervisor: Eduard Hoehn, Eawag

Impacts of Climate Change and Contamination on Springs

The proposed master theses are in the **framework** of the activities of a working group "Climate Change and Ground Water" of the Swiss Hydrogeological Society (SGH) and the Swiss Federal Office of the Environment (BAFU). The working group plans to inform the authorities and the waterworks about a possible impact of climate change on ground water. The Swiss Federal Institute of Aquatic Science and Technology (Eawag) in cooperation with Geologisches Büro Dr. H. Jäckli AG (Dr. Peter Haldimann) is offering the following master theses in hydrogeology:

Regional warming, which has been proven to effect the temperatures of rivers and lakes, might also result under certain conditions in a rise of groundwater temperatures. A quantitative change in groundwater resources due to regional climate change is, however, probably difficult to assess. Karst springs and small springs may be among the first groundwater systems to respond. To this end, historical time-series data of the discharge rates of such springs and its long-term behavior (especially recessions segments and discharge fluctuations) can be analyzed. Given that karst springs and small springs are susceptible to contamination, a concomitant analysis of spring water temperatures and quality could yield further evidence on impacts of regional climate change.

The **goal** of these Master Theses is to analyze historical instrumental records on spring-water discharge rates, for a possible response to climate forcing and climate change. To detect trends and long-term fluctuations, data must cover a scale of decades. Time series and other statistical methods will be employed for this analysis in both the time domain and the frequency domain (e.g., trend analysis, cross-correlation functions). The statistical analysis can be made with the help of Eawag expertise, partly with MATLAB functions. Concomitant field work of this study includes mapping the catchment combined with water sampling for chemical analysis (analysis performed by professionals) and tracer analyses (e.g., $^{3}H/^{3}He$) at Eawag.

For these Master Theses, we have 3 options (choose one):

i) Two big alpine springs, Ursprung Spring near Stans/OW (captured for drinking water) and the Pertusio Spring near Olivone/TI (uncaptured). Of these springs, we dispose of historical data, which go back some decades. Some of the data will have to be digitized, most of it with software, to a machine-readable form.

ii) About 60 springs of Wasserversorgung Zürich of all discharge rates in alluvial gravels (Hochgelegene Schotter) near Menzingen. These springs have records that go back to 1900! Here we could study long-time changes.

iii) Some small springs located within the city limits of Zürich (Läufe-Quellen, Albisrieden) also have records back to 1900. Here we could study concomitant anthropogenic impacts.

Supervisors: Dr. Eduard Hoehn and Prof. Rolf Kipfer, both Eawag, and Dr. Peter Haldimann, Geologisches Büro Dr. H. Jäckli AG, Zürich
Further MSc Thesis Project Documents can be made available.

Abstract on homepage:

Impacts of Climate Change and Contamination on Springs

The **goal** of this Master Thesis is to analyze historical instrumental records on spring-water monitoring, for a possible response to climate forcing and climate change. Historical data may go back some decades. Springs will be studied, whose data will partly have to be digitized. Time series analyses and other statistical methods will be employed in both the time domain and the frequency domain, to yield insight into the discharge behavior of an individual spring. The statistical analysis can be made with the help of Eawag expertise, mainly with MATLAB functions. The springs are expected to be contaminated, therefore, concentration time series give additional information about the flow system. Mapping the catchment combined with tracer analyses (e.g., $^{3}H/^{3}He$) as well as water chemical analyses (analyses performed by professionals) at Eawag will complement the study with field work.