Coupled Ecological, Hydrological and Social Dynamics in Restored and Channelized Corridors of a River at the Catchment Scale

RECORD CATCHMENT

River restoration in the context of climate and global change

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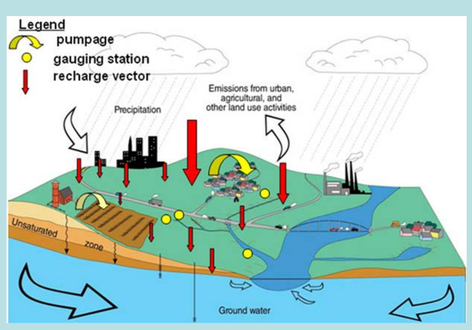
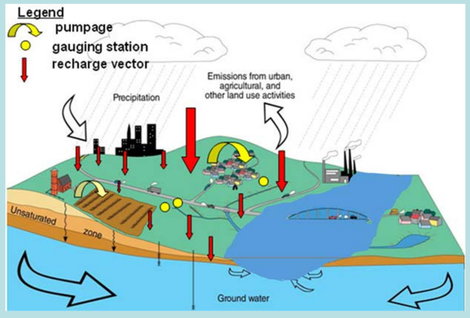
- The aim of the multidisciplinary **RECORD Catchment** project is to comprehensively investigate what measures are most effective to influence the river corridor. With this information, **river restoration** and groundwater flow systems can be designed to **help mitigate the effects of floods and droughts**, in the context of climate and global change. We develop indicators on how the measures will affect different functions of groundwater (water use, sustainable eco-/agricultural systems, flood mitigation) and, more generally, how groundwater flow systems modify the response of catchments to **climate change**.
- The study is centered on the **Thur catchment (NE Switzerland)**. The study sites include high altitude groundwater flow systems that play an integral role for **drinking water supply** and groundwater flow systems in **alluvial plains**.
- We focus on the more natural **flood-dependent groundwater recharge in restored river reaches** within the Thur catchment in comparison to channelized sections. Special attention will be given to the behavior of the physical and biogeochemical state of the interface between the river bed and the aquifer, as well as on **interactions between the soil moisture and groundwater storages**. The results of the studies will be generalized by developing a method for assessing the **vulnerability of groundwater flow systems** to climate change.

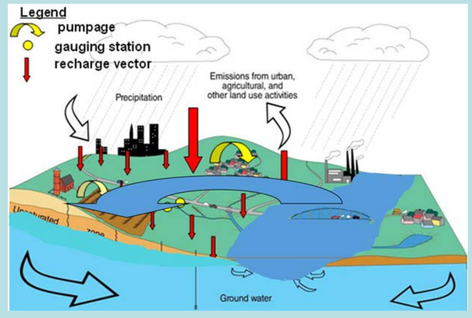
A way of dampen dry periods?



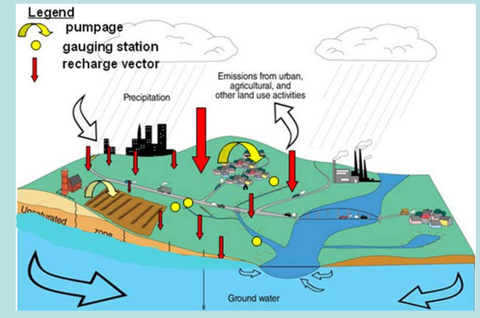
Situation A at t_1: „Normal" discharge



Situation B at t_2: Flood event

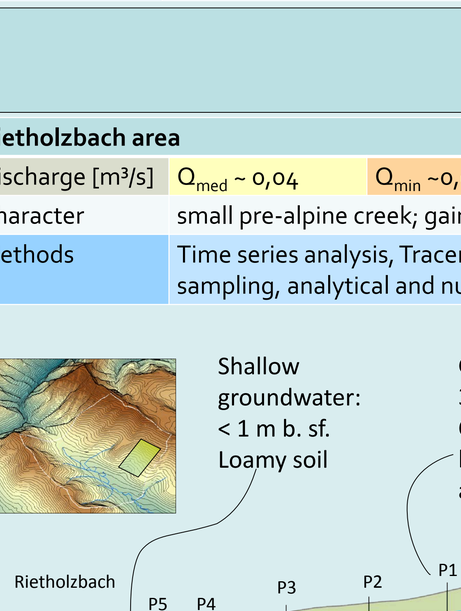


Situation C at t_3: Infiltration of river water and dampen of the flood wave

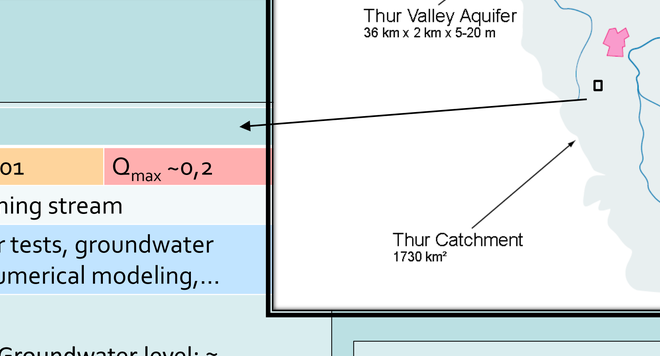


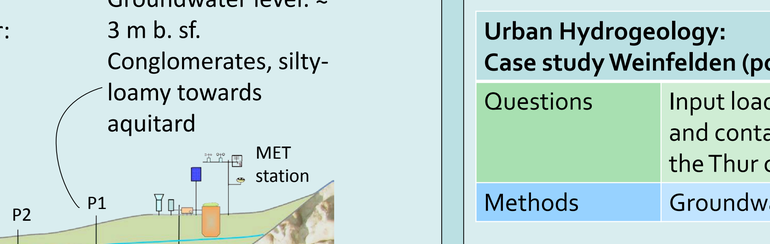
Situation D at t_4: „Normal" Discharge, artificially recharged groundwater exfiltrates to the river

The RECORD Catchment project comprises **local-scale studies at the current RECORD** (RECORD – Restored Corridor Dynamics) **field sites** Niederneunforn / Altikon and Widen as well as the pre-alpine Rietholzbach catchment. These local-scale sites serve as **long-term natural hydrological, atmospheric and ecological observatories** to study water fluxes, ecological and biogeochemical interactions within the context of climate change. Furthermore, the RECORD Catchment project **investigates the larger scale influence of processes on the local scale and vice versa**.



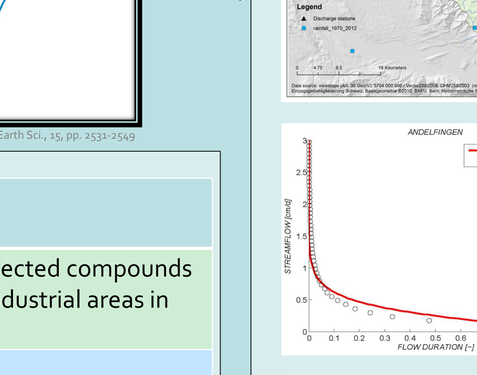
Picture: BHAteam, Frauenfeld

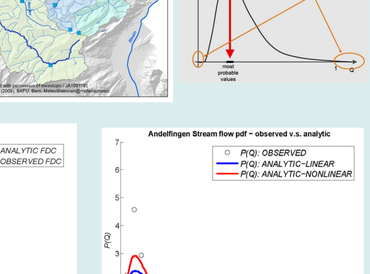


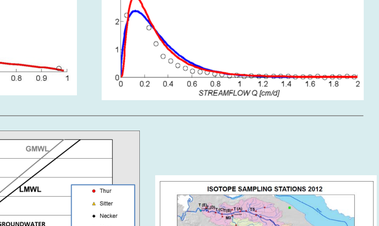


S. Diem et al. (2013), submitted

Widen / Felben-Wellhausen	
Discharge	like Niederneunforn / Altikon
Character	Channelized Thur section with pumping station; losing stream
Methods	Time series analysis, DTS, Tracer tests, groundwater sampling,…

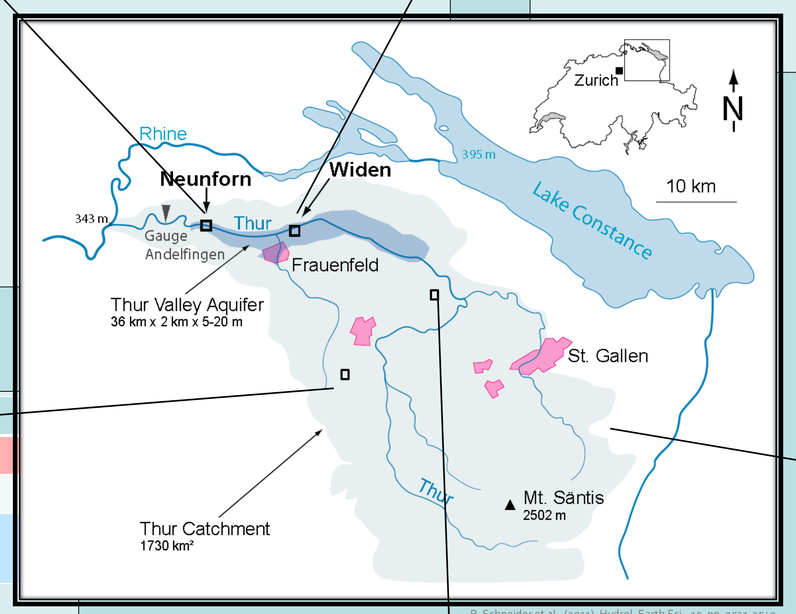






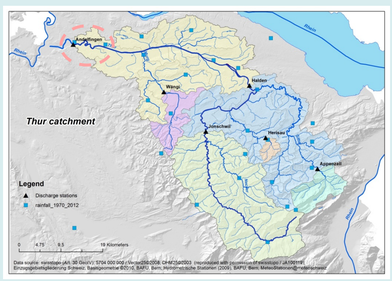
Figures from O. A. Cirpka et al. (2007, Ground Water 45, no. 3, pp. 318-328

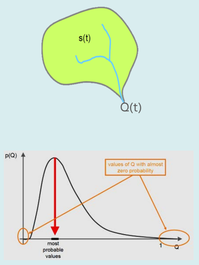
Niederneunforn / Altikon			
Discharge [m³/s]	Q_{med} ~ 53	Q_{min} ~3	Q_{max} ~1100
Character	One restored, one channelized Thur section with pumping station; losing stream		
Methods	Analytical modeling, numerical flow and transport modeling, time series analysis, Distributed Temperature Sensing (DTS), groundwater sampling,…		

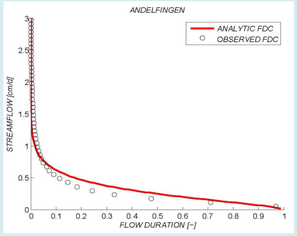


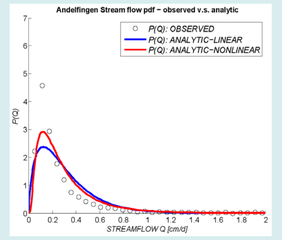
P. Schneider et al.. (2011), Hydrol. Earth Sci., 15, pp. 2531-2549

Entire catchment	
Methods	Stochastic modeling, isotopic hydrogeology, groundwater sampling,…





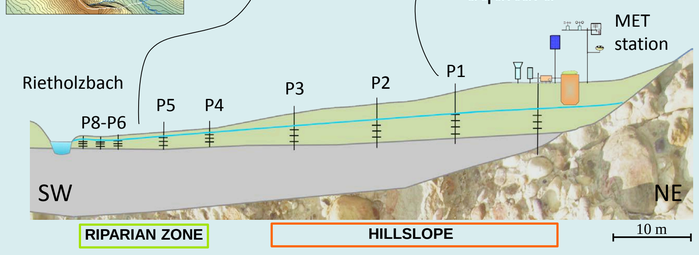


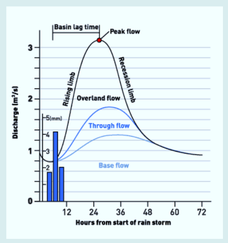


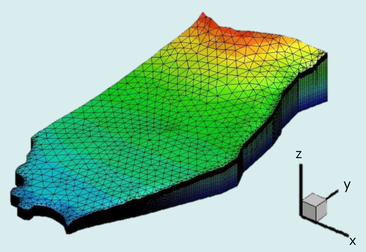
Rietholzbach area			
Discharge [m³/s]	Q_{med} ~ 0,04	Q_{min} ~0,01	Q_{max} ~0,2
Character	small pre-alpine creek; gaining stream		
Methods	Time series analysis, Tracer tests, groundwater sampling, analytical and numerical modeling,…		

Shallow groundwater: < 1 m b. sf. Loamy soil

Groundwater level: ≈ 3 m b. sf. Conglomerates, silty-loamy towards aquitard

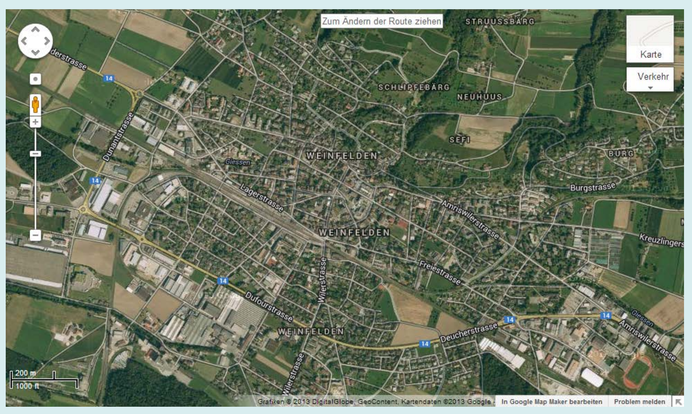


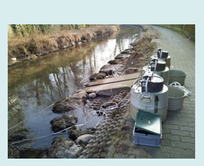


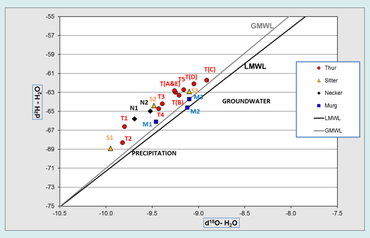


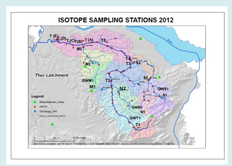
Jana von Freyberg, Mehdi Ghasemizade

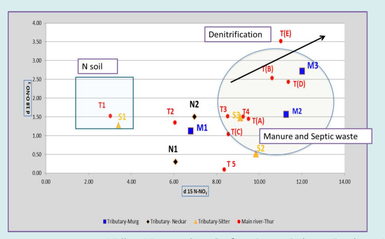
Urban Hydrogeology: Case study Weinfelden (population ~10.000)	
Questions	Input load of urban areas for selected compounds and contaminants? Impact of industrial areas in the Thur catchment?
Methods	Groundwater sampling, GIS,…











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Key Collaborators: Swiss Federal Institute of Aquatic Science and Technology (Eawag); Swiss Federal Institute of Technology Zurich (ETHZ); Swiss Federal Institute of Forest, Snow, and Landscape Research (WSL); École Polytechnique Fédéral de Lausanne (EPFL). **PARTNERS**: Agency for the Environment (AfU), Canton Thurgau; Office of Waste, Water, Energy and Air (AWEL), Canton Zürich; Swiss Federal Office for the Environment (FOEN). **FUNDING:** Environment and Sustainability Competence Centre (CCES) of the Swiss Federal Institute of Technology (ETH); Swiss National Science Foundation; European Commission (Marie Curie Initial Training Network - ADVOCATE)

Eawag: Swiss Federal Institute of Aquatic Science and Technology