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CHARACTERIZATION OF RIVER AND CREEK INFILTRATION | ESTIMATING TRAVEL TIMES BY MEANS OF TIME SERIES ANALYSIS OF NATURAL TRACERS

PRODUCTS

In alluvial aquifers, drinking water wells are often located close to rivers leading to significant fractions of river infiltrate in pumped groundwater. In terms of drinking water protection, the fraction of freshly infiltrated river water and its travel time are important parameters influencing water quality. A good understanding of river-groundwater interactions is of particular importance for the realization of hydraulic engineering measures, such as river restoration.

Electrical conductivity can be used as a natural tracer for the characterization of river infiltration, provided the existence of natural fluctuations in the river (e.g. induced by floods or seasonal trends) that propagate into groundwater by infiltration. Analyzing time series of electrical conductivity by means of innovative methods (e.g. deconvolution) allows for the reconstruction of the breakthrough curve of river water, and hence for the determination of the travel time distribution of infiltrated river water and its fraction in groundwater.

YOUR ADVANTAGES

Compared to conventional tracer tests, the characterization of river infiltration based on natural tracers provides significant advantages:

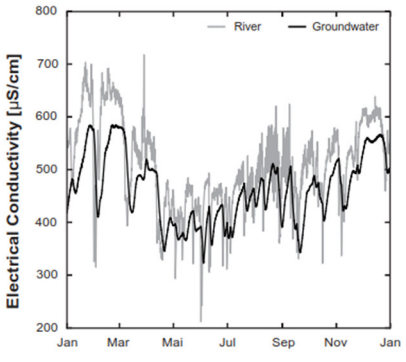
- Data collection is simple and cost-efficient.
- Travel times and fractions of river infiltrate are derived from longer periods covering multiple hydrologic conditions.

Time series analysis of electrical conductivity is, for example, being applied to the following problems:

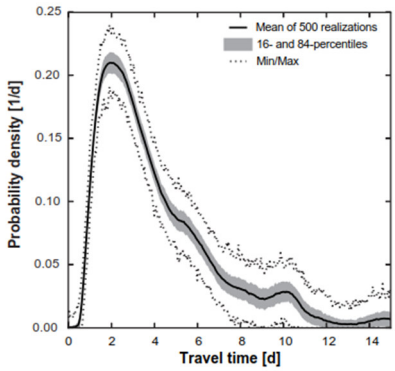
- Planning of new drinking water wells in the vicinity of rivers, dimensioning of protection zones
- Assessment of the conditions at existing drinking water wells with regard to renewing or increasing the concession
- Evaluation of river-groundwater interactions in the framework of hydraulic engineering measures in the river corridor (river restoration, construction of hydropower stations)

OUR SERVICES

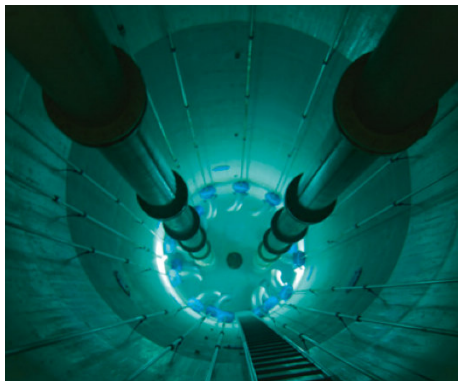
- Elaboration of a measurement concept, tailor-made to the requirements of the project and taking into account the hydrogeological conditions:
  - > Selection of observation wells
  - > Specification of the parameters to be recorded with sampling frequency and measurement period
- Data acquisition with online data transfer
- Determination of travel times and fractions of infiltrated river water by using a software-toolbox, specifically developed for this purpose. Besides different analysis methods, the toolbox incorporates a broad range of algorithms for data preprocessing, therefore allowing for an efficient analysis procedure, tailored to the data quality and characteristics.
- Appraisal of the results within the hydrogeological context and formulation of measures and recommendations for the present project.



Time series of electrical conductivity in a river (grey) and in groundwater (black)



Reconstructed breakthrough curve by means of deconvolution (Swiss Geoscience Meeting 2015)



Drinking water well in the Töss Valley in vicinity of the river (Source: Stadtwerk Winterthur)