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Finding an optimal strategy for measuring the quality of groundwater as a source for drinking water

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A good chemical and microbiological water quality is of great importance in riverbank filtration systems that are used as public water supplies. Water quality is ideally monitored frequently at the drinking water well using a steady pumping rate. Monitoring source water (like groundwater) however, can be more challenging. First of all, piezometers should be drilled in the correct layer of the aquifer. Secondly, the sampling design should include all preferred parameters (microbiological and chemical parameters) and should also take the hydrological conditions into account. In this study, we made use of different geophysical techniques (ERT and FDEM) to select the optimal placement of the piezometers. We also designed a sampling strategy which can be used to sample fecal indicators, biostability parameters, standard chemical parameters and a wide range of micropollutants.

Several time series experiments were carried out in the study site Porous GroundWater Aquifer (PGWA) – an urban floodplain extending on the left bank of the river Danube downstream of the City of Vienna, Austria. The upper layer of the PGWA consist of silt and has a thickness from 1 to 6 meter. The underlying confined aquifer consists of sand and gravel and has a thickness of in between 3 and 15 meter. Hydraulic conductivities range from 5 x 10-2 m/s up to 5 x 10-5 m/s. Underneath the aquifer are alternating sand and clay/silt layers.

As fecal markers Escherichia coli, enterococci and aerobic spores were measured. Biostability was measured using leucine incorporation. Additionally, several micropollutants and standard chemical parameters were measured.

Results showed that physical and chemical parameters stayed stable in all monitoring wells during extended purging. A similar trend could be observed for E coli and enterococci. In the wells close to the river, aerobic spores and leucine incorporation decreased after 30 min. of pumping, whereas the well close to the backwater showed a different pattern.

Overall, purging for 45 minutes was the optimal sampling procedure for the microbiological parameters. Samples for the detection of micropollutants were taken after 15 min. purging.