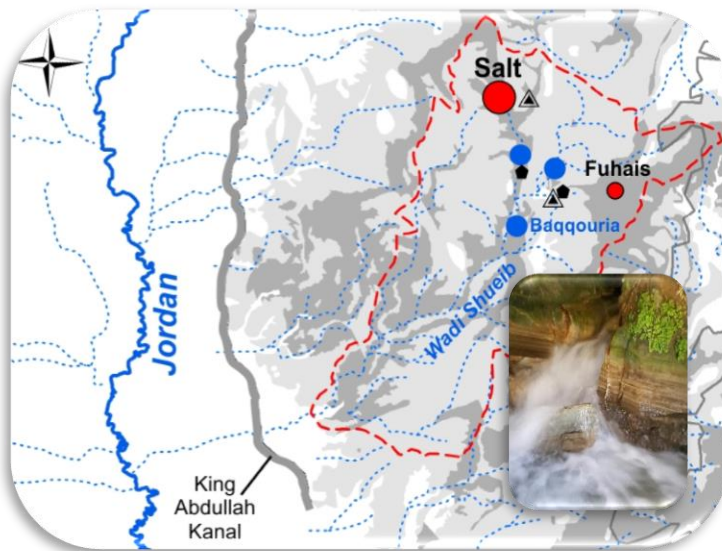


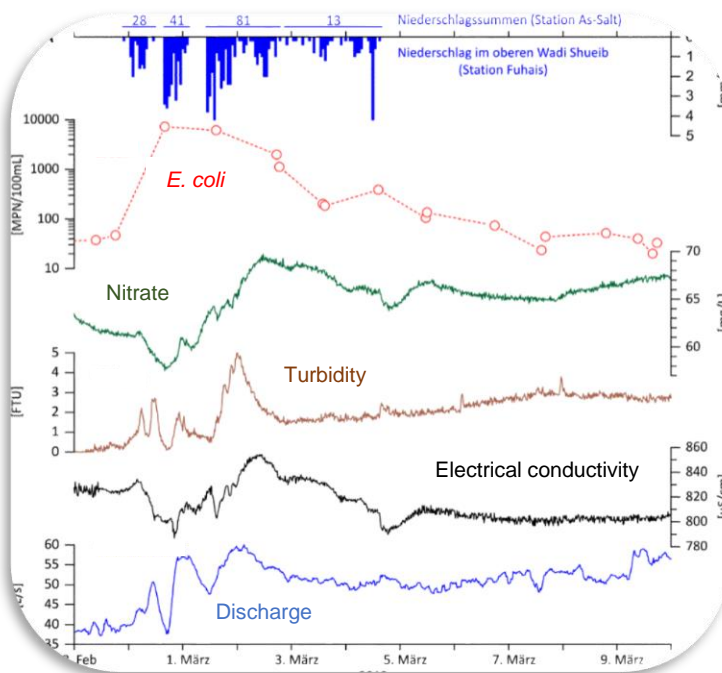
# Early Warning System for spring water contamination



A considerable share of the water supply in the Jordan Valley region relies on groundwater captured from wells and spring discharge. Major supply challenges of this semi-arid region are the intermittent and highly variable water availability. Moreover, leaky sewer systems lead to frequent fecal contamination in groundwater.



In Jordan, about 20 km west of Amman, Wadi Shueib was chosen as an intensive measurement test site to develop an online hydrometric monitoring network. By those measurements, water quality parameters of karst springs and other components of the local water cycle are made available in a high time resolution. Amongst others, state-of-the-art optical measurement methods are used, which comprise the first steps in the development of an early warning system.



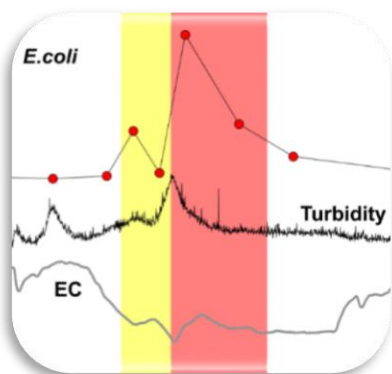
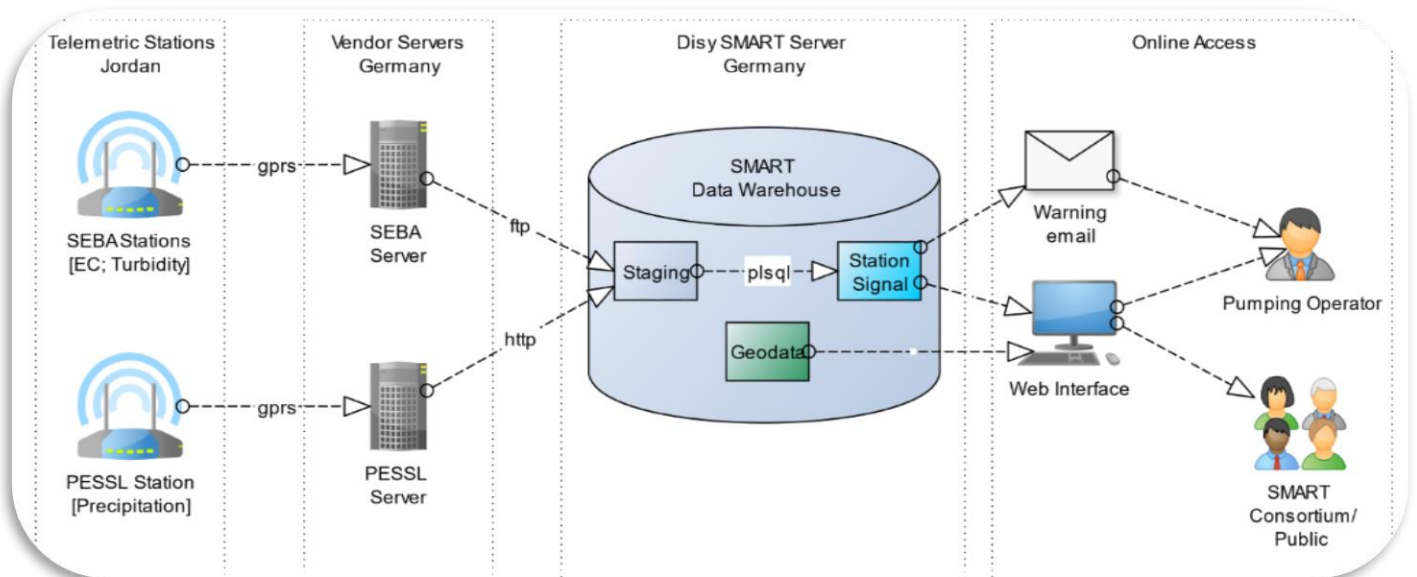
In the Wadi Shueib Catchment time series correlation analyses showed that infiltrated rain water transfers the fecal contamination in groundwater karst system quickly to the springs. This mechanism threatens the local water supply. Unfortunately, it was not feasible to monitor *E. coli* bacteria continuously by an automated measuring station. To establish a preventive protection, a parameter combination, which could indicate bacterial contamination, was developed.



# Early Warning System for spring water contamination



The measurement data of the monitoring stations are transferred online to a database. Based on the hydrological monitoring data, automated combined signal analyzes are performed. A database algorithm calculates continuously the risk potential in near real time and warns about the risk of contamination for spring water quality. The system sends a warning via email in case a large rain event occurs in combination with turbidity or electrical conductivity in a specific time sequence at a spring station. Thus, affected drinking water suppliers can be informed about a high microbial contamination risk.



Indeed, an empirical relationship between major rain events and subsequent bacterial contamination was identified. Adding the parameters electrical conductivity and turbidity into this analysis, results in a more robust correlation. This forms the basis of our early warning system (EWS).

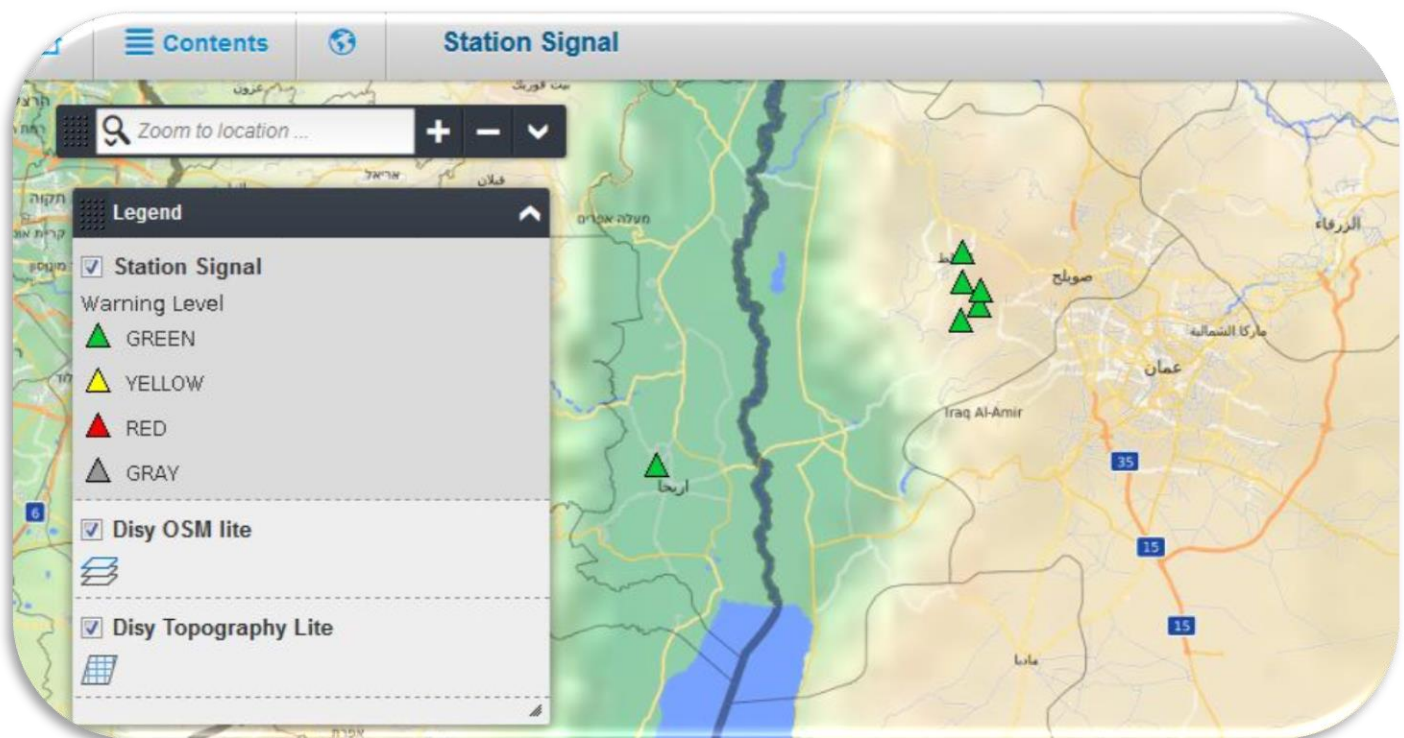
After a successful testing period in Wadi Shueib, a similar set-up was also implemented at Sultan Spring in Jericho (West Bank), which serves as the only water supply source of the city.



# Early Warning System for spring water contamination



The measurement data of the monitoring stations is accessible in an online portal every hour. All users of the online portal can search, analyse, and visualize the current and historical data and diagrams. Additionally the online portal provides various background geodata for the project region.



In November 2016 a technical training with employees of Jordanian and Palestinian water authorities and water suppliers on high-resolution monitoring and the functionality of the EWS was held.

