



MONITORING OF WATER QUALITY CHANGES DUE TO RISING TEMPERATURES DURING PRODUCTION, STORAGE AND DISTRIBUTION

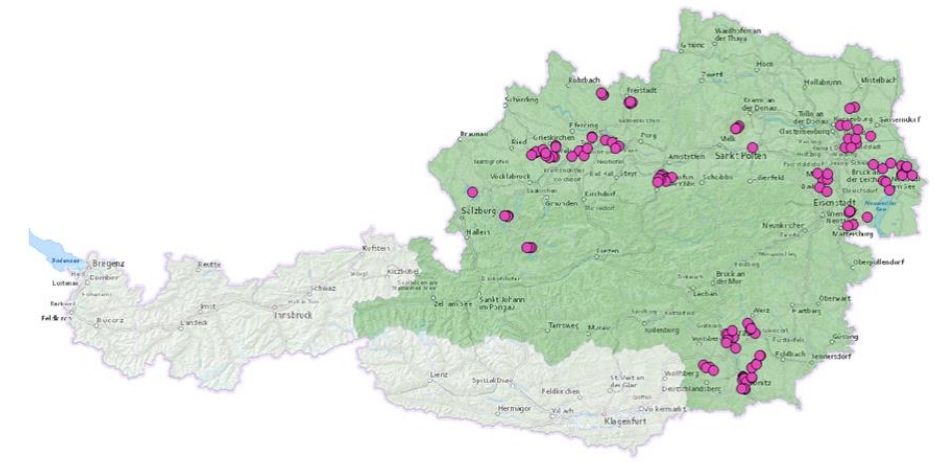
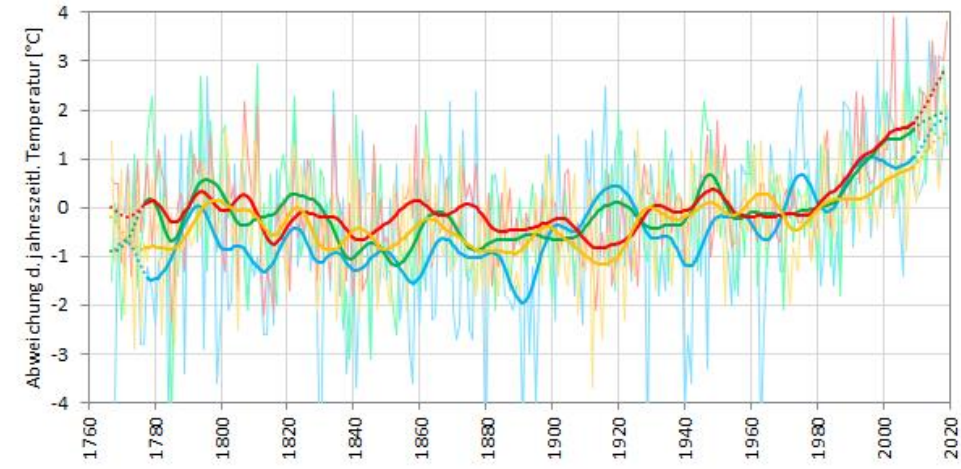
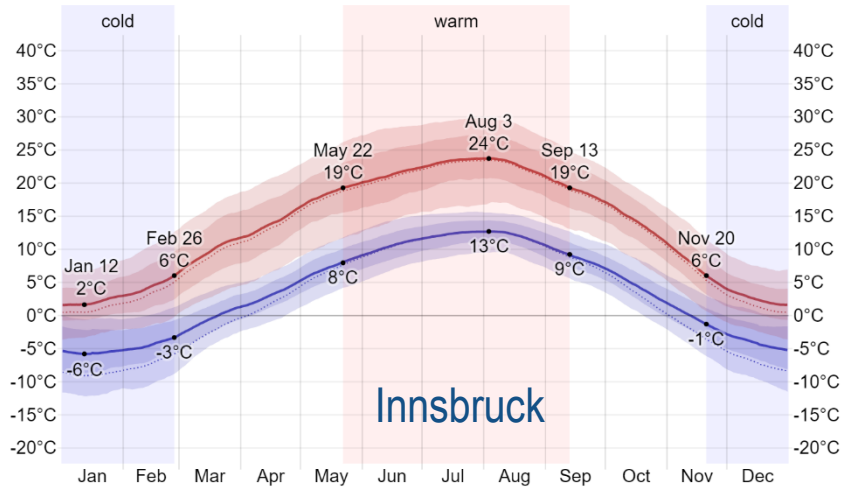
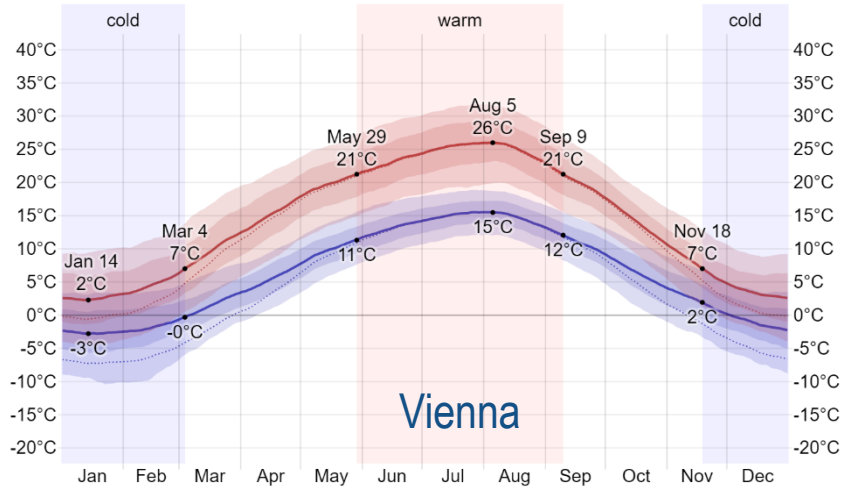
P. Proksch, C. Schönher, C. Wagner

COMPANY HISTORY

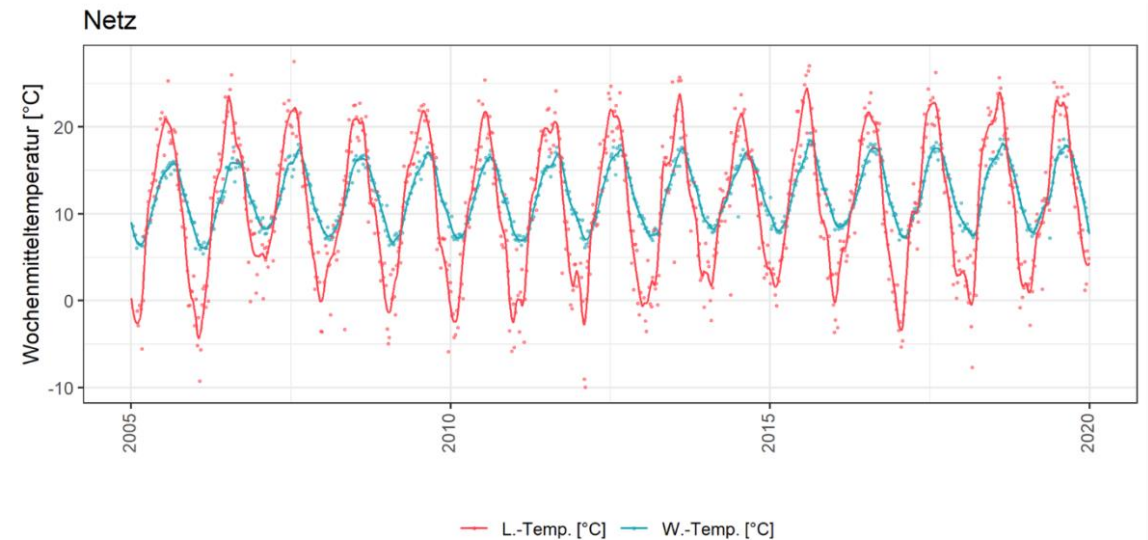
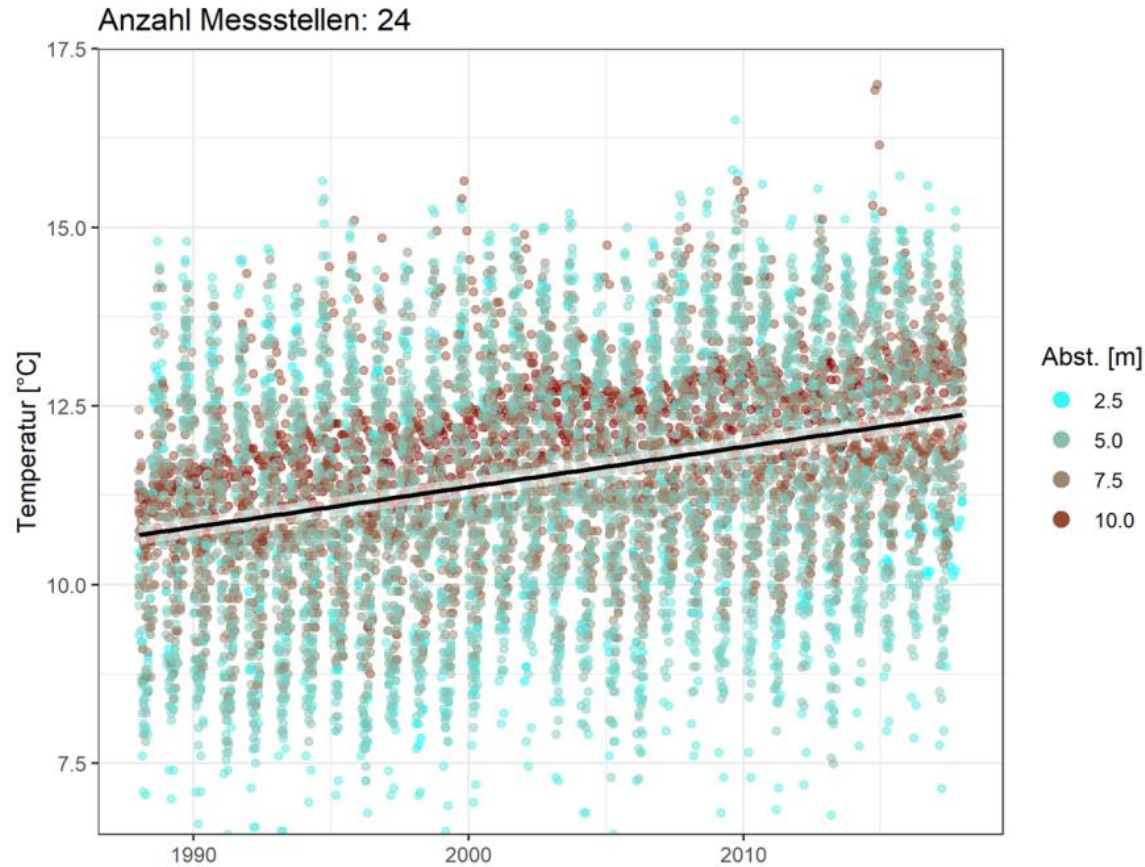
- Founded in 1999, University Spin-Off from the University of Natural Resources and Applied Life Sciences
- Owned by Badger Meter, Inc. since Nov. 2020
- Headquarters in Vienna, Austria
- 4 Subsidiaries in USA, Mexico, Spain, France
Offices in India, China, Italy, and Portugal.
- 45 Sales partners globally
- We unite R&D, manufacturing, sales, and services
- 75 staff globally, 10 in R&D



THE LOCAL TEMPERATURES



WATER TEMPERATURE SURVEY



[1] Auswirkungen von erhöhten Wassertemperaturen bei der Trinkwassergewinnung, -speicherung und -verteilung
DI Christoph Schönher, DI Philipp Proksch, DI David J. Kerschbaumer, DI Christina Fiedler, DI Dr. Marija Zunabovic-Pichler,
DI Ernest Mayr and PD DI Dr. Reinhard Perfler, October 2021

USED MONITORING EQUIPMENT

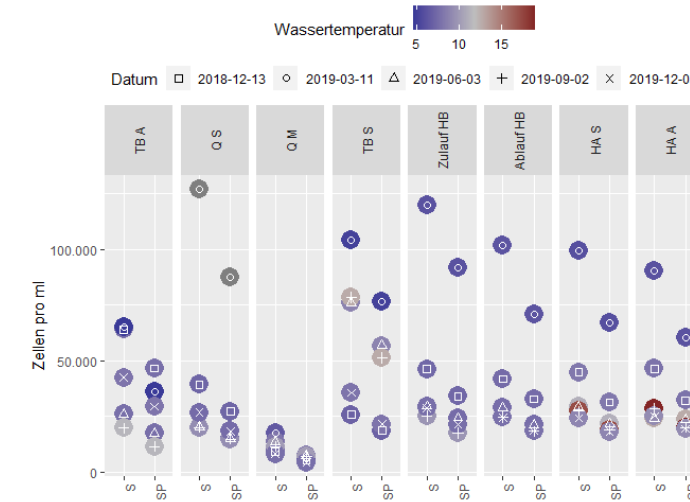
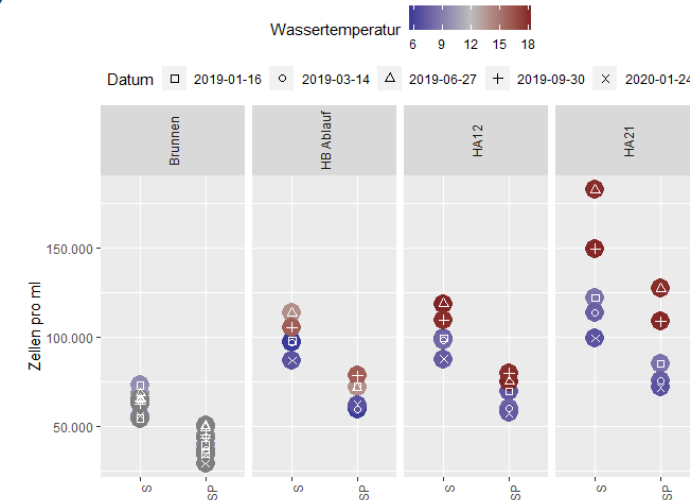
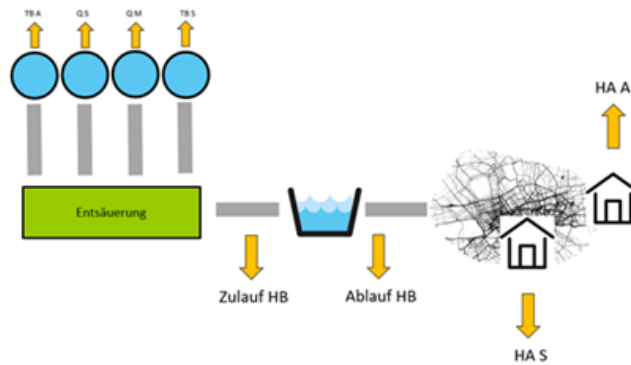
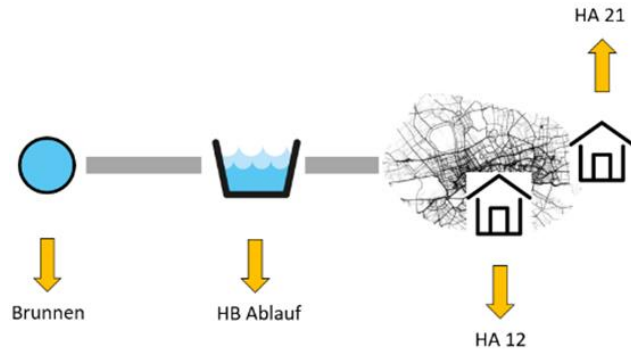


pipe::scan

- TOC
- DOC
- UV254
- Turbidity
- Color
- Chlorine
- pH or Redox
- Conductivity
- Temperature
- Pressure

Measurement under pipe pressure - No non-revenue water

CELL COUNT MEASUREMENTS

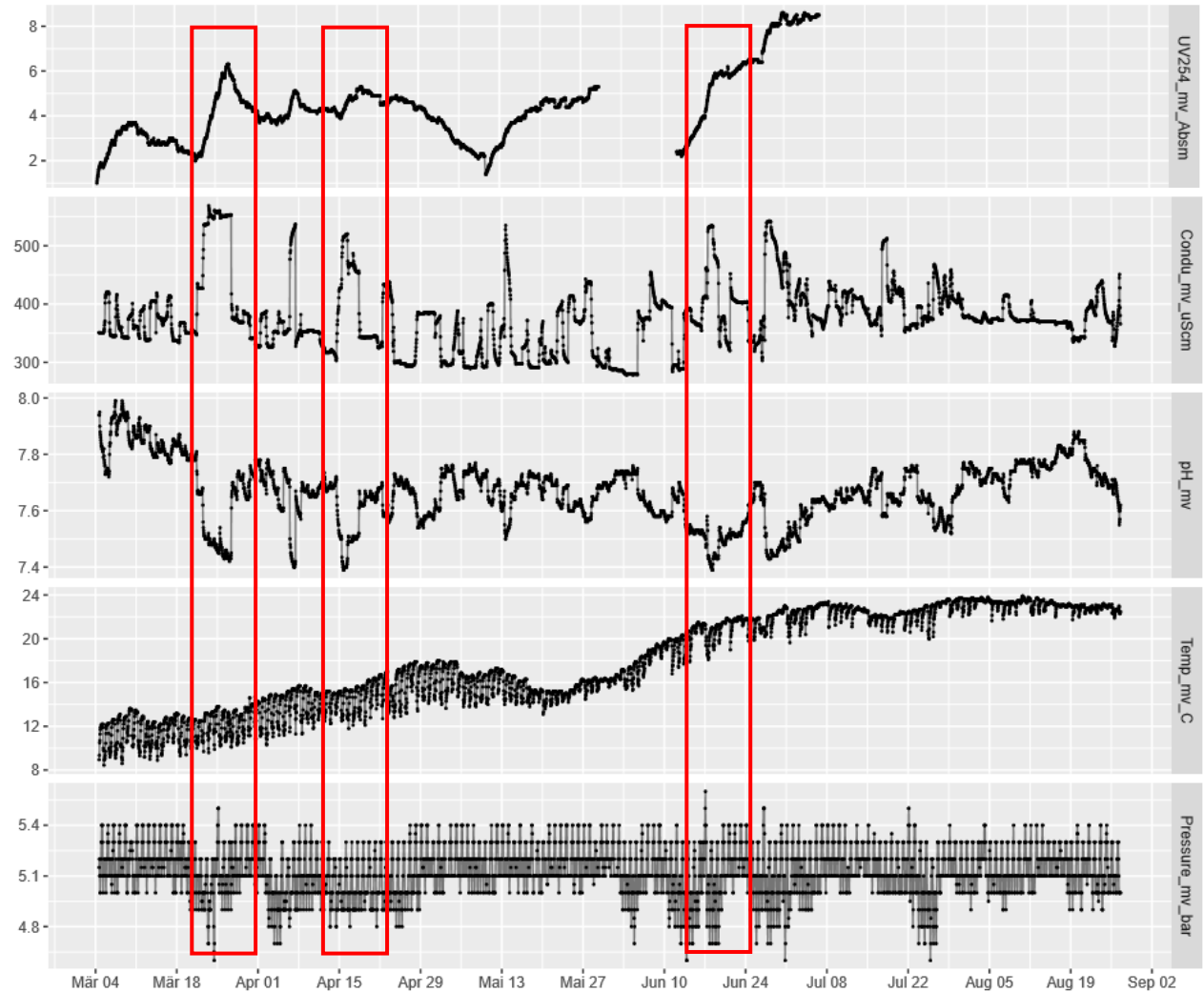


[1] Auswirkungen von erhöhten Wassertemperaturen bei der Trinkwassergewinnung, -speicherung und -verteilung
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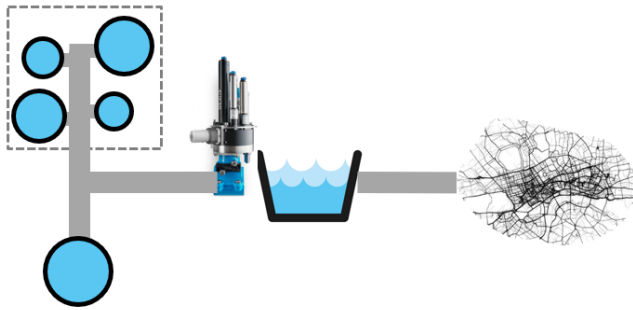
INSTALLATION SITE 1



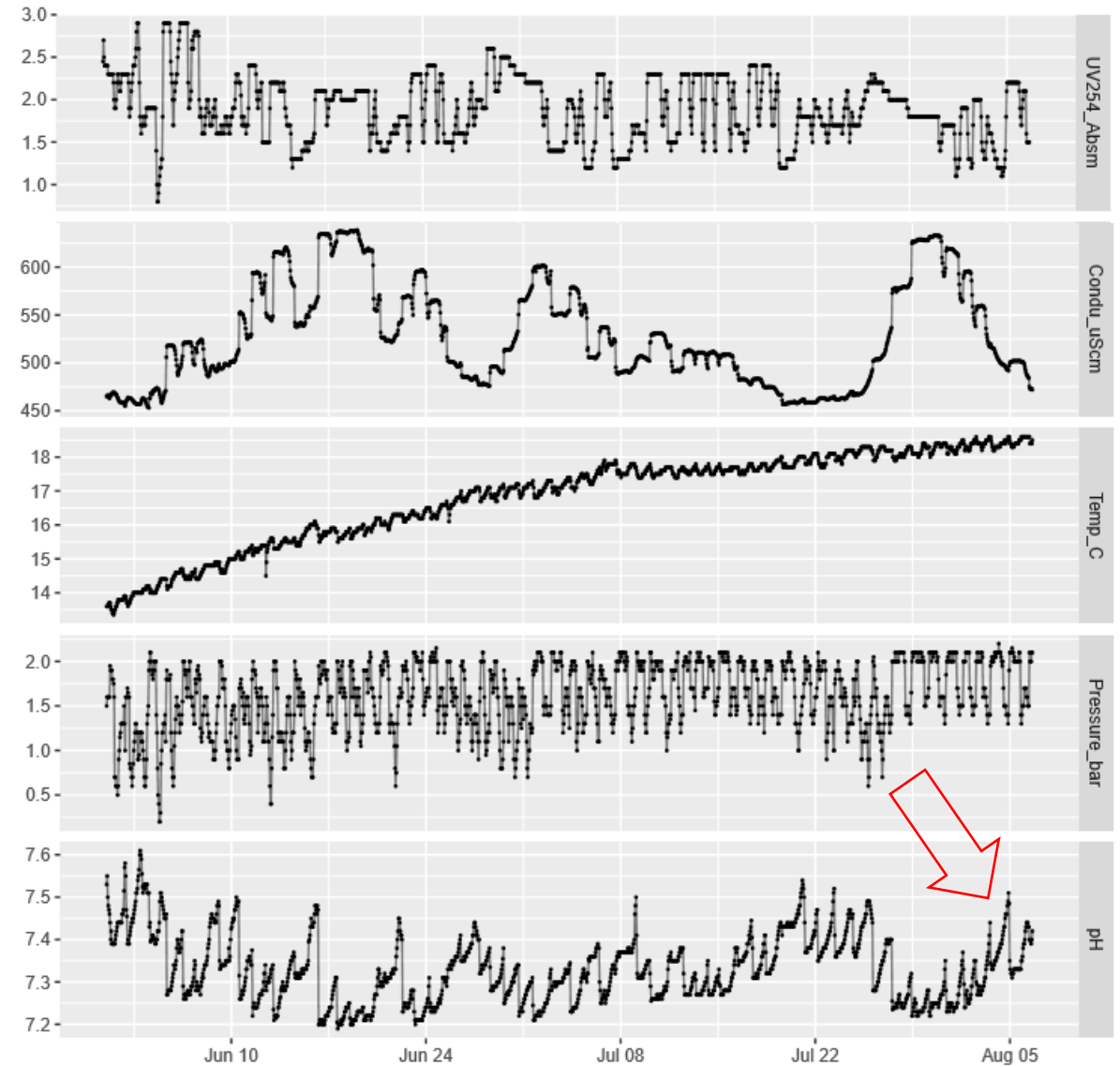
- Installation in pumping station of gardening nursery
- At end of widespread distribution system
- Two different resources
- Conductivity as tracer
- Clear distinction between resources possible
- Estimation of flow time possible



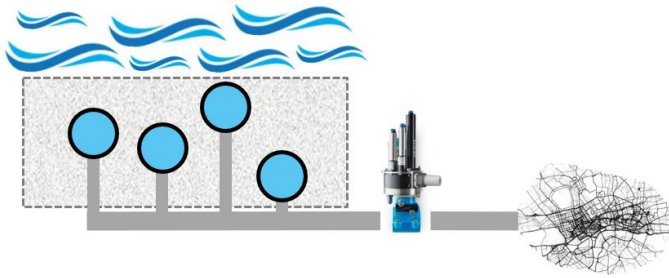
INSTALLATION SITE 2



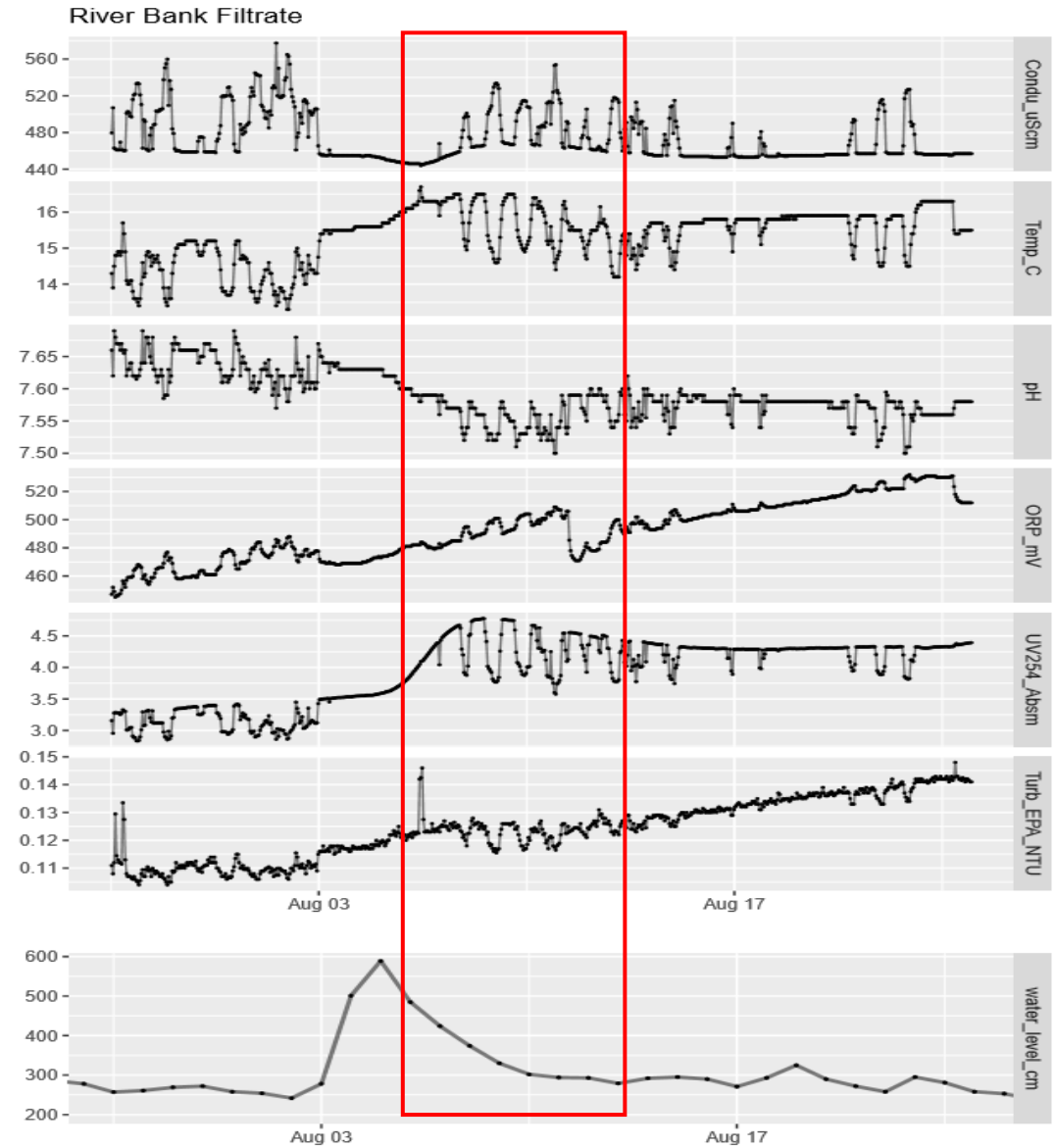
- Installation in inflow of storage tank
- Two different supply lines
- Pressure allows distinction
- Absorption, pH and conductivity change with resource
- Rise in pH unresolved



INSTALLATION SITE 3

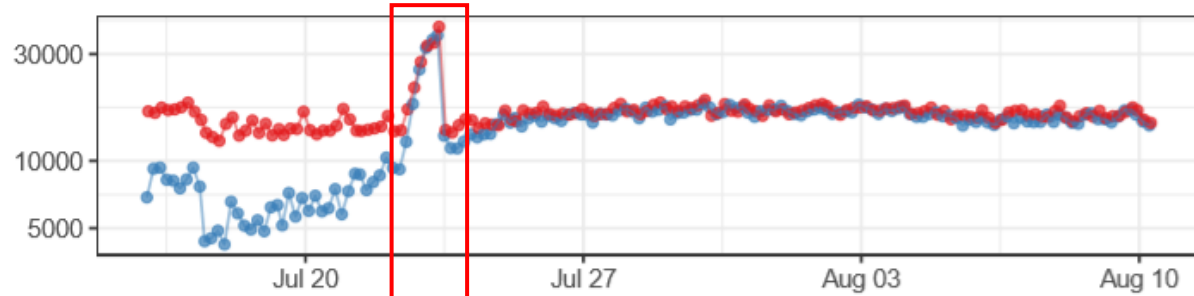


- River bank filtrate
- Four wells along danube with varying distance
- Small flooding event
- Lag between flood and quality changes in well
- Clear difference between wells

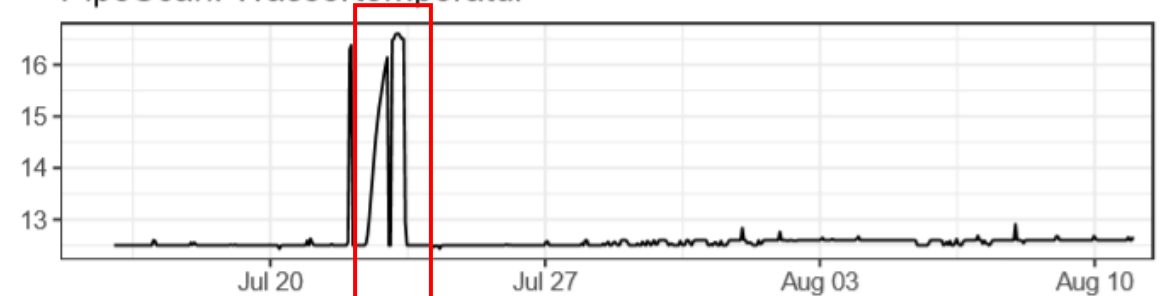


INSTALLATION SITE 4

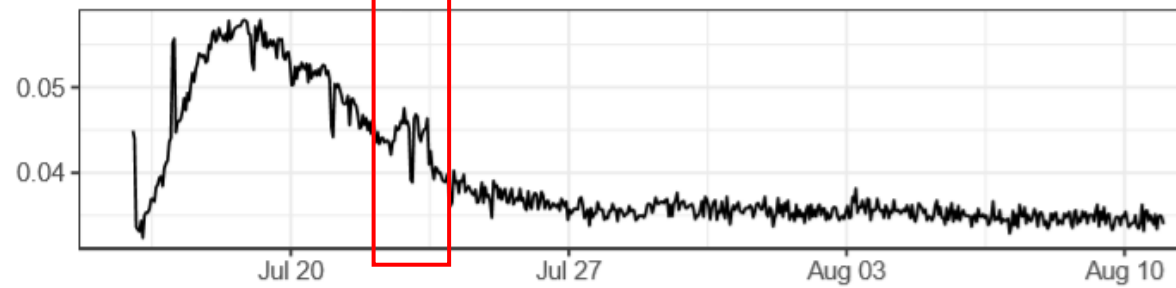
OBA: TCC und ICC



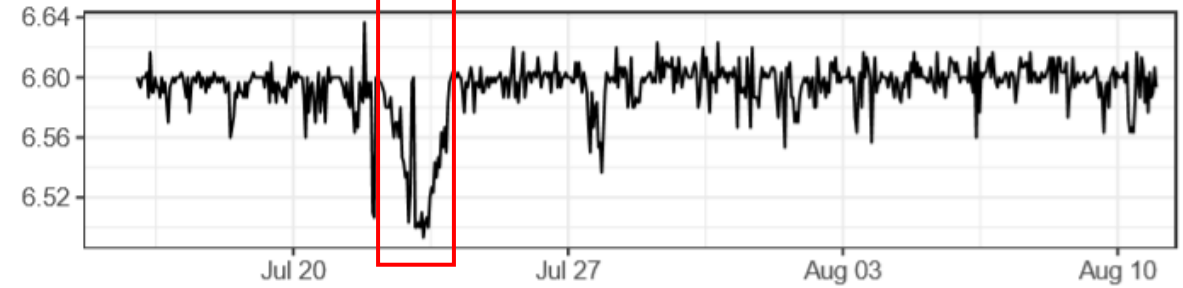
PipeScan: Wassertemperatur



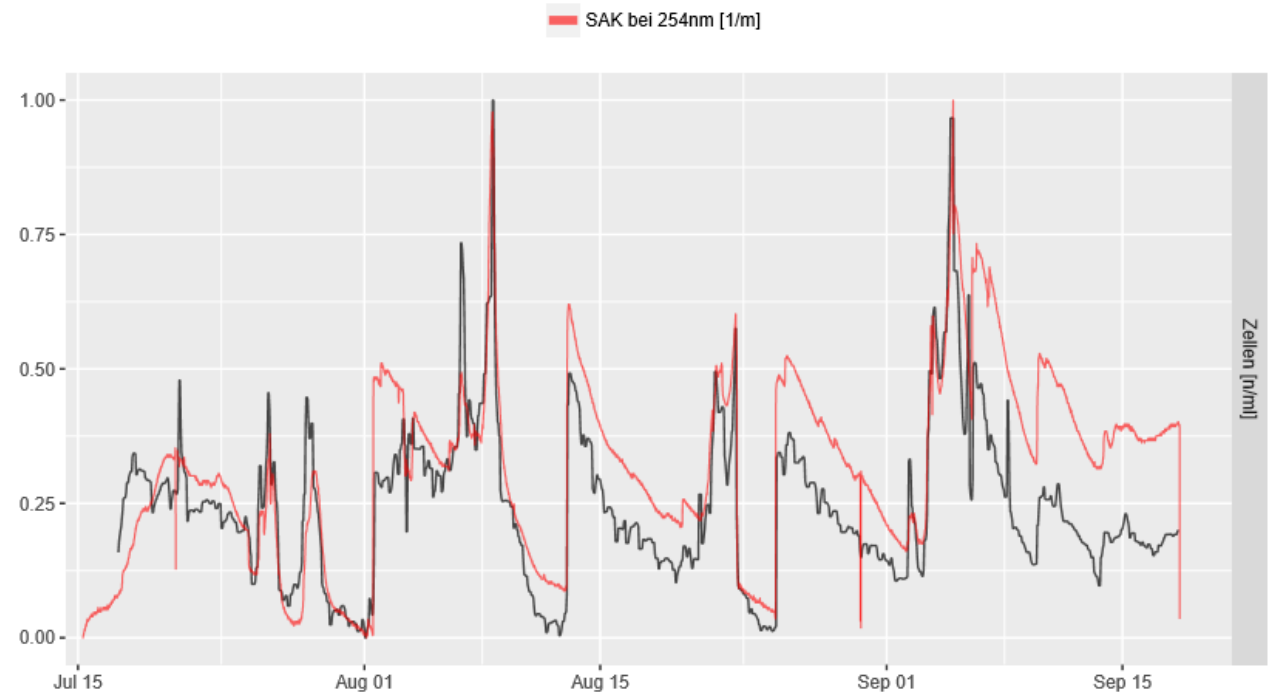
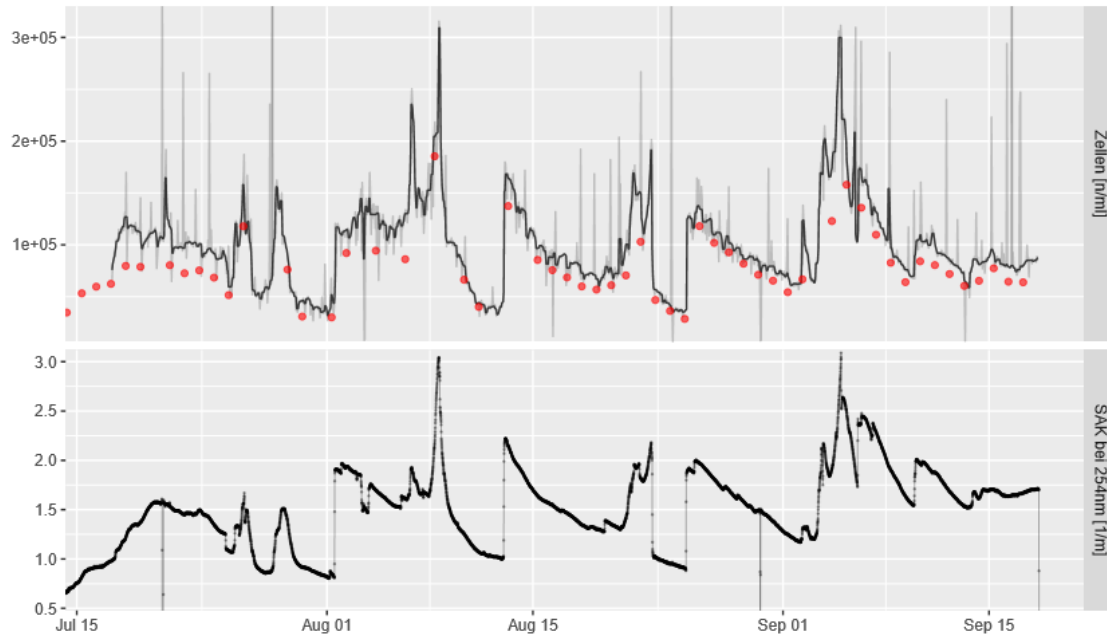
PipeScan: Truebe



PipeScan: Druck



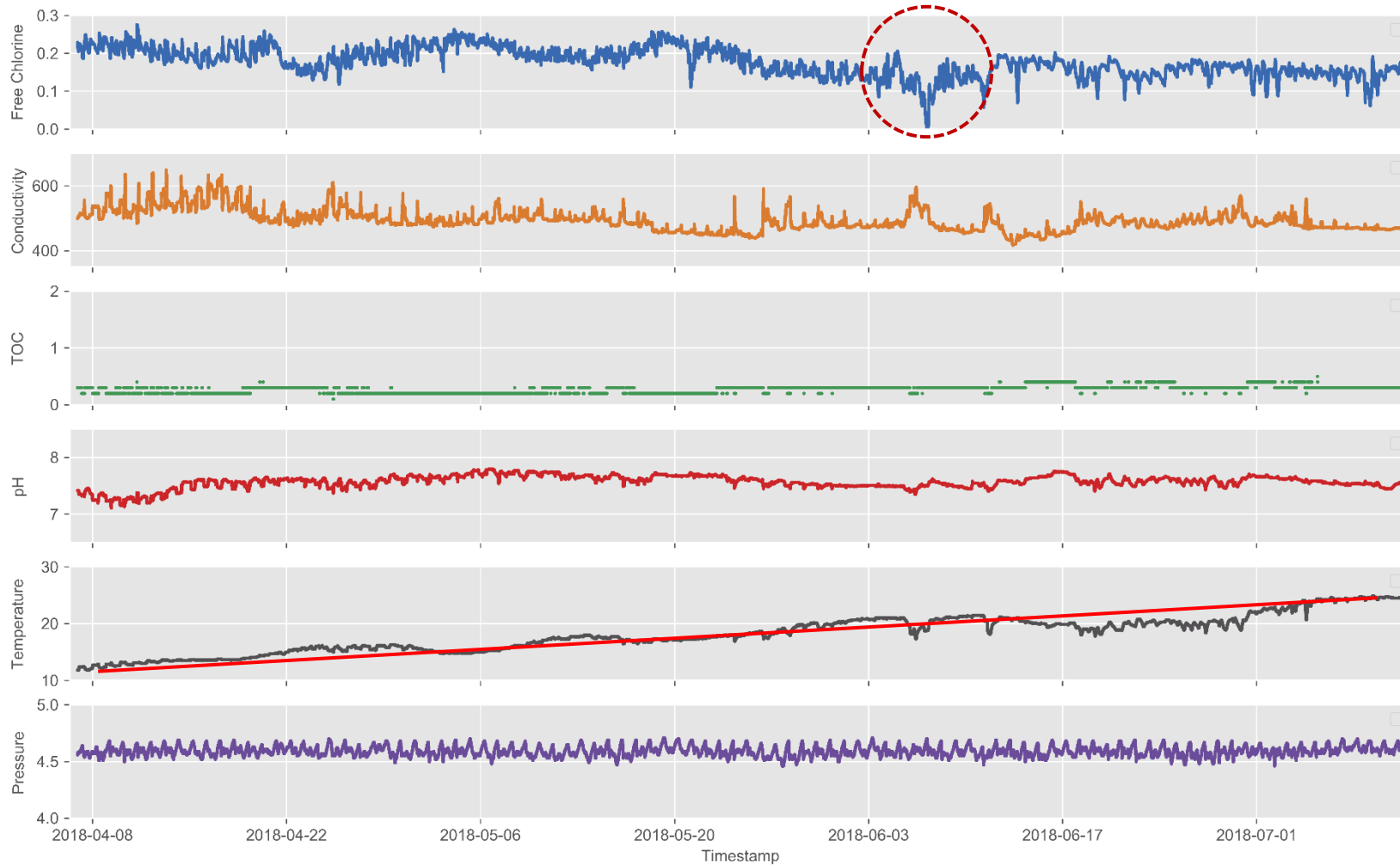
CELL COUNTS VS. UV254



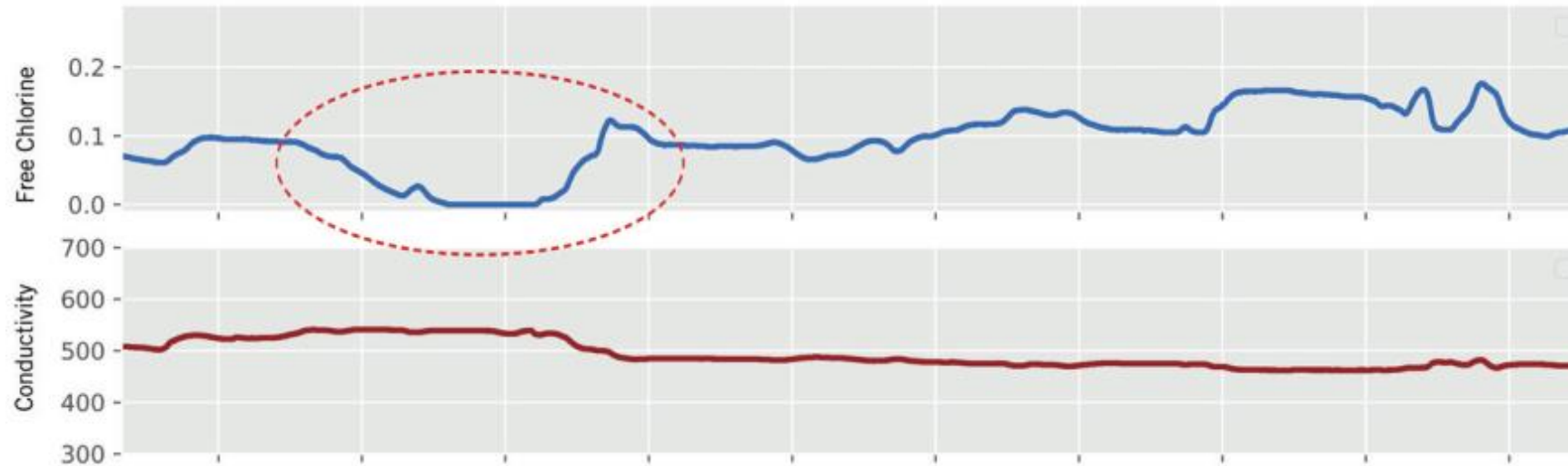
Multiple carstic springs feeding into one pipeline



DISTRIBUTION MONITORING IN A EUROPEAN CITY



3H WITHOUT DISINFECTION



- 3 hours without disinfection
- Probability to catch this event:
 - Twice a year sampling: 0.07%
 - Weekly sampling: 1.8%



vs.



CONCLUSION

- Higher water temperatures promote cell growth
- Online monitoring gives valuable insights
 - Combination of parameters depend on location
- Complex flow cytometry measurements can potentially be replaced by spectroscopic techniques
- Combining temperature, organics and disinfection monitoring in the network allow good judgment of bacterial growth likelihood



THANK YOU



Special thank goes to my colleagues from BOKU
Christoph Schönher und Philipp Proksch

Time for questions

