



# EiCLaR Horizon Europe project Open Symposium

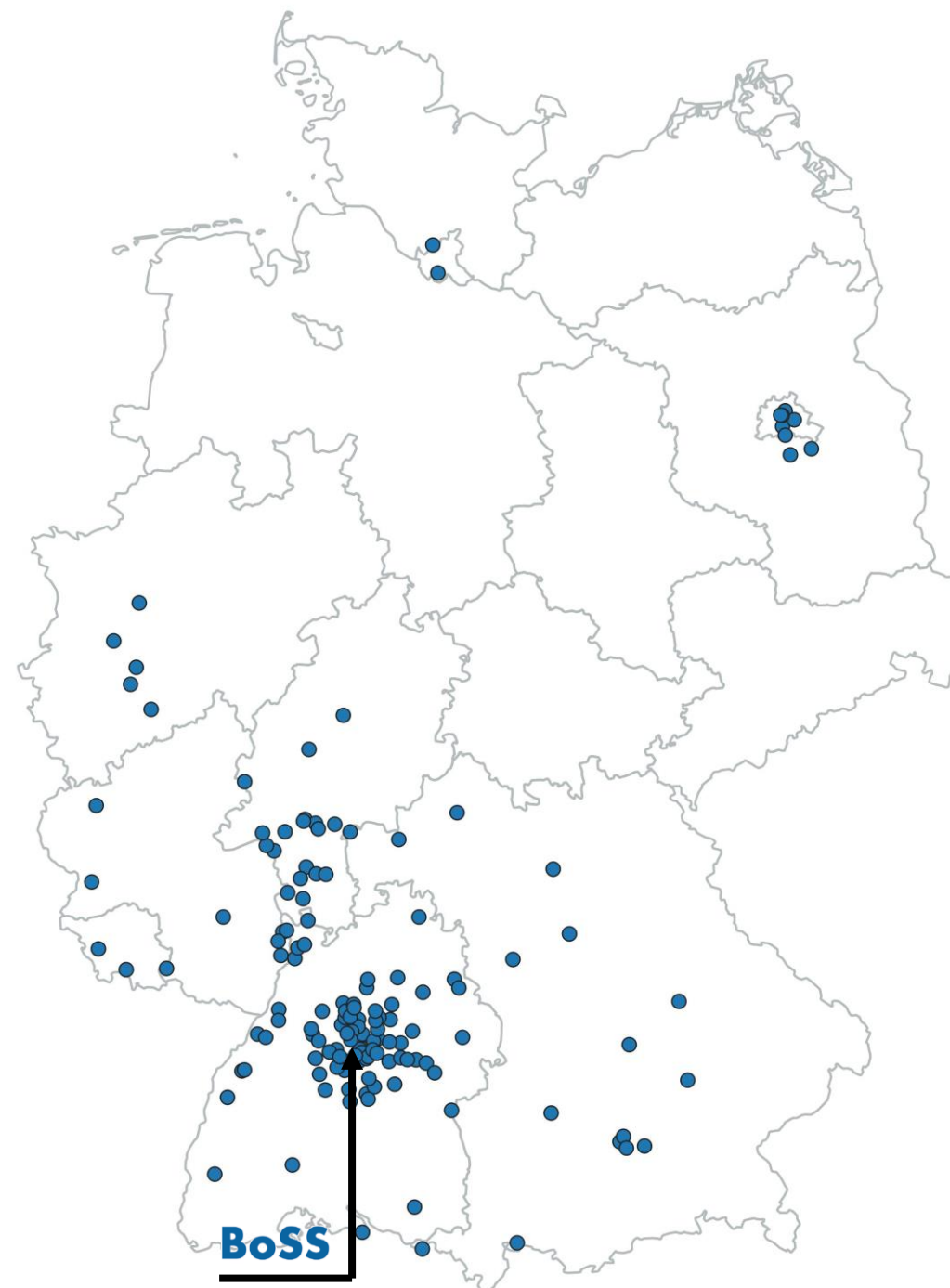
Rotterdam, October 3, 2024

**BoSS** consult  
environmental solutions

## BoSS Consult - always one idea ahead

### Who we are

- Founded in 2005 by Michael **B**oger, Stefan **S**pitzberg, and Uli **S**chollenberger
- Currently nine employees (hydrogeologists, geologists, geoecologists, environmental engineers), two student employees
- Projects in all over Germany and the Middle East
- Participation in **EU-Projects**
  - FOKS - *Focus on Key Sources of Environmental Risks*
  - MAGPlan - *Management plan to prevent threats from point sources on the good chemical status of groundwater in urban areas*
  - MAGIC - *Management of Groundwater at Industrially Contaminated Areas*
  - EiCLaR - *Enhanced In Situ Bioremediation for Contaminated Land Remediation*



BoSS Consult project sites in Germany

### What we do

- **Contaminated sites**
  - Site investigation
  - Data acquisition and evaluation
- **Brownfield redevelopment**
  - Assessment of cost risks due to contamination
  - Due diligence phase I, II & III
- **Groundwater**
  - Aquifer diagnosis
  - High-resolution trace substances
  - Isotope methods
- **Groundwater modelling**
  - Flow-, transport-, and heat-models
  - Uncertainty quantification
  - Evaluation of existing models

### Our clients

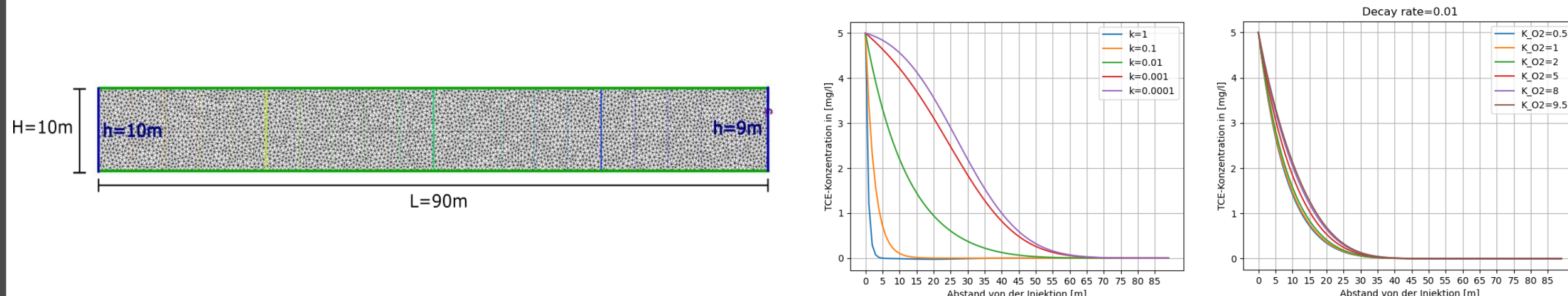
- Real Estate and Development
- Architecture and Construction
- Environmental and Waste Management
- Transportation
- Energy and Utilities
- Government and Public Services
- Manufacturing and Industry



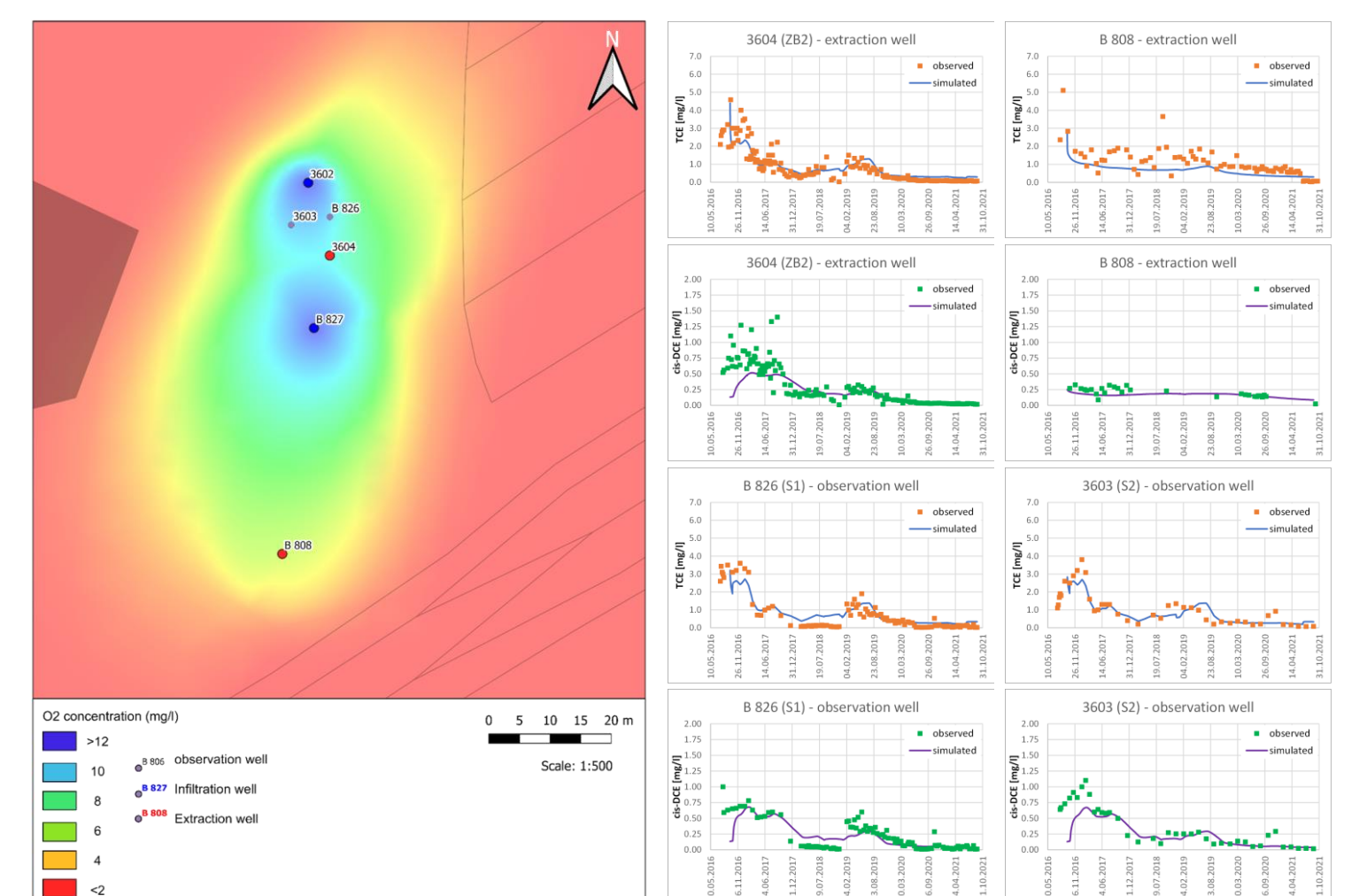
## Reactive Transport Numerical Modelling within EiCLaR

BoSS is championing the **reactive transport numerical model** for monitored bioaugmentation (MBR) and bioelectrochemical remediation (BER) applications. The aim of this software is to describe the **aerobic degradation of chloroethenes**, including electro-bioaugmentation and electro-kinetic transport, and ultimately to optimise in-situ bioremediation. The approach consists in modelling simplified, controlled systems to understand reaction mechanisms and parameter sensitivity before moving on to more complex field sites.

### Sensitivity analysis of reaction kinetics' parameters in a 1d synthetic experiment



### TCE degradation at a pilot test site near Stuttgart (in collaboration with German Water Centre, TZW)



Chloroethene biodegradation rates can be described by **multi-Monod kinetics**:

$$R_{TCE} = -r_{TCE,max} \cdot \frac{C_{O_2}}{K_{O_2} + C_{O_2}} \cdot \frac{C_{TCE}}{K_{TCE} + C_{TCE}}$$

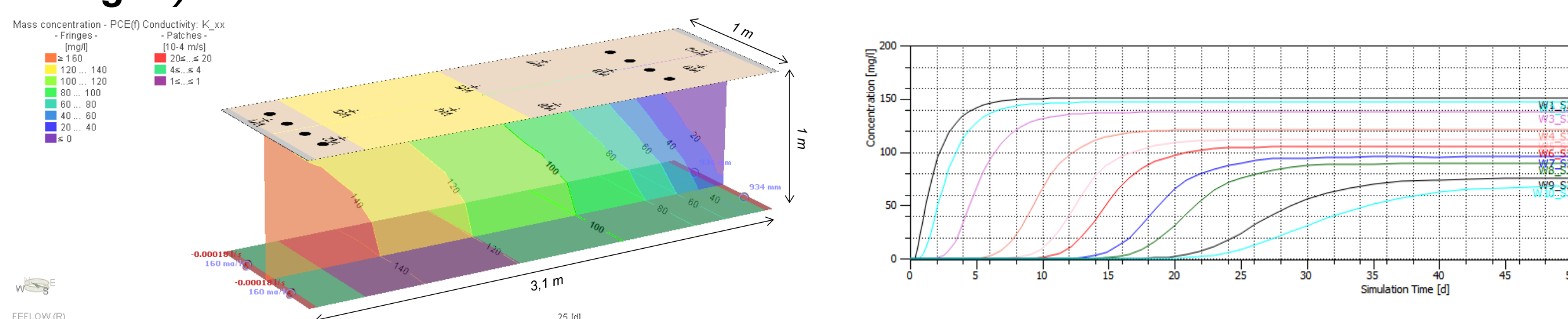
$$R_{cDCE} = -r_{cDCE,max} \cdot \frac{C_{O_2}}{K_{O_2} + C_{O_2}} \cdot \frac{C_{TCE}}{K_{TCE} + C_{TCE}} \cdot \frac{C_{cDCE}}{K_{cDCE} + C_{cDCE}}$$

$r_{i,max}$  : maximum degradation rate ( $i = O_2, TCE, cDCE$ )

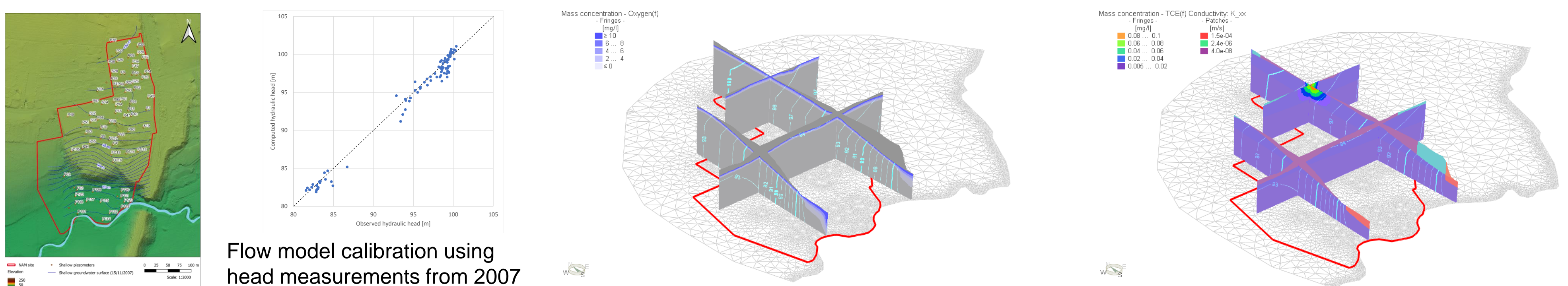
$K_i$  : half-saturation constant of the limiting substrate  $i$

$C_i$  : concentration

### PCE degradation in sand box experiments (in collaboration with VEGAS, University of Stuttgart)



### Flow and reactive transport model for the NAM site, Belgium



Flow model calibration using head measurements from 2007

### Acknowledgement:

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