online

Implementation of modePROCON showcasing for surface water – Dresden-Hosterwitz, Germany

boDEREC-CE I Chair of Hydrology and River Basin Management

OUTLINE

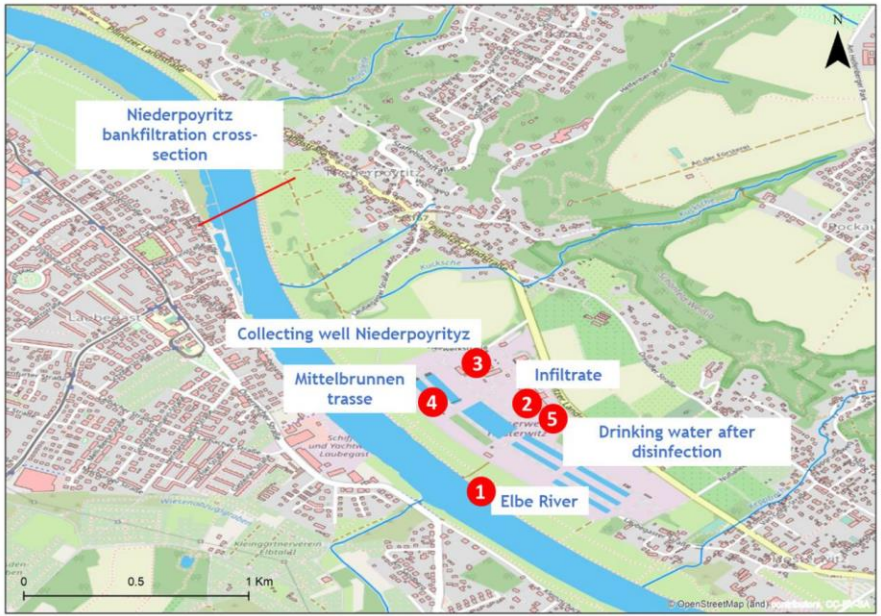
1 Study area

2 Detected PPCPs

3 Applying modePROCON

4 Model results

STUDY AREA

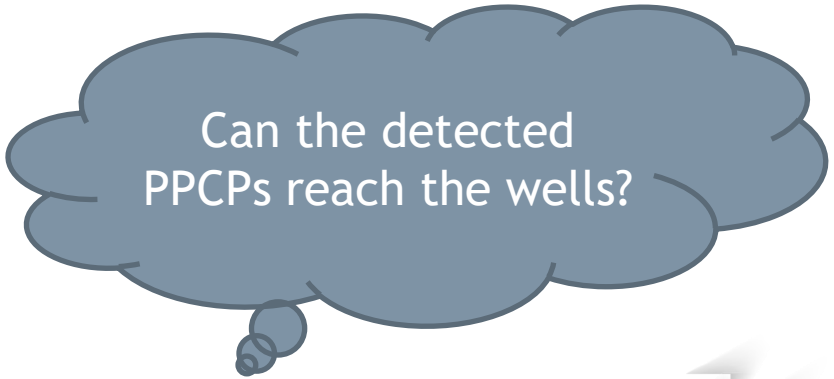


Location of sampling points at Niederpoyritz and Hosterwitz

- Investigated abstraction well for drinking water supply
- A site of riverbank filtration: Dresden-Hosterwitz and -Niederpoyritz
- Riverbank filtration is considered as a showcase of surface water use, but in fact a groundwater water model is applied for the investigation.

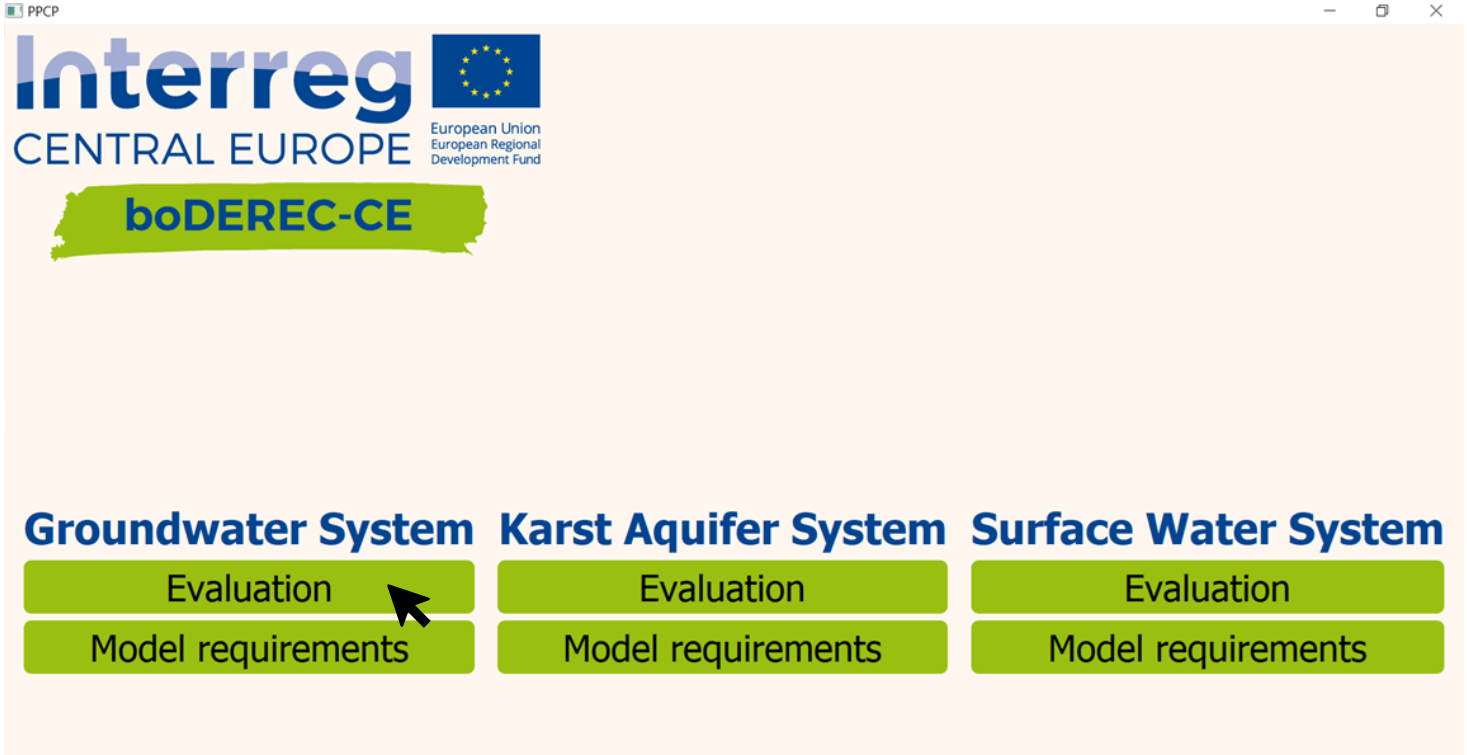
DETECTED PPCPs

- The following PPCPs were detected and selected to be modeled in the Dresden-Hosterwitz pilot area are:
  - 4-Formylaminoantipyrine
  - Benzotriazole
  - 5-methyl-1-H-benzotriazole
  - Carbamazepine
  - Lamotrigine
  - Oxypurinol

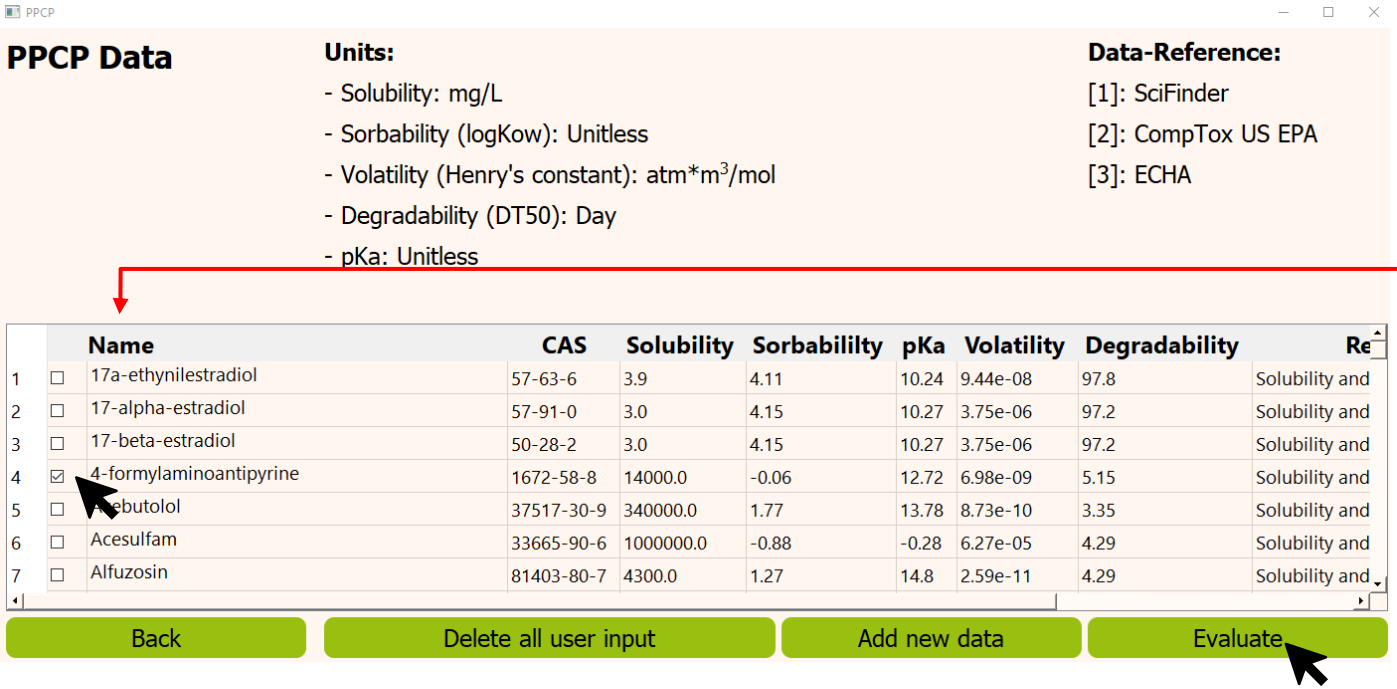


APPLYING modePROCON

Selecting the water source

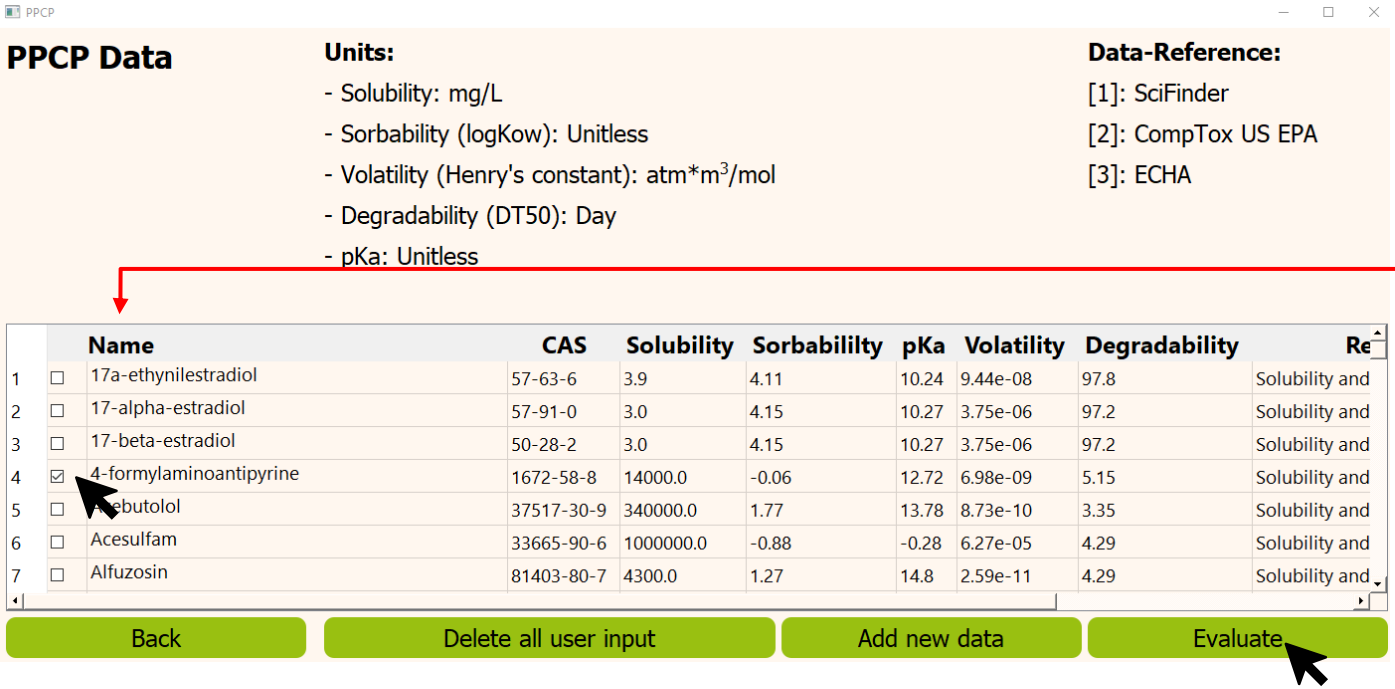


APPLYING modePROCON
Selecting the PPCPs



- All the 6 detected and selected to be modelled PPCPs are contained in the database
- But only 5 can be **selected simultaneously** in modePROCON.

APPLYING modePROCON
Selecting the PPCPs



- In this showcase, we focus on 5 depending on their importance for the stakeholders and the others can be analysed **successively**.

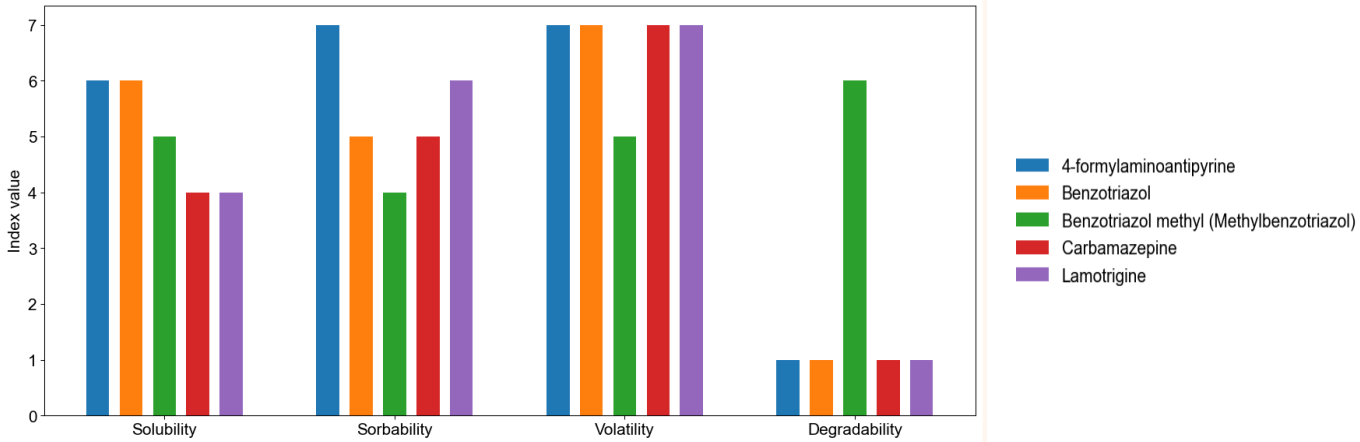
APPLYING modePROCON
Probability Estimation

PPCP

Indexes and Result

Modelling is recommended when likelihood is '**Very Likely**' or '**Likely**'

	Name	Solubility	Sorbabililty	Volatility	Degradability	Likelihood	Literature
1	4-formylaminoantipyrine	6	7	7	1	Very likely	https://doi.org/10.1016/j.watres.2020.115523
2	Benzotriazol	6	5	7	1	Likely	https://doi.org/10.1016/j.watres.2020.115523
3	Benzotriazol methyl (Methylbenzotriazol)	5	4	5	6	Very likely	https://doi.org/10.1016/j.scitotenv.2012.04.059
4	Carbamazepine	4	5	7	1	Likely	https://doi.org/10.1016/j.scitotenv.2012.04.059
5	Lamotrigine	4	6	7	1	Likely	https://doi.org/10.1016/j.envpol.2020.115387



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Go to model requirements

- Although the degradability of most PPCPs is very high, **5-methyl-1-H-benzotriazole** has a very **low degradability**.

APPLYING modePROCON
Probability Estimation

PPCP

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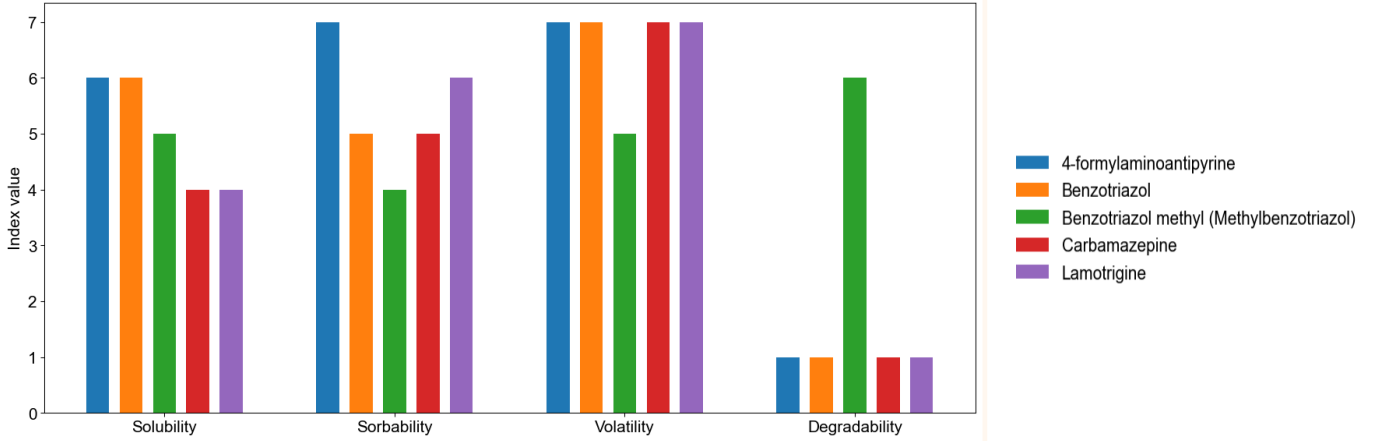

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Go to model requirements

4-Formylaminoantipyrine and 5-methyl-1-H-benzotriazole are very likely to be detected.

APPLYING modePROCON
Probability Estimation

PPCP

Indexes and Result

Modelling is recommended when likelihood is '**Very Likely**' or '**Likely**'

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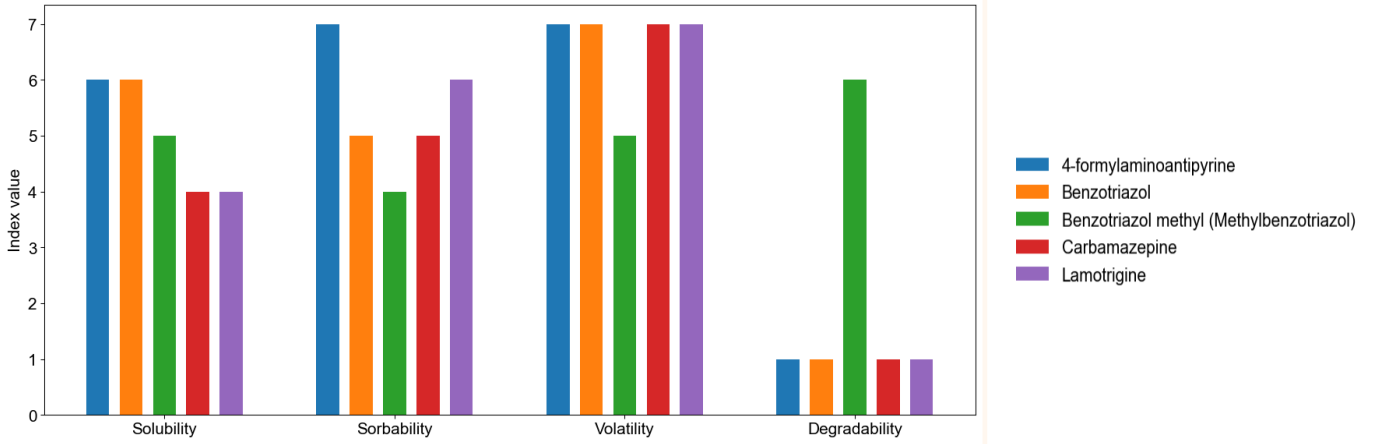

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Go to model requirements

- **Benzotriazole, Carbamazepine, and Lamotrigine** are **likely** to be detected in the water, due to the **higher solubility**.

APPLYING modePROCON
Probability Estimation

PPCP

Indexes and Result Modelling is recommended when likelihood is '**Very Likely**' or '**Likely**'

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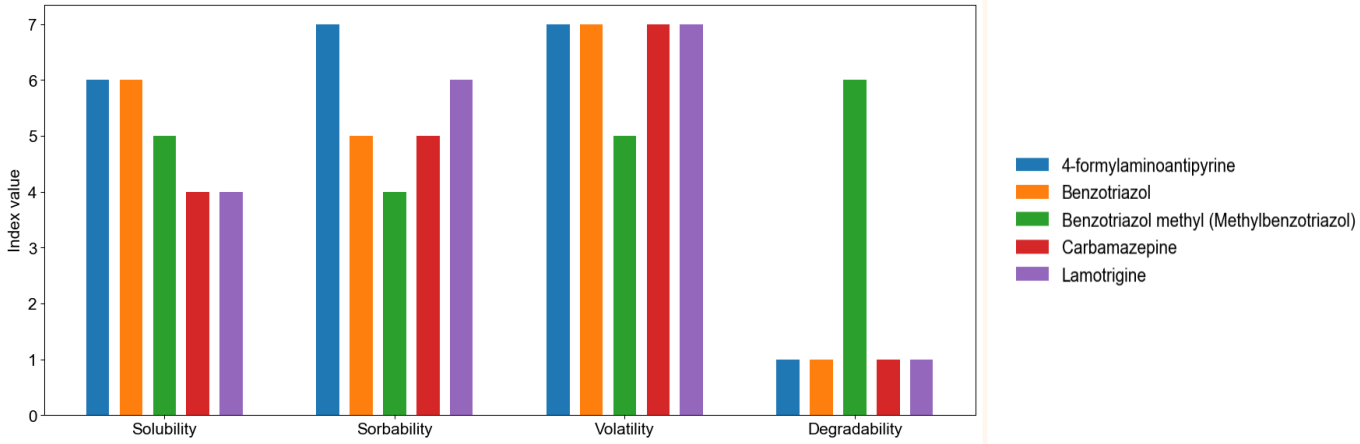

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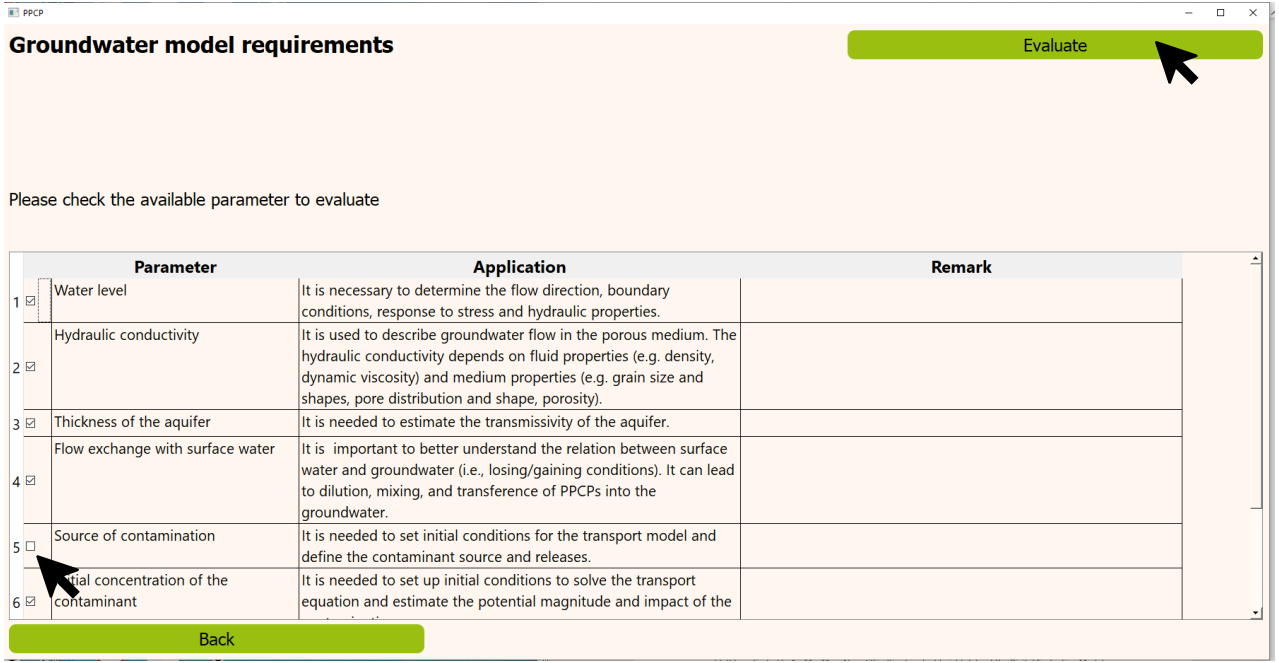
Go to model requirements

- As the investigated PPCPs are **very likely** or **likely** to be detected in water, modePROCON **recommends to develop a model** for further investigation.

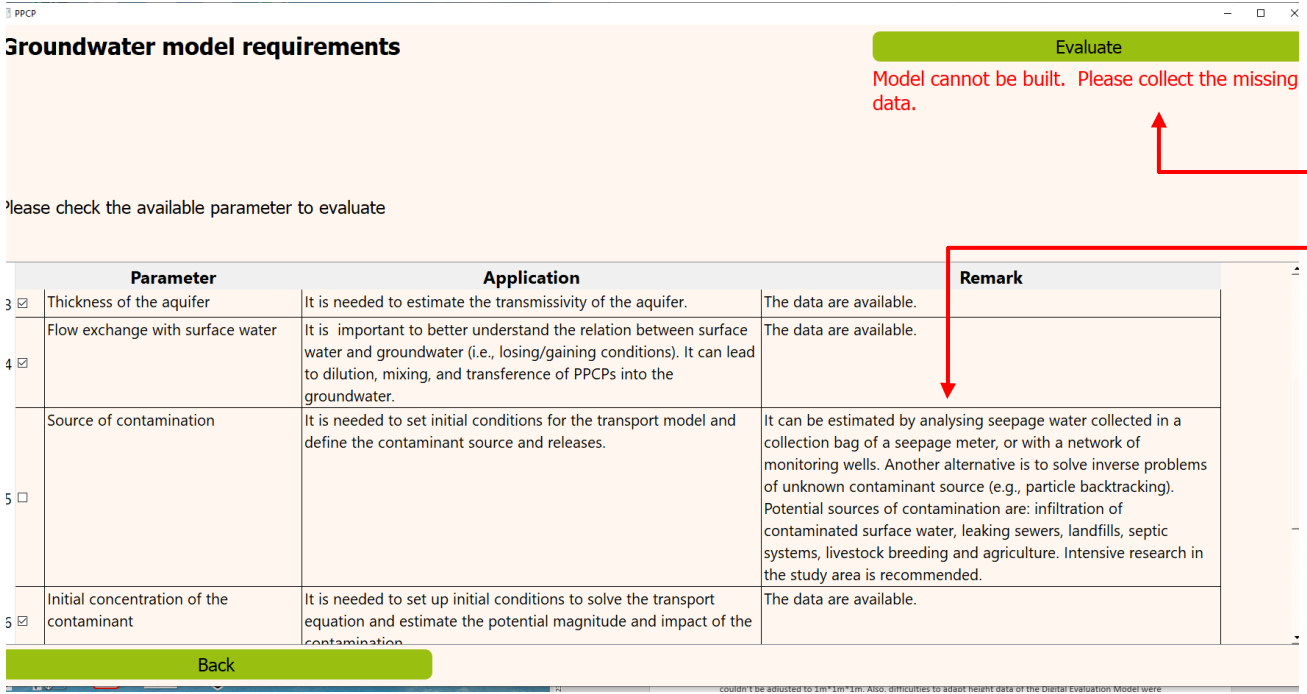
APPLYING modePROCON
Model requirements



	Parameter	Application	Remark
1 ☑	Water level	It is necessary to determine the flow direction, boundary conditions, response to stress and hydraulic properties.	
2 ☑	Hydraulic conductivity	It is used to describe groundwater flow in the porous medium. The hydraulic conductivity depends on fluid properties (e.g. density, dynamic viscosity) and medium properties (e.g. grain size and shapes, pore distribution and shape, porosity).	
3 ☑	Thickness of the aquifer	It is needed to estimate the transmissivity of the aquifer.	
4 ☑	Flow exchange with surface water	It is important to better understand the relation between surface water and groundwater (i.e., losing/gaining conditions). It can lead to dilution, mixing, and transference of PPCPs into the groundwater.	
5 ☐	Source of contamination	It is needed to set initial conditions for the transport model and define the contaminant source and releases.	
6 ☑	tial concentration of the contaminant	It is needed to set up initial conditions to solve the transport equation and estimate the potential magnitude and impact of the	

- All the required model **parameters** are known in this case, **except** of the **source of contamination.**
- modePROCON evaluates the data…

APPLYING modePROCON
Model requirements


PPCP

Groundwater model requirements

Evaluate

Model cannot be built. Please collect the missing data.

Please check the available parameter to evaluate

	Parameter	Application	Remark
3 ☑	Thickness of the aquifer	It is needed to estimate the transmissivity of the aquifer.	The data are available.
4 ☑	Flow exchange with surface water	It is important to better understand the relation between surface water and groundwater (i.e., losing/gaining conditions). It can lead to dilution, mixing, and transference of PPCPs into the groundwater.	The data are available.
5 ☐	Source of contamination	It is needed to set initial conditions for the transport model and define the contaminant source and releases.	It can be estimated by analysing seepage water collected in a collection bag of a seepage meter, or with a network of monitoring wells. Another alternative is to solve inverse problems of unknown contaminant source (e.g., particle backtracking). Potential sources of contamination are: infiltration of contaminated surface water, leaking sewers, landfills, septic systems, livestock breeding and agriculture. Intensive research in the study area is recommended.
6 ☑	Initial concentration of the contaminant	It is needed to set up initial conditions to solve the transport equation and estimate the potential magnitude and impact of the contamination	The data are available.

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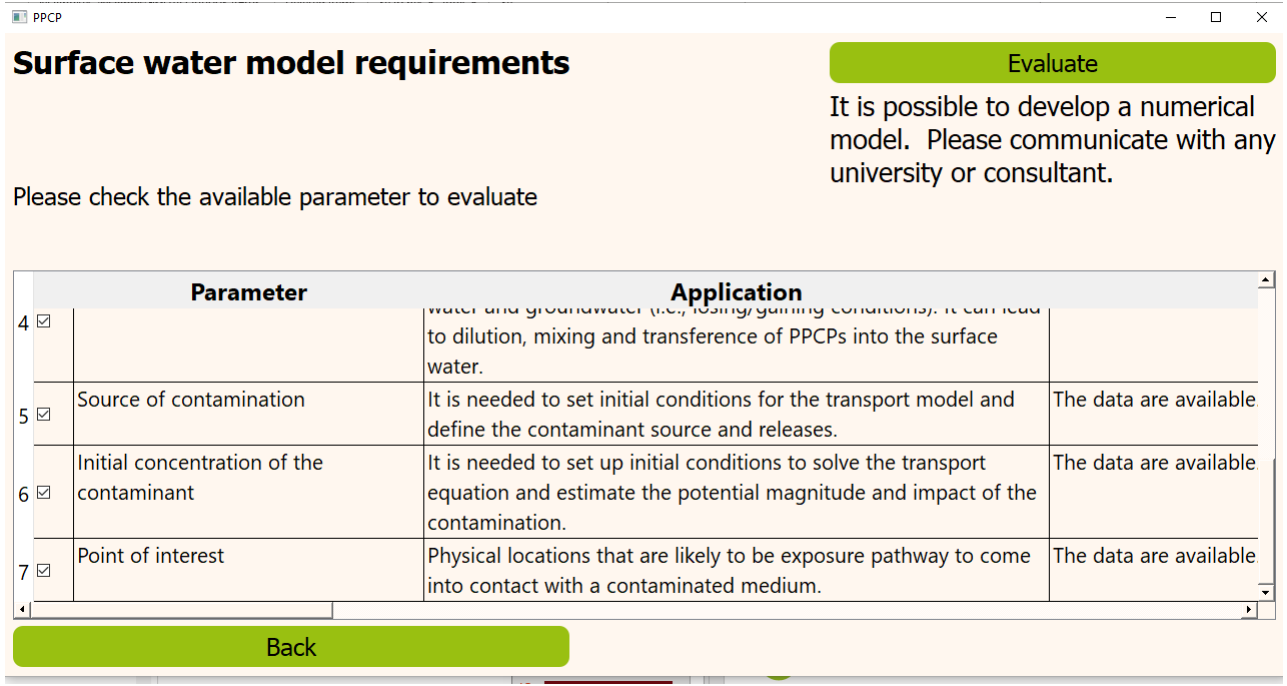
couldn't be adjusted to 1m*1m*1m. Also, difficulties to adapt height data of the Digital Evaluation Model were

- … and replies that a **model cannot be built** with the available data.
- modePROCON suggests a **possibility to obtain** the **missing data** in the remark column.

APPLYING modePROCON

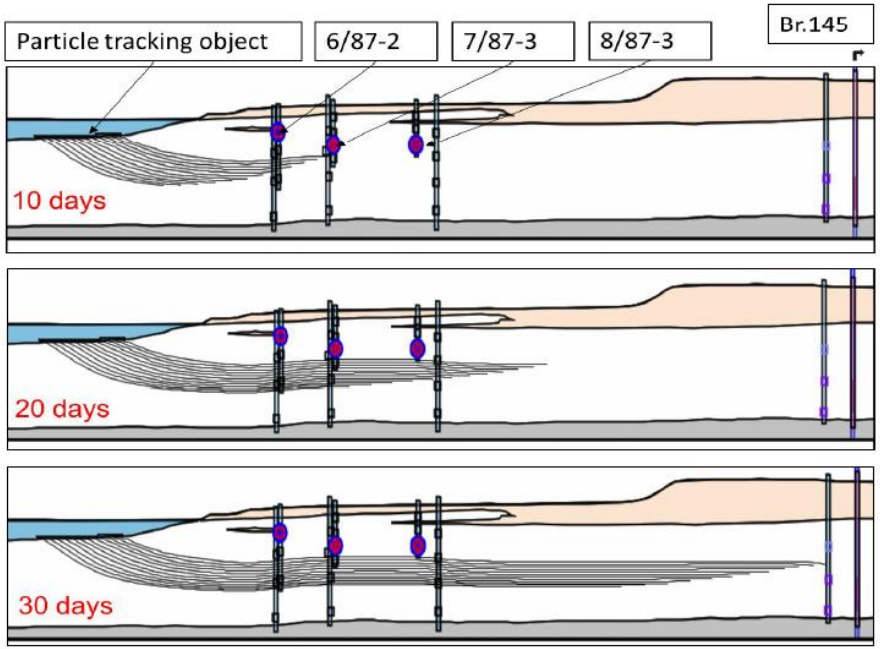
Model requirements



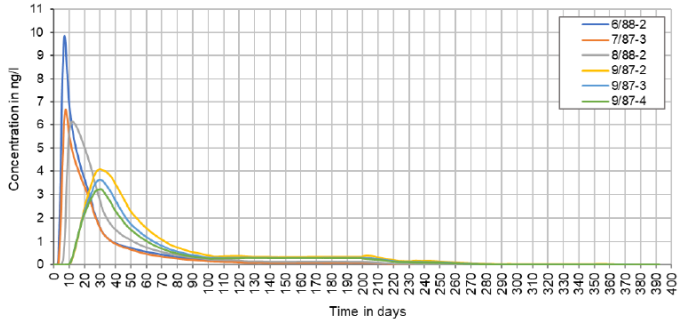
- In this case, two scenarios **were investigated.**
- The first scenario simulates the breakthrough curve of 1-day spill of oxypurinol with a concentration of 500 ng/l in the Elbe River on the first day of simulation time. The concentration of 500 ng/l refers from **median value of 526 ng/l from 7 sampling campaigns**.
- The second scenario simulates the change in concentration arriving at OW 9/87-3 next to the abstraction well Br.145. It corresponds to **different spill times of input source** in the Elbe River water.

MODEL RESULTS

Travel time and flow paths of particles moving from the river to the abstraction well



Scenario 1: Breakthrough curve after a 500 ng/l oxypurinol input conc. in Elbe River water due to a 1-day spill.



Scenario 2: Change in concentration at OW 9/87-3 after different spill durations in Elbe River water