

## Prediction of environmental concentrations of pharmaceuticals in the Vechte River catchment using the GREAT-ER model

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#### Motivation





#### Selected active pharmaceutical ingredients (APIs)

	Therapeutic class	Annual domestic consumption rate [1/inh/yr]	Hospital share (GER/NL)	Excretion rate	STP removal efficiency
Amantadine	Antiviral	mg	very low/very low	high	moderate
Carbamazepine	Anti-epilepticum	mg	very low/very low	low	very low
Ciprofloxacin	Antibiotic	mg	very low/very low	moderate	high
Clarithromycin	Antibiotic	mg	low/very low	moderate	moderate
Cyclophosphamide	Cytostatic	mg	moderate/very high	moderate	moderate
Diclofenac	NSAID	mg	very low/very low	moderate	moderate
Doxycycline	Antibiotic	mg	very low/very low	moderate	moderate
Erythromycin	Antibiotic	mg	very low/very low	moderate	low
Ethinylestradiol	Hormone	μg	very low/very low	moderate	moderate
Iopamidol	Contrast medium	μg	very high/very low	very high	moderate
Metformin	Antidiabetic	g	very low/very low	moderate	very high
Metoprolol	Beta blocker	g	very low/very low	low	low
Oxazepam	Psycholeptic	mg	very low/very low	high	low
Phenazone	Analgesic	mg	very low/very low	very low	moderate
Sulfamethoxazole	Antibiotic	mg	very low/very low	moderate	moderate
Valsartan	Hypertensive	mg	very low/very low	high	high





### Model performance

Number of samples taken (van Heijnsbergen et al., in prep.)

	Netherlands	Germany	Total
STP influent	34	25	69
STP effluent	33	25	68
In-stream	18	21	39







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Netherlands

10<sup>0</sup>

1:10 - 10:1 ratio

100%

100%

Measured load [kg/yr]

### Model performance: STPs

• STP influent and effluent predictions for: diclofenac (DCF), carbamazepine (CBZ), metformin (MET), metoprolol (MEP) and ciprofloxacin (CIP)





### Model performance: In-stream

- In-stream predictions for diclofenac (DCF), metformin (MET) and Metoprolol (MEP)
- Measurements were assigned to the scenarios based on date, gauging data and pumping activities
- API concentrations normalized by concentrations of a conservative tracer (carbamazepine) to elimate the effect of variation in flow



• DCF • MET • MEP





















Average conditions







#### PECs - Vecht River









#### PECs - Vecht River





### Potential Hot Spots

 5% of simulated segments in the river network with highest predicted concentrations





#### Conclusion

- Spatially explicit prediction of surface water concentrations in the Vecht River catchment for 16 APIs for an *average* and a *dry summer* scenario
- Border effect for diclofenac and ethinylestradiol
- Identification of potential hotspots for these APIs



## Thank you for your attention!