



Water quality modeling in Luxembourgish watersheds for the identification and quantification of sources for river water pollution

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The M3-project

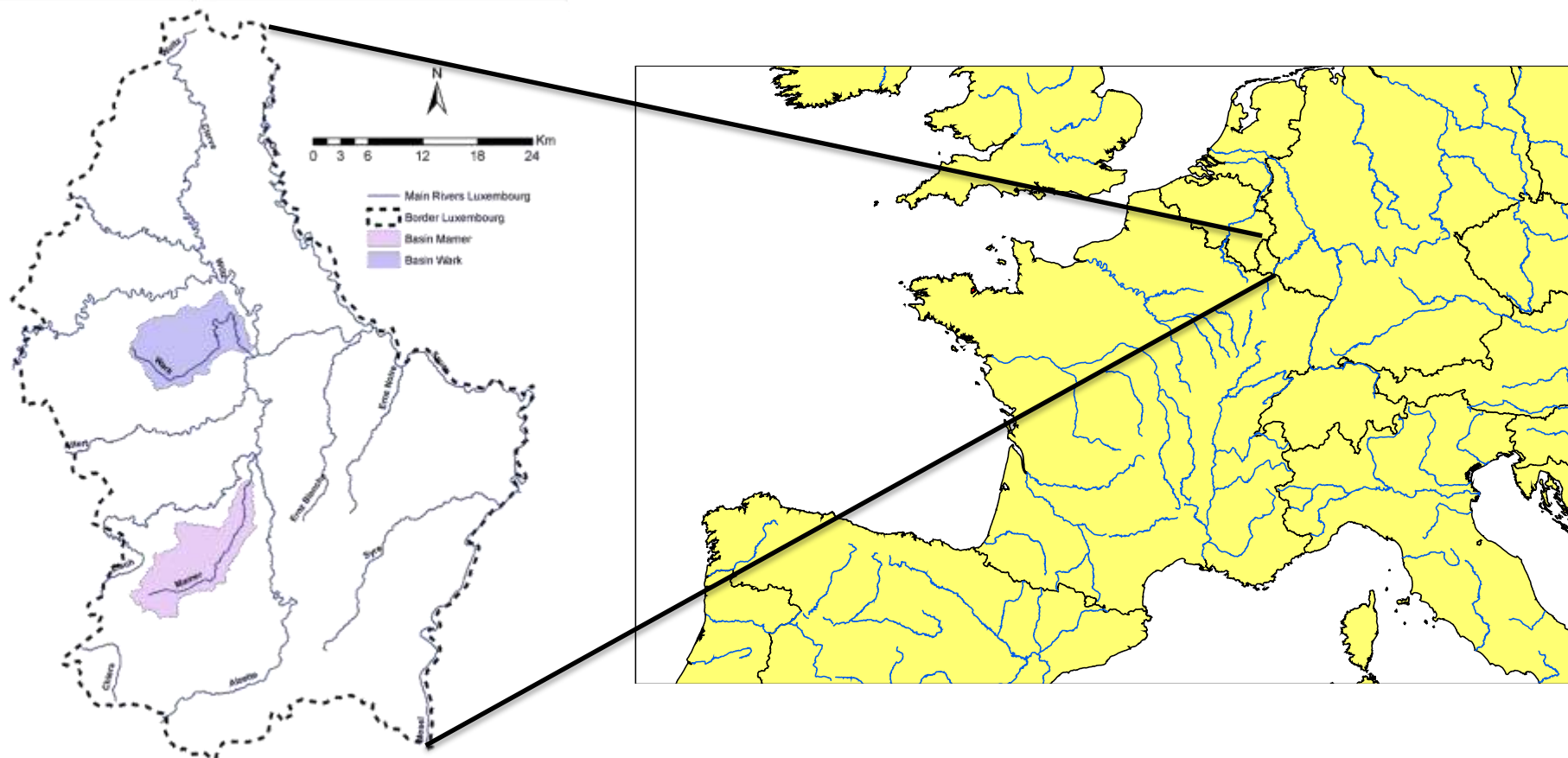


M3 = Modelling, Monitoring, Management

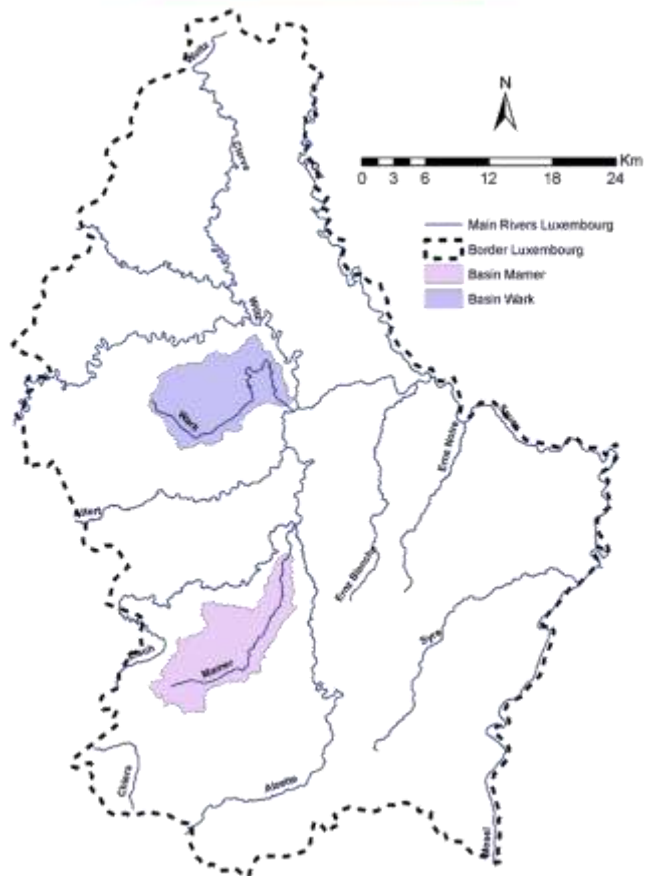
Under the scope of the EU – Water Framework Directive we want to:

- develop monitoring strategies to evaluate river water quality and identify sources of water pollution
- use models to quantify the contribution of these source and analyze their spatial distribution
- finally develop measures to reduce pollution

Introduction of study area



Introduction of study area



Wark :

- 81.5 km²
- mainly agriculture

Mamer :

- 82 km²
- agriculture and urban areas

Introduction of study area



elevation



slope



landuse



elevation [m] a.s.l.



- Land use: ~ 30% managed pasture
~ 30% agriculture (corn, winter cereals, summer cereals)
~ 12% urban area

Modeling Approach

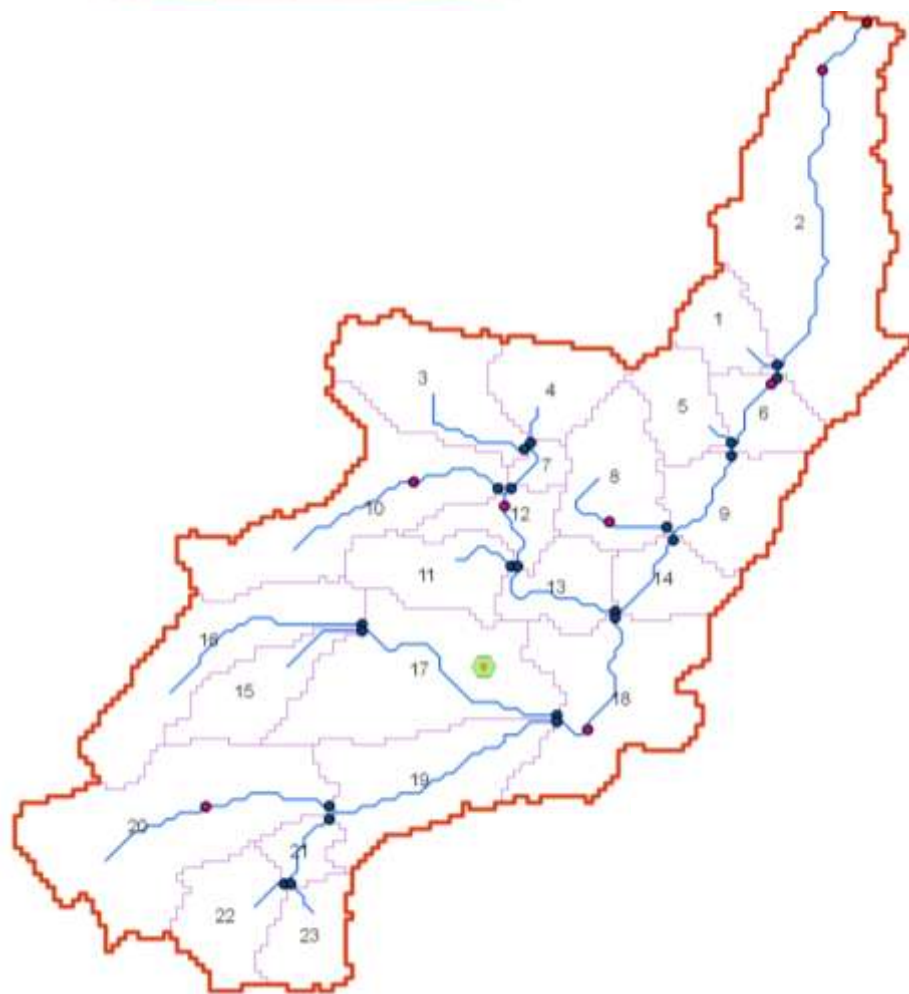


Our goal:

Prerequisite for good AQUATOX runs are well calibrated SWAT-runs

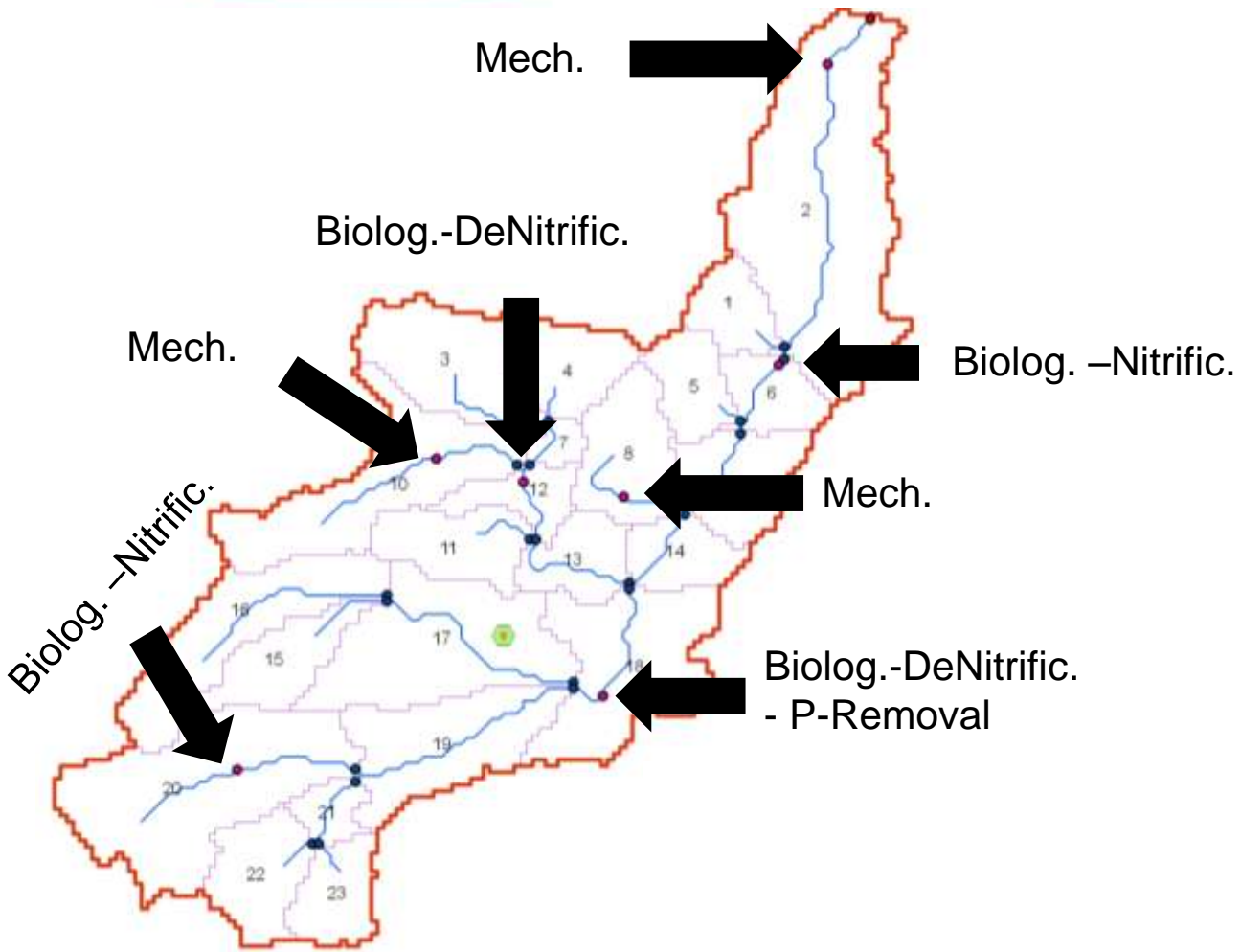
- Data needs: discharge, nutrient and pollutant loads for segments

Model set up



- 23 subbasins
- 1128 HRU

Model set up

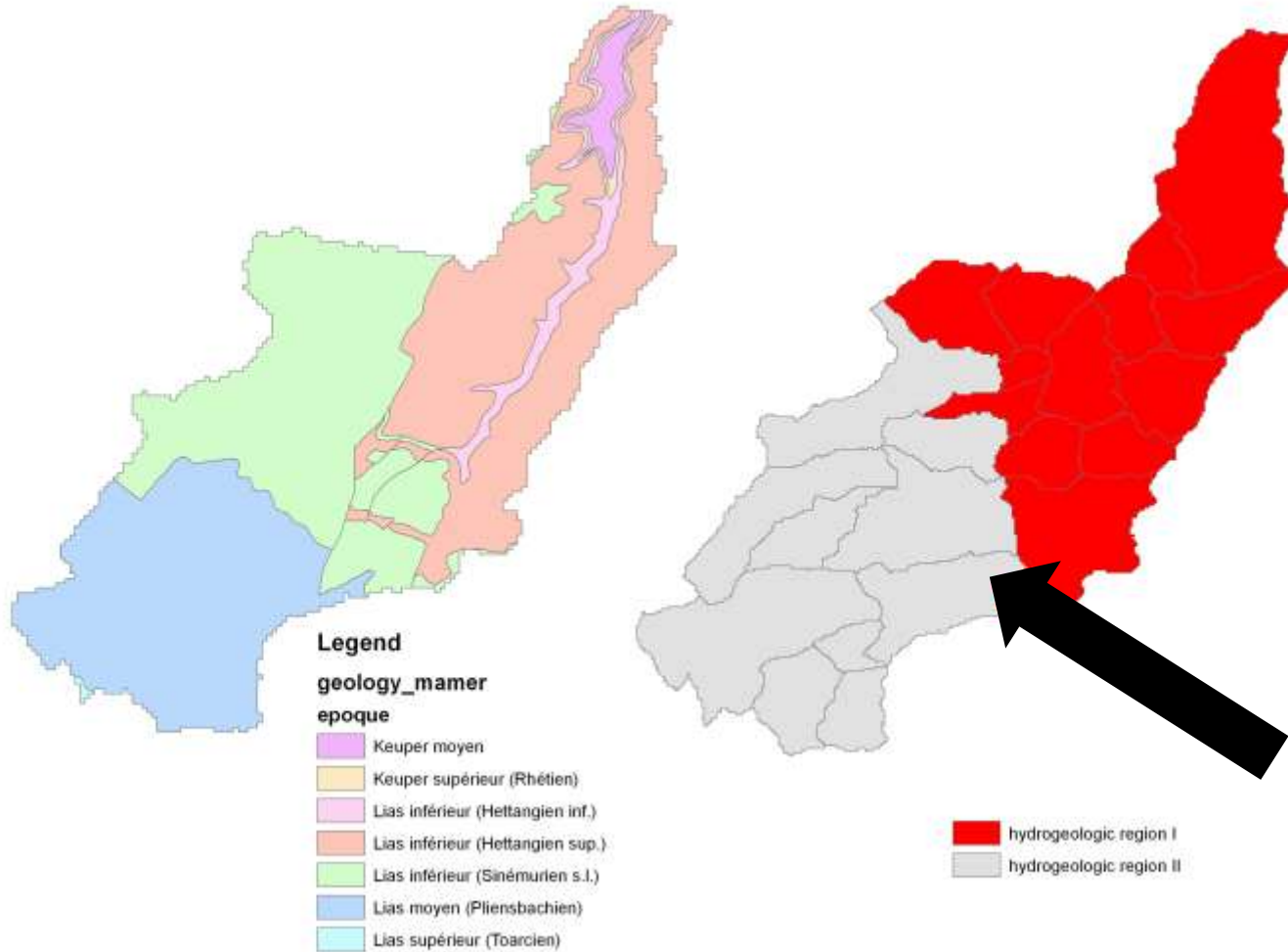


- 23 subbasins
- 1128 HRU

Total:

- 6990 m³ day⁻¹
(10% of avg. Q)
- 72 kg day⁻¹ NO₃-N
- 16 kg day⁻¹ NH₄-N
- 17 kg day⁻¹ MinP

Model set up - geology



- impervious layer at depth of 1.60 m
- different groundwater parameters

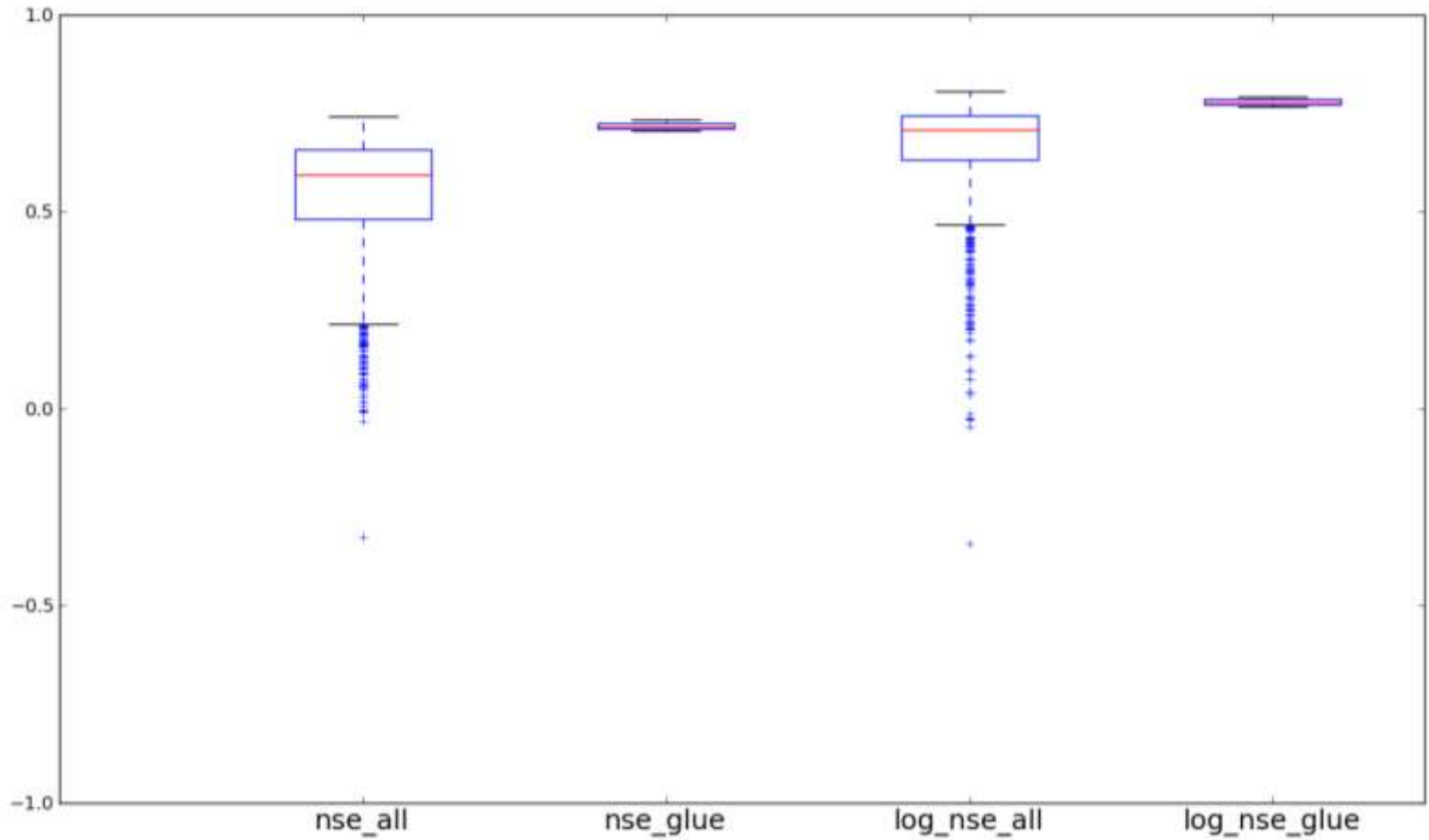
Modelling Strategy



Monte Carlo Simulation – Latin Hypercube Sampling:

SWAT-model parameter [units]	Lower bound	Upper bound
Surface run off lag time [d]	1	10
Manning's roughness coefficient main channel [-]	0.01	0.3
Hydraulic conductivity channel bottom [mm h ⁻¹]	0	25
Baseflow alpha factor [d ⁻¹]	0.01	1
Groundwater delay time [d]	1	25
Groundwater revap coefficient [-]	0.02	0.2
Threshold for baseflow [mm]	0	100
Available water capacity [mm mm ⁻¹]	-15 *1	15 *1
soil hydraulic conductivity I [mm h ⁻¹] (<75% rock)	-15 *1	15 *1
Rate factor humus mineralization [-]	0.0001	0.001
Nitrogen uptake distribution parameter [-]	10	30
Nitrate percolation coefficient [-]	0.01	1
Residue decomposition coefficient [-]	0.01	0.1
Denitrification rate coefficient [-]	0	3.0
Threshold for denitrification [-]	0.5	1.10

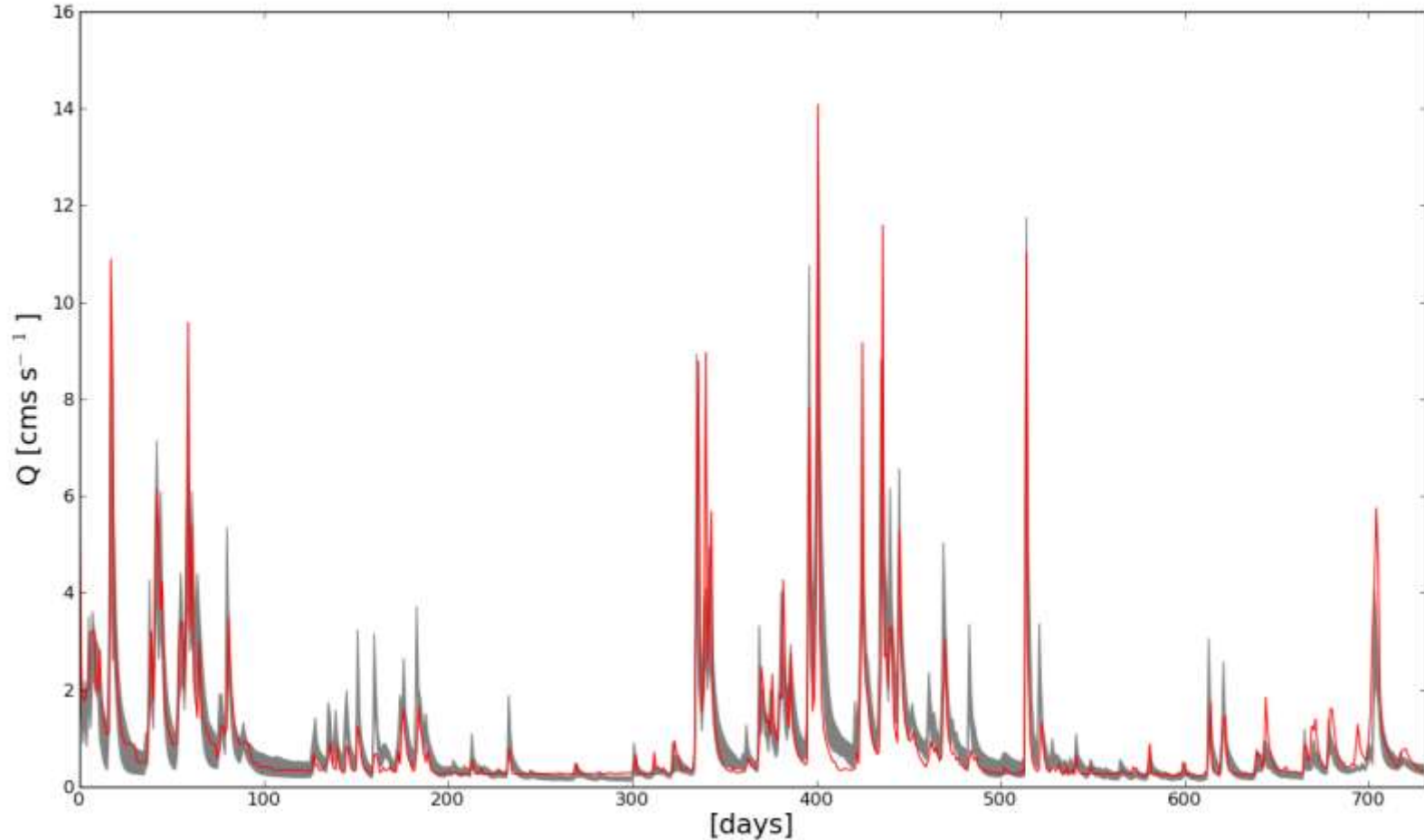
preliminary results - hydrology



preliminary results - hydrology



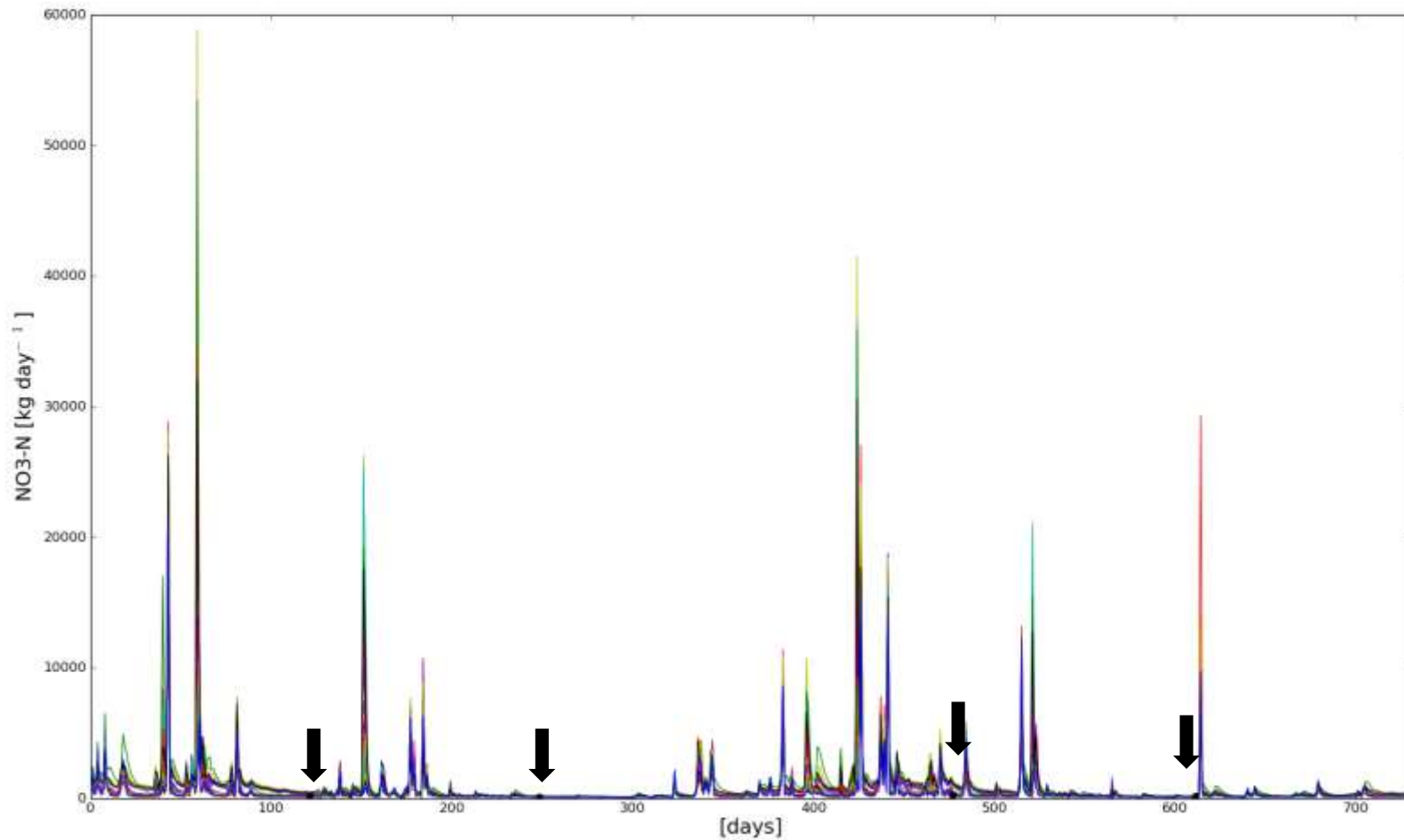
Mamer 2007-2008



preliminary results - nitrate



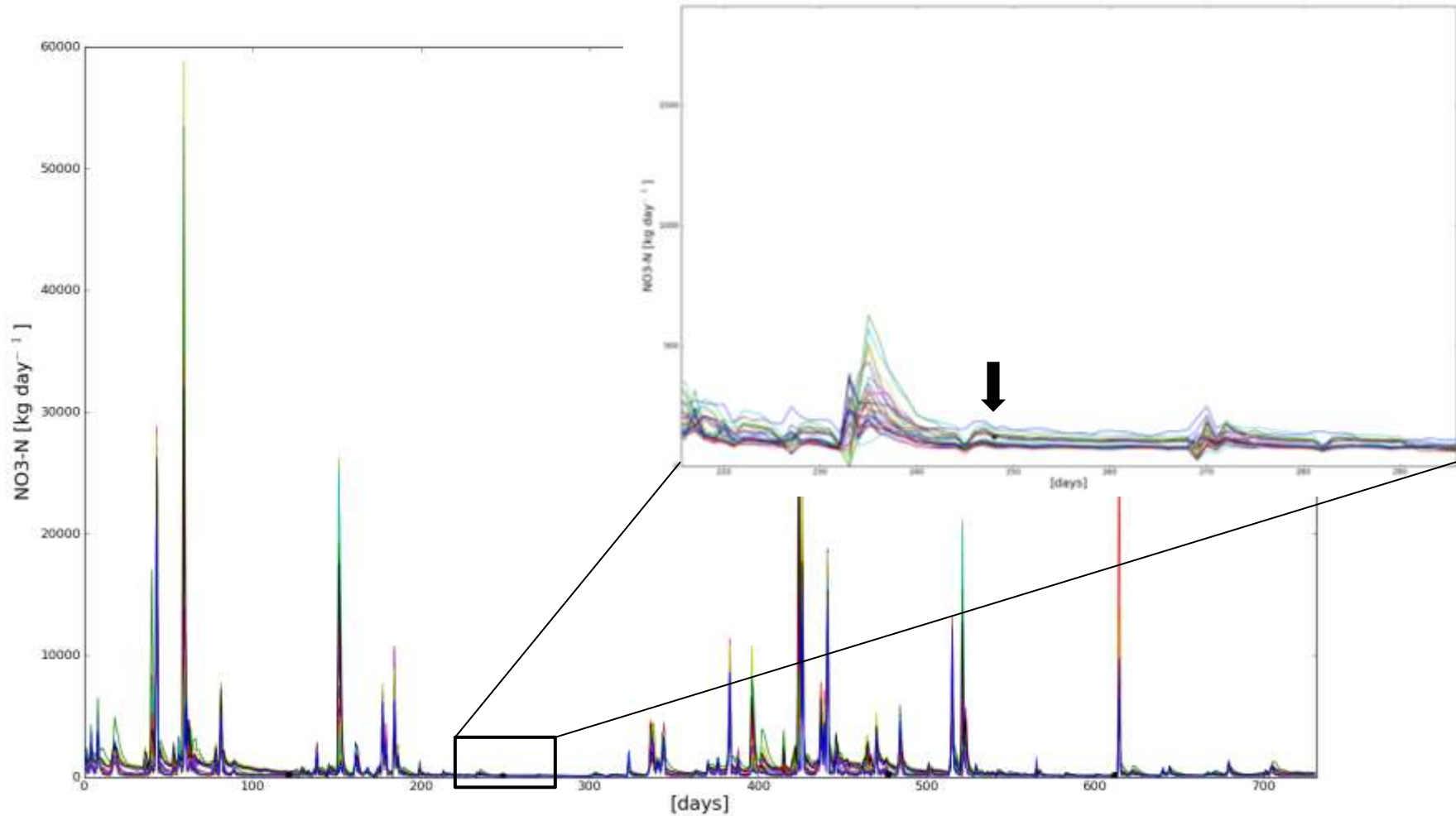
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preliminary results - nitrate



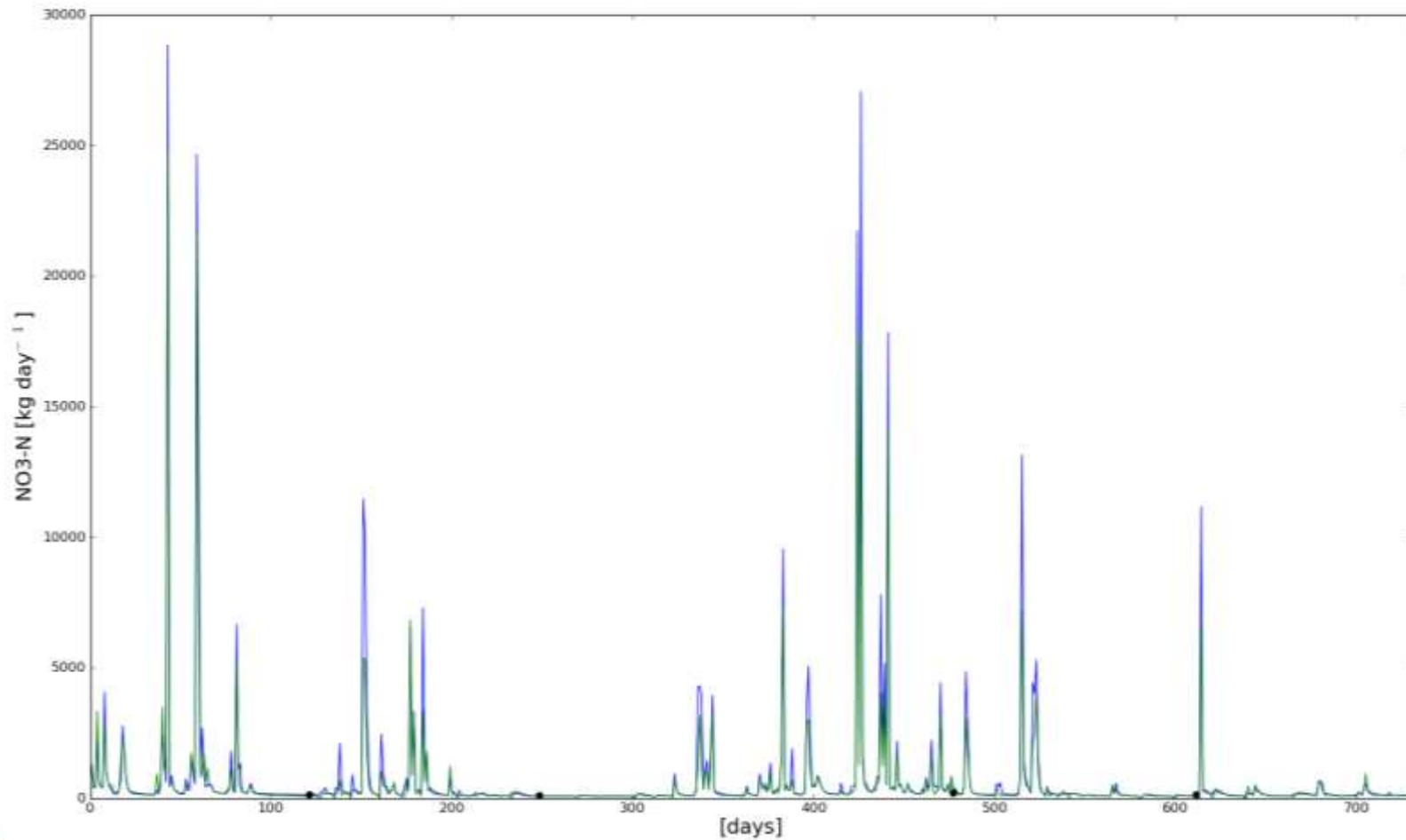
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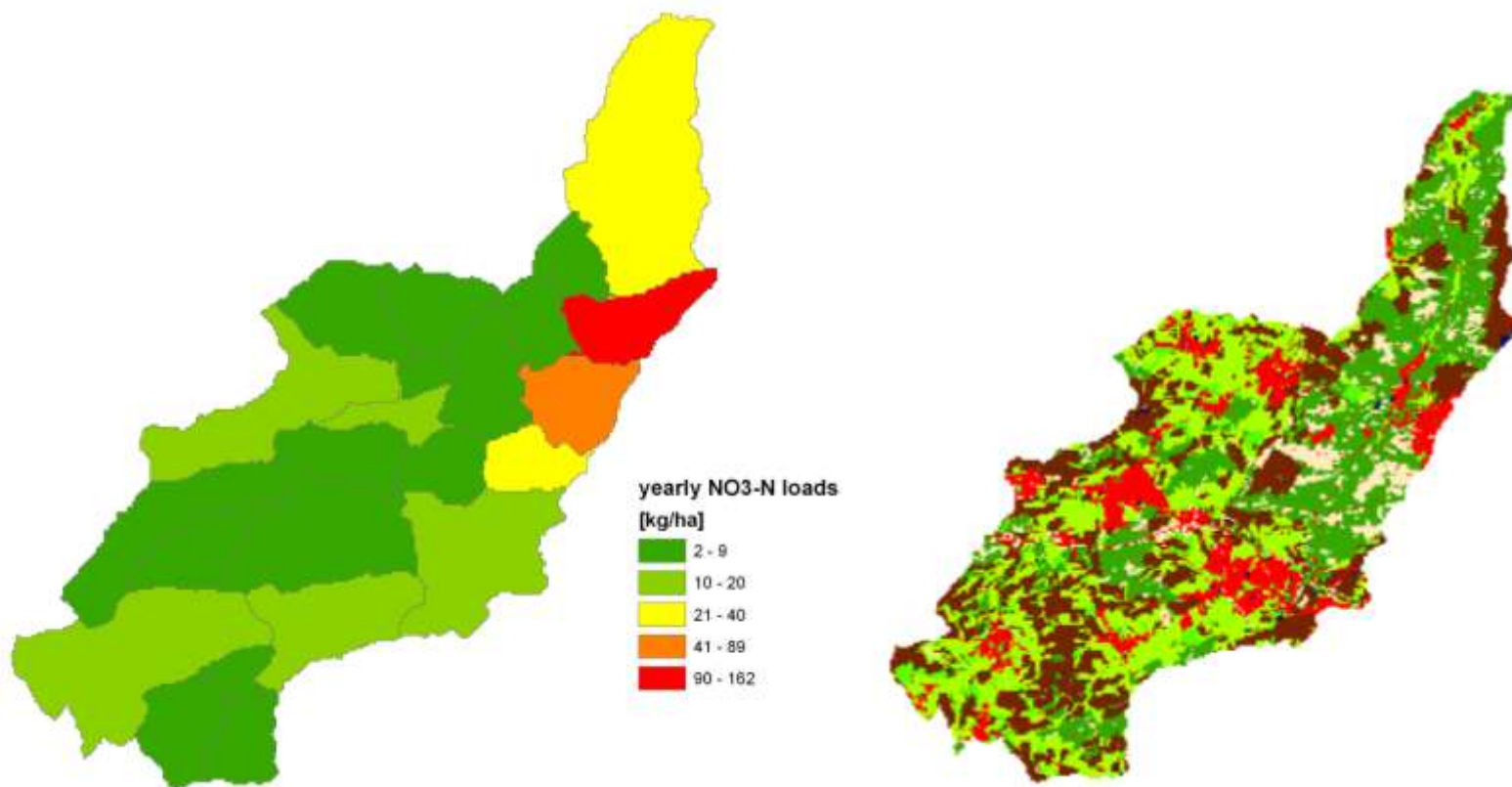
preliminary results - nitrate



Mamer 2007-2008



preliminary results - nitrate





- model performance regarding nitrate is not satisfying
- due to too few observed data points
- too much uncertainty on model performance for non observed periods

We are currently:

- monitoring with autosampler → event based sampling for nutrient and organic pollutants at two sites in the watershed
- include new data for new simulations



Thank you for your attention !



