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Water quality modelling for the Spreewald wetland regio (Germany)

Federal Ministry for Education and Research

Environmental Agency of the Free State of Saxonia

Environmental Agency of the State of Brandenburg

1. Workshop Wethydro
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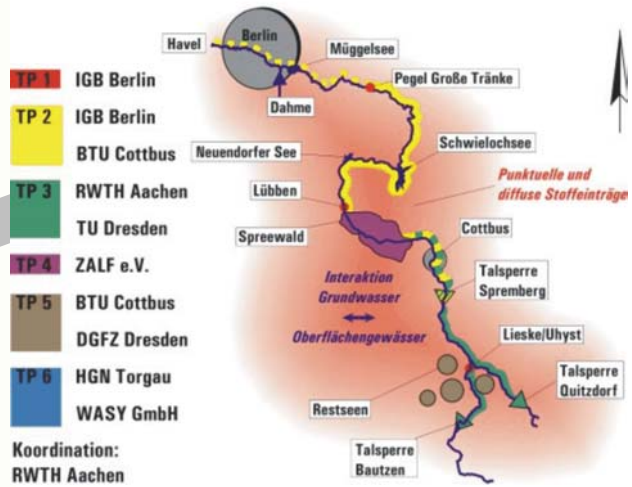
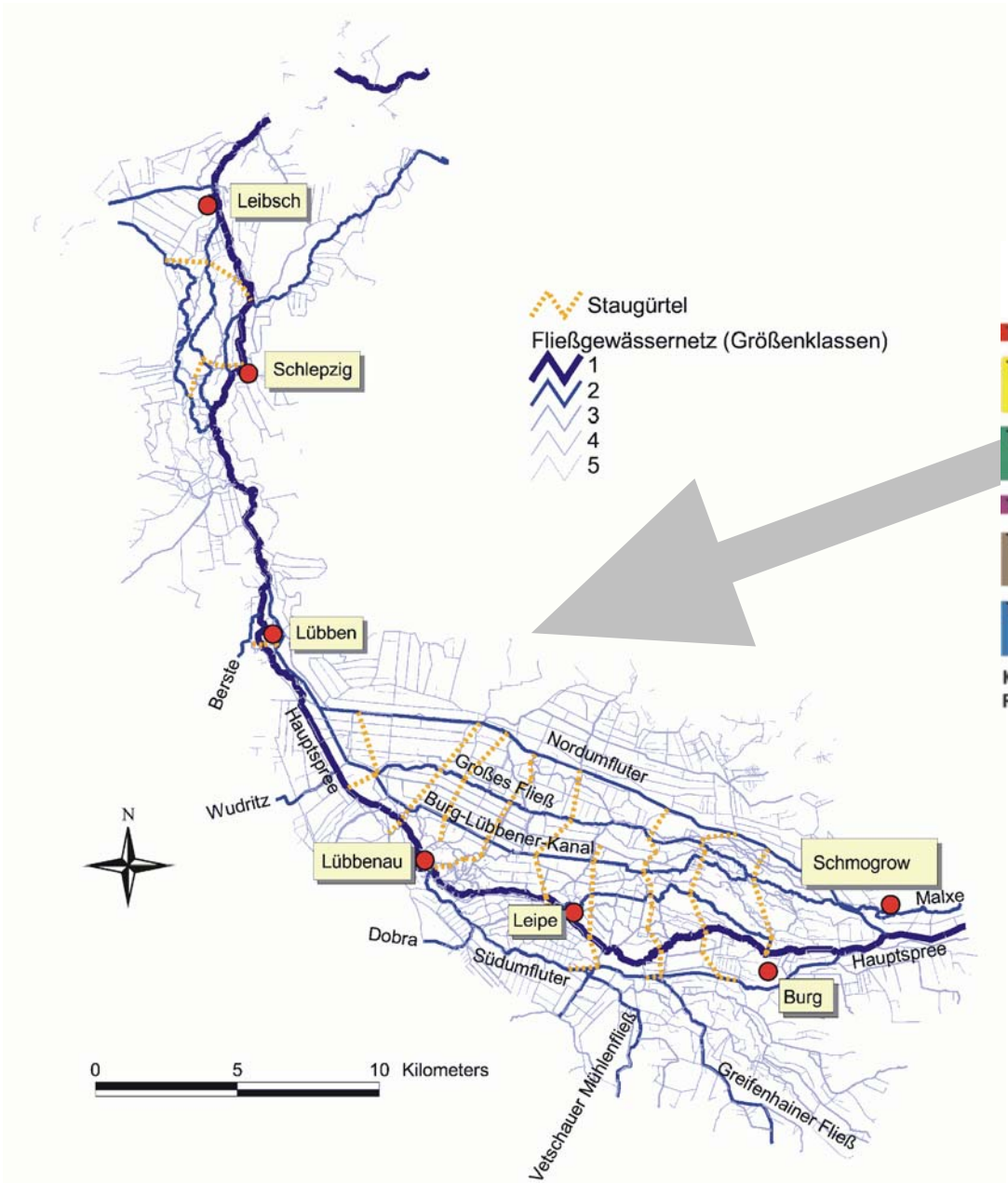
Joint Project Spree

PV Spree

Joint project Spree





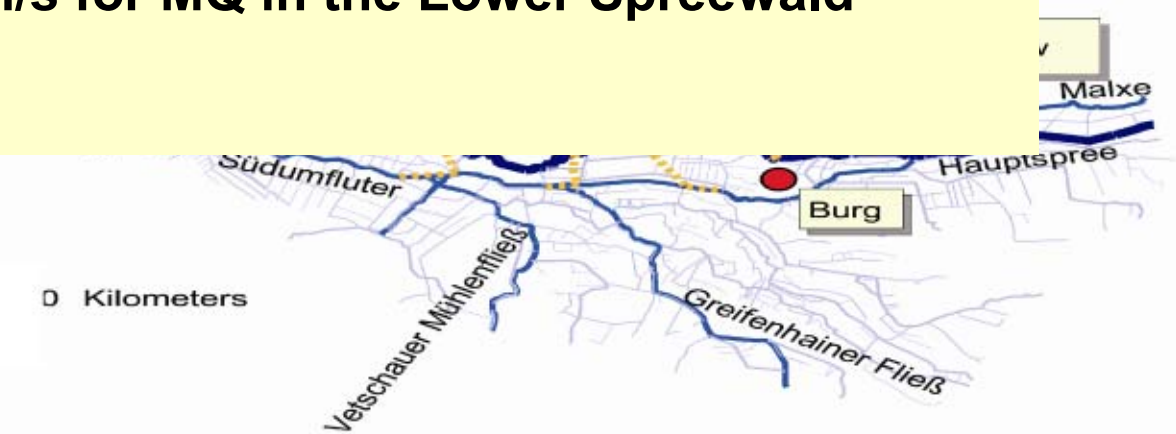
Matter transformation in the Spreewald wetland region

Study site

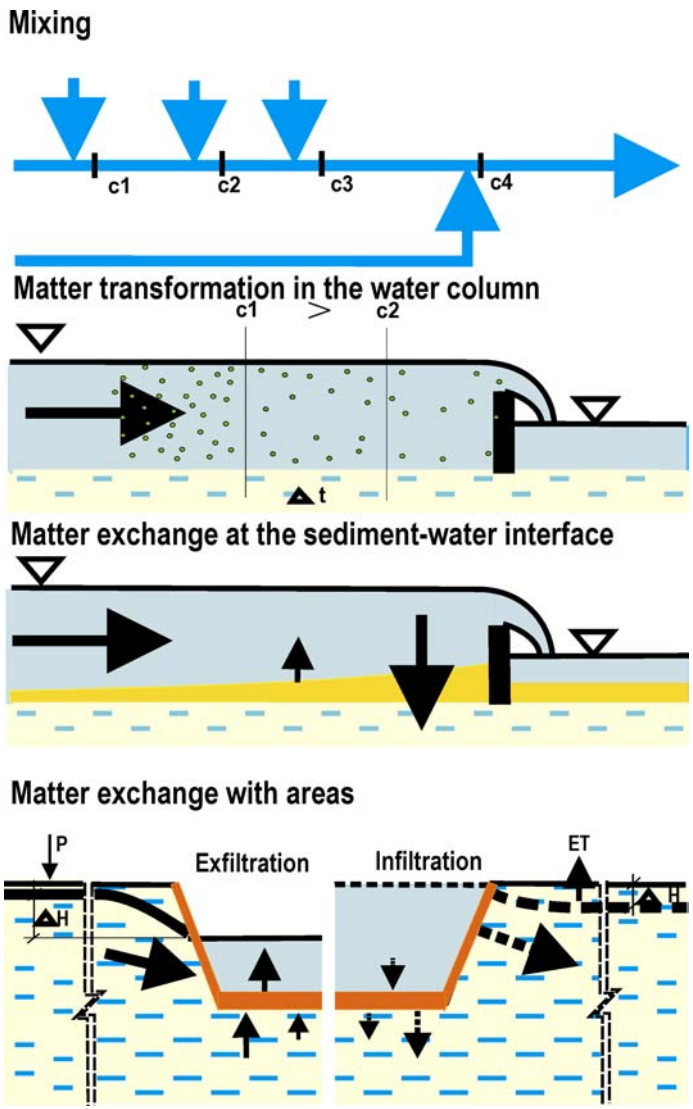
- channel network with high density
- high groundwater table, 30% fens
- water consumptive area in summer time
- groundwater-table control (13 cascades)
- different flooding regimes during winter and summer seasons with partly flooding
- low flow velocities in channels

  v_m = 0,01 m/s for MQ in the Upper Spreewald

  v_m = 0,1 m/s for MQ in the Lower Spreewald

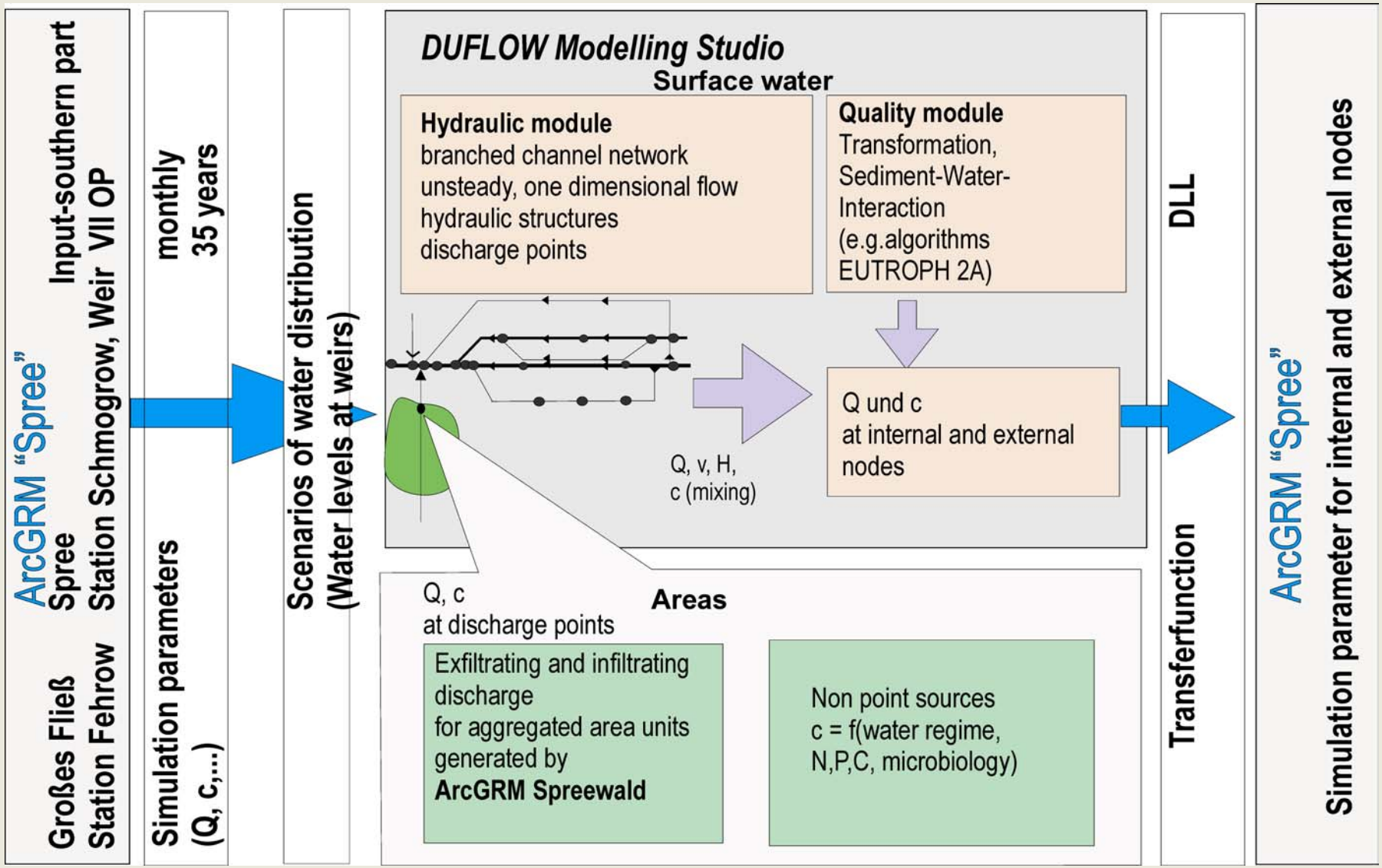


Water quality processes

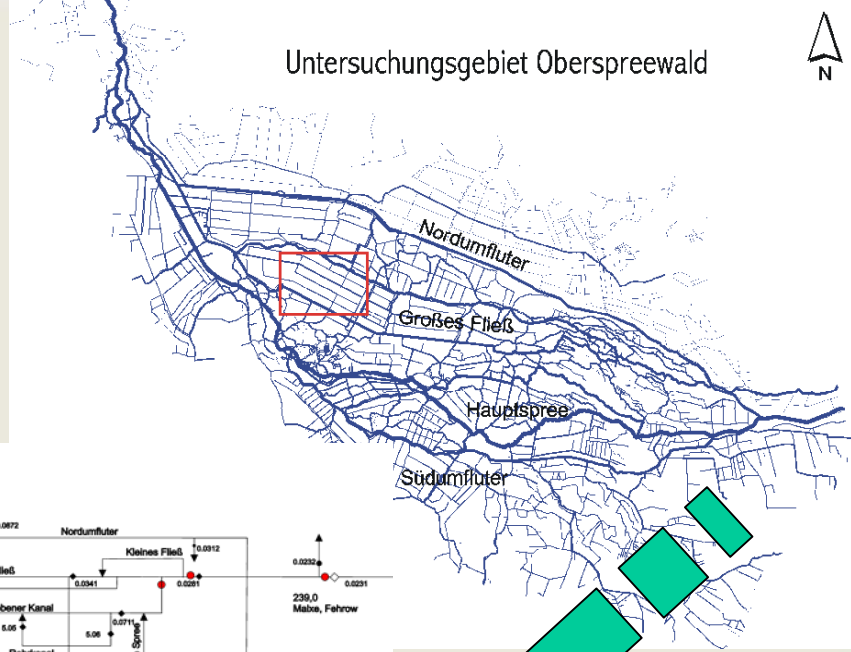


Q, c	input (e.g. Spree, Malxe)
t, v	Hydraulic structures
c	pore water concentrations
c	water column
± Q, c	area water exchange, loads
c	matter concentrations of sediment
?	

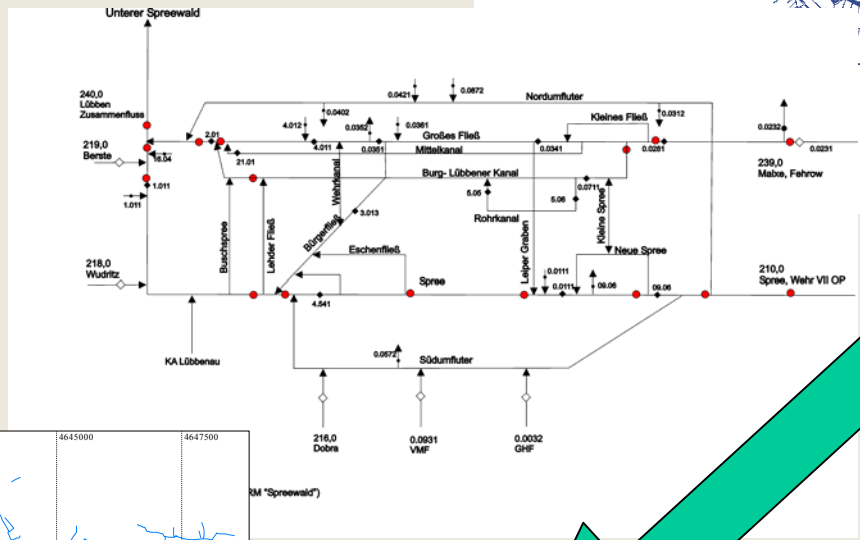
Conceptual model



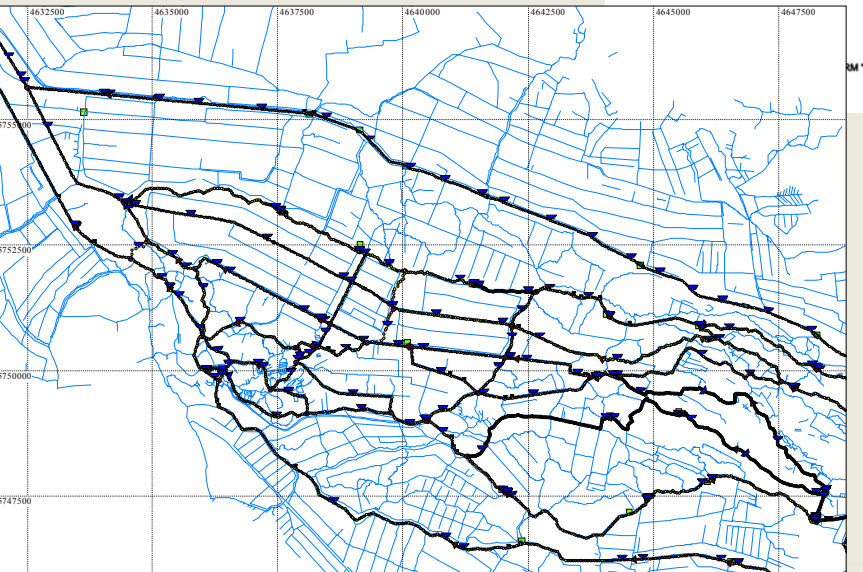
Modelled structure



Scheme



Complex model DUFLOW

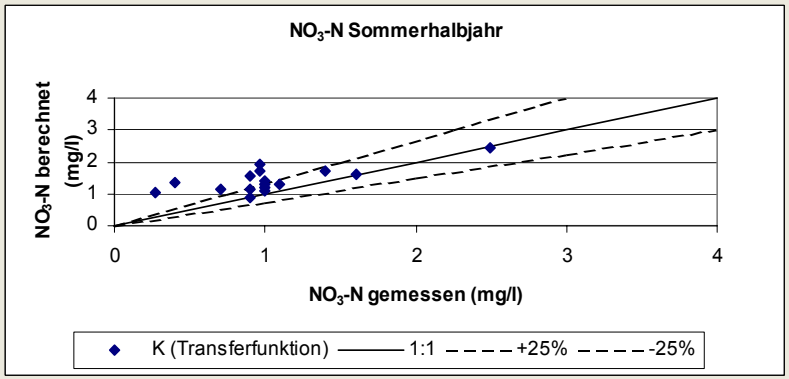


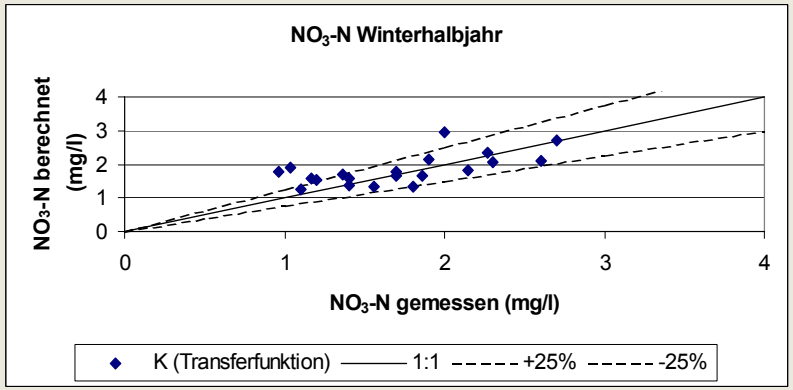
Reduction of the network

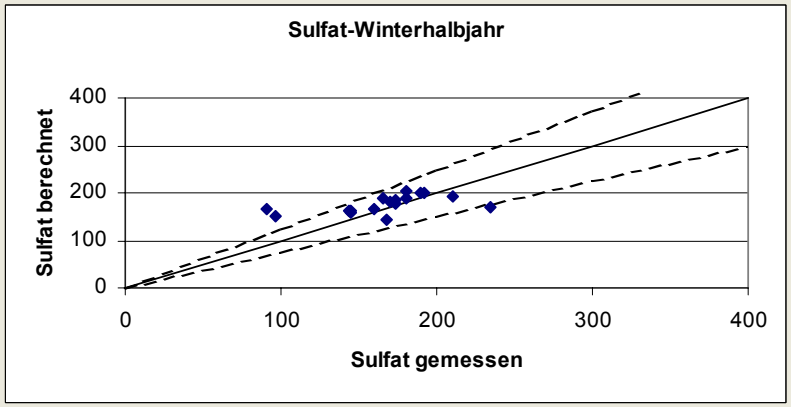
Data acquisition, monitoring networks

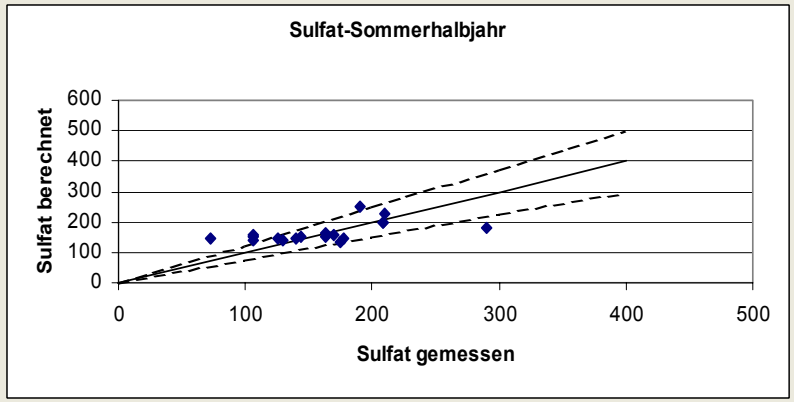
Hydrology, Hydraulics	Water quality
Discharges (1991-2000, monthly mean)	Surface water quality (1991-2000, monthly, appointed date)
Channel network, profiles	Ground water quality (near to surface)
Water levels at weirs (1991-2000, monthly mean)	Rate data (reaction kinetics)
Ground water levels	**Sediment chemistry**
	Distribution of substrates
	Pore water profiles
	Chemical composition of substrates

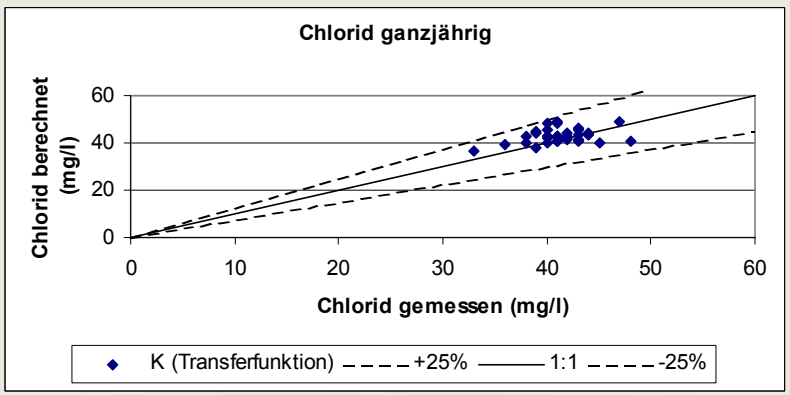
Simulation accuracy of transfer functions

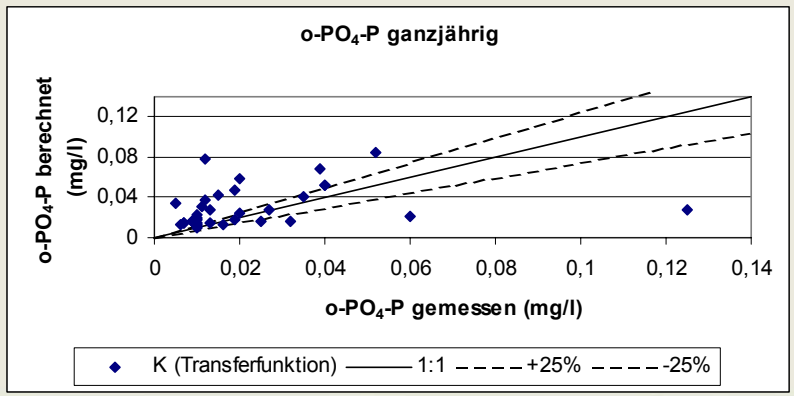












Sink and source function for sulphate

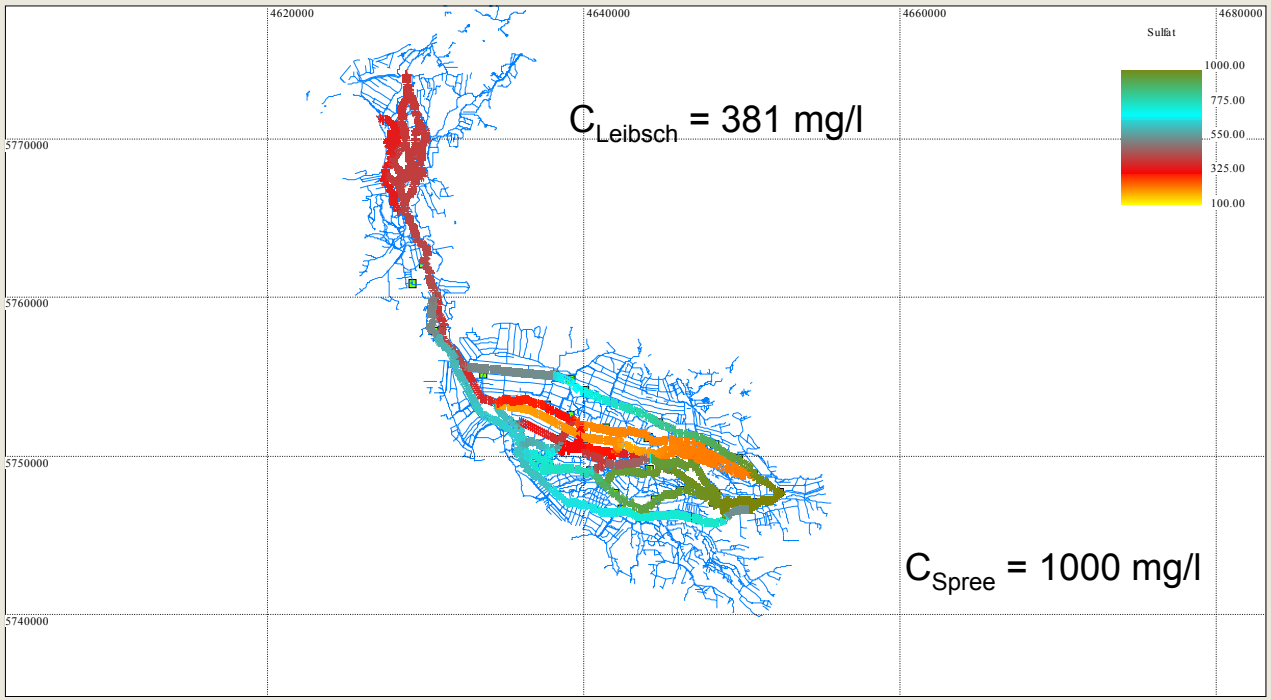
Hydraulic calculations for different discharge scenarios:

Summer- half year (SH) NW, MW, MHW, Winter- half year (WH) MW, HW

Area loads: simulated by „ArcGRM Spreewald“ in dependence on time (month) and input discharge

Algorithm for sulphate:

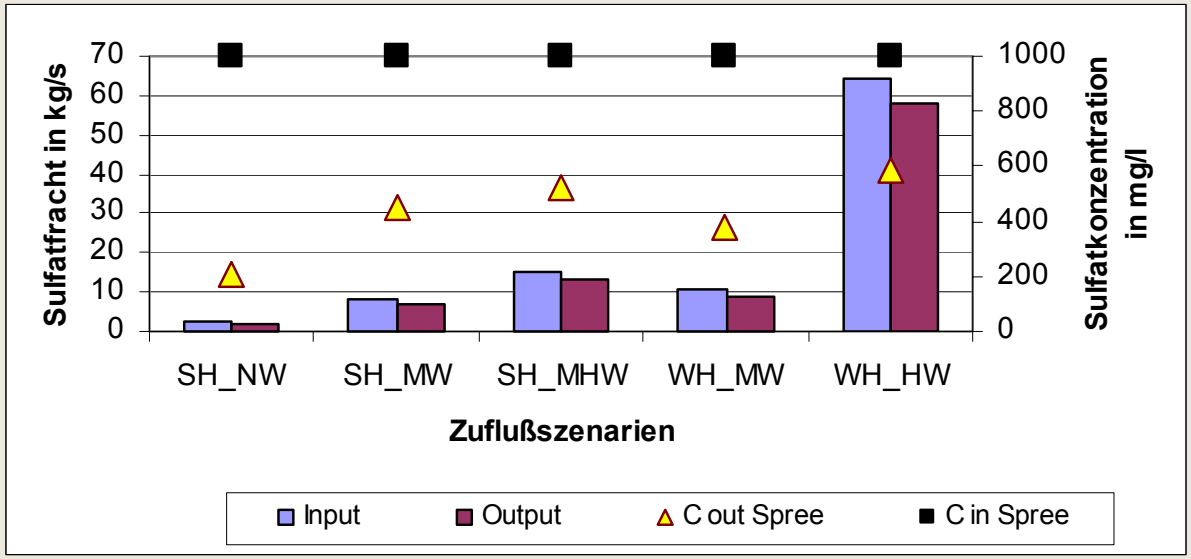
$$u \cdot \frac{\delta C_{SO4}}{\delta x} = -k_{SO4} \cdot T_W \cdot C_{SO4}$$



Sulphate reduction

by the

Spreewald wetland region



		SH_NW	SH_MW	SH_MHW	WH_MW	WH_HW
Portion on sulphate load reduction by running water system (**sink**)	% of input	**21**	**18**	**12**	**21**	**10**
Load reduction by water consumption and flooding (infiltration, **sink**)	% of input	**15**	**2**	**2**	**0**	**0**
Load addition by ground water (exfiltration, **source**)	% of output	**0**	**0,1**	**3**	**4,5**	**0**

Summary

- Water quality modelling of the Spreewald wetland region at catchment scale needs model reductions
- Reduced model has to consider the main quality processes
- Special effect of wetlands is the load exchange with adjacent areas (in both directions)
- Governmental monitoring systems are not sufficient for data supply


Thank you
Confluence of Große Fließ and Mittelkanal