M³'s sampling campaigns: going beyond static grab samples

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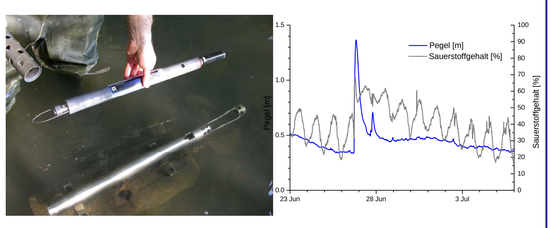
Motivation for the choice of exemplary monitoring campaigns with the M³ project

In its review of current monitoring approaches in the 3 regions under scrutiny, the M³ project team has identified several shortcomings concerning the addressing of pollutant dynamics and the link to ecosystem functioning. The team decided to focus on complementary monitoring schemes that foster holistic system understanding with cost-effective methods

River metabolism

Ecosystem metrics are powerful monitoring tools which allow for the characterization of the metabolism of a whole river stretch. Metrics like Gross Primary Production (GPP) and Ecosystem Respiration (ER) are directly linked to eutrophication and the carbon immission situation (sediment budgets): M³ will combine continuous oxygen and dissolved nutrient measure-ments to validate water quality models.



Continuous oxygen measurements with fluorescence probes. Impact of floodwaves on Respiration level.

Base-flow suspended matter

Assessing exposure of biota to particulate-bound pollutants is very challenging, as the latter can depend on the transient storage of sediments and the feeding behaviour of animals. Grab samples in the water column suffer from limit of detection issues (low susp. matter content). Silk-net passive sampling is an alternative as it integrates resuspended material over days and hence covers material available to filterers, grazers and collectors.

Setup for silk-net exposure .

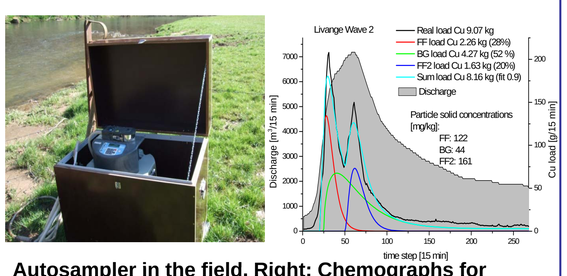
Ambient pesticide exposure

Diffuse and point pollution by pesticides has been identified as the pressure which is insufficiently addressed in the 3 regions under investigation. On one hand the actual use of pesticides cannot be quantified and hence risk assessment is impeded. On the other hand the seasonal and hydrological dynamics cannot be captured by regular grab samplings. Passive sampling with membranes is an alternative although very dynamic situations like flood waves will need to be checked for reliability. The M³ project team has developed a hypothesis based site selection method to optimize source discrimination between WWTP and surface runoff sources both in agricultural and urban settings. (see companion poster).

POCIS-Membranes in a triplicate setup. Right: closed exposure cage.

Diffuse pollution in flood waves

A number of pollutants are mobilized and discharged to receiving rivers during precipitation events. Among them are pesticides, Zink from roofs, eroded particulate matter and pollutants with high affinity for solid phases (PAH, phosphorus, lead). Triggered auto-samplers with continuous turbidity and conductivity observation are the only way to capture first-flush phenomena and to quantify pollution sources. The M³ team will implement two sampling stations which will be operational over a whole year. One of the monitored catchments will be dominated by agricultural activity, the other will feature sealed surfaces and CSO.



Autosampler in the field. Right: Chemographs for particulate Copper and sources according to a mixing model fit.

M³'s monitoring campaigns

Targeted pressure	Monitoring type	Hydrological regime covered	Period of coverage	Number of sites in parallel	Analytes	Choice of sites	Benefit
Ambient pesticide exposure	Passive sampling in rivers. POCIS membranes	Mixed	1 month in application periods (early spring, late spring, early fall)	12 3 campaigns per year	Dissolved pesticides of relevance (user stats, pesticide mobility); some pharmaceuticals	Based on GIS analysis on WWTPs with number of farms attached and agricultural land use in catchment	Assessment of mean exposure of pesticides (14 day coverage per sampling)
River metabolism (nutrient pollution- eutrophication)	Continuous monitoring of oxygen and nutrients; Sediment respiration; Tracer test (Rhodamine WT)	Base-flow	3 days per site	1 site 12-24 sites per year	O_2, o-PO_4, NH_4, NO_3 (online); sediment analysis: BOD_{24}; Corg, Chlorophyll a	Based on ecological status and community composition	Calibration of water quality models (hydraulics, oxygen, nutrients); P/R relationship and magnitude (correlation with biota); river bed permeability (tracer test)
Base-flow suspended matter (sediment accumulated pollution)	Silk-net accumulation of suspended matter	Base-flow	1-2 days May-September	6 6 campaigns per year	Corg, Chlorophyll a; N & P; Metals, HOC (PAH, alkylphenols); pesticides (with particle affinity)	Longitudinal profiles; can be coordinated with metabolism measurements	Characterizes pollution of biota food resources (as baseflow seston is resuspended bed material)
CSO emissions (diffuse pollution urban areas)	Triggered high resolution autosampler and turbidty probing	Flood waves	All year events (probably about 10 events)	1 site	Turbidity, conductivity, temperature, discharge (continuous) Susp. Matter; POC; DOC; Ntot, P_{tot}, NH_4; NO_3, o-PO_4, Metals, HOC (PAH)	Relevant immission situation (sealed areas with small receiving river)	Load estimation CSO from the immission perspective
Diffuse pollution agriculture	Triggered high resolution autosampler and turbidty probing	Flood waves	All year events (probably about 10 events)	1 site	Turbidity, conductivity, temperature, discharge (continuous) Susp. Matter; POC; DOC; N_{tot}, P_{tot}, NO_3, Pesticides	Catchment with high agricultural land use	Load estimation erosion, N & P and pesticides in suspended matter

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