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present

Ready to jump ?!

11th IBP PhD Congress

"Saving our planet, lifting people out of poverty, advancing economic growth, these are one and the same fight. We must connect the dots between climate change, water scarcity, energy shortages, global health, food security and women's empowerment. Solutions to one problem must be solutions for all."

Ban Ki-moon

Welcome to the 11th IBP PhD Congress!

Program

8:30 **Registration & Coffee**

9:00 **Welcome by Chairmen**

Taylor Nelson & Lorenzo Lagostina

9:10 **Opening Talk**

Professor Bernhard Wehrli

Talk Session 1

9:20 **Caroline Davis**
Environmental photodegradation of diarylamines reveals an unexpected kinetic solvent isotope effect

9:40 **Nicolas Walpen**
Quantification of Phenol and Quinone Moieties in Peat Dissolved Organic Matter

10:00 **Sung-Eun Lim**
Reaction of aliphatic amines with ozone

10:20 ***Poster Session A & Coffee Break***

Talk Session 2

11:30 **Biqing Zhu**
Origin and Distribution of Methane Entrapped in Calcareous Glacier-Forefield Soils

11:50 **Philip Eickenbusch**
Anaerobic microbial cycling of formate in sediments

12:10 **Lorenzo Lagostina**
How does organic matter composition influence microbial communities in marine sediments?

12:30 **Lunch**

Talk Session 3

14:00 **Frederik T. Weiss**
Passive Sampling reveals continuous Pesticide Pollution in the tropic Rio Tapezco Catchment

14:20 **Philipp Staudacher**
Policy and Practice Gap in Smallholder Pesticide Use

14:40 **Stefan Achermann**
Combined trend analysis of micropollutant biotransformation rates and enzyme transcript abundance

15:00 ***Poster Session B & Coffee Break***

Talk Session 4

16:10 **Lisa Neu**
Small-scale heterogeneity in drinking water biofilms

16:30 **Lorenz Ammann**
Inference of hydrological end error model parameters: problems and potential solutions

16:50 **Rohini Athavale**
In situ application of profiling ion selective sensors in lakes

17:10 ***Closing speech & Acknowledgements***

17:40 ***Apéro & Awards***

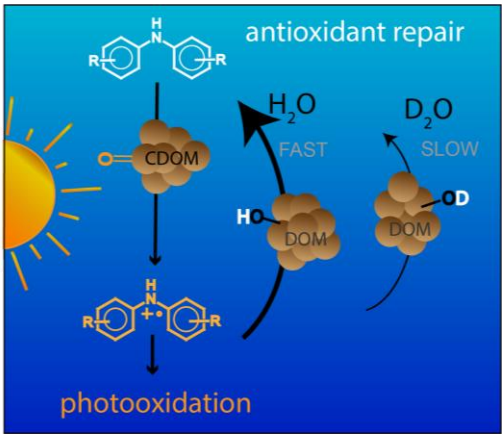
18:30 ***Dinner & After Party***

Talk 1 – Caroline Davis

Environmental Chemistry UCHEM | ETH ZENTRUM - Eawag

Environmental photodegradation of diarylamines reveals an unexpected kinetic solvent isotope effect

The environmental photodegradation of five diarylamines pharmaceuticals was investigated. These compounds are not completely removed during wastewater treatment, and enter surface waters via wastewater effluent. Their near-surface photochemical half-lives ranged from minutes to hours. All diarylamines were oxidized by hydroxyl radicals, and triplet sensitizers. The triplet mechanism was shown to go through a radical intermediate, using laser spectroscopy. Susceptibility to reaction with singlet oxygen, ($^1O_2$), was determined using the kinetic solvent isotope effect (KSIE), comparing degradation rates in H_2O to those in D_2O. We show that although most diarylamines react mildly with $^1O_2$, antioxidant repair of radical intermediates also proceeds more slowly in D_2O. This effectively causes the parent compound to degrade faster overall, a previously unstudied KSIE.



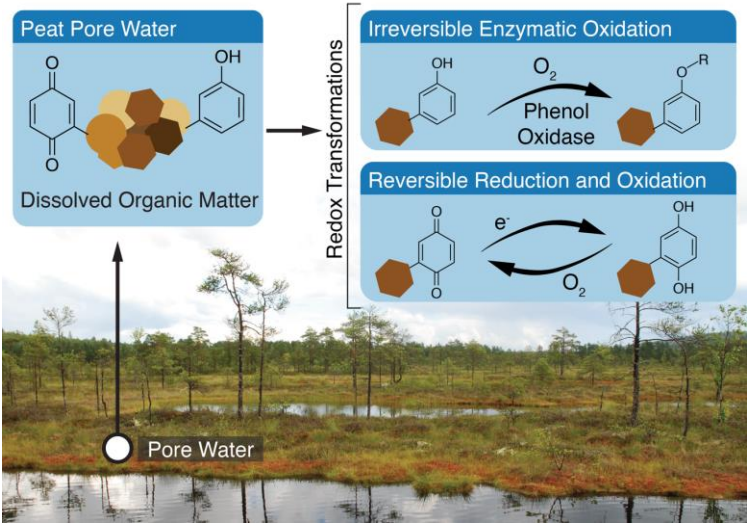
Photodegradation and antioxidant repair of model diarylamines. Antioxidant repair proceeds slower when phenolic moieties undergo H/D exchange in D_2O.

Talk 2 – Nicolas Walpen

Environmental Chemistry UCHEM | ETH ZENTRUM

Quantification of Phenol and Quinone Moieties in Peat Dissolved Organic Matter

Northern peatlands store significant amounts of carbon. Redox-active phenol and quinone moieties in peat dissolved organic matter (DOM) are considered to affect carbon cycling in these systems. However, information on the concentrations and redox transformations of these moieties was missing due to analytical challenges. This work presents a highly-sensitive flow-injection analysis system coupled to electrochemical detection that allows quantifying these moieties. Analysis of peat DOM samples demonstrated the presence of both quinone and phenol moieties. The phenol moieties were present in large concentrations and were irreversibly oxidized by phenol oxidases in oxic laboratory incubations. Conversely, quinone moieties were reversibly reduced under mild reductive conditions. The implications of these redox transformations to carbon cycling in peatlands will be highlighted.

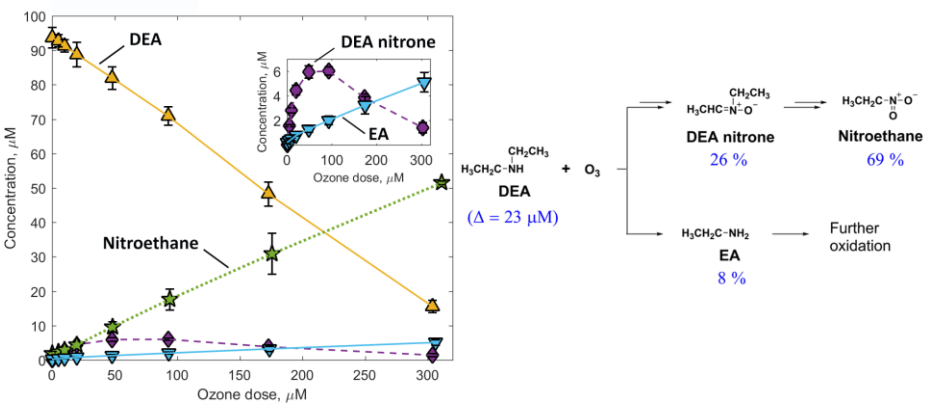


Talk 3 – Sung-Eun Lim

Water Resources and Drinking Water | WUT - Eawag

Reaction of aliphatic amines with ozone

Aliphatic amines are common constituents of micropollutants. They can be key moieties where transformation reactions occur, when ozone is used as an oxidant in water treatment. However, current information on the corresponding ozone reactions is limited to tertiary amines. This study aims to broaden the understanding of the reactions on primary and secondary amines. Ethylamine (EA), diethylamine (DEA), and trimethylamine (TEA) were chosen as target compounds and their transformation products were determined after ozonation. All amines mainly underwent oxygen transfer reactions. However, unlike triethylamine, ethyl- and diethylamine led to a more oxidized end product, nitroethane, with high yields. The significant formation of nitroethane observed in this study may pose toxicological problems in drinking water and the aquatic environment.



Reaction of diethylamine with ozone and the formation of transformation products.

Talk 4 – Biqing Zhu

Environmental Chemistry UCHEM | ETH ZENTRUM

Origin and Distribution of Methane Entrapped in Calcareous Swiss Glacier-Forefield Soils

Methane (CH_4) was recently discovered to be entrapped in calcareous Swiss glacier-forefield soils. But its origin, distribution, and abundance remain unknown. We wanted to 1) identify whether soil-entrapped CH_4 is of microbial, thermogenic, or abiotic origin, 2) determine abundance and distribution of soil-entrapped CH_4 within and across glacier forefields, and 3) estimate the total quantity of CH_4 entrapped in calcareous glacier forefields in Switzerland. We collected soils, rocks, and pore-water samples from five glacier forefields, and performed geochemical, stable-isotope, and molecular analyses, as well as batch incubations. Soil-entrapped CH_4 was largely of thermogenic origin, but evidence for local microbial CH_4 production was found. Soil-entrapped CH_4 was abundant in all glacier forefields, but CH_4 content varied considerably within and across forefields.

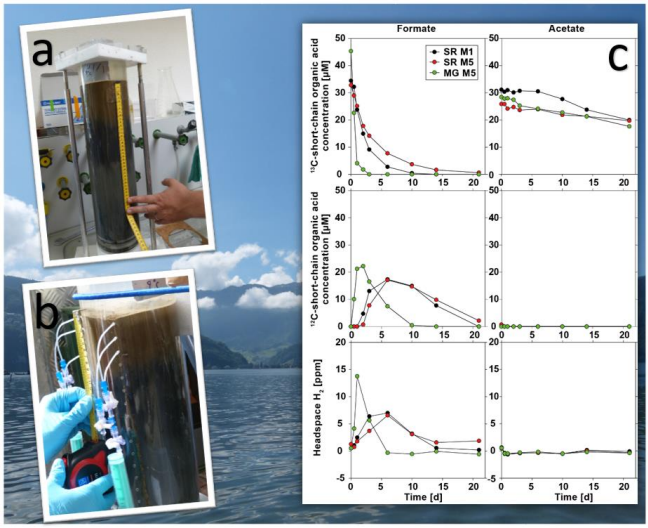
Wildstrubel glacier forefield, 2017

Talk 5 – Philip Eickenbusch

Environmental Microbiology UM | ETH ZENTRUM

Anaerobic microbial cycling of formate in sediments

Formate plays an important role as energy substrate for microbial metabolisms and is the product of microbial fermentation of organic matter in sediments. We observed rapid depletion of ^{13}C-labeled formate spikes along with hydrogen production in batch incubations of Baltic Sea and Lake Lucerne sediments. Intermediate production of ^{12}C-formate, likely from the unlabeled ^{12}C-dissolved inorganic carbon pore water pool and produced hydrogen, as well as enrichment in ^{13}C-dissolved inorganic carbon were observable. The bidirectional turnover of formate is inhibited by azide, indicating enzymatic turnover. For further investigation of involved microbes, we sequenced amplicons of the formate dehydrogenase-α-subunit gene and its transcripts. Results show high sequence diversity.



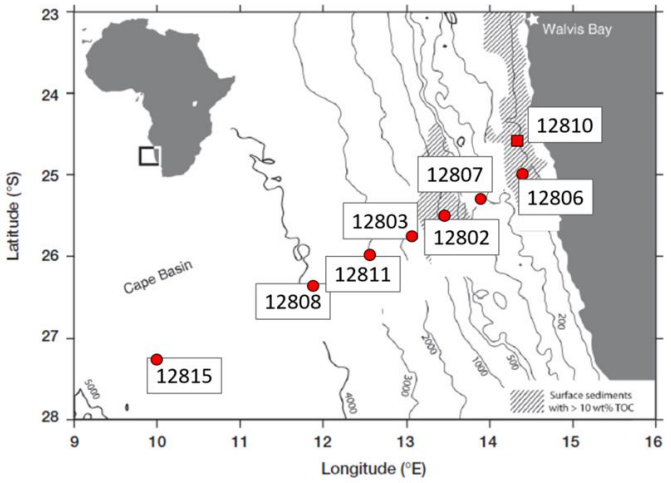
Sediment (a) and pore water (b) sampling for batch incubations and time series of formate, acetate and H_2 concentrations in batch incubations (c).

Talk 6 – Lorenzo Lagostina

Environmental Microbiology UM | ETH ZENTRUM

How does organic matter composition influence microbial communities in marine sediments?

Organic matter (OM) in sediments can differ considerably in terms of chemical composition depending on age, source and sedimentary settings. We hypothesize that the macromolecular composition of buried OM is a key factor shaping subseafloor microbial communities in sediments. To address this, we thoroughly characterized microbial communities from a transect of sampling stations in the Benguela upwelling system spanning across a natural OM gradient from the Namibian shelf to abyssal plain using 16S rRNA gene amplicon sequencing. These stations reflect different OM chemical compositions. Parallel to the microbial community and metagenome analyses, an extensive characterization of the OM present in the stations was performed. Correlations between specific OM fingerprints and microbial taxa will provide insights into ecological community drivers.



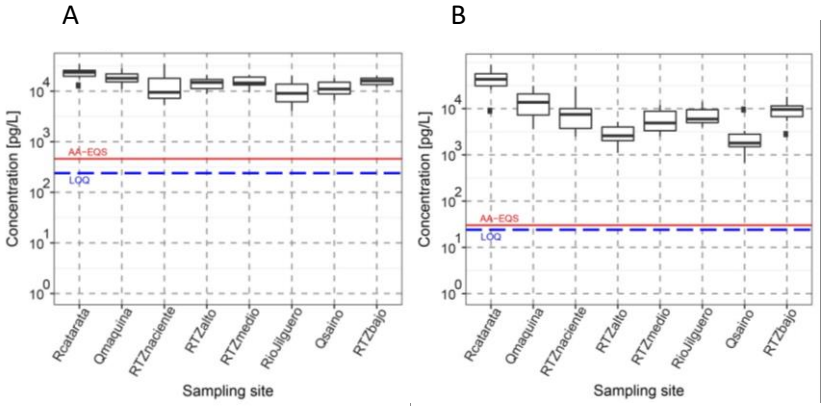
Map showing the studied transect. Numbers are indicating analyzed sites. Shaded areas indicates surface sediments with TOC content higher than 10 %.

Talk 7 – Frederik T. Weiss

Environmental Chemistry UCHEM | Eawag

Passive Sampling reveals continuous Pesticide Pollution in the tropic Rio Tapezco Catchment

Even though pesticide application rates are very high in many tropical areas, comprehensive information about the degree of pesticide pollution and knowledge about the environmental fate and distribution of pesticides is often absent. To counter this, we conducted two continuous water quality sampling campaigns in 2015 and 2016 by using three different passive sampling approaches in the tropical Rio Tapezco catchment in Costa Rica. In both years elevated levels of the apolar insecticides chlorpyrifos and cypermethrin-alpha have been chronically exceeding ecotoxicologically-based water quality standards. The more polar pesticides and metabolites such as carbendazim, fipronil-desulfinyl, propamocarb, dimethoate, linuron, acephate, or dimethomorph were detected at concentrations levels up to µg/L. In total up to 110 different compounds were detected in our catchment.



Range of the concentrations of chlorpyrifos (A) and cypermethrin-alpha (B) at the different sampling points of the Rio Tapezco catchment, Costa Rica. AA-EQS=chronic environmental quality standard, LOQ=Limit of quantification.

Talk 8 – Philipp Staudacher

Environmental Chemistry UCHEM | Eawag

Policy and Practice Gap in Smallholder Pesticide Use

In low and middle income countries, a large agriculturally based population suffers from environmental impacts and acute poisonings due to inadequate pesticide applications. In 2017, we conducted research to describe pesticide use and negative impacts on humans and the aquatic environment in central Uganda. Using interdisciplinary methodologies, we collected quantitative and qualitative environmental, human health and institutional data. We interviewed and clinically assessed more than 300 farmers, monitored 10 water collection sites over three months, and interviewed dozens of stakeholders. We will quantify cost and benefit of pesticide use in tropical smallholder farming and identify discrepancies between actual pesticide use and corresponding regulations. Subsequently, we will present our results to stakeholders, discuss the findings and then design and execute an experimental intervention to reduce inappropriate pesticide use.

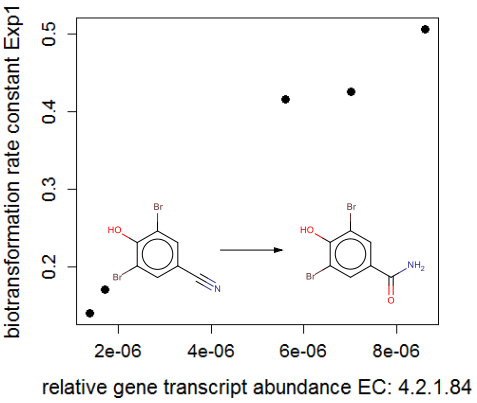
Pesticide spraying without safety equipment – *Philipp Staudacher*

Talk 9 - Stefan Achermann

Environmental Chemistry UCHEM | Eawag

Combined trend analysis of micropollutant biotransformation rates and enzyme transcript abundance

The biotransformation of 42 micropollutants was investigated in activated sludge cultivated at different SRTs, revealing a variety of different trends in rate constants. Remarkably, a number of micropollutants show consistent trends that depend on the type of transformation reaction (e.g., S-oxidation, nitrile hydration or the conjugation of sulfonamide antibiotics). For many micropollutants undergoing oxidative transformations (e.g., phenylureas), a positive association of rate constants and SRT was detected. Together with metatranscriptomic sequencing, the differences in trends observed for different biotransformation reaction types provide a basis for testing relationships between enzyme transcript abundances and trends in biotransformation rates. For a number of reactions, including monooxygenase-catalyzed reactions and nitrile hydration (Figure), positive relationships were observed.



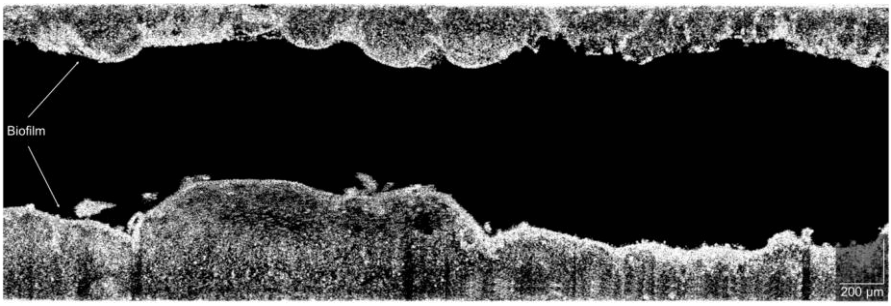
Biotransformation rate constants of bromoxynil (L g_{TSS}^{-1} d^{-1}) vs. relative gene transcript abundances corresponding to the enzymes classified as nitrile hydratases (enzyme commission number 4.2.1.84).

Talk 10 – Lisa Neu

Environmental Microbiology UMIK | Eawag

Small-scale heterogeneity in drinking water biofilms

The majority of drinking water bacteria reside in biofilms and multiple factors give rise to heterogeneity within these. To quantify this on small-scale, we characterized biofilms grown under controlled conditions inside shower hoses, using optical coherence tomography (µm-scale), flow cytometry (cm-scale) and 16S rDNA amplicon sequencing (cm-scale). We found considerable heterogeneity on small-scale throughout the hose. Biofilm thickness varied up to 50 % within as little as 300 µm and total cell concentrations of successive 1.2 cm pieces showed differences between 0.04 – 96.4 %. These findings are particularly valuable with respect to (1) an improved understanding of biofilm ecology, (2) developing sensible biofilm sampling strategies, and (3) understanding how this impacts the microbiology of building plumbing systems on large scale.



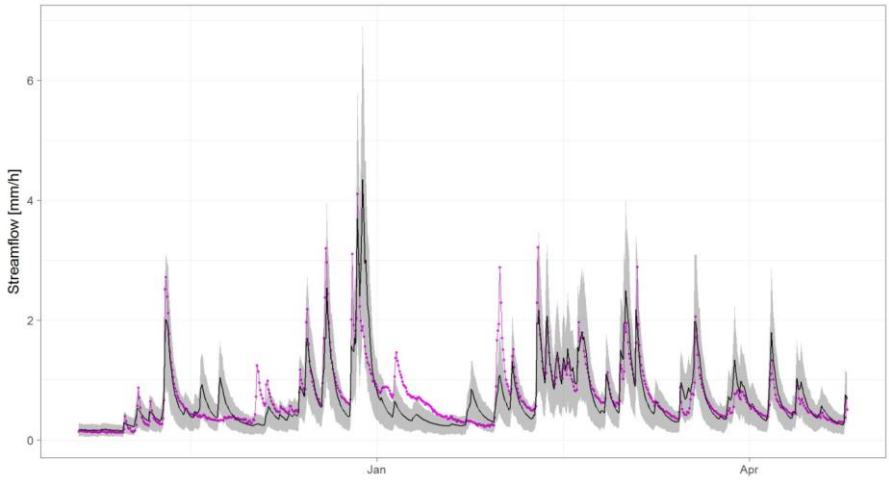
Heterogeneity within 4 mm length of a shower hose biofilm, visualized by optical coherence tomography (distance between bottom and top not to scale).

Talk 11 – Lorenz Ammann

SIAM | Eawag

Inference of hydrological and error model parameters: problems and potential solutions

We present the theoretical framework of a new likelihood function to describe total output uncertainty of hydrological models considering heteroscedastic, correlated and non-normal errors. The performance of the developed likelihood function and its sensitivity to various assumptions are analyzed and compared to well-known existing error models. Problematic interactions between hydrological and error model parameters, especially on the rising limb of the hydrograph, are identified and discussed. Based thereon, we present methods to mitigate such interactions, which allowed us to reach a more stable joint inference of hydrological and error model parameters. If the presented approach can be successfully extended to other case studies and models, it could contribute to more reliable predictions of hydrological quantities and their associated total uncertainties.



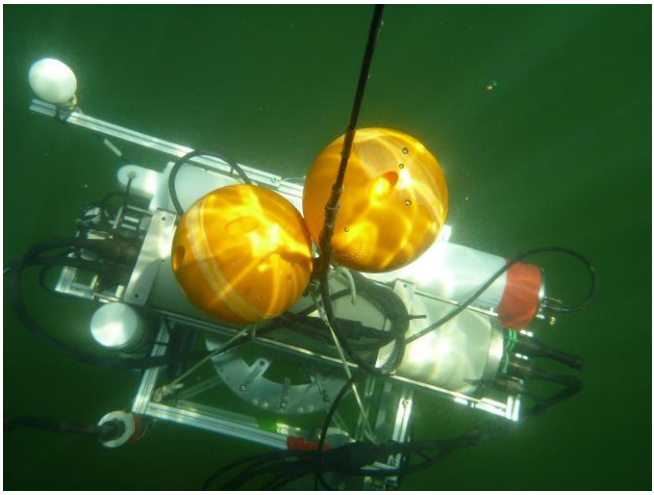
Modelled (black) and observed (red) streamflow in the Murg River, including the 90 %-confidence intervals.

Talk 12 – Rohini Athavale

Surface Waters – Research and Management SURF | Eawag

In situ application of profiling ion selective sensors in lakes

Biogeochemical processes are often confined to very narrow zones in aquatic systems. To study such processes, highly resolved measurements are required. Potentiometric ion selective electrodes (ISEs) are promising tools for such an application. But profiling in the lake water column and resolving small gradients could be challenging because of several reasons such as low analyte concentration, presence of dissolved organics, interfering ions and reactive solutes like sulfide in anoxic parts of eutrophic lakes. Most designs of ISEs work well under laboratory conditions but can fail to meet challenges of natural water matrices. We fabricated robust designs of ISEs, applied these sensors in a custom built profiling set up and demonstrated the potential of this system for high resolution in-situ measurements.



Profiling ion analyzer (PIA) during deployment in Rotsee.

Poster Session A

A1 **Fabian Bärenbold**
On-site analysis of gas concentrations in Lake Kivu, Central Africa

A2 **Marie Sophie Maier**
Tracking down hotspots of CO_2 and CH_4 in the Danube Delta

A3 **Pascal Wiesli**
Off-Flavour control in land-based salmon production

A4 **Domitille Louchard**
The Amazon River imprint on the marine biogeochemistry

A5 **Fridolin Haag**
Identifying value functions for river assessment based on uncertain indifference statements

A6 **Michael Daniels**
Effects of species diversity on community function

A7 **Ben Saïd Sami**
The Assembly of Misfits – spatial segregation for optimizing microbial interactions

A8 **Werner Leonardo Desiante**
Biotransformation Potential of Natural Stream Biofilms

A9 **Jangwoo Lee**
Occurrence of antibiotic resistance bacteria in Swiss rivers

A10 **Regiane Natumi**
(Co-)Production Dynamics of Cyanobacterial Peptides

A11 **Katharina Sodnikar**
Environmental fate of dsRNA-based plant incorporated protectants

A12 **Emanuel Müller**
A new dominant sink for marine DMS

A13 **Rachele Ossola**
Dissolved organic sulfur (DOS) photomineralization in aquatic systems

A14 **Elaheh Ghadiri**
Noble-gas evidence on the groundwater origin in the coastal plain of Salalah, Oman

A15 **Iris E. Schilling**
Carbon and Hydrogen Kinetic isotope effects of enzymatic transformation reactions of hexachlorocyclohexane

A16 **Barbara Franziska Günthardt**
Assessment of the plant toxin's aquatic micropollution potential

A17 **Sabine Anliker**
Detecting industrial micropollutant emissions in treated wastewater

A18 **Daniela Rechsteiner**
Passive sampling of natural estrogens in surface waters influenced by agriculture

A19 **Anne-Marie Wefing**
^{129}I and ^{236}U as water mass tracers in the Fram Strait

A20 **Cara Nissen**
Coccolithophore controls on Southern Ocean biogeochemistry

A21 **Markus Schmitt**
Determination of quenching rate constants for triplet-state chromophoric dissolved organic matter

Poster Session B

B1 **Longhui Deng**
Impacts of bioturbation on microbial reactions and communities

B2 **Samuel Bickel**
Soil microbial diversity and abundance related to land and climatic attributes

B3 **Johanna Donhauser**
Temperature sensitivity of the high alpine soil microbiome

B4 **Xingguo Han**
Microbial community compositions in surface sediments of Swiss lakes

B5 **Kathrin Baumann**
The role of microbial communities in the nitrogen cycle of lakes

B6 **Christine Egli**
Mapping photochemical modifications within aquatic extracellular enzymes

B7 **Charlotte Driesen**
Transgenerational Fate Modeling of Polychlorinated Biphenyls in Cattle

B8 **Carina Daria Schönsee**
Mobility of natural toxins in the aquatic environment

B9 **Jonas Mechelke**
Enantiomeric Fractionation – an indicator of biotransformation during a water-sediment flume study

B10 **Taylor Nelson**
Using stable carbon isotopes to track polyester fate during biodegradation

B11 **Karin Kiefer**
Suspect screening of pesticide metabolites using high resolution mass spectrometry

B12 **Lena Schinkel**
Transformation of chloroparaffins to chloroolefins during metal drilling

B13 **Alma Dal Co**
A small world: how local cell-cell interactions drive microbial community-level dynamics

B14 **Jasmin Fetzer**
Feedbacks between treeline shift and nutrient availability in Northern Russian mountains

B15 **Damiano Righetti**
Global marine phytoplankton patterns

B16 **Kevin Hoffmann**
Effects of metal-to-sulfide ratio, NOM, and Mn^{2+} on sulfide nanoparticle characteristics

B17 **Meret Aeppli**
Fe^{2+}-induced transformation of ferrihydrite: Linking iron oxide reducibility to mineralogy

B18 **Natacha Van Groeningen**
Sorption interactions between Cd(II) and Mn(II) on Fe-free montmorillonite under anoxic conditions

B19 **Badrudin Stanicki**
Mid-infrared laser spectroscopy for three-dimensional methane mapping by unmanned aerial vehicles

B20 **Aryeh Feinberg**
Evidence for long-range atmospheric selenium transport

B21 **Sanja Vranic**
Iron Oxide Phase Transformations during Microbial Reduction of Ferrihydrite

List of Participants

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