



# Going dynamic – the potential of online water quality monitoring tools

6–7 November 2024  
Hybrid course



## Aim of the course

This course aims to provide an overview of the application and the potential of available online methods for environmental monitoring, including online biomonitoring, online chemical monitoring, online flow cytometry and online sensors for water quality monitoring.

## Course description

This one and a half day course aims to provide an overview of the application of various online tools for environmental monitoring of water quality. The tools presented range from online biomonitoring over online chemical monitoring and online flow cytometry to online sensors. Online tools are capable of assessing water quality with high temporal resolution thus allowing to capture patterns of peak events. Online biomonitoring systems monitor the responses of aquatic organisms in real time, while online chemical monitoring tracks the concentrations of a range of target substances at short intervals. In addition, online flow cytometry allows the composition of the bacterial community to be followed in real time and online sensors monitor various water quality parameters such as pH, conductivity and other abiotic parameters. All of these methods allow a much faster response and action in the event of an incident and are important tools for the water quality monitoring of the future.

An overview of the methods will be followed by presentations of selected case studies for water quality monitoring. In addition, future research needs and perspectives for the application of online monitoring tools in routine water quality surveillance and regulation will be discussed. The second day will be devoted to demonstrations of some of the methods presented.

# Wednesday, 6 November 2024

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08:30 Welcome coffee

09:00 General introduction to the topic + first exchange  
*Benoît Ferrari & Cornelia Kienle*

## **Online biomonitoring**

09:20 Overview on online biomonitoring  
*Cornelia Kienle*

09:30 Real-time and *in situ* monitoring of aquatic environments using indigenous microbial community-based biosensors  
*Jean-Michel Monier*

09:50 Online biomonitoring with algae and water flea  
*Florian Schulz*

10:10 Online biomonitoring of diffuse pollution in a small Swiss river using aquatic invertebrates  
*Miriam Langer*

10:30 Coffee break

10:50 ToxMate: Operational biomonitoring for micropollutant surge alerting via real-time invertebrate behavioural analysis  
*George Ruck*

11:10 RAINBOWflowCHIPonline: A fish cell-based impedance sensor to monitor water quality  
*Jenny Maner*

11:30 Lunch break

12:30 Discussion

## Online monitoring of abiotic parameters, chemicals and bacteria

- 13:00 Overview
- 13:10 Online sensors for continuous wastewater surveillance  
*Marco Kipf*
- 13:30 Online measurement tools for monitoring of abiotic parameters and metals in a mobile laboratory  
*Gabriel Billon*
- 13:50 From laboratory to *in situ* monitoring of trace metals in aquatic ecosystems  
*Mary-Lou Tercier Waeber*
- 14:10 Automated online flow cytometry for *in situ* monitoring of microbial dynamics  
*Frederik Hammes*
- 14:30 Coffee break
- 15:00 The MS2field – a transportable automated HRMS platform for on-site monitoring of pollutant dynamics  
*Heinz Singer*
- 15:20 Pesticide and bacteria dynamics in a karst spring in the Swiss Jura  
*Johannes Schorr*
- 15:40 Combined application of online biomonitoring and online chemical monitoring at wastewater treatment plants  
*Ali Kizgin*
- 16.00 Evaluation part 1
- 16:10 Plenary discussion
- 16.40 Get together
- 17.30 End of the first day

# Thursday, 7 November 2024 (no online participation possible)

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- 08:30 Welcome coffee
- 09:00 Introduction + assignment to groups  
*Cornelia Kienle*
- 09:10 Demonstrations\*
- 10:30 Coffee break
- 11:00 Demonstrations\*
- 12:20 Evaluation part 2 and concluding remarks
- 12:40 Apéro riche

## **Demonstrations: Online biomonitoring\***

- BBE Algae and Daphnia Toximeter and Sensaguard  
*Ali Kizgin*
- Online Algae Biosensor to monitor the photosynthetic efficiency in biofilm by a PAM fluorometer  
*Elisabetta Canuti*
- ToxMate  
*George Ruck*
- RAINBOWflowCHIPonline  
*Jenny Maner*

## **Demonstrations: Online monitoring of abiotic parameters, chemicals and bacteria\***

- Online sensors for continuous wastewater surveillance  
*Marco Kipf*
- On-chip microsensors and mini/micro integrated analytical systems for measuring metals in complex media  
*Mary-Lou Tercier Waeber*
- Automated online flow cytometry for in-situ monitoring of microbial dynamics  
*Jürg Sigrist*
- The MS2field – a transportable automated HRMS platform for on-site monitoring of pollutant dynamics  
*Phillip Longrée*

## **Target audience**

The course is aimed at professionals from industry, authorities and science who are interested in online monitoring methods.

Course participants will receive a certificate of attendance. The documentation will be available for electronic download before the course. The course language is English.

## **Course management**

Dr. Cornelia Kienle  
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## **Course organisation**

Brigitte Bracken  
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## **Course fee**

CHF 450.– (1.5 days)  
CHF 370.– (Online participation, first day only)

The price includes course fees, documentation and meals according to the course programme. Not included are overnight stays. Online participation is only possible for the first day.

## **Registration deadline**

Wednesday, 16 October 2024  
Online registration under:  
[www.ecotoxcentre.ch/expert-service/continuing-education](http://www.ecotoxcentre.ch/expert-service/continuing-education)

## **Course location**

Room C 20  
Forum Chriesbach (FC)  
Eawag, Überlandstrasse 133, 8600 Dübendorf  
or online (first day only, link will follow)

## Speakers

**Prof. Dr. Gabriel Billon** has been working as a chemist at the University of Lille for about twenty years on the contamination of aquatic systems (water and sediment). He develops trace element analysis methods and pollution monitoring systems, depending on the problem. He is involved in monitoring water quality over different time scales and has developed a mobile laboratory for this purpose.

**Dr. Elisabetta Canuti** has been working as a researcher in analytical chemistry at the Joint Research Centre of the European Commission since 2000. She develops and validates methods for the detection of phytoplankton pigments in water. She organises inter-comparison exercises to evaluate uncertainties of in-situ observations in support of remote sensing. She has also contributed to the development of prototypes for monitoring multiple parameters of environmental stressors that affect phytoplankton.

**Dr. Frederik Hammes** leads the Environmental Microbiology department and the Drinking Water Microbiology group at Eawag (Switzerland). He received a PhD from the University of Gent (Belgium) in microbiology. His group at Eawag studies the microbial ecology of drinking water treatment and distribution systems, focusing on novel detection methods and understanding microbial biofilm growth, with a special focus on *Legionella*.

**Dr. Benoît J.D. Ferrari** has been the director of the Ecotox Centre since September 2019. He completed a PhD in ecotoxicology at the University of Lorraine (France). After working as a researcher at INRAE (formerly IRSTEA) in Lyon (France) and at the F.-A. Forel Institute at the University of Geneva, he joined the Ecotox Centre at EPFL in 2013 as head of the Soils and Sediment team.

**Dr. Cornelia Kienle** has been an aquatic ecotoxicologist at the Ecotox Centre since 2008. She studied biology at the Universities of Konstanz and Bremen and received her PhD from the University of Tübingen on the toxicity of environmental chemicals and their mixtures. At the Ecotox Centre, she is mainly involved in evaluating and applying *in vitro* and *in vivo* test systems for monitoring aquatic ecosystems.

**Marco Kipf** is working as a technician in the Process Engineering department of Eawag. He is responsible for the measurement devices of the department and the operation and maintenance of the wastewater treatment plant in the Eawag experimental hall.

**Ali Kizgin** has been a PhD candidate at ETH since 2021. He studied ecology at the University of Heidelberg (Germany). His transdisciplinary work on online biomonitoring focuses on the application of online biological early warning systems at wastewater treatment plants for the surveillance of wastewater effluent in cooperation with Eawag, FHNW and the Ecotox Centre.

**Prof. Dr. Miriam Langer** is head of the working group Ecotoxicology at the Institute for Ecopreneurship at the University of Applied Sciences Northwestern Switzerland. She studied biology at the University of Tübingen, where she received her doctorate in ecotoxicology. After various positions in industry, research and teaching, including as a study director in an ecotoxicological contract laboratory and as a research associate at the Ecotox Centre, she has been working at the FHNW since 2018.

**Jenny Maner** has been a PhD student in the Department Environmental Toxicology at Eawag since 2020. She studied biology and environmental sciences at the University of Basel and the ETH Zurich. The topic of her PhD is the application of fish cell lines for *in vitro* chemical toxicity testing and aquatic toxicity testing in the field.

**Dr. Jean Michel Monier** obtained his PhD in Environmental Science at UC Berkeley (US). After 15 years of academic research in the field of environmental microbiology, he founded Enoveo, a company specialising in environmental biotechnologies, where he developed microbial biosensors for monitoring aquatic environments. In 2019, after the takeover of Enoveo by the Halma group, he joined the group as CTO of the Environmental Department.

**Dr. George Ruck** has been the lead research and data scientist at Viewpoint since finishing his PhD in early 2024. He completed his PhD in ecotoxicology and data science at the University of Lyon 1 in partnership with INRAE Ecotoxicology, INSA DEEP laboratories and the company Viewpoint. In his new role, he remains in close contact with the INRAE ecotoxicology laboratory, continuing joint research with Viewpoint in the development of the ToxMate.



**Dr. Florian Schulz** is employed as support engineer for online toxicity monitors of a German manufacturer of these types of instruments (bbe Moldaenke). He studied biology at the University of Kiel and received his PhD on studies about the ecophysiology of plants in the Antarctic. For about 20 years he has been supporting any kind of online toxicity monitor from the company worldwide, working with daphnia, fish and algae with applications in environmental control, water production and wastewater treatment.

**Johannes Schorr** holds a MSc in Environmental Geoscience from the University of Tübingen. In 2024, he completes his PhD in the group of Juliane Hollender in the Department of Environmental Chemistry at Eawag with a focus on pesticide dynamics in Swiss karst springs. He used online sensors and high-resolution pesticide measurements to correlate pesticide concentrations with various parameters such as bacterial cell counts, nitrate or turbidity. His PhD work also included the development of a method based on ion chromatography to analyse very polar and anionic compounds in water.

**Jürg Sigrist** has been working as a technician in the Environmental Microbiology department since 2013. As a specialist in flow cytometry, he is involved in various drinking water projects in Switzerland and internationally.

**Heinz Singer** heads the research group of Environmental Analytics in the Department of Environmental Chemistry at Eawag. After studying chemistry and spending five years at an industry-related research institute in Munich, he moved to Eawag in 1997 and has since been working on the development of mass spectrometric methods for the sensitive and selective detection of emerging pollutants in the water cycle.

**Dr. Mary-Lou Tercier Waeber** holds a PhD in Chemistry and Environmental sciences. She is senior research associate in the group of Prof. Bakker at the university of Geneva and leads the analytical voltammetry and environmental chemistry research team of the group. She is a pioneer and recognized expert on developing innovative on-chip microsensors and submersible probes for *in situ* quantification of trace metals in aquatic systems and on applying these devices to study their biogeochemical cycles.

# Location plan

## Public transport

From Zurich Main Station (HB) by S-train (S3, S9, S12) to Stettbach.

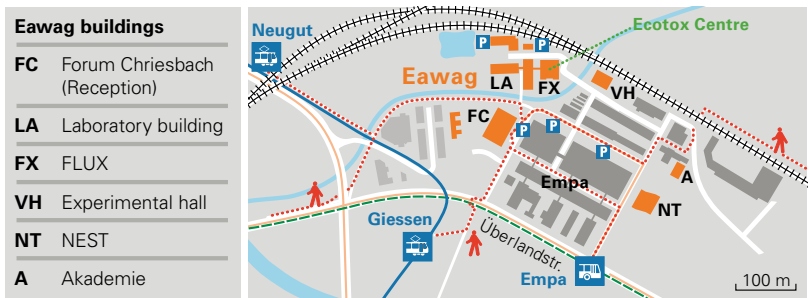
From there about 20 minutes walk to Eawag (see map), or by tram No. 12 to "Am Ring" or by bus No. 760 to "Empa".

From Zurich Oerlikon by train S14 to Dübendorf and then by bus No. 760 to "Empa" or walk to Eawag, about 20 minutes.

From Zurich-Airport by tram No. 12 to "Neugut" or "Am Ring" (about 20 minutes driving time).

## Car

Motorway A1, exit Dübendorf, to the right towards Dübendorf, 300 meters after the major crossing turn left into the Empa Eawag Campus.



## Ecotox Centre, Eawag

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Picture: Water fleas can be used as test organisms in online biomonitors to assess water quality (A. Schäfer).