Barbara Günthardt, Matthew Moy de Vitry and Marius Neamtu win ETH medal

October 18, 2021 | Claudia Carle und Andri Bryner
Topics: Organisation & Staff

The environmental chemist Barbara F. Günthardt and the two environmental engineers Matthew Moy de Vitry and Marius Neamtu are awarded the ETH Medal for their doctoral theses. Plant toxins, urban flooding and complicated flows were the topics. Congratulations!

The environmental chemist Barbara F. Günthardt has been awarded the ETH Medal for her doctoral thesis on plant toxins. She has not only developed methods for quantifying these substances, but has also built up a database and identified the releasing plants for individual substances.

Database of toxic plant substances established

When it comes to micropollutants in water, most people think primarily of pesticides, pharmaceuticals or chemicals from households and industry. But there are also thousands of substances of plant origin that are toxic. In her dissertation, Barbara F. Günthardt collected around 1600 of these substances from over 800 plants and their effects on the aquatic environment. She also searched for them in water bodies. Now she is being awarded the ETH Medal for her systematic and carefully worked out approach.

Starting from a newly built database, the doctoral student prioritised around 500 toxins based on their persistency, chemical-physical properties and frequency of occurrence. She has published a separate article on this in the Journal of Agricultural and Food Chemistry of the ACS **[1]** and in Science of the Total Environment **[2]**. In addition, the TPPT database (for Toxic Plant-PhytoToxin) is freely available on the Agroscope website **[3]**.

In her dissertation, Barbara Günthardt subsequently developed an analytical method to quantify the 134 most important phytotoxins in samples using high-resolution mass spectrometry. She also immediately applied her method in the field and examined samples from 20 streams. She was able to publish an article on this in a special issue of the journal Chimia on Chemistry and the Environment **[4]**. Günthardt has placed a special focus on the investigation of pyrrolizidine alkaloids. These substances are found in around 6000 plants worldwide, which use them to protect themselves from browsing. Some of them have a liver-toxic, genotoxic or carcinogenic effect on animals. The researcher has uncovered the invasive greiseweed Senecio inaequidens as the main causative agent in the samples from Swiss streams - in some cases with considerable concentrations. Günthardt was also able to publish an article on this in the journal Environmental Science and Technology **[5]**.

The 4 publications of the dissertation entitled "A Systematic Assessment of the Aquatic Exposure to Phytotoxins" are open access in DORA. The thesis itself https://doi.org/10.3929/ethz-b-000488067 is currently still under embargo. The work was jointly supervised by Dr Thomas Bucheli (Agroscope) and Prof Juliane Hollender (Eawag and ETH). Most of the work was carried out at Agroscope, but Barbara Günthardt was able to use sampling equipment and the high-resolution analytical instruments at Eawag.

Improve the prediction of urban floods

Matthew Moy de Vitry received the award for his dissertation on "Public Surveillance and the Future of Urban Pluvial Flood Modelling" **[6]** supervised by Prof. Max Maurer in the Department of Urban Water Management. The aim of his work was to improve the prediction of urban floods and, thus, to be able to better protect urban population and infrastructure. As the models used for forecasting were previously not sufficiently reliable, owing to a lack of data for calibration and validation, he developed innovative and cost-effective approaches for additional data sources - such as images and videos from traffic surveillance cameras or social media. Matthew has already been honoured for this work with the Otto Jaag Water Conservation Prize in November 2020.

"I would love to cut the ETH medal into pieces and share it with the many colleagues who made the work possible," says Matthew, "i.e. supervisors, technicians, co-authors and all the people who contribute to the special Eawag atmosphere".

Since completing his dissertation, Matthew works as a web developer and data scientist at Hades Technologies Ltd, an ETH spin-off that develops data models for automatic detection damage of defects in sewers, using machine learning.

Better understanding of turbulent flows

Marius Neamtu was awarded the ETH Medal for his dissertation on "Objective Coherent Structures Near the Turbulent/Non Turbulent Interface in a Stably Stratified Turbulent Flow" **[7]** at the Department Surface Waters, supervised by Prof. Markus Holzner. This work contributes to a better understanding of turbulent flows. Such flows are ubiquitous in nature and industrial applications. One example is the smoke issuing from a chimney. In many turbulent flows (e.g. turbulent jets, wakes and boundary layers), surrounding irrotational fluid is continuously entrained in the turbulent region across a sharp interface – called turbulent/non-turbulent interface. This phenomenon, called turbulent entrainment, has a direct impact on the turbulent flow evolution and development. Marius investigated the turbulent entrainment, and more specifically the role of vortical structures in this process. He applied novel mathematical methods to unravel vortical structures from turbulent flows and he elucidated how these structures modulate the turbulent entrainment. This provides an important basis for better modelling turbulent flows - for example, ocean currents and the associated climatic effects.

"I was very surprised when my work was awarded the ETH Medal," says Marius, "because I had rather

in mind what I could have done better. I am very honored to receive this prize and grateful to those who contributed to this work”. He would like to invest the prize money in his further education. Marius Neamtu now works as a project engineer at the Holinger company in Zurich, where he is responsible for planning major international water supply projects.

The ETH Medal, which comes with prize money of 2000 Swiss francs, is awarded every year to outstanding doctoral theses. The award for Neamtu and Moy de Vitry was presented by Rector Sarah Springmann at the doctoral ceremony on 9 July, the one for Günthardt is scheduled for the beginning of 2022.

Cover picture: Eawag

Original papers

[1]

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phytotoxins database and its application in assessing aquatic micropollution potential, *Journal of Agricultural and Food Chemistry*, 66(29), 7577-7588, doi:10.1021/acs.jafc.8b01639, Institutional Repository

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streams triggered by biogeography, vegetation growth stage, and precipitation, *Science of the Total Environment*, 798, 149128 (11 pp.), doi:10.1016/j.scitotenv.2021.149128, Institutional Repository

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Toxic Plants – Phytotoxin (TPPT) Database

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 Urban pluvial flooding is an issue o
f increasingly critical importance due to climate change and urbanization. H
owever, the numerical models used for flood forecasting and risk mitigation
suffer from a pronounced lack of monitoring data, which affects model accura
cy. Monitoring data are necessary so the models, which contain undefined par
ameters, can be calibrated and validated against real flood events. In parti
cular, it is important that the models are able to reproduce flood behavior
in and around buildings, where the most damage is caused. However, conventio
nal flow and water level sensors reach their limits in public spaces like st
reets due to irregular topography, moving obstacles, and the risk of vandali
sm. It has been suggested that surveillance cameras and social media could p
rovide the necessary surface flooding data at a fraction of the cost of conv
entional sensors. The objective of this thesis is to explore how trend-like
data can be extracted from surveillance footage and assimilated to boost the
reliability of urban pluvial flood models. [...]

Motivation
und Zielsetzung
 Urbane regenbedingte Überschwemmungen sind aufgr
und des Klimawandels und der Urbanisierung von immer größerer Bedeutung, a
ber den numerischen Modellen zur Hochwasservorhersage und Risikominderung ma
ngelt es an Überwachungsdaten, was die Modellgenauigkeit einschränkt. Übe
rwachungsdaten sind notwendig, damit die Modelle, welche unsichere Parameter
enthalten, gegen echte Hochwasserereignisse kalibriert und validiert werden
können. Insbesondere ist es wichtig, dass die Modelle das Überschwemmungs
verhalten in und um Gebäude herum nachbilden können, wo die meisten Schäd

pographie, beweglicher Hindernisse und der Gefahr von Vandalismus an ihre Gr
enzen. Deswegen gibt es ...' (2407 chars) serialnumber => protected'' (0 chars) doi => protected'10.3929/ethz-b-000397587' (24 chars) uid => protected20182 (integer) _localizedUid => protected20182 (integer)modified _languageUid => protectedNULL _versionedUid => protected20182 (integer)modified pid => protected124 (integer) Moy de Vitry, M. (2019) Public surveillance and the future of urban pluvial flood modelling, 143 p, doi: 10.3929/ethz-b-000397587, Institutional Repository

[7]

Neamtu-Halic, Marius M. (2020). Objective Coherent Structures Near the Turbulent/Non-Turbulent Interface in a Stably Stratified Turbulent Flow (Doctoral dissertation, ETH Zurich). https://doi.org/10.3929/ethz-b-000476303

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https://www.eawag.ch/en/info/portal/news/news-archive/archive-detail/barbara-guenthardt-matthew-moy-de-vitry-and-marius-neamtu-win-eth-medal