UDM 2022

COSTA MESA • CALIFORNIA • USA

PROGRAM

January 10-12, 2022

12th International Conference on Urban Drainage Modelling

CONFERENCE ORGANIZERS/SUPPORTERS

SCCWRP Established 1969

Geosyntec consultants
engineers | scientists | innovators

EWRI ASCE

IWA the international water association

IAHR AIRH

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PARADIGM ENVIRONMENTAL

WELCOME

Welcome to the Urban Drainage Modeling Conference! The UDM conference series started in 1986 in Dubrovnik, former Yugoslavia. The second edition of UDM was organized in 1991 also in Dubrovnik. After the first two editions in Dubrovnik, the conference has travelled across the globe to the River Volga (1994), London (1998), Orlando (2001), Dresden (2004), Melbourne (2006), Tokyo (2009), Belgrade (2012), Québec (2015), and Palermo (2018).

The UDM Conference seeks to create a forum for deep discussion and exchange of ideas amongst technical experts including engineers, scientists, professionals and academics. The UDM Conference brings focus to the data and models needed to develop better understanding and advance the management of the urban drainage system (e.g., water quality and quantity, urban flooding and modelling, urban flood forecasting and risk analysis, modelling tools, data etc.).

The 12th UDM conference is offered as a hybrid online and in-person event. For those that can make it in person, we will gather in Costa Mesa, California. Thank you to the Southern California Coastal Water Research Project for hosting this event!

Our exciting technical program offers 74 oral presentations and 18 posters with flash presentations covering topics including:

- Application of machine learning processes and protocols
- Data collection to support modeling development, calibration, and validation
- Representation and performance of BMPs, SCMs, WSUDs, SUDs, LID, GI, etc.
- Representing rainfall and hydrology
- Extreme events: wildfires, droughts, and deluges (& their impacts on urban drainage management)
- Coupled integrated modeling: surface-subsurface hydrology, infiltration management systems-groundwater interactions, etc.
- Real-time control, analytics, and software integration
- Modelling interactions and integrated systems
- Transport and sewer processes of microconstituents and pathogens
- Alternative modeling applications

The program includes keynote and plenary speakers to challenge delegates and broaden perspectives. Special sessions and workshops during the conference are designed to engage attendees, inviting you to be part of active discussion on focused topics to advance the state of the practice. Our pre-conference workshops give attendees a chance to get hands-on with PCSWMM and to learn the basics of real-time controls in urban drainage applications

The Best Student Paper Presentation will be recognized. Selected papers will be considered for special issue and special collection journals.

We wish to thank the International Working Group on Data and Models and the Joint Committee on Urban Drainage for the opportunity to host UDM2022. We thank you all for your support.

Best wishes for an inspiring UDM2022!

Elizabeth Fassman-Beck, Ph.D.
Conference Chair
Southern California Coastal Water Research Project

Scott Struck, Ph.D.
Technical Chair
Geosyntec Consultants

PROGRAM AT A GLANCE

PST	Monday 1/10	Tuesday 1/11	Wednesday 1/12
8:00 am	Breakfast for in-person delegates	Breakfast for in-person delegates	Breakfast for in-person delegates
8:15 am		**Special Session B** 1. *Performance Metrics for Green Stormwater Infrastructure* 2. *Trace Contaminants*	**Keynote:** Prof. Lizzie Kendon. *Future changes in short-duration precipitation extremes from the latest high-resolution climate scenarios.* *Sponsor: Villanova University Center for Resilient Water Systems*
8:30 am	**Opening Ceremony** 1. *Welcomes* from Dr. David McCarthy & Dr. Steve Weisberg 2. ***Plenary****:* Dr. Mark Gold 3. *Taking care of business:* Dr. Elizabeth Fassman-Beck		
8:45 am			
9:00 am		**Flash Poster Presentations 3**	
9:15 am			
9:30 am	**Concurrent Technical Sessions A** 1. MLPP - 1 2. MIIS - 1 3. SCM - 1	**Concurrent Technical Sessions D** 1. RFL - 1 2. RTC - 1 3. SCM - 3	**Flash Poster Presentations 4**
9:45 am			
10:00 am			Refreshment Break
10:15 am			
10:30 am			**Concurrent Technical Sessions G** 1. EXTEV - 1 2. DATA - 3 3. SCM - 5
10:45 am		Refreshment Break	
11:00 am	Refreshment Break		
11:15 am		**Plenary:** Asst. Prof. Allison Horst. *Missing the point: missing values, misinterpretations, and missed opportunities in environmental data science.*	
11:30 am	**Concurrent Technical Sessions B** *Sponsor: Paradigm Environmental* 1. COPINT - 1 2. ALTAPP-1		
11:45 am			
12:00 pm			**Closing Ceremony** 1. Best Student Paper & Best Poster Awards 2. Report-outs from Special Sessions and workshops 3. Announcements from the Int'l Working Group on Data and Models 4. Announcements from the JCUD
12:15 pm			
12:30 pm		Lunch ***Sponsor: Innovyze, an Autodesk Company***	
12:45 pm			END
1:00 pm	Lunch		
1:15 pm			
1:30 pm	**Workshop/Special Session A** 1. *Community-driven Open-Source SWMM* 2. *Modelling for a More Resilient Stormwater System*		
1:45 pm			
2:00 pm	**Flash Poster Presentations 1**	**Concurrent Technical Sessions E** 1. RFL - 2 2. SCM - 4	
2:15 pm			
2:30 pm	Refreshment Break		
2:45 pm			
3:00 pm	**Flash Poster Presentations 2**	Refreshment Break	
3:15 pm			
3:30 pm		**Workshop/Special Session C** 1. *Moving towards an open urban water modeling paradigm* 2. *Fun & functional tips for sharing your work with R Markdown*	
3:45 pm			
4:00 pm	**Concurrent Technical Sessions C** 1. DATA - 1 2. MIIS - 2 3. SCM - 2		
4:15 pm			
4:30 pm		**Concurrent Technical Sessions F** 1.TRANSP - 1 2. RTC - 3 3. DATA - 2	
4:45 pm			
5:00 pm			
5:15 pm	Optional tour of SCCWRP facilities		
5:30 pm	Transportation from SCCWRP to "The Lab" for dinner on your own		
5:45 pm			
6:00 pm		Dinner Social for in-person delegates	
6:15 pm			
6:30 pm			
6:45 pm			
7:00 pm			

SCIENTIFIC PROGRAM COMMITTEE

Scott Struck, Ph.D.	Geosyntec Consultants
Virginia Stovin Ph.D.	University of Sheffield
Arash Massoudieh, Ph.D.	Catholic University of America
Hayes Lenhart	Wright Water Engineers
Mina Behrouz	Virginia Tech
Collin Bell	City & County of Denver
Dayton Marchese	Opti

EVENT LOCATION

ORANGE COUNTY

Orange County is located in the southern Los Angeles metropolitan area and is known as the heart of Southern California.

"Whether it's manicured beach towns or celebrated theme parks, all framed by oceanfront towns, "The OC" stands out as one of the state's iconic destinations. The always-amazing Disneyland Resort continues to be one of the best-loved theme parks in the world, while Knott's Berry Farms and other attractions amp up the fun meter. Explore idyllic Laguna Beach, shop in Newport Beach or Costa Mesa's spectacular South Coast Plaza, catch a wave in Huntington Beach, and sample culinary delights at the Anaheim Packing District. Every town has its own charm and personality, and every sunset is worth watching." (www.visitcalifornia.com)

VENUE: SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT (SCCWRP)

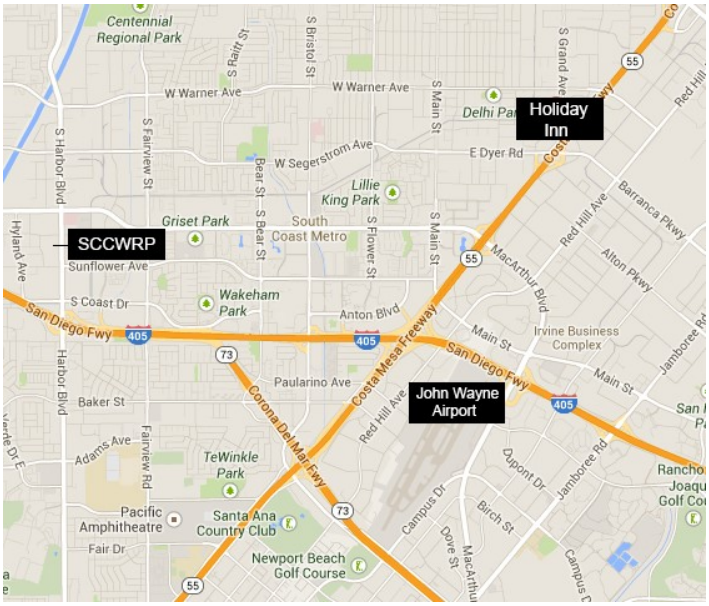
SCCWRP welcomes you to Costa Mesa, CA and the UDM 2022 Conference. We look forward to seeing you here! We are an aquatic sciences research institute that works to improve management of aquatic systems in Southern California and beyond. Since its founding as an intergovernmental public agency in 1969, SCCWRP has been developing strategies, tools and technologies that the region's water-quality management community relies on to more effectively protect and enhance the ecological health of Southern California's coastal ocean and the watersheds that drain to it. As an R&D agency, SCCWRP's reputation is built on conducting research and translating this science into actionable guidance and recommendations that inform management decision-making and policy development. Visit our website to learn more about us at www.sccwrp.org.

IN-PERSON EVENING SOCIALS

Sunday: Please join us for a welcome reception at the Holiday Inn Santa Ana-Orange County Airport. Light refreshments will be served. Beer and wine are available for purchase. Guests staying at the Holiday Inn enjoy one complimentary drink ticket.

Monday: For those interested, transportation will be provided from SCCWRP to The Lab and The Camp, adjacent outdoor "anti-mall" establishments in Costa Mesa. The Lab and The Camp offer a wide variety of food and beverage options, many of which provide outdoor seating. Dinner and drinks are on your own.

Tuesday: We're pleased to invite in-person delegates and their guests to the conference dinner on Tuesday evening for dinner at The Rusty Pelican at 2735 West Coast Highway, Newport Beach. Transportation will be provided from SCCWRP to the restaurant for all attendees. We will be seated in a private, indoor area. The conference dinner is included in your registration. A cash bar is available.



HOTEL

The Holiday Inn Santa Ana-Orange County Airport in Santa Ana is about a 10-minute drive from both John Wayne Airport and the conference's location at SCCWRP. Through a long-standing partnership with SCCWRP, the hotel offers special rates for all SCCWRP visitors.

TRANSPORTATION

Follow this link for the most recent COVID-19 related information from the US CDC on travelling to the USA: https://www.cdc.gov/coronavirus/2019-ncov/travelers/international-travel/index.html

TRANSPORTATION TO AND FROM THE HOLIDAY INN OCA

We will be providing transportation to and from the Holiday Inn OCA to SCCWRP, where the conference sessions will be held. Transportation between the hotel and conference venue is provided only for guests staying at the Holiday Inn OCA. Guests staying elsewhere are responsible for their own transportation.

RECOMMENDED AIRPORTS

The closest airport to SCCWRP and to SCCWRP's preferred hotel is **John Wayne/Orange County Airport (SNA)** https://www.santa-ana-airport.com/. This airport is about a 10-minute drive from both the recommended conference hotel (see below) and from SCCWRP. Many major carriers serve SNA including American, Delta, United, Frontier, Southwest, and Alaska Airlines. We cannot emphasize enough the convenience of **John Wayne/Orange County Airport (SNA)** if flying domestically, or for international travelers who will make a connection within the United States.

The next closest airport is **Long Beach Airport (LGB)**, about a half-hour drive from SCCWRP and the recommended hotel.

Los Angeles International Airport (LAX), the region's largest airport and a major hub for international travel, is about a 45-minute drive from SCCWRP without traffic. The drive can easily take 1-1 ½ hr during morning, midday, and evening rush hour.

HEALTH AND SAFETY

Our aim is to take as many precautions as we can to promote a healthy environment, but our success also relies on you. In-person delegates should have received an email request to upload proof of COVID-19 vaccination or a recent negative test. If you haven't yet done so, we expect you to show the record upon arrival at the first conference-related activity that you attend.

Local requirements mandate wearing a face covering/ mask in places like stores, restaurants, etc. Everyone must remain masked when inside any building at the conference venue. We encourage wearing a face covering wherever you go, whether indoors or out. We're providing masks and hand sanitizers (thanks, Geosyntec!) for your personal use. There will be more available at the conference venue, so use these precautions liberally. We are happy to keep refilling!

If you are attending the Sunday evening reception at the Holiday Inn (5:00-7:00 pm), we will provide an at-home self-test kit to take a test sometime on Sunday. The test takes only 15-min to process. Detailed instructions are found inside the box for administering the self-test. Guests staying at the Holiday Inn Santa-Ana, will receive an at-home self-test kit in an orange box at check-in. Guest staying elsewhere, but attending the reception should arrive by 4:30 pm to collect a kit and take a test. Everyone must take a photo of the test result to show a SCCWRP representative to enter the reception.

We understand that our international guests have probably been tested several times before leaving home. Regardless, all attendees **must** show the test result to a SCCWRP representative before being welcome into the conference venue. If you were unable to join us at the reception, please arrive at SCCWRP by no later than 7:45 am to take your test before entering. A SCCWRP representative will greet people at the door.

Each test kit contains two tests. We strongly encourage you to take the second test on Tuesday prior to the conference dinner. There is plenty of space at SCCWRP to conduct a self-test in private, and/or outside. The conference dinner will be an indoor event (it's a bit chilly at night for outdoor dining!), but we will be in a space separated from the rest of the restaurant.

Follow this link for the most recent COVID-19 related information from the US CDC on travelling to the USA: https://www.cdc.gov/coronavirus/2019-ncov/travelers/international-travel/index.html

KEYNOTE SPEAKER

PROFESSOR LIZZIE KENDON

Science Fellow and Manager at Met Office Hadley Centre, Professor in Faculty of Science at Bristol University

www.metoffice.gov.uk/research/people/lizzie-kendon

MEET OUR KEYNOTE SPEAKER

Lizzie has 15 years of experience working at the Met Office Hadley Centre on regional climate modelling. She leads a team of scientists using very high-resolution (kilometre-scale) models to study climate change, with a focus on gaining a better understanding of extremes and their future change. Her work has been pioneering in the field of convection-permitting climate modelling, with high-profile papers in Nature Climate Change and Nature Comms. She recently led work delivering the first national climate scenarios at convection-permitting scale as part of the UK Climate Projections (UKCP) project. Lizzie also has a joint position as Professor in the Faculty of Science at Bristol University, with collaborative work on exploiting new high-resolution climate projections for impacts modelling (e.g. flooding) and user applications. Lizzie has given many talks at conferences and has considerable experience of communicating with the media. This includes appearances on the BBC Panorama programme as well as interviews on BBC News and the Radio 4 Today Programme.

Prior to joining the Met Office, Lizzie did a PhD at Imperial College London. As an undergraduate Lizzie studied Natural Sciences (Physics) at Cambridge University and also has an MSc in Pollution and Environmental Control from Manchester University. Lizzie is a keen mountaineer and has climbed widely in the European Alps and the greater ranges, including an ascent of Cho Oyu (8200m) in the Himalayas. Closer to home, Lizzie enjoys running, walking and exploring nature with her young family.

KEYNOTE, WED. JAN 12

Future changes in short-duration precipitation extremes from the latest high-resolution climate scenarios

ABSTRACT

Climate projections at very high resolution (km-scale grid spacing) are becoming affordable. These 'convection-permitting' models (CPMs), commonly used for weather forecasting, better represent small-scale processes in the atmosphere such as convection and are able to provide credible projections of changes in local weather extremes. At the UK Met Office we have carried out climate change simulations at 2.2km resolution over a pan-European domain, and also the first ensemble of CPM climate projections over a UK domain as part of the next set of UK Climate Projections (UKCP). In this talk I will highlight new understanding of changes in hourly rainfall extremes important for flash flooding. I will also provide examples of how these new CPM projections are being used in flood inundation modelling, and will discuss the implications for official climate change allowances for urban drainage design and surface water flooding.

Many thanks to our **Keynote Sponsor, Villanova University's Center for Resilient Water Systems**

VILLANOVA UNIVERSITY
COLLEGE OF ENGINEERING
CENTER FOR RESILIENT WATER SYSTEMS

PLENARY SPEAKERS

DR. MARK GOLD

Executive Director, Ocean Protection Council; Deputy Secretary for Ocean and Coastal Policy, California Natural Resources Agency

https://www.opc.ca.gov/

MEET OUR OPENING CEREMONY PLENARY SPEAKER

Mark Gold joined OPC in July of 2019. As Executive Director of OPC and the Deputy Secretary for Ocean and Coastal Policy for the California Natural Resources Agency, Mark serves as a key advisor to Governor and the Secretary of Natural Resources and directs policy, scientific research, and critical partnerships to increase protection of coastal and ocean resources in California. Prior to his appointment, he was the UCLA Associate Vice Chancellor for Environment and Sustainability where he led their Sustainable Los Angeles Grand Challenge effort. Prior to UCLA, Mark was the first hire at Heal the Bay, where he served as their President for 18 years. During that time, he worked on ocean and coastal legislation and policy, stormwater, watershed management, and marine conservation and coastal restoration issues, projects and programs. Over the course of his career, his research focused on beach water quality and health risks, as well as sustainable water resources management. Mark received his bachelor's and master's in Biology as well as his doctorate in Environmental Science and Engineering, all from UCLA.

ASSISTANT PROFESSOR ALLISON HORST

Assistant Professor at the Bren School of Environmental Science and Management at UC Santa Barbara

https://www.allisonhorst.com/

MEET OUR PLENARY SPEAKER

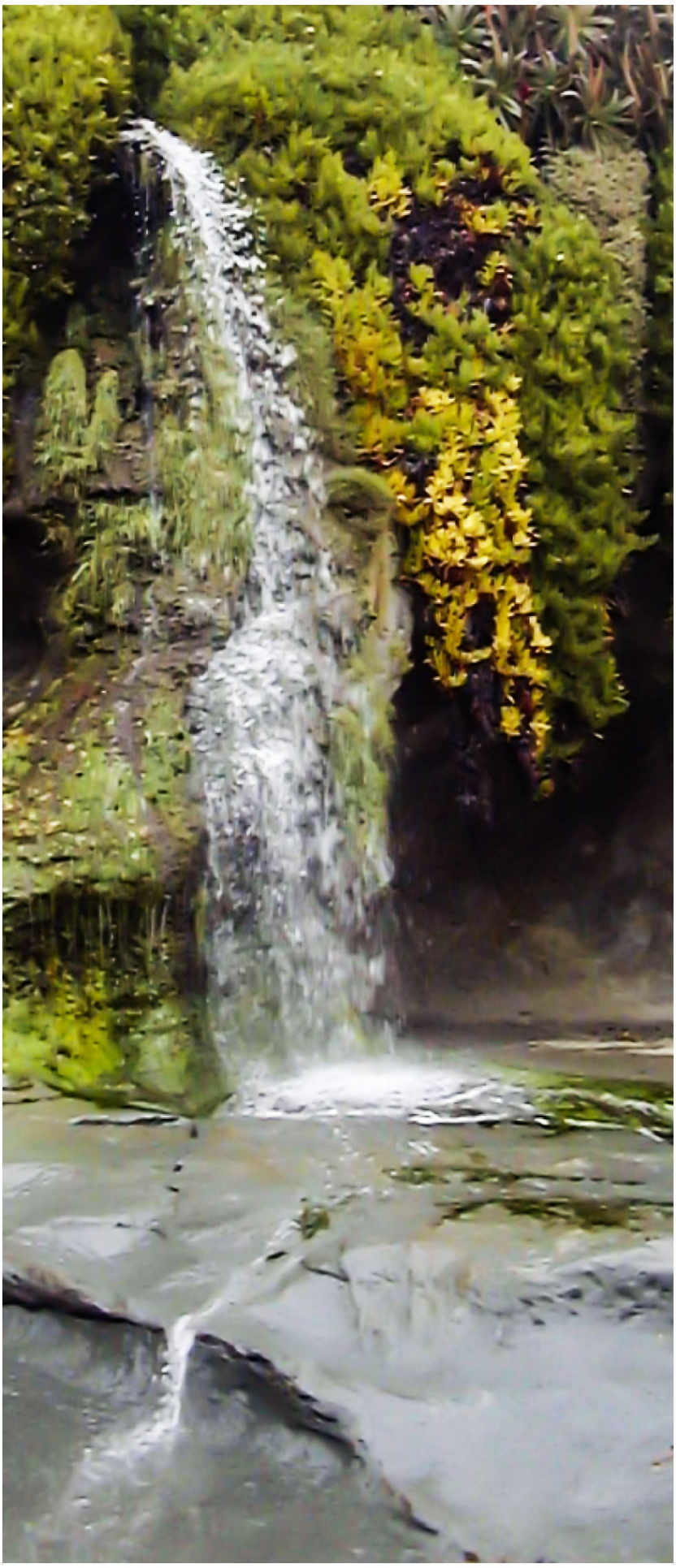
Allison teaches programming, statistics, math, data analysis, data visualization and presentation skills for environmental data science at the Bren School at UC Santa Barbara. She studied engineering (BS Chemical Engineering, MS Mechanical Engineering) before earning her PhD from UCSB in 2012 (Environmental Science and Management, emphasis in Nanotoxicology). She actively contributes to open resources and software for data science education, including the palmerpenguins R package and a library of original didactic illustrations that are used in data science courses and workshops around the world. She co-founded Santa Barbara R-Ladies in 2018 and was RStudio's first Artist-in-Residence from 2019 – 2020. When she isn't teaching or drawing, she enjoys looking for animal tracks, fly fishing, and walking with her dog Teddy.

PLENARY, TUES. JAN. 11

Missing the point: Missing values, misinterpretations, and missed opportunities in environmental data science

ABSTRACT

Getting my hands on new, raw environmental data is exciting, and so is diving into a fresh pool of data wrangling, analysis and visualization. In this talk, I consider different flavors of "missing the point," asking: what might I be missing when I launch headfirst into a new data science project? Motivated by past mistakes, I share three ways I've missed the point when starting a project due to (1) missing data, (2) misinterpretation, and (3) missed opportunity. Through personal anecdotes and public examples I highlight the risk of these "misses" in data science projects, then share tools and strategies to avoid them moving forward, so that we can all dive enthusiastically into projects a bit more responsibly.



PROGRAM

JANUARY 10-12, 2022

UDM 2022

COSTA MESA • CALIFORNIA • USA

January 10 - 12

MONDAY JAN 10
09:30 - 11:00 PST

CONCURRENT TECHNICAL SESSIONS A

MLPP-1 Application of machine learning processes and protocols		**Small Conf Rm**
SESSION CHAIR - *David McCarthy*, ONLINE MODERATOR – *Lynze Cheung*		
Matej Radinja	Analysis of Urban Stormwater Control Measures Using Automated Modeling and Multi-criteria Evaluation	
Alireza Koochali	Leveraging Generative Adversarial Networks (GANs) to Improve the Accuracy of Data-Driven Combined Sewer Flow Prediction Models	
Chaim Harpaz (Q&A by Roni Penn)	Potential of machine learning for estimating the impact of water efficient scenarios on solids accumulation in sewers	
Jean-David Therrien	Using the right wastewater characteristics for early COVID-19 pandemic warning and forecast using deep machine-learning.	

MIIS-1 Modeling Interactions and Integrated Systems		**Medium Conf Rm**
SESSION CHAIR - *Scott Struck*, ONLINE MODERATOR - *Lena Mutzner*		
Manfred Schutze	A Multi-Domain Solver for integrated modelling	
Luca Vezzaro	The power of Open Data - Using free data for a preliminary screening of impact from urban wet-weather discharges on Danish streams	
Lianhui Wu	A computationally efficient urban flood model with a novel approach for determining water discharge through complex drainage network	
Ben R. Hodges	New modeling capabilities with the SWMM5+ parallel hydraulic solver	

SCM-1 Representation and performance of SCMs/SUDs/WSUDs		**Large Conf Rm**
SESSION CHAIR - *Elizabeth Fassman-Beck, ONLINE MODERATOR - Luca Vezzaro*		
Ghada Diab	Fine Scale Hydrologic Modelling of Bioretention Using DRAINMOD	
Simon De-Ville	Using LID Physical Properties to Predict Unsaturated Flows with SWMM	
Birgitta Hörnschemeyer	Modeling Long-Term Water Balances of Green Infrastructures using SWMM Extended with the Evapotranspiration Model SWMM-UrbanEVA	
James Kruegler	Comparing Estimates of Urban Tree Impacts on Stormwater Runoff using i-Tree Hydro Model Predictions and Hyperlocal Observations	

MONDAY JAN 10
11:15 - 12:45 PST

CONCURRENT TECHNICAL SESSIONS B
Generously Sponsored by Paradigm Environmental

COPINT-1 Coupled and/or Integrated Modelling	**Medium Conf Rm**
SESSION CHAIR - *Shaohua Marko Hsu,* ONLINE MODERATOR - *Martina Hauser*	
Teresita Scheuch	Coupling SWMM and MODFLOW: Developing and applying a model integration scheme for urban settings with wetlands and shallow groundwater
Whitney Lisenbee	Modelling bioretention hydrology in the SWMM LID module and DRAINMOD-Urban
Xixi Shi	Modelling hydrodynamic and pathogen dynamics in a stormwater constructed wetland with multiple inflows
Arash Massoudieh	Prediction of the Catchment-Scale Efficiency of Stormwater Control Measures in an Urban Watershed using a Process-Based Modelling Approach

ALTAPP-1 Alternative Modeling Applications	**Large Conf Rm**
SESSION CHAIR - *Hugo Daniel Macedo,* ONLINE MODERATOR - *Grant Sharp*	
Yousef Sangsefidi	Vulnerability of Coastal Stormdrain System to Compound Seawater, Groundwater, and Stormwater Flooding under Climate Change
Albert König	Analysis of sampling strategies for pulse loads in sewer catchments
Rich Wildman	The South Orange County, California Flow Ecology Study: Part 1, Watershed Hydrology
Kris Taniguchi-Quan	The South Orange County, California Flow Ecology Study: Part 2, Flow Ecology Approach for Flow Management Prioritization

MONDAY JAN 10
15:45 - 17:15 PST

CONCURRENT TECHNICAL SESSIONS C

DATA-1	Data Collection in Support of Model Development, Calibration, and Validation	Small Conf Rm
SESSION CHAIR - *Omar Wani,* ONLINE MODERATOR – *Arash Massoudieh*		
Esteban Sañudo	Laboratory experiments in a large-scale urban drainage physical model considering roofs, streets and drainage system.	
Guilhem Dellinger	Benchmark of hydrodynamic models for urban flooding modelisation	
James Conrad Pritchard	Modeling Organic Contaminant Removal Stormwater Runoff by Biochar-Amended Rapid-Flow Filters	
Agnethe Nedergaard Pedersen	Diagnosing the location of uncertainty in urban drainage models with hydrologic and hydraulic signatures: a real case study with a complex internal overflow structure	

MIIS-2	Modeling Interactions and Integrated Systems	Medium Conf Rm
SESSION CHAIR - *Conrad Pritchard*, ONLINE MODERATOR - *Ryan Winston*		
Q&A by Alexandra Finotti (Video by L. Azevedo)	Coding disasters: an open tool for managing municipal drainage network in risk areas	
Fabian Funke	Impact of model structure on analysing malfunctions in urban drainage systems	
Victoria Hennon	Dilution and pollution: effects of wastewater reuse on water quality in the Los Angeles River	
Hugo Macedo	Data-Driven Extraneous Water Quantification	

SCM-2	Representation and performance of SCMs/SUDs/WSUDs	Large Conf Rm
SESSION CHAIR - *Lena Mutzner,* ONLINE MODERATOR - *Bridget Wadzuk*		
Robert Traver	Design Storm and Continuous Simulation methods for Resilient SCM Design	
David Spelman	Models of wet basin design response with residence time metrics for presumptive guidance	
Claudia Campusano Garcia	Sensitivity analysis of long-term transformation strategies for sustainable rainwater and wastewater management within an integrated model	
Jason Wright	Maximizing BMP Performance in Urban Areas: A Modeling Approach to More Accurately Estimate Performance to Minimize BMP Footprint	

TUESDAY JAN 11
9:15 - 10:45 PST

CONCURRENT TECHNICAL SESSIONS D

RFL-1 Representing Rainfall and Hydrology		**Small Conf Rm**
SESSION CHAIR - *Phillip Aarestrup,* ONLINE MODERATOR - *Tone Muthanna*		
Victoria Rexhausen	Using isotopic source partitioning of urban runoff to verify effective impervious area model in a partially forested, partially developed urban watershed	
TJ Moon	Where Old Data Meets New Technology: The Los Angeles Flood Control District Hydraulic and Hydrologic Model	
Karim Sedki	Requirements for case-specific calibration in urban hydrological modeling	
Alejandro Mendoza Reséndiz	Simulation of historical and design rainfall events in two large sewage collectors in the Valley of Mexico	
RTC-1. Real-time Control, Analytics, and Software Integration		**Medium Conf Rm**
SESSION CHAIR - *Ryan Brown,* ONLINE MODERATOR - *Manfred Kleidorfer*		
Jeroen Langeveld	Development and implementation of a large-scale Real Time Control system: the Rotterdam case study	
Nadia Lund	Screening tool for control potentials in urban drainage systems - reviving a dormant research field	
Matthew Bartos	Pipedream: a digital twin model for stormwater networks	
Sovanna Tik	Towards fault-tolerant strategies for water quality-based control of the integrated urban wastewater system	
SCM-3 Representation and performance of SCMs/SUDs/WSUDs		**Large Conf Rm**
SESSION CHAIR - *John Gulliver,* ONLINE MODERATOR - *Jason Wright*		
Q&A by Alexandra Finotti (Video by F. Wu)	Hydraulic and hydrologic modelling to evaluate the design of permeable pavement in a catchment perspective	
Amin Bakhshipour	Combined sewer networks for cities with hot and dry climates; a design optimization approach	
Bakkiyalakshmi Palanisamy	Challenges and opportunities for storage and infiltration-based LIDs in coastal catchments of Chennai, India	
Jeil Oh	Simulation of historical and design rainfall events in two large sewage collectors in the Valley of Mexico.	

TUESDAY JAN 11
13:15 – 14:45 PST
CONCURRENT TECHNICAL SESSIONS E

RFL-2 Representing Rainfall and Hydrology		**Medium Conf Rm**
SESSION CHAIR - *Kris Taniguchi-Quan*, ONLINE MODERATOR - *TJ Moon*		
Philippa Mohan	Geostatistical Approach to Understanding the Effect of Rainfall Spatial-Temporal Uncertainty on a Small Urban Hydraulic Model	
Michael Geyer	Radar data for long-term simulation - a viable alternative to rain gauges?	
Frederic Gogien	Future evolution of CSO discharges under climate change, a case study in the Mediterranean region	
Phillip Aarestrup	Using weather radar to improve the prediction accuracy of LSTM neural networks for anomaly detection of water level measurements in UDS	

SCM-4 Representation and performance of SCMs/SUDs/WSUDs		**Large Conf Rm**
SESSION CHAIR - *Agnethe Pedersen*, ONLINE MODERATOR - *Mina Shahed Behrouz*		
Timothy Jia Young Lim	Riparian buffer strips: Case study of a catchment in Victoria, Australia	
Ryan Winston	Using random forest algorithms and globally sourced data to improve floating treatment wetland design and stormwater pond performance	
James Li	Design of An Oil/Grit Separator Under Dry and Wet Weather Conditions	

TUESDAY JAN 11
16:15 - 17:45 PST

CONCURRENT TECHNICAL SESSIONS F

TRANSP-1	Transport and Sewer Processes of Microconstituents and Pathogens	**Small Conf Rm**
SESSION CHAIR – *David McCarthy,* ONLINE MODERATOR - *Ruben Kertesz*		
Robert Sargent	Detecting human faecal pollution in mixed use rural-residential catchments using a Markov Chain Monte Carlo source apportionment model	
Lynze Cheung	Improving QMRAs with next generation sequencing	
William Walujono	Effective Deployment Strategy Model of SARS-CoV-2 Sampling Tools for Wastewater-Based Epidemiology	
Kamilia Haboub	Particles' characterisation and transport processes in view of modelling the fate of SARS-CoV-2 in sewer systems	
RTC-3	Real-time Control, Analytics, and Software Integration	**Medium Conf Rm**
SESSION CHAIR - *Matt Bartos,* ONLINE MODERATOR – *Edward Tiernan*		
Nandan Shetty	Studying the hydrological performance of a rainwater harvesting cistern with real time control collecting stormwater runoff from a green roof	
Jon Hathaway	Hydrologic and Water Quality Implications of Real-Time Control Schemes in Bioretention	
Pengfei Shen	BioRTC: a new model that simulates and explores real time control strategies of stormwater biofilters	
Job van der Werf	Real Time Control in Urban Drainage Systems: Risks associated with rainfall and system capacity uncertainty	
DATA-2	Data Collection in Support of Model Development, Calibration, and Validation	**Large Conf Rm**
SESSION CHAIR – *Scott Struck,* ONLINE MODERATOR - *Kiera Nissen*		
Lena Mutzner	Stochastic modelling of trace contaminants in wet-weather discharges	
Omar Wani	Does distributed monitoring improve the calibration of urban drainage models?	
Dusan Jovanovic	Insights into stormwater drain hydrology and water quality via low-cost sensor monitoring	
Austin Orr	Aliso Creek Smart Watershed Network: A High-Resolution Data Acquisition and Analysis Platform to Support Urban Runoff Management and Water Recovery	

WEDNESDAY JAN 12
9:45 - 11:15 PST

CONCURRENT TECHNICAL SESSIONS G

EXTEV-1	Extreme events: Deluges and Droughts	**Small Conf Rm**
SESSION CHAIR - *Philippa Mohan,* ONLINE MODERATOR - *Peter Mikkelsen*		
Mirjam Lawens	Application of an optimization system to manage the risks of flash floods	
Joao P. Leitao	Leveraging video data to assess urban pluvial flood hazard	
Thea Ingeborg Skrede	Comparison of tools for mapping floodways in urban planning	

DATA-3	Data Collection in Support of Model Development, Calibration, and Validation	**Medium Conf Rm**
SESSION CHAIR - *Nandan Shetty,* ONLINE MODERATOR - *Simon Tait*		
Scott Struck	Developing a Surface Water – Groundwater Model for Green Stormwater Infrastructure to Estimate Water Supply Benefits	
Kiera Nissen	Evaluation of methods of measuring flowrates for bioretention planters	
Shaohua Marko Hsu	Reduction on nutrient concentration of Non-Point Source Pollution - an Example in Hu-Shan Reservoir, Taiwan	
Mina Shahed Behrouz	Predicting Event Mean Concentrations (EMCs) of Nutrients and Sediments in Urban Runoff Using A Random Forest Approach	

SCM-5	Representation and performance of SCMs/SUDs/WSUDs	**Large Conf Rm**
SESSION CHAIR - *Robert Traver,* ONLINE MODERATOR - *Jordy Wolfand*		
Joanna Lewis	Development of an Online Performance Calculation Tool for Bioretention Projects in Seattle, WA, USA	
Emily Darin & Matthew McGauley	How Many Events Do You Need? A Statistical Approach to Developing a GSI/BMP Monitoring Program	
Andrew Tirpak	Bioretention Design Modifications Targeting Climate Resiliency	
Mayra Rodriguez	Spatial impact of green infrastructures on urban drainage resilience	

POSTER/FLASH PRESENTATIONS
SESSIONS (HYBRID) 1 & 2

Poster/Flash Presentation Title	Presenting Author	Session (Hybrid)	Session (Online only)	Topic
Impact of CSOs on agro-urban rural channels through numerical simulations with SWMM model: lesson learnt from an Italian case study	*Margherita Evangelisti*	**1**	**4**	Data Collection In Support of Model Development, Calibration, and Validation
Factor prioritization for multi objectives Green infrastructure design	*Vincent Pons*	**1**	**4**	Representation and Performance of SCMs/SUDs/WSUDs
Frequency analysis of short-duration rainfall extremes in Liguria (Italy)	*Ilaria Gnecco*	**1**	**3**	Rainfall, Hydrology, & Climate Change
The Los Angeles River Environmental Flows Project: Managing Trade-offs in Water Reuse and Ecosystem Services	*Jordyn Wolfand*	**1**	**4**	Integrated Systems
Dynamically priced stormwater discharge fees as a way to organize distributed stormwater infrastructure	*Albert König*	**1**	**4**	Real-Time Controls & Machine Learning
Quality over Quantity: A Data-Driven, Automated Quality Assurance and Control Process for Continuous, Hydrological Data	*Matthew McGauley*	**2**	**3**	Data Collection In Support of Model Development, Calibration, and Validation
What do we do with these old tires?	*John S. Gulliver*	**2**	**3**	Data Collection In Support of Model Development, Calibration, and Validation
More than words: Textual analysis as urban water planning and management document assessment tool	*Alexandra Finotti*	**2**	**3**	Representation and Performance of SCMs/SUDs/WSUDs
Leveraging Technology for an Integrated Drainage and Water Quality Master Plan	*Venkat Gummadi*	**2**	**4**	Rainfall, Hydrology, & Climate Change
An evaluation of the impacts of mesh resolution on the results of a 2D hydraulic model when using a flexible, depth-averaged, flat element mesh	*Ryan Brown*	**2**	**3**	Real-Time Controls & Machine Learning

POSTER/FLASH PRESENTATION
SESSIONS (HYBRID) 3 & 4

Poster/Flash Presentation Title	Presenting Author	Session (Hybrid)	Session (Online only)	Topic
Integrated data management to prevent data loss and raise data quality	*Markus Pichler*	**3**	**2**	Data Collection In Support of Model Development, Calibration, and Validation
Qualitative techniques to evaluate urban flood models	*Stefan Reinstaller*	**3**	**2**	Data Collection In Support of Model Development, Calibration, and Validation
Rainwater harvesting for urban flood management: a modelling framework for sub-catchment scale installations	*Palla Anna*	**3**	**2**	Representation and Performance of SCMs/SUDs/WSUDs
Calibration of SWMM Model with Continuous Simulation at Riacho Fundo I, Federal District, Brazil	*Maria Elisa Leite Costa*	**3**	**2**	Rainfall, Hydrology, & Climate Change
Assessment of random forest method to classify suspended solid and nutrient first flush in urban watersheds	*Angela Gorgoglione*	**3**	**2**	Real-Time Controls & Machine Learning
Combined sewer overflow characteristics: results of a monitoring campaign on a peri-urban catchment in Italy	*Daniele Masseroni*	**4**	**1**	Data Collection In Support of Model Development, Calibration, and Validation
Combining different precipitation databases for flash-flood analysis in an urban watershed in Campinas, Brazil.	*Vinicius Araujo*	**4**	**1**	Data Collection In Support of Model Development, Calibration, and Validation
Mike Urban+ modeling to support urban drainage management at Meio river watershed, Florianópolis-SC	*Alexandra Finotti*	**4**	**1**	Data Collection In Support of Model Development, Calibration, and Validation
“RICHIE” – the virtual sewer worker for improved monitoring data quality, network maintenance and operation	*Andy Disch*	**4**	**1**	Real-Time Controls & Machine Learning

SPECIAL SESSIONS AND WORKSHOPS

One of the aspects we love about UDM events is the deep discussion fostered by inspirational topics. We've set aside time in the conference program for you to join in these discussions during 1-hr Special Sessions and Workshops.

Online participants are welcome to turn on cameras and microphones to actively contribute to the conversation! These sessions will be run logistically as breakout rooms. Online participants can enter the breakout room up to 15 min before the session starts.

Look for these topics in the conference program:

- **Workshop A:** Community-driven Open-source SWMM, Where Next?
- **Workshop B:** Performance Metrics for Green Stormwater Infrastructure
- **Workshop C:** R Markdown for fun, functional & reproducible reporting
- **Special Session A:** Modelling for a more resilient stormwater system-A basic introduction to real-time modelling and digital twin concepts
- **Special Session B:** A decade of collecting data on trace contaminant in wet weather discharges – are we ready to model them?
- **Special Session C:** Moving towards an open urban water modeling paradigm: perspectives from academia and industry

WORKSHOPS

Workshop A

Community-driven Open-source SWMM, Where Next?

CONVENOR: PROF. BEN HODGES, UNIVERSITY OF TEXAS AT AUSTIN

This workshop aims to gain insight into the community perceptions on the future development of open-source SWMM. Although EPA-SWMM is formally maintained and distributed by the US EPA, it is (and always has been) a public-domain open-source model. The new development of SWMM5+ and the establishment of the Center for Infrastructure Modelling and Management (CIMM) as a US-based 501c(3) non-profit (charitable) organization has the potential to jump-start community involvement in improving the SWMM code. This objective of this workshop is to establish whether or not the community is interested in participating in open-source code development for SWMM. The end product of the workshop will be a short paper that provides a discussion of community perceptions, consensus, and disagreements.

Of particular interest are opinions on:

1. What new capabilities are needed in SWMM?
2. What people/organizations are interested in making open-source contributions?
3. What are some of the funding sources that the community might look to?
4. What are recommended “best practices” for integrating the community product with EPA?

The workshop is looking to document diverse opinions rather than establish a consensus on such complex topics. The work product of the workshop will be a short paper. The draft paper prepared by the convenors and reported out at the close of the conference to all participants. The convenors will circulate the draft for comments among all conference participants and prepare a final version incorporating feedback within 30 days of the conference completion

Workshop B

Performance Metrics for Green Stormwater Infrastructure

CONVENOR: PROF. VIRGINIA STOVIN, UNIVERSITY OF SHEFFIELD

In most jurisdictions, conventional stormwater infrastructure for runoff quantity control (i.e. underground pipes and tanks) is designed based on idealized high return period design storms. Often the system is assumed to be 'empty' prior to the start of rainfall. There are several reasons why this approach may be inappropriate for the design and approval of SuDS/LIDs:

- SuDS/LID devices are typically reliant on natural hydrological processes (infiltration and/or evapotranspiration) to restore their retention capacity. These may occur more slowly compared with drain-down times associated with conventional drainage systems, such that the SuDS/LID will not always be at full retention capacity when the next storm occurs. Depending on assumption made (0-100% capacity available), the system will be over-or under-designed respectively.
- A focus on high return period events may rule out SuDS/LID options unable to achieve such stringent requirements, whilst ignoring multiple other hydromorphological and water quality benefits that could be achieved through the effective management of routine events.

The aim of this workshop is to consider alternative approaches to setting performance targets. It is expected that suitable metrics would be derived from simulated responses to long duration (10 yr+) high temporal resolution (5 min) continuous rainfall inputs. What are the right metrics to use in a drainage design/regulatory context? These could include probabilistic performance targets based on flow duration curves, or multiple metrics aimed at characterizing runoff volumes and runoff rates for events with lower return periods (e.g. annual) (Stovin et al., 2017; Quinn et al.,2021). We expect the discussion to focus mainly on stormwater runoff quantity, but implications for water quality and other (multiple) benefits should be noted. While continuous simulation is feasible at the device/development scale, its computational expense prevents such approaches being applied at the city/catchment scale. Simplified/surrogate modelling techniques are potentially useful in this context.

The format of the workshop will be a brief introductory presentation followed by an open discussion. It is anticipated that the workshop discussions will lead to a position paper being submitted to a relevant academic journal.

Workshop C

R Markdown for fun, functional & reproducible reporting

CONVENOR: ASSIST. PROF. ALLISON HORST, UC SANTA BARBARA

R Markdown is a tool that allows data scientists to combine code, outputs and text in a single place, facilitating more efficient and reproducible report preparation. The goal of this 1-hour workshop is to inspire R users, and R Markdown beginners, to explore features of R Markdown that transform basic documents into professional-quality reports that can be rendered to a range of final output types. The objectives of the workshop are to:

1. Give an overview of R Markdown as a tool for reproducible reporting and publishing
2. Review basics of combining code, outputs and formatted text in R Markdown
3. Introduce a number of quick tips and tricks to customize reports

Experience with R Markdown is not required. However, participants who want to follow along should have a recent version of RStudio installed (version > 1.4) - you can download the Desktop version of RStudio for free.

SPECIAL SESSIONS

Special Session A

Modelling for a More Resilient Stormwater System: A basic introduction to real-time modelling and digital twin concepts

CONVENOR: RYAN BROWN, INNOVYZE, AN AUTODESK COMPANY

Develop a better understanding of what is a digital twin, how it can be used, and how real time (live) modelling can improve system design and management to save costs associated with damage from flooding events and prevent loss of life through both concept description and applied case studies from around the world.

Special Session B

A decade of collecting data on trace contaminant in wet weather discharges – are we ready to model them?

CONVENORS: LUCA VEZZARO, PH.D., TECHNICAL UNIVERSITY OF DENMARK (DTU), LENA MUTZNER, PH.D., TECHNICAL UNIVERSITY OF DENMARK (DTU), CHARLES WONG, PH.D. (SCCWRP)

Presentations

1. **What have we learnt from past monitoring studies?** Lena Mutzner (DTU)
2. **The efforts to identify relevant trace contaminants – the analytical and eco-toxicological perspective.** Charles Wong (SCCWRP)
3. **How can we use these data in our models?** Luca Vezzaro (DTU)

In the last decade, large efforts have been made to collect data on trace contaminants (micropollutants) in wet-weather discharges. The increasing data availability will allow us to build models to simulate trace contaminants concentration in wet-weather discharges, their removal in blue-green infrastructure systems, and their impacts on the status of receiving water bodies. Such models are needed to inform stormwater managers, water utilities and regulators in a wide range of applications (planning of investments, discharge regulations, dimensioning, etc.).

The aim of this session is to collect and discuss recommendations for future monitoring efforts based on the data requirement by modellers. Through the discussion in the session, we aim to draft a shared understanding on data availability and quality, necessary data documentation and meta data collection as well as model requirements and expectations for different applications. In the session we will present the current state of data on trace contaminants, what we can learn from this data, what is the effort required for data collection and analysis, and what are the implications for modellers.

Special Session C

Moving towards an open urban water modeling paradigm: perspectives from academia and industry

CONVENORS: ABHIRAM MULLAPUDI, PH.D., SARA C. TROUTMAN, PH.D., CALEB BUAHIN, PH.D, RUBEN KERTESZ, PH.D., BRYANT E. MCDONNELL, (XYLEM INC.), SARA P. RIMER, PH.D (ARGONNE NATIONAL LABORATORY), BRANKO KERKEZ, PH.D. (UNIVERSITY OF MICHIGAN)

Presentations

1. **Industry and open source: a win-win for smart sewers?**	Bryant E. McDonnell, Ruben Kertesz, Caleb Buahin
2. **Breaking barriers to adoption: leveraging open-source tools to build smart and resilient urban water infrastructure.**	Branko Kerkez, Sara P. Rimer, Sara C. Troutman, Abhiram Mullapudi

This special session aims to provide the attendees an insight into the current state of open-source in urban drainage modeling and have a directed discussion on the role of open-source in ushering a new era of smart urban water systems. Smart water technologies are emerging as a viable alternative for addressing the challenges associated with climate change and urban sustainability. The advent of these smart technologies is creating the merger of the digital and physical worlds. Unlike the classical infrastructure systems, software and simulation tools are integral to the operation of smart urban water infrastructure systems. Hence, ensuring that these tools remain open and accessible to the various stakeholders is essential for transitioning smart water technologies into adoption and improving the trust of stakeholders in these technologies.

This session is divided into two segments. The first segment comprises two talks; these talks draw on the expertise from academia and industry to provide a holistic perspective on the state of open source in urban water modeling. This segment also leans on the experience of the maintainers of open-source tools to discuss the challenges of maintaining open-source projects in the urban water domain. The second segment discusses the role of open source in the future of urban water modeling. This discussion is not limited to but focuses on the following questions:

- How does one get started with open source?
- How does the industry benefit from supporting open source?
- What is the cost of open-source, and who shoulders it?
- How do we ensure the sustainability of open-source projects?

We hope this session will provide a fruitful discussion on the role of open source in urban drainage modeling and help us chart a course for moving towards a future where urban drainage modeling tools are open and accessible to communities worldwide. We plan to submit a position paper to a relevant academic journal based on the discussions in this session.