



# SCIENTIFIC PROGRAMME

OF THE 11<sup>TH</sup> IWA SYMPOSIUM ON

# MODELLING AND INTEGRATED ASSESSMENT

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23 - 27 SEPTEMBER 2023  
QUEBEC CITY, CANADA

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# SPONSORS AND SUPPORTING ORGANIZATIONS



## ORGANIZERS



## OFFICIAL EVENT OF



# PROGRAMME OVERVIEW

SATURDAY, 23 SEPTEMBER		
08:00-10:00	Registration	
<p align="center"><b>Young Water Professionals Workshop</b>  <b>Location: Room A</b></p> <p align="center"><b>How Do Availability And Quality Of The Data Impact The Way We Model Water Systems?  Challenges And Good Practice</b></p> <p><b>YWP Steering Committee:</b> Saba Daneshgar (Ghent University, Belgium), Hanna Molin (Lund University, Sweden), Fanlin Meng (Tsinghua University, China), Helieh Abasi (INRS, Canada), Kester McCullough (Cornell University, USA)</p>		
Time	Topic	Presenter/Moderator
09:00-09:45	Welcome & Ice breaker activity Introduction to MIA Specialist Group	<i>S. Daneshgar</i>
09:45-10:15	Keynote: "Setting the scene"	J.D. Therrien
10:15-10:45	<b>Coffee break</b>	
10:45-11:30	Part I: What is "good" data and what can you do with it? Mechanistic modelling perspective Data-driven modelling perspective Hybrid modelling perspective	<i>H. Molin</i> B. Elduayen-Echave M. Khalil M. Schneider
11:30-12:00	Q&A and Discussion	
12:00-13:30	<b>Lunch break</b>	
13:30-14:45	Part II: Group works on the case studies <i>Participants work together in groups to find solutions to one of the case studies</i> Group 1: Case study 1 - Wastewater application Group 2: Case study 2 - Drinking water application Group 3: Case study 3 - Stormwater application	<i>K. McCullough</i>
14:45-15:15	Wrap-up	
15:15-15:45	<b>Coffee break</b>	
15:45-16:45	Reports on case studies & General discussion	<i>Organisers</i>
16:45-17:00	Wrap-up and closing	<i>S. Daneshgar</i>
17:00-19:00	<b>YWP Social Activity</b>	

# PROGRAMME OVERVIEW

SUNDAY, 24 SEPTEMBER	
08:00-10:00	<b>Registration</b>
09:00-12:00	<p style="text-align: center;"><b>Workshop 1</b> Location: Room A</p> <p style="text-align: center;"><b>How Can Hybrid Modelling Be Used For Model Complexity Reduction?</b></p> <p><b>Chair/Co-Chair:</b> E. Torfs, D. Fernandes del Pozo</p> <p><b>Contributors:</b> A. Froemelt, S. Borzooei, S. Daneshgar, C.C. Gómez Cortéz, R. Saagi, J. Sparks, X. Zou, K. Villez, M.Y. Schneider</p>
09:00-17:00	<p style="text-align: center;"><b>Workshop 2</b> Location: Room B</p> <p style="text-align: center;"><b>Shedding Light – How Can We Improve Mathematical Models To Promote And Optimize Phototrophic Systems For Water Remediation And Resource Recovery?</b></p> <p><b>Chair/Co-Chair:</b> B. Valverde-Pérez, F. Casagli</p> <p><b>Contributors:</b> B.G. Plósz, O. Bernard, J.-P. Steyer, G. Capson-Tojo, J. Laurent, S. Rossi, A. Turolla, E. Ficara, T. Lorenz, U. Theilen, J. García, E. González Flo, D. Batstone</p>
13:00-17:00	<p style="text-align: center;"><b>Workshop 3</b> Location: Room C</p> <p style="text-align: center;"><b>How Can Mathematical Modelling Integrate With Wastewater-Based Epidemiology To Enhance Public Health Protection?</b></p> <p><b>Chair/Co-Chair:</b> S. Tik, Ll. Corominas</p> <p><b>Contributors:</b> C. Huot, D. McCarthy, J.-D. Therrien, P.A. Vanrolleghem, S. Dorner, S. Nourbakhsh, S.C. Aydin, T. Maere, W. Yusuf</p>
13:30-17:00	<p style="text-align: center;"><b>Workshop 4</b> Location: Room A</p> <p style="text-align: center;"><b>From Integrated Modelling To Holistic Decision Frameworks For The Water Sector, What Are The Needs And Challenges For Interoperability?</b></p> <p><b>Chair/Co-Chair:</b> S. Daneshgar, E. Torfs</p> <p><b>Contributors:</b> P. Bach, C. Vaneeckhaute, J. Alferes Castano, P. Seuntjens, I. Nopens</p>
17:00-18:00	<p><b>Registration</b> Location: Musée National des Beaux-Arts du Québec (179 Grande Allée Ouest, Québec)</p>
17:30	<p><b>Opening Reception and Keynote</b> Location: Musée National des Beaux-Arts du Québec (179 Grande Allée Ouest, Québec)</p> <p><b>Climate Change Drives Market For Urine-Separating Toilets</b> <b>Bruce Beck</b> (FASresearch and International Institute for Applied Systems Analysis, Austria)</p>

# PROGRAMME OVERVIEW

MONDAY, 25 SEPTEMBER			
08:00-10:00	Registration		
08:30-10:00	<p>Opening Session and Plenary Keynote Location: Plenary Room</p> <p><b>Community Engagement For Water Management Under Uncertainty</b> Elmira Hassanzadeh (Polytechnique Montréal, Canada)</p> <p><b>Modelling “Palettes” - A New Dawn Of Integrated Assessment To Support Water Management's Role Towards Climate-Adaptive Cities</b> Peter Marcus Bach (Eastern Switzerland University of Applied Sciences, Switzerland)</p>		
10:00-10:30	Coffee break		
	Room A	Room B	Room C
	<p><b>SESSION 1</b> <b>SMART MONITORING AND DATA PROCESSING</b></p> <p>Moderator: K. Newhart, J.D. Therrien</p>	<p><b>SESSION 2</b> <b>FLOCCULATION AND SETTLING</b></p> <p>Moderators: B. Valverde-Pérez, D.F. del Pozo</p>	<p><b>SESSION 3</b> <b>DIGITAL TWIN CASE STUDIES</b></p> <p>Moderator: S. Daneshgar, K. McCullough</p>
10:30-12:00	<p>1.1. Multivariate Monitoring For Surveillance Networks Of SARS-CoV-2 In Sewage <i>LI. Bosch, J. Pueyo, LI. Corominas</i></p>	<p>2.1. Simulating Floc Size Distribution In Coagulation-Flocculation Processes Through Mass-Based Population Balance Models For Integral Modelling of Drinking Water Treatment Plants <i>B. Elduayen-Echave, E. Ayesa</i></p>	<p>3.1. Full Scale Digital Twin With Integrated Hybrid Model Predictive Controller For Ammonia Based Aeration Control <i>J.A. Sparks, P.A. Vanrolleghem, C.B. Bott</i></p>
	<p>1.2. Water Quality Sensor Data Processing In Applications For Water Management <i>N. Desmet, F. Van Bauwel, L. Brosens, R. Vandeputte, J. Dehaspe, P. Seuntjens</i></p>	<p>2.2. Application Of Computer Vision For Microscopy Images: A Revolutionary Approach In Predicting Activated Sludge Settling Characteristics <i>S. Borzooei, L. Scabini, G. Miranda, S. Daneshgar, L. Deblieck, R. Cornelissen, E. Van Den Broeck, P. De Langhe, O. Bruno, B. De Baets, I. Nopens, E. Torfs</i></p>	<p>3.2. MSD's Data Driven Digital Transformation Journey Over 20 Years <i>D. Tao, O. Fradet, S. Shishegar, W. Miller, S. Laughlin</i></p>
	<p>1.3. Wastewater Generation Model To Predict Impacts Of Urine Separation On Wastewater Treatment Plants <i>J. Kleckers, A. Abadi, K. Brandherm, J. Haberkamp</i></p>	<p>2.3. Impact Of Sludge Settling On Oxygen And N<sub>2</sub>O Gas Mass Transfer <i>Y. Qiu, V. Bakos, N. Stewart-Campbell, B.G. Plósz</i></p>	<p>3.3. Full-Scale Soft-Sensor Implementations Enable WRRF Hybrid Digital-Twins <i>B.R. Johnson, C. Yang, K. Lesnik, J. Registe, T. Johnson, A. Menniti, J. Kenyon</i></p>
12:00-13:30	Lunch		

# PROGRAMME OVERVIEW

	<b>SESSION 4 PLANT-WIDE MODELS</b>  Moderators: E. Belia, S. George	<b>SESSION 5 COMPARTMENTAL MODELS</b>  Moderators: J. Laurent, H. Molin	<b>SESSION 6 SYSTEM APPROACH TO SURFACE WATER</b>  Moderators: P. Bach, J. Schmidt
13:30-15:30	4.1. Re-thinking Industrial Wastewater Treatment Using Advanced Mathematical Modelling  <b>X. Flores-Alsina, V. Monje, E. Ramin, P. Ramin, J. Abildskov, K.V. Gernaey, A. Mitic, L. Lardon, L. Wolmarans, I. Coremans</b>	5.1. A Dynamic Compartmental Model Of A Sequencing Batch Reactor (SBR) For Biological Phosphorus Removal  <b>S. Daneshgar, S. Borzooei, L. Debliek, E. Van Den Broeck, R. Cornelissen, P. de Langhe, C. Piacuzzi, M. Daza, S. Duchi, U. Rehman, I. Nopens, E. Torfs</b>	6.1. Poster presentations Model Development For Cooling Towers And Optimization Of Their Fan And Pump Operation Strategy <b>C.D. Jayaweera, J. Wauman, A. Verliefde, I. Nopens, I. Hitsov</b>  A Flexible Mesh Model For Simulation Of Coastal Hydrodynamics And Water Quality In Hong Kong <b>K.T.M. Wong, Q. Ye, S.N. Chan, H.S. Lee, A.Y.W. Chiu</b>
	4.2. A Comprehensive Modelling Framework For Integral Simulation Of Drinking Water Treatment Plants  <b>B. Elduayen-Echave, E. Ayesa</b>	5.2. Development And Validation Of A New Combined Hydraulic And Biological Model For Trickling Filters In A Real WWTP  <b>K. Olaciregui-Arizmendi, S. Jaray-Valdehierro, T. Fernández-Arévalo, A. López, J. Gómez, B. Elduayen-Echave, E. Ayesa</b>	6.2. How To Evaluate WRRF Pollutant Discharge Regulations For Protecting The Quality Of Receiving Waters: A Mechanistic And Artificial Intelligence Model-Based Methodology  <b>D.A. Mendoza Grubert, T. Maere, F. Li, C. Boisvert, P.A. Vanrolleghem</b>
	4.3. Plant-wide Modelling Of Digestate Up-Cycling: The Case Of Microalgae Cultivation  <b>D. Carecci, S. Rossi, A. Catenacci, G. Ferretti, E. Ficara</b>	5.3. A Compartmental Model Approach For Dynamic Combined Simulation Of Hydraulics And Biochemistry In WRRFs  <b>A. Romay-Gainza, B. Elduayen-Echave, B. Hernández, R. Arnau, J. Climent, E. Ayesa</b>	6.3. The Influence Of Discharge Permits On Economic And Emission Performance Of Industrial Enterprises: An Agent-Based Perspective  <b>Z. Wei, M. Gong, F. Meng, Y. Liu</b>
	4.4. Evaluating Monitoring Strategies In Wastewater Treatment Plants Using Benchmark Simulation Model No. 2-M  <b>P. Ramin, E. Ramin, S.O.N. Topalian, U. Jeppsson, K.V. Gernaey, X. Flores-Alsina</b>	5.4. Compartmental Model Study Of A Pilot-Scale Activated Sludge Reactor  <b>D. Fernandes del Pozo, S. Daneshgar, I. Nopens</b>	6.4. Water-Smart Strategies To Support Decision Making For Water Resource Management In The Industrial Context  <b>J. Alferes, N. Desmet, S. Kempeneers, S. Latte, I. Hitsov, C. Jayaweera, K. De Neve, J. Wauman, R. Bosch, S. Van Ermen, P. Seuntjens, I. Genné</b>
15:30-17:30	<b>Poster Cocktail Session</b>		

# PROGRAMME OVERVIEW

15:30-17:30	Poster Cocktail Session – List of Posters
	<ol style="list-style-type: none"> <li>1 Optimal Placement Of Sensors For Networkwide Calibration Using Pressure Dependent Modelling <b>A.G. Seyoum</b>, S. Tait, J. Boxall, A.N.A. Schellart</li> <li>2 Life Cycle Analysis Of Water Resource Recovery Facilities Based On Algae-Bacteria Processes D. Penaranda, F. Casagli, F. Beline, <b>O. Bernard</b></li> <li>3 Effect Of System Nonlinearity On The Resilience Of Water Resource Recovery Facilities <b>A.S. Laino</b>, O. Wani, S. Soudjani, R.J. Davenport</li> <li>4 An Energy Use Accounting Method For WWTPs Based On A Process Unit Balance And Its Application <b>L. Yao</b>, C. Wang, Y. Liu</li> <li>5 Estimation And Analysis Of Embodied Energy Conversion In Community Septic Tank Y. Yan, C. Wang, Y. Liu, X. Dong, Y. Liu, <b>L. Yao</b></li> <li>6 Exploring The Effects Of Faults And Disturbances On The Performance Of A Biological Wastewater Treatment Process <b>H.L. Ivan</b>, V. Zaccaria</li> <li>7 Model Predictive Control For The Elimination Of Contaminants Of Emerging Concern By UV Based Advanced Oxidation Process <b>T.-M. Hwang</b>, J. Lee, S.-H. Nam, E. Kim</li> <li>8 Model Predictive Control For The Elimination Of Micropollutant During Bromide-Rich Wastewater Ozonation <b>E. Kim</b>, H. Kye, S.-H. Nam, T.-M. Hwang</li> <li>9 State Estimation In Water Distribution Networks Using The Saint-Venant Equations With Extended Kalman Filtering <b>M. Bartos</b>, M. Thomas, M. Frankel, M.-G. Kim, L. Sela</li> <li>10 Application Of Pre-Processing And Noise Reduction Methods To Improve Generalization Performance Of The Leakage Detection Model <b>M.A. Caronge</b>, Y. Arai, K. Ito, T. Kunizane, A. Koizumi, B. Bakri</li> <li>11 Smart Management Of Wastewater Treatment Based On Total Nitrogen Prediction Applying Long Short -Term Memory (LSTM) neural network <b>Y. Lee</b>, H.-W. Kim</li> <li>12 Deterioration Assessment Model Of Urban Drinking Water Distribution Pipes Using A Machine Learning Algorithm And Geographic Information System <b>J. Lee</b>, S.-H. Nam, E. Kim, T.-M. Hwang</li> <li>13 Fluorescence Excitation-Emission Matrix Spectroscopy Coupled With PARAFAC Modeling To Determine Of Chlorine Decay Constants In Metropolitan Water-Distribution Systems <b>J. Lee</b>, S.-H. Nam, E. Kim, T.-M. Hwang</li> <li>14 Residential Water And Energy Consumption Prediction At Hourly Resolution Based On A Hybrid Machine Learning Approach <b>C. Wang</b>, X. Ni, Z. Li, W. Shi, J. Zhang, J. Bian, Y. Liu</li> <li>15 Enhancing The Explanation of Household Water Consumption Through The Water-Energy Nexus Concept: A Case In Beijing, China <b>Z. Li</b>, C. Wang, Y. Liu, J. Wang</li> </ol>

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15:30-17:30	Poster Cocktail Session – List of Posters
	16 A Flexible Mesh Model For Simulation Of Coastal Hydrodynamics And Water Quality In Hong Kong <b>K.T.M. Wong</b> , Q. Ye, S.N. Chan, H.S. Lee, A.Y.W. Chiu
	17 Model Development For Cooling Towers And Optimization Of Their Fan And Pump Operation Strategy <b>C.D. Jayaweera</b> , J. Wauman, A. Verliefde, I. Nopens, I. Hitsov
	18 Myths And Reality Of The Advantages And Drawbacks Of Algae-Bacteria Processes <b>F. Casagli</b> , O. Bernard
	19 Modelling Heterotrophic Microalgae Cultivation For Nutrient Recovery From Industrial By-Products And Wastewaters <b>S. Rossi</b> , D. Carecci, E. Ficara
	20 Why Knowledge Management Systems Need To Overcome Organisational Inertia To Manage Uncertainty: A Case Study Analysis <b>K. Sritharan</b> , B.S. McIntosh, P.A. Vanrolleghem
	21 An Interactive Real-Time Control Tool To Support Urban Drainage Operators <b>J. Schmidt</b> , A. Roy, B. Kerkez
	22 Mechanistic Modelling Framework To Develop Digital Twins For Water And Wastewater Technologies G. Bellandi, R. Muoio, E. Guerrero, W. Audenaert, U. Rehman
	23 Optimal Design Module For Watershed Water Quality Monitoring Network As A GIS Toolbox W. Meng, M. Luo, Q. Liang, J. Jiang
	24 Sludge Age Predictive Modeling In Full Scale Wastewater Treatment Plant Using Recurrent Neural Network M. Djeddou, P. Wongburi, <b>A. Bachiri</b> , J.K. Park
	25 A Dynamic Model For Ion Exchange And Resin Regeneration: Model Calibration And Global Sensitivity Analysis <b>D.I. González</b> , I.P. Hitsov, B. Claessens, J.P. Gallo Molina, I. Nopens, E. Torfs



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TUESDAY, 26 SEPTEMBER			
08:00-08:30	Registration		
08:30-10:00	<p style="text-align: center;"><b>Plenary Panel Discussion</b>  <b>Location: Plenary Room</b></p> <p style="text-align: center;"><b><i>Plenty Of Modelling Methodologies, Which Ones Really Support Systems Thinking?</i></b></p> <p style="text-align: center;"><b>Panelists: Branko Kerkez</b> (University of Michigan, USA),  <b>Kate Newhart</b> (West Point, USA), <b>Simon Duchi</b> (AM-Team, Belgium)</p>		
10:00-10:30	Coffee break		
	<b>Room A</b>	<b>Room B</b>	<b>Room C</b>
	<b><u>SESSION 7</u></b> <b>HYBRID MODELS</b>	<b><u>SESSION 8</u></b> <b>URBAN HYDRAULICS</b>	<b><u>SESSION 9</u></b> <b>DIGITAL TWIN DEVELOPMENTS</b>
	Moderators: M. Schneider, M. Khalil	Moderators: W. Rauch, J. Li	Moderators: P. Ramin, B. Hernández Blázquez
10:30-12:00	7.1. Hybrid Machine Learning-Mechanistic Modeling Of Algae-Bacteria Processes Under Various Climatologies <i>F. Casagli, M. Scalabrino, J.I.F. Ulloa, O. Bernard</i>	8.1. Capacity Of 2D Shallow Water Models To Represent Unsteady Flow Characteristics In Urban Area <i>L. Guiot, G. Dellinger, F. Lawnicak</i>	9.1. A Novel Contaminant Transport Model For Natural And Urban Drainage Networks With Real-Time Data Assimilation <i>M.-G. Kim, M. Bartos</i>
	7.2. Balancing Calibration Efforts In Parallel Hybrid Modelling Of Wastewater Treatment Processes <i>L. Verhaeghe, P.A. Vanrolleghem, S. Daneshgar, G. Kirim, E. Torfs</i>	8.2. Flood4CastRTF: A Novel Flood Modelling Tool <i>M. Craninx, K. Hilgersom, G. Vaes, T. Danckaert, J. Bronders</i>	9.2. Forecasting Influent Water Quality Parameters And Flow Of WRRFs Using Weather Data <i>A. Hykkerud, A. Nair, H. Ratnaweera</i>
	7.3. Automatically Generating Hydrologic Process Models From Sensor Data <i>T.A. Dantzer, B. Kerkez</i>	8.3. Integrated Modeling Of Urban Mobility, Flood Inundation, And Sewer Hydrodynamic Processes For Resilience Assessment Of Urban Drainage Systems <i>L. Wang, X. Dong, R. Li</i>	9.3. Automatic (Re)Calibration Of Water Resource Recovery Facility Models To Ensure Continuous Model Performance <i>C. Gómez, S. Daneshgar, K. Solon, S. Borzooei, I. Nopens, E. Torfs</i>
12:00-13:30	Lunch		

# PROGRAMME OVERVIEW

	<b>SESSION 10 SOFT SENSORS I</b>	<b>SESSION 11 SEWER AND CATCHMENT</b>	<b>SESSION 12 N<sub>2</sub>O MODELLING AND MITIGATION</b>
	Moderator: B. Kerkez, K. Olaciregui-Arizmendi	Moderators: S. Tik, B. Elduayen-Echave	Moderators: X. Flores-Alsina, N. Uri Carreno
13:30-15:00	10.1. Transforming Biosolids: Linear Multimodal Modelling For Improved Fourier Transform Infrared Based Soft Sensors  <b>S.O.N. Topalian</b> , P.C. Keymer, X. Flores-Alsina, K.V. Gernaey, D.J. Batstone	11.1. A Model-Based Assessment Of In-Sewer Heat Recovery Potentials  <b>D. Muschalla</b> , W. Sprung, S. Reinstaller, F. Kretschmer	12.1. Pattern Recognition Of Operational States Leading To N <sub>2</sub> O Emissions In Full-Scale Biological Wastewater Treatment  <b>A. Froemelt</b> , L. Zueger, W. Gruber
	10.2. Soft Sensor For Substrate Characterization Through The Reverse Application Of The ADM1 Model For Anaerobic Digestion Plant Operations  A. Donoso-Bravo, M.C. Sadino-Riquelme, <b>F. Zorrilla</b> , E. Valdebenito-Rolack, D. Gómez, F. Hansen	11.2. Swift Physics-Informed Model For Hydraulic Characteristics In Sewer Networks  <b>J. Li</b> , K. Sharma, Z. Yuan	12.2. Using Artificial Intelligence For Online Prediction Of N <sub>2</sub> O Emissions In WRRFs  <b>M. Khalil</b> , A. AlSayed, P.A. Vanrolleghem, Y. Liu
	10.3. Using Machine Learning To Predict The Total Solids Concentration In Thickened Primary Sludge At Henriksdal WRRF  <b>H. Molin</b> , E. Bröndum, S. Nilsson, R. Saagi, E. Lindblom, B. Carlsson, U. Jeppsson	11.3. Rainfall Driven E.coli Dynamics In Inland Rivers  <b>V. Suslovaite</b> , V. Speight, J.D. Shucksmith	12.3. General Framework For Effective Assessment, Mitigation, And Reporting Of N <sub>2</sub> O Emissions  G. Bellandi, <b>S. Duchi</b> , <b>T. Weijtmans</b> , R. Muoio, W. Audenaert, U. Rehman
15:00-15:30	<b>Coffee break</b>		
15:30-16:30	<b>Problems, Ideas and Challenges Session</b> Location: Plenary Room		
16:30-17:30	<b>MIA Specialist Group Open Group Meeting</b> Location: Plenary Room		
18:30	<b>Surprise Conference Dinner</b>		

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WEDNESDAY, 27 SEPTEMBER			
08:00-08:30	Registration		
08:30-10:00	Poster Breakfast	Hybrid Modelling Challenge Organized by the Hybrid Modelling Working Group Location: Room C	
	Room A	Room B	Room C
	<b>SESSION 13</b> <b>PROCESS CONTROL</b>  Moderator: J. Sparks, T. Dantzer	<b>SESSION 14</b> <b>PROCESS MODELS</b>  Moderator: C. Vaneekhaute, P. Carrera	<b>SESSION 15</b> <b>DECISION SUPPORT SYSTEM FOR DESIGN</b>  Moderators: L. Corominas, R. Ktori
10:00-12:00	13.1. Long-Term Assessment Of Multi-Objective Model Predictive Control Of WRRFs  <i>P.A. Stenoft, C.L. Holmboe, B. Valverde-Pérez, L. Vezzaro</i>	14.1. A Quantified Nitrogen Metabolic Network Based On Reaction Kinetics And Mathematical Model In Treating Low COD/TN Wastewater  <i>J. Meng, Z. Sun, J. Li</i>	15.1. Poster presentations Why Knowledge Management Systems Need To Overcome Organisational Inertia To Manage Uncertainty: A Case Study Analysis <i>K. Sritharan, B.S. McIntosh, P.A. Vanrolleghem</i> Life Cycle Analysis Of Water Resource Recovery Facilities Based On Algae-Bacteria Processes <i>D. Penaranda, F. Casagli, F. Beline, O. Bernard</i> Effect Of System Nonlinearity On The Resilience Of Water Resource Recovery Facilities <i>A.S. Laino, O. Wani, S. Soudjani, R.J. Davenport</i>
	13.2. Hybridization Of A First-Principles Biofilter Model With A Data-Driven Model To Improve Performance Of A Hybrid MPC Controller Of Methanol Dosing For N-Removal In A Denitrifying Biofilter  <i>M. Serrao, V. Jauzein, S. Daneshgar, S. Azimi, V. Rocher, B. Tassin, P.A. Vanrolleghem</i>	14.2. Model Based Analysis Of Trace Metal Speciation Effects In An Anaerobic Digestion System Under Different Modes Of Operation  <i>S. George, M.R. Mattei, L. Fruzo, G. Esposito, E.D. van Hullebusch, F.G. Feroso</i>	15.2. Sustainability Assessment Framework Of Integrated Desalination And Resource Recovery: A Participatory Approach  <i>R. Ktori, M.P. Parada, M. Rodriguez-Pascual, M.C.M. van Loosdrecht, D. Xevgenos</i>
	13.3. Integrated Real-Time Control Of Urban Drainage Systems For Water Quality Using Reinforcement Learning  <i>Y. Wang, X. Dong, Z. Huang</i>	14.3. Detailed Modelling Of Radiation Transfer In Photobioreactors For Purple Phototrophic Bacteria Mixed Cultures And Integration With Biokinetics  <i>A. Amini, E. Porciatti, M. Greco, S. Rossi, E. Ficara, A. Turolla</i>	15.3. Adaptation Pathways Modelling Of Urban Wastewater Systems Under Deep Uncertainty And Urban Expansion  <i>D. Zhang, X. Dong, S. Zeng</i>
	13.4. Poster presentation An Interactive Real-Time Control Tool To Support Urban Drainage Operators <i>J. Schmidt, A. Roy, B. Kerkez</i>	14.4. Development Of A New Combined Hydraulic And Biological Model For Aerobic Granular Sludge Reactors  <i>K. Olaciregui-Arizmendi, S. Jaray-Valdehiero, T. Fernández-Arévalo, B. Elduayen-Echave, E. Ayesa</i>	15.4. Development Of An Agile Benchmarking Framework For The Evaluation Of Emerging Wastewater Treatment And Resource Recovery Technologies In QSDsan  <i>X. Zhang, S. Rai, Y. Li, B.D. Shoener, P.A. Vanrolleghem, R.D. Cusick, J.S. Guest</i>
12:00-13:30	Lunch		

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	<b>SESSION 16</b> <b>CALIBRATION AND OPTIMAL EXPERIMENTAL DESIGN</b>  Moderators: U. Jeppsson, S. Rossi	<b>SESSION 17</b> <b>SOFT SENSORS II</b>  Moderators: A. Froemelt, H. Ivan	<b>SESSION 18</b> <b>GREEN/GREY INFRASTRUCTURE</b>  Moderators: S. Duchesne, V. Suslovaite
13:30-15:00	16.1. Moving Sensor Deployment For Network-Wide Pipe Roughness Calibration  <b>A.G. Seyoum, S. Tait, J. Boxall, A.N.A. Schellart, W. Shepherd</b>	17.1. Modeling Phosphorus Recovery Within MagPrex: Lessons From A Statistical And Machine Learning-Based Analysis  <b>J. Lybik, N.G. Love, R. Maltos, B. Wisdom, K. Newhart</b>	18.1. A Flood Impact Matrix To Support Sustainable, Targeted Blue-Green-Grey Stormwater Management Solutions  <b>S. Li, J.P. Leitao, Z. Wang, P.M. Bach</b>
	16.2. Model Parameter Estimation With Imprecise Information  <b>W. Rauch</b>	17.2. Adaptive Sampling For The Calibration Of Soft Sensors  <b>M. Tobias, B. Kerkez</b>	18.2. Applying MCDA For NBS Planning: A Comparison Between A Canadian, French, And Australian Case Studies  <b>M. Bousquet, R. Lavoie, F. Bichai, P.A. Vanrolleghem</b>
	16.3. Mass-Balance-Based Approach In Planning A Measurement Campaign For Energy Factory Tilburg  <b>D. Ysebaert, Q. Le, P. Carrera, R. Schemen, S. Weijers, E.I.P. Volcke</b>	17.3. Predicting Total Solids Using Non-Contact Acoustic Sensors: Systematic Feature Reduction For Robust Model Performance  <b>G. Kittleson, B. Bhattarai, K.N. Ngo, H. Nguyen, T. Nguyen, H. De Clippeleir, N. Love, B. Kerkez</b>	18.3. Operation Strategy Of A Sewer System And Green Infrastructure Layout Based On Vulnerable Facilities  <b>C. Shen, X. Dong, X. Wang</b>
15:00-15:30	<b>Coffee break</b>		
15:30-17:00	<b>Closing Session and Closing Keynote</b> <b>Location: Plenary Room</b>  <b>An Integrated Computer Control System (IC2S) for Wastewater Treatment Plant Operation – A Digital Twin “Avant la lettre!”</b> <b>Gilles Patry (University of Ottawa, Canada)</b>		