

# 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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## OFFICIAL EVENT OF



# PROGRAMME OVERVIEW

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

# PROGRAMME OVERVIEW

SUNDAY, 24 SEPTEMBER	
08:00-10:00	<b>Registration</b>
09:00-12:30	<b>Workshop 1 (Room A)</b> <b>How Can Hybrid Modelling Be Used For Model Complexity Reduction?</b> <b>Chair/Co-Chair:</b> E. Torfs, D. Fernandes del Pozo <b>Contributors:</b> A. Froemelt, S. Borzooei, S. Daneshgar, C.C. Gómez Cortéz, R. Saagi, J. Sparks, X. Zou, K. Villez, M.Y. Schneider
09:00-17:00	<b>Workshop 2 (Room B)</b> <b>Shedding Light – How Can We Improve Mathematical Models To Promote And Optimize Phototrophic Systems For Water Remediation And Resource Recovery?</b> <b>Chair/Co-Chair:</b> B. Valverde-Pérez, F. Casagli <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
12:00-17:15	<b>Workshop 3 (Room C)</b> <b>How Can Mathematical Modelling Integrate With Wastewater-Based Epidemiology To Enhance Public Health Protection?</b> <b>Chair/Co-Chair:</b> S. Tik, Ll. Corominas <b>Contributors:</b> C. Jobin, C. Ort, D. McCarthy, J.-D. Therrien, M.-D. Rioux, M. Wade, P.A. Vanrolleghem, S. Dörner, S. Nourbakhsh, S.C. Aydin, T. Maere, W. Yusuf, W. Rauch
13:30-17:00	<b>Workshop 4 (Room A)</b> <b>From Integrated Modelling To Holistic Decision Frameworks For The Water Sector, What Are The Needs And Challenges For Interoperability?</b> <b>Chair/Co-Chair:</b> S. Daneshgar, E. Torfs <b>Contributors:</b> P. Bach, C. Vaneeckhaute, J. Alferes Castano, P. Seuntjens, I. Nopens
17:00-18:00	<b>Registration</b> Musée National des Beaux-Arts du Québec (179 Grande Allée Ouest, Québec)
17:30	<b>Opening Reception and Keynote</b> <b>Location:</b> Musée National des Beaux-Arts du Québec (179 Grande Allée Ouest, Québec) <b>Climate Change Drives Market For Urine-Separating Toilets</b> <b>Bruce Beck</b> (FASresearch and International Institute for Applied Systems Analysis, Austria)

# PROGRAMME OVERVIEW

MONDAY, 25 SEPTEMBER			
08:00-10:00	Registration		
08:30-10:00	<p><b>Opening Session and Plenary Keynote</b></p> <p><b><i>Community Engagement For Water Management Under Uncertainty</i></b>  <b>Elmira Hassanzadeh</b> (Polytechnique Montréal, Canada)</p> <p><b><i>Modelling “Palettes” - A New Dawn Of Integrated Assessment To Support Water Management's Role Towards Climate-Adaptive Cities</i></b>  <b>Peter Marcus Bach</b> (Eastern Switzerland University of Applied Sciences, Switzerland)</p>		
10:00-10:30	Coffee break		
	Room A	Room B	Room C
	<b><u>SESSION 1</u></b> <b>SMART MONITORING AND DATA PROCESSING</b>	<b><u>SESSION 2</u></b> <b>FLOCCULATION AND SETTLING</b>	<b><u>SESSION 3</u></b> <b>DIGITAL TWIN CASE STUDIES</b>
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

13:30-15:30	<b>SESSION 4 PLANT-WIDE MODELS</b>	<b>SESSION 5 COMPARTMENTAL MODELS</b>	<b>SESSION 6 SYSTEM APPROACH TO SURFACE WATER</b>
	<p>4.1. Re-thinking Industrial Wastewater Treatment Using Advanced Mathematical Modelling</p> <p><b>X. Flores-Alsina</b>, V. Monje, E. Ramin, P. Ramin, J. Abildskov, K.V. Gernaey, A. Mitic, L. Lardon, L. Wolmarans, I. Coremans</p>	<p>5.1. A Dynamic Compartmental Model Of A Sequencing Batch Reactor (SBR) For Biological Phosphorus Removal</p> <p><b>S. Daneshgar</b>, 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</p>	<p>6.1. Drinking Water Production Oriented Surface Water Quality Assessment Based On A Purification Resistance Index</p> <p><b>J. Jiang</b>, M. Zhu, X. Zhang, M. Luo, Y. Yan, H. Song, S. Chang</p>
	<p>4.2. A Comprehensive Modelling Framework For Integral Simulation Of Drinking Water Treatment Plants</p> <p><b>B. Elduayen-Echave</b>, E. Ayesa</p>	<p>5.2. Development And Validation Of A New Combined Hydraulic And Biological Model For Trickling Filters In A Real WWTP</p> <p><b>K. Olaciregui-Arizmendi</b>, S. Jaray-Valdehiero, T. Fernández-Arévalo, A. López, J. Gómez, B. Elduayen-Echave, E. Ayesa</p>	<p>6.2. How To Evaluate WRRF Pollutant Discharge Regulations For Protecting The Quality Of Receiving Waters: A Mechanistic And Artificial Intelligence Model-Based Methodology</p> <p><b>D.A. Mendoza Grubert</b>, T. Maere, F. Li, C. Boisvert, P.A. Vanrolleghem</p>
	<p>4.3. Plant-wide Modelling Of Digestate Up-Cycling: The Case Of Microalgae Cultivation</p> <p><b>D. Carecci</b>, S. Rossi, A. Catenacci, G. Ferretti, E. Ficara</p>	<p>5.3. A Compartmental Model Approach For Dynamic Combined Simulation Of Hydraulics And Biochemistry In WRRFs</p> <p><b>A. Romay-Gainza</b>, B. Elduayen-Echave, B. Hernández, R. Arnau, J. Climent, E. Ayesa</p>	<p>6.3. The Influence Of Discharge Permits On Economic And Emission Performance Of Industrial Enterprises: An Agent-Based Perspective</p> <p><b>Z. Wei</b>, M. Gong, F. Meng, Y. Liu</p>
	<p>4.4. Evaluating Monitoring Strategies In Wastewater Treatment Plants Using Benchmark Simulation Model No. 2-M</p> <p><b>P. Ramin</b>, E. Ramin, S.O.N. Topalian, U. Jeppsson, K.V. Gernaey, X. Flores-Alsina</p>	<p>5.4. Compartmental Model Study Of A Pilot-Scale Activated Sludge Reactor</p> <p><b>D. Fernandes del Pozo</b>, S. Daneshgar, I. Nopens</p>	<p>6.4. Water-Smart Strategies To Support Decision Making For Water Resource Management In The Industrial Context</p> <p>J. Alferes, <b>N. Desmet</b>, S. Kempeneers, S. Latte, I. Hitsov, C. Jayaweera, K. De Neve, J. Wauman, R. Bosch, S. Van Ermen, P. Seuntjens, I. Genné</p>
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. Casaghi, 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 E. Kim, 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>



# PROGRAMME OVERVIEW

15:30-17:30	Poster Cocktail Session – List of Posters
	<p>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</p> <p>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</p> <p>18 Myths And Reality Of The Advantages And Drawbacks Of Algae-Bacteria Processes <b>F. Casagli</b>, O. Bernard</p> <p>19 Modelling Heterotrophic Microalgae Cultivation For Nutrient Recovery From Industrial By-Products And Wastewaters <b>S. Rossi</b>, D. Carecci, E. Ficara</p> <p>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</p> <p>21 An Interactive Real-Time Control Tool To Support Urban Drainage Operators <b>J. Schmidt</b>, A. Roy, B. Kerkez</p> <p>22 Mechanistic Modelling Framework To Develop Digital Twins For Water And Wastewater Technologies <b>G. Bellandi</b>, R. Muoio, E. Guerrero, W. Audenaert, U. Rehman</p> <p>23 Optimal Design Module For Watershed Water Quality Monitoring Network As A GIS Toolbox W. Meng, <b>M. Luo</b>, Q. Liang, J. Jiang</p> <p>24 Sludge Age Predictive Modeling In Full Scale Wastewater Treatment Plant Using Recurrent Neural Network <b>M. Djeddou</b>, P. Wongburi, A. Bachiri, J.K. Park</p> <p>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</p>



# PROGRAMME OVERVIEW

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

# PROGRAMME OVERVIEW

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

# PROGRAMME OVERVIEW

WEDNESDAY, 27 SEPTEMBER			
08:00-08:30	Registration		
08:30-10:00	Poster Breakfast	Hybrid Modelling Challenge Organized by the Hybrid Modelling Working Group	
	Room A	Room B	Room C
10:00-12:00	<b>SESSION 13</b> <b>PROCESS CONTROL</b>	<b>SESSION 14</b> <b>PROCESS MODELS</b>	<b>SESSION 15</b> <b>DECISION SUPPORT SYSTEMS FOR DESIGN</b>
	13.1. Long-Term Assessment Of Multi-Objective Model Predictive Control Of WRRFs <i>P.A. Stenftoft, 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. Life Cycle Cost Based Critical Curves For Selecting Optimal Mode Of Rural Sewage Treatment Under Village-Level Resolution <i>X. Hu, J. Jiang, X. Xia, W. Wang, R. He, Y. Gu, R. Yang, Y. Zheng</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. Fermoso</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. Evaluating The Interpretability Of Deep Reinforcement Learning In Urban Drainage System Operation <i>W. Tian, G. Fu, K. Xin, Z. Zhang, Z. Liao</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		

# PROGRAMME OVERVIEW

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