

6th IWA/WEF Water Resource Recovery Modelling Seminar 2018

WRRmod
 **2018**

Lac Beauport, Canada

March 10 - 14, 2018

PROGRAMME

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WEF Committees & IWA Specialist and Task Groups:

WEF Biofilm Interest Group (BIG, Chair: Oliver Schraa)

WEF Modelling Expert Group of the Americas (Chair: John Copp)

Modelling and Integrated Assessment (MIA, Chair: Ingmar Nopens)

Specialist Group on Anaerobic Digestion (Chair: Damien Batstone)

Specialist Group on Biofilms (Chair: Eberhard Morgenroth)

Specialist Group on Instrumentation, Control and Automation (ICA, Chair: Juan Baeza)

Specialist Group on Microbial Ecology and Water Engineering (Chair: Tom Curtis)

Specialist Group on Nutrient Removal and Recovery (Chair: Sudhir Murthy)

Task Group on Benchmarking of Control Strategies for Wastewater Treatment Plants (BSM, Chair: Ulf Jeppsson)

Task Group on Design and Operations Uncertainty (DOUGroup, Chair Evangelina Belia)

Task Group on Good Modelling Practice – Guidelines for Use of Activ. Sludge Models (GMP, Chair Leiv Rieger)

TG on Use of Water Quality & Process Models for Minimiz. WW Utility GHG Footprints (GHG, Chair: Jose Porro)

Working Group for Life Cycle Analysis of Water and Wastewater Treatment (LCA-Water, Chair Lluís Corominas)

Working Group on Modelling of Integrated Urban Water Systems (MIUWS, Chair: Peter Bach)

Saturday, March 10, 2018

YWP Workshop ([click for details](#))

(reserved to YWPs)

Frontiers in WRRF Modelling - Challenges and Opportunities

The YWP workshop intends to address the frontiers as well as synergies between different modelling areas in water resource recovery facilities (WRRFs). The **main objective** is to highlight the **current needs and challenges from the utilities or ultimate stakeholder's perspective followed by a response showcasing new solutions and model development from academia as well as practice.**

The workshop will be a full-day event divided into three major topics:

- 1) *Exploring the synergies between biofilm modelling and CFD-biokinetic models*
- 2) *Linking process control modelling with modelling for operation*
- 3) *Improving EBPR modelling and new models for P recovery*

Each topic will have speakers from utilities, academia, and consulting companies. The “needs” of each topic will be presented by representatives from utilities which will be followed by a corresponding presentation on “solutions” from academia/practice. Each session ends with a discussion to explore synergies between different topics, challenges, and opportunities. The day will conclude with a final panel discussion to summarize the day's topics by promoting YWPs to interact with the expert panelists and discuss the opportunities and provide an outlook on the topics addressed.

YWP co-chairs

Jorge Santos (Nova University of Lisbon, Portugal)

Pusker Regmi (Brown and Caldwell, USA)

YWP steering Committee

Heather Stewart (CH2M, USA)

Kimberly Solon (Ghent University, Belgium)

Queralta Plana (Université Laval, Canada)

Wim Audenaert (AM-TEAM, Belgium)

17:00 Social event for YWPs

Sunday, March 11, 2018

08:30-17:00

Parallel full-day workshops:

1. Modelling solid stream processes for nutrient recovery - Current status and gaps

Chairs Rajeev Goel (Hydromantis ESS, Inc., Hamilton, ON, Canada)
 Paloma Grau (Ceit-IK4, University of Navarra, Spain)
Co-Chairs Ron Latimer (Hazen and Sawyer, New York, NY, USA)
 Adrienne Menniti (Clean Water Services, Hillsboro, OR, USA)
 Martha Dagnew (University of Western Ontario, London, ON, Canada)

[\(click for details\)](#)

2. To Mix or Not To Mix? How important is hydrodynamics for the future of water resource recovery modelling?

Chairs Julien Laurent (ENGEES, Strasbourg, France)
 Jim Wicks (The Fluid Group, Oxford, UK)
Co-Chairs Olivier Potier (Université de Lorraine, Nancy, France)
 Randal Samstag (Civil and Sanitary Engineer, Bainbridge Island, WA, US)

[\(click for details\)](#)

3. Modelling gas-liquid mass transfer: how can current academic knowledge benefit engineering practice and vice-versa?

Chair Sylvie Gillot (Irstea Lyon, France)
Co-Chairs Andreia Amaral (UGent, Belgium/Lisbon University, Portugal)
 Diego Rosso (UC Irvine, CA, USA)

[\(click for details\)](#)

4. New computational tools on the horizon: Solving the future or revelling in fancy math?

Co-Chairs Kris Villez (Eawag, Switzerland)
 Ivan Miletic (inCTRL Solutions Inc., Oakville, ON, Canada)

[\(click for details\)](#)

5. Simulation of counter diffusional biofilms: How do we take the MABR from research to practice?

Co-Chairs Leon Downing (CH2M, Madison, WI, USA)
 Kelly Gordon (Black and Veatch, Kansas City, MO, USA)
 Oliver Schraa (inCTRL Solutions Inc., Oakville, ON, Canada)

[\(click for details\)](#)

6. Aerobic granular sludge: To what extent can mathematical modeling really answer relevant questions in design and operation?

Co-Chairs Eberhard Morgenroth (Eawag/ETH, Switzerland)
 Bruce Johnson (CH2M, Denver, CO, USA)

[\(click for details\)](#)

17:00-19:00

Welcome Reception and Outdoor activity

19:30

Dinner at the venue

Monday, March 12, 2018

07:00 – 08:00	All moderators breakfast
08:30 – 09:00	<p>Welcome addresses by Kala Vairavamoorthy (IWA), Joan Hawley (WEF) and Frédéric Cloutier (Ville de Québec)</p> <p><i>Moderators: Mathieu Spérandio and Yves Comeau, Chairs of the Scientific Committee</i></p>
09:00 – 10:30	<p>Session 1: Enhanced biological phosphorus removal</p> <p><i>Moderators: John Copp and Patrick Dunlap</i></p> <p>The META-ASM model: A novel approach for modelling EBPR systems <i>Jorge Santos, Leiv Rieger, Ana B. Lanham and Adrian Oehmen</i></p> <p>Recent advances in bio-P modelling - A new approach verified by full-scale observations <i>Erika Varga, H�el�ene Hauduc, James Barnard, Patrick Dunlap, Jose Jimenez, Adrienne Menniti, Peter Schauer, Carlos M. Lopez Vazquez, April Z. Gu, Mathieu Sperandio, Imre Tak�acs</i></p>
10:30 – 11:00	<i>Coffee break</i>
11:00 – 12:30	<p>Session 2: Practical applications of modelling WRRFs</p> <p><i>Moderators: Ilse Smets and Wim Audenaert</i></p> <p>Experiences in the application of mathematical models in full scale WWTPs: Modelling from the perspective of applied research <i>Tamara Fern�andez-Ar�evalo, Bikram S. Sabherwal, Evangelia Belia, Pau Juan-Garc�a, Oliver Schraa, Leiv Rieger, Llu�s Corominas, Eduardo Ayesa</i></p> <p>Process modelling at resource recovery utilities: Lessons learned and missing tools <i>Adrienne Menniti, Hank Andres, Erika Bailey, Lina Belia, Kurt Carson, Stacy Passaro, Ana Pena-Tijerina, Mark Reeves, Oliver Schraa, Matt Seib, Spencer Snowling</i></p>
12:30 – 14:00	<i>Lunch</i>
14:00 – 15:30	<p>Session 3: Control</p> <p><i>Moderators: Ulf Jeppsson and Haydee De Clippelier</i></p> <p>Towards model predictive control: Online predictions of ammonium and nitrate removal by using a stochastic ASM <i>Peter Stenftoft Thomas Munk-Nielsen, Luca Vezzaro, Henrik Madsen and Peter Steen Mikkelsen, Jan Kloppenborg-M�oller</i></p> <p>Integrating artificial intelligence and mathematical modelling for online supervision and control of water resource recovery facilities <i>Jose Porro, Joaquim Comas, Sophie Balemans, Chaim De Mulder, Alexandra Deeke, Youri Amerlinck, Elena Torfs, Ingmar Nopens, Stefan Weijers, Ignasi Rodriguez-Roda</i></p>
15:30 – 16:00	<i>Coffee break</i>
16:00 – 17:00	<p>Reports and Discussions from Sunday Workshops 1 & 2</p> <p><i>Moderators: Charles Bott and Kelly Gordon</i></p>
17:00 - 18:30	Poster Cocktail
18:45	Bus departure for surprise dinner

Tuesday, March 13, 2018

08:30 – 09:15 Modelling WRRFs for Resource Recovery

Keynote presentation by Mark van Loosdrecht

Moderators: *Lina Belia and Chaïm De Mulder*

09:15 – 10:45 Session 4: Settling

Moderators: *Ingmar Nopens and Elena Torfs*

Model identification for hindered-compression settling velocity

Benedek Plósz, Javier Climent, Christopher T. Griffin, Pia Haecky, Nick Blackburn, Sergio Chiva, Borja Valverde-Pérez

Towards more predictive clarification models via experimental determination of flocculent settling coefficient values

Nam Ngo, Tim Van Winckel, Imre Takács, Bernhard Wett, Arash Massoudieh, Ahmed Al-Omari, Sudhir Murthy, Haydee De Clippeleir

10:45 – 11:15 Coffee break

11:15 – 12:15 Reports and Discussions from Sunday Workshops 3 & 4

Moderators: *Lorenzo Benedetti and Cyril Garneau*

12:15 – 13:45 Lunch

13:45 – 15:15 Session 5: Nitrogen

Moderators: *Ron Latimer and Pusker Regmi*

Modelling membrane biofilm reactors coupling anammox with denitrifying anaerobic methane oxidation

Tao Liu, Shihu Hu, Zhiguo Yuan, Jianhua Guo

Natural bioaugmentation of nitrifiers in activated sludge by influent wastewater: From lab-scale demonstration to full-scale modeling

Dominic Frigon, Shameem Jauffur, Zeinab Bakhshi

15:15 – 15:45 Coffee break

15:45 – 16:45 Reports and Discussions from Sunday Workshops 5 & 6

Moderators: *Adrienne Menniti and Nerea Uri Carreño*

16:45 - 17:00 Selection of WRRmod 2022 location

Moderators: *Kris Villez and Nicolas Derlon*

17:30 Bus departure to Gala Dinner

Wednesday, March 14, 2018

08:30 – 10:00 **Session 6: Physico-chemical modelling**

Moderators: *Eveline Volcke and Dominique Claveau-Mallet*

From WWTP to WRRF: A new modelling framework

Izaro Lizarralde, Tamara Fernández-Arévalo, Eduardo Ayesa, Xavier Flores-Alsina, Ulf Jeppsson, Kimberly Solon, Peter Vanrolleghem, Celine Vaneckhaute, David Ikumi, Christian Kazadi Mbamba, Damien Batstone and Paloma Grau

Incorporating sulfur reactions and interactions with iron into a general plant-wide model - From model to full scale experience

Hélène Hauduc, Tanush Wadhawan, Bruce Johnson, Charles Bott, Matthew Ward, Imre Takács

10:00 – 10:30 **Reports & Discussions from Saturday YWP Workshop**

Heather Stewart and Queralt Plana

10:30 – 11:00 *Coffee break*

11:00 - 11:45 **Modelling on Trial - Closing forum**

Diego Rosso, main instigator with Paloma Grau and Jose Jimenez, co-instigators

Witness and participate in an animated debate between two confronting teams focusing on controversial issues, instigated by a provocative crew

11:45 – 12:00 **Summary of WRRmod 2018** by *Mathieu Spérandio and Yves Comeau, SC Chairs*

12:00 – 12:15 **Outlook on WRRmod 2020** by *Kris Villez and Nicolas Derlon, Incoming SC Chairs*

Announcement of location of WRRmod 2022 by *Kris Villez and Nicolas Derlon, Incoming SC Chairs*

12:15 – 13:45 *Lunch and departure from conference center*

Posters

Biofilms

B1- Differences in co- and counter-diffusional biofilm modeling: Comparison of the most sensitive biofilm parameters in MABR and IFAS process models

Kelly Gordon, Samik Bagchi, and Sandeep Sathyamoorthy

B2- Do we really need biofilm models for aerobic granules?

J.E. Baeten, M.C.M. van Loosdrecht, E.I.P. Volcke

B3- Maximization of nitrification rate of MABR biofilm under aerobic conditions - Simulation study in GPS-X

Zebo Long, Dwight Houweling and Juliane Kagansky

B4- Model-based optimization biofilm based systems performing autotrophic nitrogen removal using the comprehensive NDHA model

Borja Valverde-Pérez, Yunjie Ma, Martin Morset, Carlos Domingo-Félez, Miguel Mauricio-Iglesias, Barth F. Smets

B5- Modelling the effects of predation on membrane-aerated biofilms

M. Aybar, P. Pérez-Calleja and R. Nerenberg

B6- Presentation and evaluation of the zero-dimensional biofilm model ODBFM

Mario Plattes

Carbon Capture and Anaerobic Digestion

C1- "Hot topic" -- Combined energy- and process modelling in thermal hydrolysis-systems

Peter Aichinger, Christine DeBarbadillo, Ahmed Al-Omari, and Bernhard Wett

C2- Colloids, flocculation and carbon capture -- A comprehensive plant-wide model

Hélène Hauduc, Ahmed Al-Omari, Bernhard Wett, Jose Jimenez, Haydee De Clippeleir, Arifur Rahman, Tanush Wadhawan, Imre Takacs

C3- Anaerobic digester performance assessment using CFD modelling coupled with biokinetics

Javier Climent, Rosario Arnau, Mehlika Ayla Kiser, Raúl Martínez-Cuenca, Lluís Corominas, Jorge Rodriguez, Sergio Chiva

C4- Data validation for full-scale wastewater treatment plants: bilinear vs. linear mass balances

Quan H. Le, Peter J.T. Verheijen, Mark C.M. van Loosdrecht and Eveline I.P. Volcke

C5- Model development to compare the impacts of thermal pretreatment on waste activated sludge

Hyungun (Brian) Jo and Wayne Parker

C6- Modelling polyphosphate release during anaerobic digestion of sludge from nutrient removal systems

David S Ikumi, George A Ekama and Christopher J Brouckaert

C7- Modelling syntrophic acetate oxidation in a two-phase anaerobic configuration fed with waste activated sludge

Daniele Montecchio, Giovanni Esposito, Maria Cristina Gagliano, Agata Gallipoli, Andrea Gianico and Camilla Braguglia

C8- Process schemes for future energy-positive water resource recovery facilities

Kimberly Solon, Mingsheng Jia and Eveline I.P. Volcke

Enhanced Biological Phosphorus Removal

E1- Integrating Monte Carlo methods with dynamic process simulations to assess phosphorus removal reliability

Adrienne Willoughby, Ansel Bather, Colin Fitzgerald and Leon Downing

Hydrodynamics and Mass Transfer

H1- Compartmental modelling in a plant-wide context: Exploration and potential

Chaïm De Mulder, Usman Rehman, Tony Flameling, Stefan Weijers, Youri Amerlinck, and Ingmar Nopens

H2- Tanks in series versus compartmental model configuration: Considering hydrodynamics helps in parameter estimation for an N₂O Model

Giacomo Bellandi, Chaïm De Mulder, Stijn Van Hoey, Youri Amerlinck, Lisha Guo, Peter A. Vanrolleghem, Stefan Weijers, Riccardo Gori and Ingmar Nopens

H3- Assessing impact of variable alpha factors on dynamic simulation of full scale WRRF aeration

Reenste Filler, Martha Dagneu, Rajeev Goel and Geordie Gauld

H4- Improvement of effluent quality and cost saving at a 750,000 pe WRRF using an extensively validated CFD model

U. Rehman, W. Audenaert, G. Bellandi, T. Flameling, S. Weijers, I. Nopens

H5- Inclusion of the effects of hollow fibre membrane bunches on the mass transfer in a counter diffusional biofilm model

Andras Nemeth, Eoin Casey and Michael J. Semmens, Eoin Syron

H6- Resource recovery and advanced CFD: A required marriage

Ingmar Nopens, Jim Wicks, David Fernandes del Pozo, Youri Amerlinck, Miklos Patziger, John Bridgeman, Kamalakanta Satpathy and Usman Rehman

Microalgae

M1- Microalgae modeling in water resource recovery facilities: Toward a consensus

Jeremy Guest, Brian Shoener, Fabrice Béline, Olivier Bernard, Benedek Gy. Plósz, Stephanie Schramm, Spencer Snowling, Jean-Philippe Steyer, Borja Valverde-Pérez, Carlos Martinez von Dossow, Dorottya Wágner

N₂O Emissions

N1- Optimization fo aeration strategies for NOB suppression and nitrous oxide reduction in deammonification systems

Xi Lu, Hussein E. Al-Hazmi, Li Xie, Qi Zhou, Giorgio Mannina and Jacek Makinia

N2- Application of the NDHA model to describe N₂O dynamics in activated sludge mixed culture biomass

Carlos Domingo-Félez and Barth F. Smets

N3- Dynamic simulation of N₂O emissions from a full-scale partial nitrification reactor

Kris E. Mampaey, Mark C.M. van Loosdrecht, and E.I.P Volcke

N4- Modelling N₂O emissions from a full-scale nitrifying BAF: Impact of gas-liquid transfer hypotheses

Justine Fiat, Ahlem Filali, Yannick Fayolle, Jean Bernier, Vincent Rocher, Mathieu Sperandio, Sylvie Gillot

N5- Modeling nitrous oxide (N₂O) emissions from denitrifying filters

Fabrizio Sabba, Cristian Piciooreanu and Robert Nerenberg

Nitrification, Denitrification and Anaerobic Ammonium Oxidation

N6- Effects of F/M ratio and temperature on NO₂ accumulation via specialist denitrifying microorganisms

Mehran Andalib, Sam Ledwell, Maurice Gutierrez, Art Umble, Joe Jacangelo

N7- Harnessing biofilm models to advance nitrogen removal from mainstream anaerobic wastewater treatment processes

Zerihun A. Bekele, Jeseth Delgado Vela, Imre Takacs, Charles B. Bott, and Nancy G. Love

N8- Last but not least: Modelling nitrogen polishing in the Context of shortcut nitrogen removal to meet stringent discharge limits

Ahmed Al-Omari, Tri Le, Haydee De Clippeleir, Sudhir Murthy, Charles Bott, Ingmar Nopens and Bernhard Wett

N9- Modeling pH variation for determining effect of free ammonia and free nitrous acid on nitrite pathway

Zhiqiang Zuo, Min Zheng and Yanchen Liu

N10- Partial nitrification/anammox biofilm model behaviour under sidestream and mainstream loading

Alex Rosenthal, Oliver Schraa, Mahsa Mehrdad, Paul Roots, Krish Ramalingam, John Fillos, Leiv Rieger, and George Wells

N11- Simulation of unique low dissolved oxygen nitrification communities: How do comammox organisms impact energy efficient nitrogen removal?

Leon Downing, Colin Fitzgerald, Adrienne Willoughby, Alex Rosenthal, George Wells, Nerea Uri, Mike Young

Physico-Chemical Modelling

P1- Advanced modelling tools for struvite recovery in WRRF

Beñat Elduayen-Echave, Izaro Lizarralde, Philip A. Schneider, Gorka S. Larraona and Paloma Grau

P2- Inviting P-removing alkaline granular filters in mechanistic models

Dominique Claveau-Mallet, Étienne Boutet and Yves Comeau

P3- Lost crystals -- Investigating when nutrient recovery isn't meeting low-P expectations

Thomas D. Johnson, Leon Downing, Adrienne Menniti, William Leaf, Matthew Seib and Ron Gearhart

P4- San Diego (CA) North City Water Reclamation Facility integrated dynamic modeling

Thomas D. Johnson, Muriel Steele and Matthew Deavanport