6th IWA/WEF Water Resource Recovery Modelling Seminar 2018

WRRmod 2018

Lac Beauport, Canada

March 10 - 14, 2018

FINAL PROGRAMME

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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)
Queralt Plana (Université Laval, Canada)
Wim Audenaert (AM-TEAM, Belgium)

Sunday, March 11, 2018

08:30 – 08:45 **Welcome** *by Mathieu Spérandio and Yves Comeau - Chairs of the Scientific Committee*

08:45 – 17:00 **Parallel full-day workshops**

08:45-10:15	Presentations and Discussion
10:15-10:30	Coffee break
10:30-12:00	Presentations and Discussion
12:00-13:30	Lunch break (extend to 90 min)
13:30-15:00	Presentations and Discussion
15:00-15:30	Coffee break
15:30-16:30	Presentations and Discussion
16:30-17:00	Wrap-up

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 **Welcome Reception and Dinner**

Monday, March 12, 2018

08:30 – 09:00 **Welcome address by IWA representative**

09:00 – 10:30 **Session 1: Enhanced biological phosphorus removal**

The META-ASM model: A novel approach for modelling EBPR systems
Jorge Santos, Leiv Rieger, Ana B. Lanham and Adrian Oehmen

Recent advances in bio-P modelling - A new approach verified by full-scale observations
Erika Varga, Hélène Hauduc, James Barnard, Patrick Dunlap, Jose Jimenez, Adrienne Menniti, Peter Schauer, Carlos M. Lopez Vazquez, April Z. Gu, Mathieu Sperandio, Imre Takács

10:30 – 11:00 *Coffee break*

11:00 – 12:30 **Session 2: Practical applications of modelling WRRFs**

Experiences in the application of mathematical models in full scale WWTPs: Modelling from the perspective of applied research
Tamara Fernández-Arévalo, Bikram S. Sabherwal, Evangelia Belia, Pau Juan-García, Oliver Schraa, Leiv Rieger, Lluís Corominas, Eduardo Ayesa

Process modelling at resource recovery utilities: Lessons learned and missing tools
Adrienne Menniti, Hank Andres, Erika Bailey, Lina Belia, Kurt Carson, Stacy Passaro, Ana Pena-Tijerina, Mark Reeves, Oliver Schraa, Matt Seib, Spencer Snowling

12:30 – 14:00 *Lunch*

14:00 – 15:30 **Session 3: Control**

Towards model predictive control: Online predictions of ammonium and nitrate removal by using a stochastic ASM
Peter Stentoft Thomas Munk-Nielsen, Luca Vezzaro, Henrik Madsen and Peter Steen Mikkelsen, Jan Kloppenborg-Møller

Integrating artificial intelligence and mathematical modelling for online supervision and control of water resource recovery facilities
Jose Porro, Joaquim Comas, Sophie Balemans, Chaïm De Mulder, Alexandra Deeke, Youri Amerlinck, Elena Torfs, Ingmar Nopens, Stefan Weijers, Ignasi Rodriguez-Roda

15:30 – 16:00 *Coffee break*

16:00 – 17:00	**Reports and Discussions from Sunday Workshops 1 & 2**
17:00 - 18:30	**Poster Session**
19:00	**Dinner**

Tuesday, March 13, 2018

08:30 – 09:15	**Modelling WRRFs for Water Resource Recovery** *Keynote presentation by Mark van Loosdrecht*
09:15 – 10:45	**Session 4: Settling** **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**
12:15 – 13:45	*Lunch*
13:45 – 15:15	**Session 5: Nitrogen** **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**
16:45 - 17:00	**Selection of WRRmod 2022 location**
17:30	**Bus departure to Gala Dinner**

Wednesday, March 14, 2018	
08:30 – 8:45	**Welcome Address** by WEF representative
08:45 – 10:15	**Session 6: Physico-chemical modelling** **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 Vaneeckhaute, 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*
10:15 – 10:45	*Coffee break*
10:45 – 11:45	**Report from Saturday YWP Workshop and Discussion**
11:15 - 12:00	**Closing session - Panel discussion – Opportunities in and outlook on modelling WRRFs** *Main Instigator - Diego Rosso*
12:00 – 12:15	**Summary of WRRmod 2018** *by Mathieu Spérandio and Yves Comeau, SC Chairs*
12:15 – 12:30	**Outlook on WRRmod 2020** *by Kris Villez and Nicolas Derlon, Incoming SC Chairs*
12:30 – 13:30	*Lunch and departure from conference center*

Posters

Biofilms

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

Do we really need biofilm models for aerobic granules?
J.E. Baeten, M.C.M. van Loosdrecht, E.I.P. Volcke

Maximization of nitrification rate of MABR biofilm under aerobic conditions - Simulation study in GPS-X
Zebo Long and Dwight Houweling

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

Modelling the effects of predation on membrane-aerated biofilms
M. Aybar, P. Pérez-Calleja and R. Nerenberg

Presentation and evaluation of the zero-dimensional biofilm model 0DBFM
Mario Plattes

Carbon Capture and Anaerobic Digestion

"Hot topic" -- Combined energy- and process modelling in thermal hydrolysis-systems
Peter Aichinger, Christine DeBarbadillo, Ahmed Al-Omari, and Bernhard Wett

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

Comprehensive 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

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

Model development to compare the impacts of thermal pretreatment on waste activated sludge
Hyungun (Brian) Jo and Wayne Parker

Modelling polyphosphate release during anaerobic digestion of sludge from nutrient removal systems
David S Ikumi, George A Ekama and Christopher J Brouckaert

Modelling sulphate-reducing processes on anaerobic sewage treatment systems
F. Durán, A. Robles, A. Seco, J. Ferrer, J. Ribes and J. Serralta

Modelling syntrophic acetate oxidation in a two-phase configuration fed with waste activated sludge
Daniele Montecchio, Giovanni Esposito, Maria Cristina Gagliano, Agata Gallipoli, Andrea Gianico and Camilla Braguglia

Process schemes for future energy-positive water resource recovery facilities
Kimberly Solon, Mingsheng Jia and Eveline I.P. Volcke

Enhanced Biological Phosphorus Removal

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

Compartmental modelling in a plant-wide context: Exploration and potential
Chaïm De Mulder, Usman Rehman, Tony Flameling, Stefan Weijers, Youri Amerlinck, and Ingmar Nopens

Estimating dynamic alpha factor using dynamic parameter estimation model
Reenste Filler, Martha Dagnew, Rajeev Goel and Geordie Gauld

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

Modelling mixing in a hollow fibre MABR
Andras Nemeth, Eoin Casey and Michael J. Semmens, Eoin Syron

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

Accounting for background turbidity in microalgae growth for an optimal use in wastewater treatment
Carlos Martinez and Olivier Bernard

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

pH as state-indicator of microalgae cultivation system yields
M.V. Ruano, J. González-Camejo, A. Robles, R. Barat, A. Seco and J. Ferrer

N_2O Emissions

A comprehensive analysis formechanisms of N_2O production by advanced mathematical techniques
Xi Lu, Hussein E. Al-Hazmi, Li Xie, Qi Zhou, Giorgio Mannina and Jacek Makinia

Application of data driven methods to predict N_2O emissions in full-scale
Morad Danishvar, Vasileia Vasilaki, Zhengwen Huang, Evina Katsou, and Ali Mousavi

Application of the NDHA model to describe N_2O dynamics in activated sludge mixed culture biomass
Carlos Domingo-Félez and Barth F. Smets

Dynamic simulation of N_2O emissions from a full-scale partial nitritation reactor
Kris E. Mampaey, Mark C.M. van Loosdrecht, and E.I.P Volcke

Modelling N_2O 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

Modeling nitrous oxide (N_2O) emissions from denitrifying filters
Fabrizio Sabba, Cristian Picioreanu and Robert Nerenberg

Tanks in series versus compartmental model configuration: Considering hydrodynamics helps in parameter estimation for an N_2O Model
Giacomo Bellandi, Chaïm De Mulder, Stijn Van Hoey, Youri Amerlinck, Lisha Guo, Peter A. Vanrolleghem, Stefan Weijers, Riccardo Gori and Ingmar Nopens

Nitrification, Denitrification and Anaerobic Ammonium Oxidation

Effects of F/M ratio and temperature on NO_2 accumulation via specialist denitrifying microorganisms
Mehran Andalib, Sam Ledwell, Maurice Gutierrez, Art Umble, Joe Jacangelo

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

Last but not least: Modelling nitrogen polishing in thecContext 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

Modeling pH variation for determining effect of free ammonia and free nitrous acid on nitrite pathway
Zhiqiang Zuo, Min Zheng and Yanchen Liu

Partial nitritation/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

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

Physics and Physical-Chemical Modelling

Advanced modelling tools for struvite recovery in WRRF
Beñat Elduayen-Echave, Izaro Lizarralde, Philip A. Schneider, Gorka S. Larraona and Paloma Grau

Clarifier modelling: A lot of ideas floating around, it's time to get things settled
Alonso Griborio, Elena Torfs, Benedek Plósz, Amanda Ford, John Alex McCorquodale, Michael K. Stenstrom, Imre Takacs, Julien Laurent, Ed Wicklein, Ingmar Nopens, Jose Jimenez, Haydee DeClippeleir, Stefan Diehl, Raimund Bürger, Maria Elena Valle, David Kinnear, Hany Gerges, Krish Ramalingam, Peter Vanrolleghem

Integrating P-removing alkaline granular filters in mechanistic models
Dominique Claveau-Mallet, Étienne Boutet and Yves Comeau

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

Modelling anaerobic digestion of food waste: The importance of the physico-chemical model
G. Capson-Tojo, J. Jiménez, J. Ferrer, M. Rouez, M. Crest, J-P. Delgenès, J-P. Steyer, A. Seco, R. Escudié, A. Robles

San Diego (CA) North City Water Reclamation Facility integrated dynamic modeling
Thomas D. Johnson, Muriel Steele and Matthew Deavanport