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## 5<sup>th</sup> IWA/WEF Wastewater Treatment Modelling Seminar 2016



Annecy, France

2 – 6 April, 2016

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## PROGRAMME

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## Saturday, April 2<sup>nd</sup> 2016

**09:00 – 17:00 YWP workshop ([click for full details](#))**

**Keeping up with the future: What's the best way to advance process modelling?**

### **Introduction (Sherri Cook)**

09:00 - 09:20 : Workshop overview; Group orientation and ice breakers

### **Part I: Today's Model and Interactive Demonstrations: New models you should know about (Leiv Rieger, Lorenzo Benedetti, Damien Batstone)**

- 09:20 - 09:30 Overview of Activities
- 09:30 - 10:30 First Round of Activities
- 10:30 - 11:00 Coffee break
- 11:00 - 12:00 Second Round of Activities
- 12:00 - 13:30 Lunch break

### **Part II: Tomorrow's Models: Models you may be developing soon (Leon Downing, Oliver Schraa, David Weissbrodt, George Wells, Sherri Cook, Lluís Corominas, Ingmar Nopens)**

- 13:30 - 13:55 Topic 1: Modelling Granule-based Processes
- 13:55 - 14:20 Topic 2: Microbial Ecology
- 14:20 - 14:40 Coffee break
- 14:40 - 15:05 Topic 3: Life Cycle and Sustainability Assessments
- 15:05 - 15:30 Topic 4: Population Balance Modelling
- 15:30 - 16:30 Small Group Discussions
- 16:30 - 17:10 Small Group Reporting (back to entire group)

### **YWP organising committee**

*Sherri Cook (University of Colorado-Boulder, USA)*

*Wim Audenaert (Ghent University, Belgium)*

*Kelly Martin (Black & Veatch, USA)*

*Nick Landes (Feese and Nichols, USA)*

## Sunday, April 3<sup>rd</sup> 2016

**08:30 – 08:45**      **Welcome** by Evangelina Belia and Sylvie Gillot - Chairs of the Scientific Committee

**08:45 – 09:45**      **Opening Lecture** by J.B. Neethling, HDR Engineering

**09:45 – 17:15**      **Parallel full-day workshops**

**09:45-10:45**      Presentations and Discussion

**10:45-11:15**      Coffee break

**11:15-12:45**      Presentations and Discussion

**12:45-13:45**      Lunch break

**13:45-15:15**      Presentations and Discussion

**15:15-15:45**      Coffee break

**15:45-16:45**      Presentations and Discussion

**16:45-17:15**      Wrap-up

### Themes:

**1. Mind the gap – Overcoming data issues in process modelling**

*Adrienne Menniti, Kris Villez, John Copp and Oliver Schraa ([click for details](#))*

**2. Modelling industrial wastewater treatment processes with the IWA activated sludge models: What works, what doesn't, and what's missing?**

*Spencer Snowling and Janet Goodfellow ([click for details](#))*

**3. Physicochemical modelling of phosphorus removal and recovery from wastewater**

*Dominique Claveau-Mallet ([click for details](#))*

**4. Where to direct modelling efforts for a faster road towards resource recovery?**

*Chaim De Mulder and Mark Miller ([click for details](#))*

**5. Process control strategies for dynamic efficiency modelling: From unit to whole-plant**

*Pusker Regmi and Lluís Corominas ([click for details](#))*

**17:15 – 18:00**      **Report preparation** (*workshop chairs*)

**18:30**                **Welcome reception and dinner** at the conference venue

## Monday, April 4<sup>th</sup> 2016

<b>08:30 – 09:00</b>	<b>Opening</b> by <i>Diane D'Arras, IWA President-Elect</i>
<b>09:00 – 10:00</b>	<b>Reports and discussion from Sunday workshops 1&amp;2</b> <i>Moderators: Peter Vanrolleghem and Gamze Kirim</i>
<b>10:00 – 10:30</b>	<i>Coffee break</i>
<b>10:30 – 12:00</b>	<b>Session 1: Incorporating new knowledge in hydrolysis and EBPR models</b> <i>Moderators: Ingmar Nopens and Haydee De Clippeleir</i>  <b>Modelling hydrolysis: simultaneous versus sequential biodegradation of the hydrolysable fractions</b> <i>Julie Jimenez, Cyrille Charnier, Eric Latrille, Michel Torrijos, Jerome Harmand, Dominique Patureau, Mathieu Sperandio, Eberhard Morgenroth, Fabrice Beline, George Ekama, Peter A. Vanrolleghem, Angel Robles, Aurora Seco, Damien J. Batstone, and Jean-Philippe Steyer</i>  <b>Rethinking EBPR: What do you do when the model will not fit real-world evidence?</b> <i>Patrick Dunlap, Kelly Martin, Gerry Stevens, Nick Tooker, James Barnard, April Gu, Imre Takacs, Andrew Shaw, Annalisa Onnis-Hayden, and Yueyun Li</i>
<b>12:00 – 13:15</b>	<i>Lunch</i>
<b>13:15 – 14:45</b>	<b>Session 2: Rethinking biokinetic parameters under specific environmental conditions</b> <i>Moderators: Mathieu Spérandio and Alma Masic</i>  <b>Rethinking growth and decay kinetics in activated sludge- towards a new adaptive kinetic approach</b> <i>Michael Friedrich, Jose Jimenez, Amy Pruden, Jennifer H. Miller, Jacob Metch, and Imre Takács</i>  <b>Sludge reduction via biodegradation of the endogenous residues (<math>X_E</math>): experimental verification and modelling</b> <i>Cheikh Fall, Ericka L. Millan-Lagunas, Carlos M. Lopez-Vazquez, Christine Hooijmans, and Yves Comeau</i>
<b>14:45 – 15:15</b>	<i>Coffee break</i>
<b>15:15 – 16:45</b>	<b>Session 3: Model structures revisited</b> <i>Moderators: Andy Shaw and Laura Snip</i>  <b>A new approach to modelling biofilm reactors</b> <i>Joshua P. Boltz, Bruce R. Johnson, Imre Takács, Glen T. Daigger, Eberhard Morgenroth, Doris Brockmann, Róbert Kovács, Jason M. Calhoun, Jean-Marc Choubert, Robert Simm, Nicolas Derlon, and Erika Varg</i>  <b>Concentration-driven models revisited: Towards a unified framework to model settling tanks in WWTPs</b> <i>Elena Torfs, Florent Locatelli, Sophie Balemans, Julien Laurent, Peter A. Vanrolleghem, Raimund Bürger, Stefan Diehl, Pierre François, Robert Mosse, and Ingmar Nopens</i>
<b>18:00</b>	<b>Fun rally through the Old Town of Annecy</b>
<b>20:00</b>	<b>Dinner at the conference venue</b>

## Tuesday, April 5<sup>th</sup> 2016

<b>08:30 – 9:00</b>	<b>Welcome address</b> by <i>Diego Rosso and Jose Jimenez, WEF representatives</i>
<b>09:00 – 09:30</b>	<b>Reports from Saturday YWP workshop and Discussion</b> <i>Moderators: Leiv Rieger and Julie Jimenez</i>
<b>9:30 – 10:30</b>	<b>Reports from Sunday workshops 3&amp;4</b> <i>Moderators: Bruce Johnson and Kimberly Solon</i>
<b>10:30 – 11:00</b>	<i>Coffee break</i>
<b>11:00 – 12:30</b>	<p><b>Session 4: N<sub>2</sub>O modelling</b> <i>Moderators: Eveline Volcke and H��l��ne Hauduc</i></p> <p><b>Comparison of different 2-pathway models for describing the combined effect of DO and nitrite on the nitrous oxide production by ammonia-oxidizing bacteria</b> <i>Longqi Lang, Mathieu Pocquet, Mathieu Sp��randio, Bing-Jie Ni, and Zhiguo Yuan</i></p> <p><b>Predicting N<sub>2</sub>O emissions from biofilm systems</b> <i>Fabrizio Sabba, Cristian Picioreanu, Joshua P. Boltz and Robert Nerenberg</i></p>
<b>12:30 – 13:45</b>	<i>Lunch</i>
<b>13:45 – 15:15</b>	<p><b>Session 5: Unit process modelling</b> <i>Moderators: Magnus Arnell and Sovanna Tik</i></p> <p><b>Towards advanced aeration modelling: from blower to bubbles to bulk</b> <i>Andreia Amaral, Oliver Schraa, Leiv Rieger, Sylvie Gillot, Yannick Fayolle, Giacomo Bellandi, Youri Amerlinck, S��verine Mortier, Riccardo Gori, Ramiro Neves, and Ingmar Nopens</i></p> <p><b>Towards better models for describing mixing using compartmental modelling: a full-scale case demonstration</b> <i>Usman Rehman, Chaim De Mulder, Youri Amerlinck, Marina Arnaldos, Stefan R. Weijers, Olivier Potier, and Ingmar Nopens</i></p>
<b>15:15 – 15:45</b>	<i>Coffee break</i>
<b>15:45 – 16:15</b>	<b>Reports from Sunday workshop 5</b> <i>Moderators: George Ekama and Heather Stewart</i>
<b>16:15 – 16:45</b>	<b>Communication from IWA and WEF Working/Task Groups</b>
<b>19:00</b>	<b>Gala dinner</b> at <i>Ferme de Gy</i>

## Wednesday, April 6<sup>th</sup> 2016

<b>08:30 – 8:45</b>	<b>Welcome address</b> by <i>Pierre Buffière, GIS EEDEMS</i>		
<b>08:45 – 10:15</b>	<p><b>Session 6: Case studies</b>  <b>Moderators:</b> <i>Damien Batstone and Ana Barbara Bisinella de Faria</i></p> <p><b>Modelling long-term nutrient removal performance of membrane bioreactor at high temperatures</b>  <i>Murat Sarioglu, Nilay Sayi Ucar, Güçlü Insel, Emine Cokgor, Derin Orhon, and Mark M.C. Van Loosdrecht</i></p> <p><b>Diagnosis and optimization of WWTPs using the PWM library: Full-scale experiences</b>  <i>Tamara Fernández-Arévalo, Izaro Lizarralde, Mikel Maiza, Paloma Grau, and Eduardo Ayesa</i></p>		
<b>10:15 – 10:45</b>	<i>Coffee break</i>		
<b>10:45 – 12:00</b>	<p><b>Closing session – Debate moderated by Andy Shaw</b></p> <p><b>Are our models getting too complex to be useful?</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><u>“Les protagonistes”</u></p> <p><i>Leiv Rieger</i>  <i>Adrienne Menniti</i>  <i>Damien Batstone</i>  <i>Patrick Dunlap</i></p> </td> <td style="width: 50%; vertical-align: top;"> <p><u>“Les antagonistes”</u></p> <p><i>Mark van Loosdrecht</i>  <i>Eveline Volcke</i>  <i>Kim Soerensen</i>  <i>Laura Snip</i></p> </td> </tr> </table>	<p><u>“Les protagonistes”</u></p> <p><i>Leiv Rieger</i>  <i>Adrienne Menniti</i>  <i>Damien Batstone</i>  <i>Patrick Dunlap</i></p>	<p><u>“Les antagonistes”</u></p> <p><i>Mark van Loosdrecht</i>  <i>Eveline Volcke</i>  <i>Kim Soerensen</i>  <i>Laura Snip</i></p>
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<b>12:00 – 12:15</b>	<b>Summary of WWTmod2016</b> by <i>Evangelina Belia and Sylvie Gillot</i>		
<b>12:15 – 12:30</b>	<b>Outlook on WWTmod2018</b> by <i>Yves Comeau and Mathieu Spérandio, incoming chairs</i>		
<b>12:30 – 13:30</b>	<i>Lunch and departure from conference center</i>		

## Posters

### Advanced biological WWTP modelling

**A comprehensive C-model describing physiological behaviour of ordinary heterotrophic organisms under different sludge retention times for efficient COD management**

*Tanush Wadhawan, Arifur Rahman, Jose J Jimenez, Haydee De-Clippelier, Abdul Mancell Egala, Mark Miller, Rumana Riffat, Charles Bott, Sudhir Murthy, Imre Takacs, Bernhard Wett and Ahmed Al-Omari*

**Application and validation of the META-ASM model at an A<sup>2</sup>O WWTP: Performance comparison with the ASM2d model**

*Jorge Santos, Ana da Silva, António Martins and Adrian Oehmen*

**The case of K<sub>s</sub> part II: explaining inhibition due to particulate COD using a mechanistic diffusion model**

*Haydee De Clippelier, Qi Zhang, Andy Shaw, Ahmed Al-Omari, Bernhard Wett, Imre Takacs and Sudhir Murthy*

**Informing the development of the membrane aerated biofilm reactor (MABR) through multidimensional biofilm modelling**

*Kelly Martin, Marcelo Aybar, Patricia Perez Calleja, Cristian Picoreanu and Robert Nerenberg*

**Effect of foam on temperature prediction and heat recovery potential from biological wastewater treatment**

*Luis Corbala-Robles, Eveline I.P. Volcke, Arne Samijn, Frederik Ronsse and Jan G. Pieters*

**Towards an optimal experimental design for N<sub>2</sub>O model calibration during biological nitrogen removal**

*Carlos Domingo-Félez, Borja Valverde-Pérez, Benedek Gy. Plósz, Gürkan Sin and Barth F. Smets*

### Advanced physico-chemical WWTP modelling

**The use of an advanced aqueous phase chemistry approach with IWA biological process models in a plant-wide context**

*Xavier Flores-Alsina, Christian Kazadi Mbamba, Emma Thomson-Brewster, Kimberly Solon, Darko Vrecko, Stephan Tait, Ulf Jeppsson, Krist V. Gernaey and Damien J. Batstone*

**Modelling of iron, sulfur and phosphorus interactions in sewer system and wastewater treatment plant under different sewer iron dosing strategies**

*Lisha Guo, Keshab Raj Sharma and Zhiguo Yuan*

**Analysis and modelling of multiple phosphate precipitation for P recovery from high-strength wastewaters**

*Hélène Hauduc, Mathieu Pocquet, Aurélie Capdevielle, Angela Manas, Béatrice Biscans and Mathieu Spérandio*

**Modelling physico-chemistry in extreme conditions**

*Emma Thompson Brewster, Stephan Tait, Darko Vrecko, Xavier Flores-Alsina, Christian Kazadi Mbamba, Kimberly Solon, Ulf Jeppsson, Krist V. Gernaey and Damien J. Batstone*

## Posters

### Unit process modelling

**Development of a model for activated sludge aeration systems: Linking air supply, distribution, and demand**

*Oliver Schraa, Leiv Rieger and Jens Alex*

**Towards improved membrane fouling modelling: from an empirical to a spatially explicit framework**

*Wouter Naessens, Glenn Van De Staey, Jan M. Baetens, Ilse Smets and Ingmar Nopens*

**An empirical settler model for fast simulation including wet-weather conditions**

*Lorenzo Benedetti*

**Modelling of sedimentation processes: combining Population Balance Model and 1D settler flux model**

*Nicolas Descoins, Marc Pau-Roig and Mark Matzopoulos*

**Detailed computational fluid dynamics modelling of rotating belt filters for primary wastewater treatment**

*Christopher T. DeGroot, Domenico Santoro, Damien J. Batstone and Diego Rosso*

### Energy modelling

**Combining energy- with mass-flow based process models within the fence of a wastewater treatment plant: energy-fractionation for process characterization**

*Bernhard Wett, Peter Aichinger, Ahmed Al-Omari, Jose Jimenez, Tanush Wadhawan, Imre Takacs and Sudhir Murthy*

**A plant-wide energy model for WWTPs: application to AnMBR technology**

*Ruth Pretel, Angel Robles, María Victoria Ruano, Aurora Seco and José Ferrer*

### Nutrient removal and recovery modelling

**Dual substrate limitation model for mainstream deammonification**

*Heather Stewart, Ahmed Al-Omari, Charles Bott, Haydée De Clippeleir, Arash Massoudieh, Sudhir Murthy, Andrew Shaw, Imre Takacs, Tanush Wadhawan and Bernhard Wett*

**Systematic design of optimal control systems for WWTPs: case study of the SHARON-Anammox process**

*Borja Valverde-Pérez, Miguel Mauricio-Iglesias and Gürkan Sin*

**Model Based assessment of the optimum phosphorus management strategies in a full-scale WWTP**

*Izaro Lizarralde, Tamara Fernández-Arévalo, Silvia Monge, Ángela Manas, Mikel Maiza, Eduardo Ayesa, Paloma Grau and Joaquín Suescun*

**Assessing nutrient recovery potential of AnMBR-based technology through LCA**

*Ruth Pretel, Angel Robles, María Victoria Ruano, Aurora Seco and José Ferrer*



## Posters

### Anaerobic processes modelling

**Energy rich and electron poor - modelling photo-anaerobic processes**

*Daniel Puyol, Tim Huelsen, Edward Barry and Damien J. Batstone*

**Extension of ADM1 for phosphate release during anaerobic fermentation of EBPR sludge**

*Ruyi Wang, Yongmei Li, Wenling Chen, Jinte Zou and Yinguang Chen*

**Substrate fractionation for modelling of anaerobic co-digestion with a plant-wide perspective**

*Magnus Arnell, Sergi Astals, Linda Åmand, Damien J. Batstone, P.D. Jensen and Ulf Jeppsson*

**Long-term dynamic simulation of a full-scale anaerobic digester treating sludge from an urban WWTP: model calibration and validation**

*Guillermo Baquerizo, Justine Fiat, Pierre Buffiere, Romain Girault and Sylvie Gillot*

### Alternate model applications

**Use of artificial intelligence for WRRF knowledge based N<sub>2</sub>O model selection**

*Giacomo Bellandi, Jose Porro, Cecilia Caretti, Ignasi Rodriguez-Roda, Joaquim Comas, Ingmar Nopens and Riccardo Gori*

**A model-based framework to support decisions in urban wastewater systems by assessing environmental and socio-economic impacts under uncertainty**

*Antonia Hadjimichael, Lluís Corominas, Evangelina Belia and Joaquim Comas*

**Evaluating the impact of green infrastructure on treatment process performance for Detroit, Michigan USA**

*Yanchen Liu, Sara Troutman, Kelly Martin, Glen Daigger, Branko Kerkez and Nancy Love*

**Biokinetic model identification via extents of reaction**

*Alma Mašić, Sriniketh Srinivasan, Julien Billeter, Dominique Bonvin and Kris Villez*