

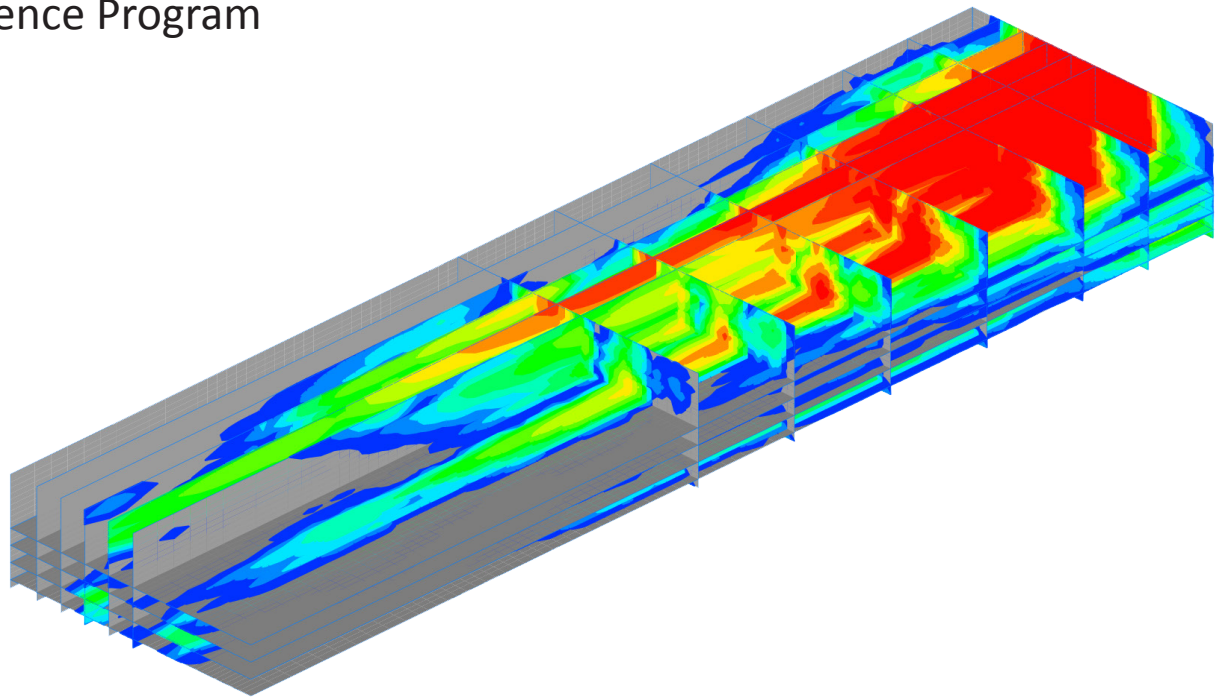
Computational Methods in Water Resources 2016

XXI International Conference

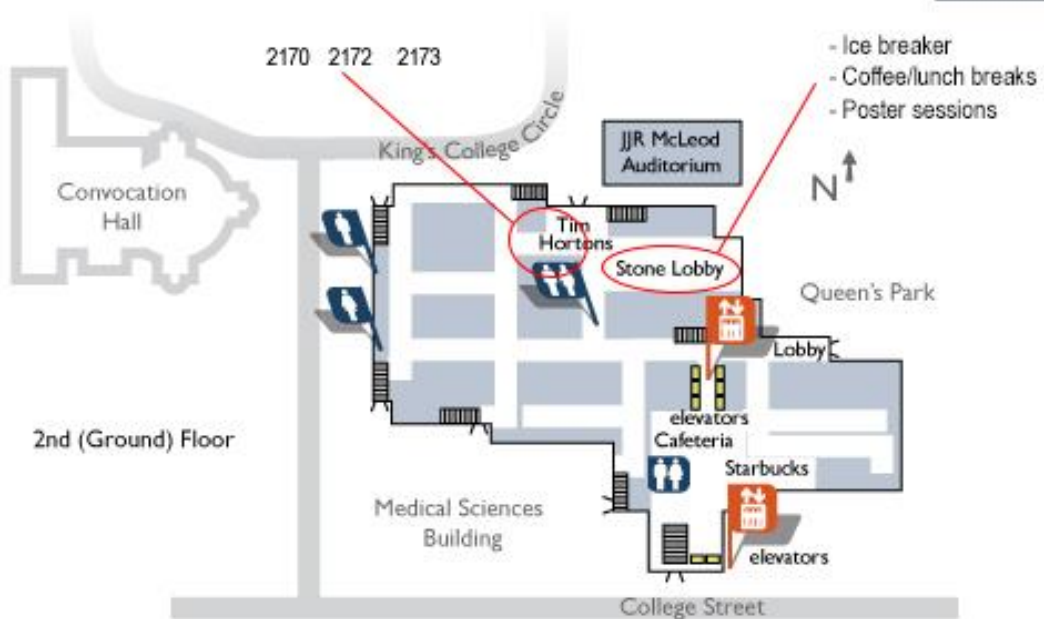
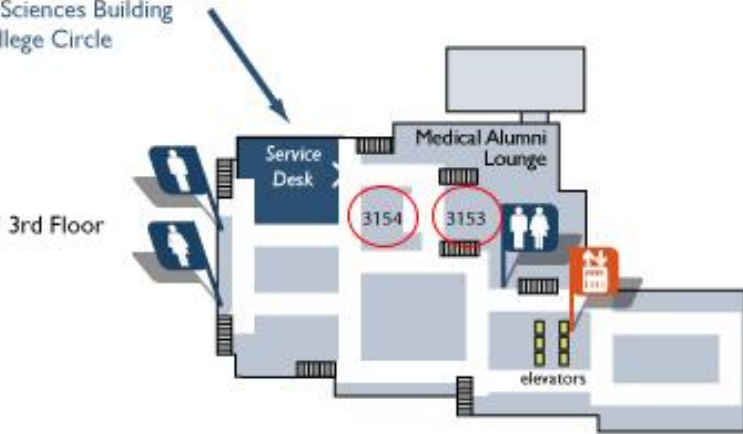
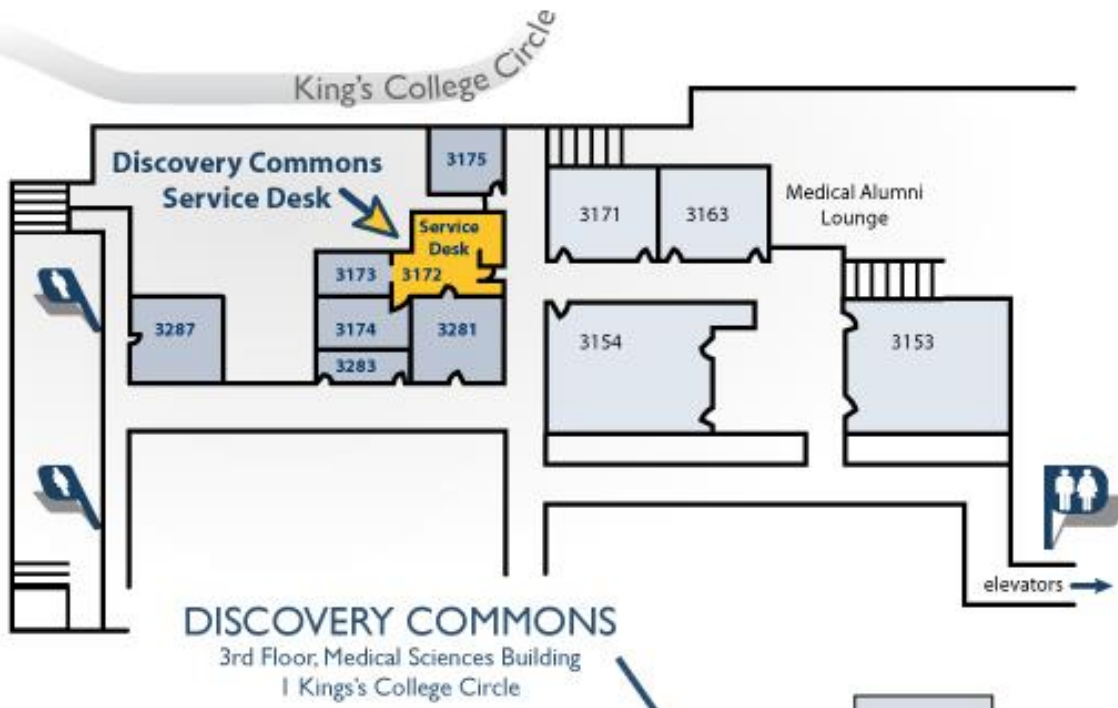
University of Toronto

June 20-24th 2016

Conference Program



UNIVERSITY OF
TORONTO



Monday, 20/Jun/2016

6:00pm - 8:00pm **W-1: Welcome Reception**
Location: **Stone Lobby**
Medical Science Building

Tuesday, 21/Jun/2016

8:15am - 8:30am **Opening: Introduction to CMWR2016**
Location: **Med Sci 3153**

8:30am - 9:30am **Keynote-1: David DiCarlo: Measurements of Three-Phase Flow and How Three-Phase Flow is Both More Complicated and Simpler Than Two-Phase Flow**
Location: **Med Sci 3153**

9:40am - 10:40am **11-1: Computational Ecohydrology**
Location: **Med Sci 2170**
Conveners: Valeriy Y. Ivanov, University of Michigan and Edoardo Daly, Monash University

4-1: Parameter Estimation and Uncertainty Analyses in Water Resource Models
Location: **Med Sci 2172**
Conveners: Walter A. Illman, University of Waterloo and Sabine Attinger, Helmholtz Centre for Environmental Research – UFZ

1-1: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media
Location: **Med Sci 3153**
Conveners: Florian Doster, Heriot-Watt University and Mark Porter, Los Alamos National Laboratory

2-1: Mixing and Reaction Across Scales in Hydrological Systems
Location: **Med Sci 3154**
Conveners: Marco Dentz, Institute of Environmental Assessment and Water Research and Tanguy Le Borgne, University of Rennes

10:40am - 11:00am **CB-1: Morning Coffee Break**
Location: **Stone Lobby**

11:00am - 12:20pm **11-2: Computational Ecohydrology**
Location: **Med Sci 2170**
Conveners: Valeriy Y. Ivanov, University of Michigan and Edoardo Daly, Monash University

4-2: Parameter Estimation and Uncertainty Analyses in Water Resource Models
Location: **Med Sci 2172**
Conveners: Walter A. Illman, University of Waterloo and Sabine Attinger, Helmholtz Centre for Environmental Research – UFZ

1-2: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media
Location: **Med Sci 3153**
Conveners: Florian Doster, Heriot-Watt University and Mark Porter, Los Alamos National Laboratory

2-2: Mixing and Reaction Across Scales in Hydrological Systems
Location: **Med Sci 3154**
Conveners: Marco Dentz, Institute of Environmental Assessment and Water Research and Tanguy Le Borgne, University of Rennes

12:20pm - 1:20pm **L-1: Lunch Break**
Location: **Stone Lobby**

1:20pm - 2:20pm **Keynote-2: Christine Shoemaker: Efficient Surrogate Methods for Global Optimization and Uncertainty Quantification of Computationally Expensive Nonconvex Models of Hydrogeologic Systems**
Location: **Med Sci 3153**

2:30pm - 3:30pm **4-3: Parameter Estimation and Uncertainty Analyses in Water Resource Models**
Location: **Med Sci 2172**
Conveners: Walter A. Illman, University of Waterloo and Sabine Attinger, Helmholtz Centre for Environmental Research – UFZ

1-3: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media
Location: **Med Sci 3153**
Conveners: Florian Doster, Heriot-Watt University and Mark Porter, Los Alamos National Laboratory

2-3: Mixing and Reaction Across Scales in Hydrological Systems
Location: **Med Sci 3154**
Conveners: Marco Dentz, Institute of Environmental Assessment and Water Research and Tanguy Le Borgne, University of Rennes

3:30pm - 3:50pm **CB-2: Afternoon Coffee Break**
Location: **Stone Lobby**

3:50pm - 5:30pm **13-1: Targeting Evolving Computational Environments to Advance Hydrological Models**
Location: **Med Sci 2170**
Conveners: Katherine Evans and Matthew Norman, Oak Ridge National Laboratory

4-4: Parameter Estimation and Uncertainty Analyses in Water Resource Models
Location: **Med Sci 2172**
Conveners: Walter A. Illman, University of Waterloo and Sabine Attinger, Helmholtz Centre for Environmental Research – UFZ

1-4: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media
Location: **Med Sci 3153**
Conveners: Florian Doster, Heriot-Watt University and Mark Porter, Los Alamos National Laboratory

2-4: Mixing and Reaction Across Scales in Hydrological Systems
Location: **Med Sci 3154**
Conveners: Marco Dentz, Institute of Environmental Assessment and Water Research and Tanguy Le Borgne, University of Rennes

6:00pm - 8:00pm **P-1: Poster Session 1**
Location: **Stone Lobby**

Short Course: Christine Shoemaker: Python & Matlab Software for Surrogate Global Optimization Toolbox in Water Resources
Location: **Med Sci 2173**

Wednesday, 22/Jun/2016

8:30am - 9:30am	Keynote-3: Ruben Juanes: Induced Seismicity in Subsurface Technologies: New Operational Constraints in Need of New Computational Models. Location: Med Sci 3153			
9:40am - 10:40am	6-1: Hybrid Multiscale Modelling of Subsurface Flow and Reactive Transport Location: Med Sci 2170 Conveners: Tim Scheibe, Pacific Northwest National Laboratory and Ilenia Battiato, San Diego State University	8-1: Hydro-Mechanical and Thermo-Hydro-Mechanical Modelling of Subsurface Processes Location: Med Sci 2172 Conveners: Joshua White Lawrence Livermore National Laboratory and Nicola Castelletto, Stanford University	5-1: Advances in Numerical Solvers for Water Resources Applications Location: Med Sci 3153 Conveners: Carol Woodward, Lawrence Livermore National Laboratory and Peter Bastian, Universität Heidelberg	7-1: Novel Developments and Data-Integration in Complex Biogeochemical and Hydrological Process Models Location: Med Sci 3154 Conveners: Li Li, Pennsylvania State University and Christof Meile, University of Georgia
10:40am - 11:00am	CB-3: Morning Coffee Break Location: Stone Lobby			
11:00am - 12:20pm	15-1: Advances in Fluvial Eco-Hydraulics and Morphodynamics Location: Med Sci 2170 Conveners: Donatella Termini, University of Palermo; Grant Gordon, OSU Oregon State University	8-2: Hydro-Mechanical and Thermo-Hydro-Mechanical Modelling of Subsurface Processes Location: Med Sci 2172 Conveners: Joshua White Lawrence Livermore National Laboratory and Nicola Castelletto, Stanford University	1-5: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media Location: Med Sci 3153 Conveners: Florian Doster, Heriot-Watt University and Mark Porter, Los Alamos National Laboratory	2-5: Mixing and Reaction Across Scales in Hydrological Systems Location: Med Sci 3154 Conveners: Marco Dentz, Institute of Environmental Assessment and Water Research and Tanguy Le Borgne, University of Rennes
12:20pm - 1:20pm	L-2: Lunch Break Location: Stone Lobby			
1:20pm - 2:20pm	Keynote-4: Stéphane Zaleski: The simulation of droplets, bubbles and interfaces Location: Med Sci 3153			
2:30pm - 3:30pm	6-2: Hybrid Multiscale Modelling of Subsurface Flow and Reactive Transport Location: Med Sci 2170 Conveners: Tim Scheibe, Pacific Northwest National Laboratory and Ilenia Battiato, San Diego State University	14-1: General Session on Advances in Computational Methods for Subsurface Water Resources Location: Med Sci 2172 Conveners: Valeriy Y. Ivanov, University of Michigan	5-2: Advances in Numerical Solvers for Water Resources Applications Location: Med Sci 3153 Conveners: Carol Woodward, Lawrence Livermore National Laboratory and Peter Bastian, Universität Heidelberg	7-2: Novel Developments and Data-Integration in Complex Biogeochemical and Hydrological Process Models Location: Med Sci 3154 Conveners: Li Li, Pennsylvania State University and Christof Meile, University of Georgia
3:30pm - 3:50pm	CB-4: Afternoon Coffee Break Location: Stone Lobby			
3:50pm - 5:30pm	8-3: Hydro-Mechanical and Thermo-Hydro-Mechanical Modelling of Subsurface Processes Location: Med Sci 2170 Conveners: Joshua White Lawrence Livermore National Laboratory and Nicola Castelletto, Stanford University	5-3: Advances in Numerical Solvers for Water Resources Applications Location: Med Sci 3153 Conveners: Carol Woodward, Lawrence Livermore National Laboratory and Peter Bastian, Universität Heidelberg	7-3: Novel Developments and Data-Integration in Complex Biogeochemical and Hydrological Process Models Location: Med Sci 3154 Conveners: Li Li, Pennsylvania State University and Christof Meile, University of Georgia	14-2: General Session on Advances in Computational Methods for Subsurface Water Resources Location: Med Sci 2173 Conveners: Valeriy Y. Ivanov, University of Michigan
6:00pm - 8:00pm	P-2: Poster Session 2 Location: Stone Lobby			

Thursday, 23/Jun/2016

8:30am - 9:30am	Keynote-5: Randall Leveque: Multi-scale Tsunami Modeling and Probabilistic Hazard Assessment.			
	Location: Med Sci 3153			
9:40am - 10:40am	20-1: Advances in Computational Methods for Surface Hydrological Processes	3-1: Recent Advances in Coastal Ocean Modelling of Waves, Circulation and Transport	10-1: Reusable Software for Accurate, Efficient, and Reproducible Water Resources Simulation	5-4: Advances in Numerical Solvers for Water Resources Applications
	Location: Med Sci 2170 Conveners: Matteo Camporese, University of Padua; Florian Doster, Heriot-Watt University	Location: Med Sci 2172 Conveners: Casey Dietrich, North Carolina State University; Clint Dawson, University of Texas at Austin	Location: Med Sci 3153 Conveners: Chris Kees, US Army Engineer Research & Development Center and Mark Bakker, Delft University of Technology	Location: Med Sci 3154 Conveners: Carol Woodward, Lawrence Livermore National Laboratory and Peter Bastian, Universität Heidelberg
10:40am - 11:00am	CB-5: Morning Coffee Break			
	Location: Stone Lobby			
11:00am - 12:20pm	9-1: Integrated Hydrologic Models: Advancements and Applications	3-1: Recent Advances in Coastal Ocean Modelling of Waves, Circulation and Transport	10-2: Reusable Software for Accurate, Efficient, and Reproducible Water Resources Simulation	16-1: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale
	Location: Med Sci 2170 Conveners: Reed Maxwell, Colorado School of Mines and Mario Putti, University of Padova	Location: Med Sci 2172 Conveners: Casey Dietrich, North Carolina State University; Clint Dawson, University of Texas at Austin	Location: Med Sci 3153 Conveners: Chris Kees, US Army Engineer Research & Development Center and Mark Bakker, Delft University of Technology	Location: Med Sci 3154 Convener: Branko Bijeljic, Imperial College; Maša Prodanović, University of Texas at Austin; Matteo Icardi, University of Warwick
12:20pm - 1:20pm	L-3: Lunch Break			
	Location: Stone Lobby			
1:20pm - 2:20pm	Keynote-6: Gabrielle de Lannoy: Assimilation of SMOS and SMAP Observations into the NASA GEOS-5 Land Surface Model to Improve Global Estimates of Surface and Root-Zone Soil Moisture			
	Location: Med Sci 3153			
2:20am - 2:35am	CB-6: Afternoon Coffee Break			
	Location: Stone Lobby			
2:35pm - 4:15pm	9-2: Integrated Hydrologic Models: Advancements and Applications	12-1: Modelling and Computational Aspects of Coupled Porous Medium and Free Flow Systems	3-2: Recent Advances in Coastal Ocean Modelling of Waves, Circulation and Transport	16-2: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale
	Location: Med Sci 2170 Conveners: Reed Maxwell, Colorado School of Mines and Mario Putti, University of Padova	Location: Med Sci 2172 Conveners: Iryna Rybak, University of Stuttgart and Marco Discacciati, Loughborough University	Location: Med Sci 3153 Conveners: Casey Dietrich, North Carolina State University; Clint Dawson, University of Texas at Austin	Location: Med Sci 3154 Convener: Branko Bijeljic, Imperial College; Maša Prodanović, University of Texas at Austin; Matteo Icardi, University of Warwick
6:00pm - 9:00pm	D-1: Conference Dinner			
	Location: Mill Street Brewery . Shuttle buses will leave King's Circle at 5:00 pm. Please show your conference badge to the driver as you enter the bus.			

Friday, 24/Jun/2016

8:30am - 9:30am	Keynote-7: Harry Vereecken: High Performance Scientific Computing in terrestrial hydrology: linking data and models Location: Med Sci 3153			
9:40am - 10:40am	17-1: Data Assimilation in Water Resources Modelling Location: Med Sci 2170 Co-Conveners: Henrik Madsen, DHI Group; Paulin Coulibaly, McMaster University	18-1: Multiscale Algorithms and Their Applications: From Upscaling to Scalable Solvers and Multiphysics Modelling Location: Med Sci 2172 Conveners: Pavel Tomin (Stanford University), Hadi Hajibeygi (TU Delft), and Ivan Lunati, University of Lausanne	10-3: Reusable Software for Accurate, Efficient, and Reproducible Water Resources Simulation Location: Med Sci 3153 Conveners: Chris Kees, US Army Engineer Research & Development Center and Mark Bakker, Delft University of Technology	16-3: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale Location: Med Sci 3154 Convener: Branko Bijeljic, Imperial College; Maša Prodanović, University of Texas at Austin; Matteo Iccardi, University of Warwick
10:40am - 11:00am	CB-7: Morning Coffee Break Location: Stone Lobby			
11:00am - 12:20pm	17-2: Data Assimilation in Water Resources Modelling Location: Med Sci 2170 Co-Conveners: Henrik Madsen, DHI Group; Paulin Coulibaly, McMaster University	18-2: Multiscale Algorithms and Their Applications: From Upscaling to Scalable Solvers and Multiphysics Modelling Location: Med Sci 2172 Conveners: Pavel Tomin (Stanford University), Hadi Hajibeygi (TU Delft), and Ivan Lunati, University of Lausanne	16-4: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale Location: Med Sci 3154 Convener: Branko Bijeljic, Imperial College; Maša Prodanović, University of Texas at Austin; Matteo Iccardi, University of Warwick	19-1: Computational Developments in Modelling Climate Change and Water Resources Location: Med Sci 2173 Convener: Peter Bastian, Heidelberg University
12:20pm - 1:20pm	L-4: Lunch Break Location: Stone Lobby			
1:20pm - 2:20pm	Keynote-8: Richard Peltier: Climate Coupled Hydrology in a Warming World Location: Med Sci 3153			
2:20am - 2:35am	CB-8: Afternoon Coffee Break Location: Stone Lobby			
2:35pm - 4:15pm	9-3: Integrated Hydrologic Models: Advancements and Applications Location: Med Sci 2170 Conveners: Reed Maxwell, Colorado School of Mines and Mario Putti, University of Padova	19-2: Computational Developments in Modelling Climate Change and Water Resources Location: Med Sci 2172 Convener: Peter Bastian, Heidelberg University	18-3: Multiscale Algorithms and Their Applications: From Upscaling to Scalable Solvers and Multiphysics Modelling Location: Med Sci 3153 Conveners: Pavel Tomin (Stanford University), Hadi Hajibeygi (TU Delft), and Ivan Lunati, University of Lausanne	16-5: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale Location: Med Sci 3154 Convener: Branko Bijeljic, Imperial College; Maša Prodanović, University of Texas at Austin; Matteo Iccardi, University of Warwick
4:15pm - 4:45pm	Closing: Closing Session Location: Med Sci 3153 Student poster awards will be presented and the location of the next CWMR conference announced.			

Keynotes

David DiCarlo: Measurements of Three-Phase Flow and How Three-Phase Flow is Both More Complicated and Simpler than Two-Phase Flow

Christine Shoemaker: Efficient Surrogate Methods for Global Optimization and Uncertainty Quantification of Computationally Expensive Nonconvex Models of Hydrogeologic Systems

Ruben Juanes: Induced Seismicity in Subsurface Technologies: New Operational Constraints in Need of New Computational Models.

Stéphane Zaleski: The simulation of droplets, bubbles and interfaces

Randall Leveque: Multi-scale Tsunami Modeling and Probabilistic Hazard Assessment.

Gabrielle de Lannoy: Assimilation of SMOS and SMAP Observations into the NASA GEOS-5 Land Surface Model to Improve Global Estimates of Surface and Root-Zone Soil Moisture

Harry Vereecken: High Performance Scientific Computing in terrestrial hydrology: linking data and models

Richard Peltier: Climate Coupled Hydrology in a Warming World

Sessions

Session 1	The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media
Session 2	Mixing and Reaction Across Scales in Hydrological Systems
Session 3	Recent Advances in Coastal Ocean Modelling of Waves, Circulation and Transport
Session 4	Parameter Estimation and Uncertainty Analyses in Water Resource Models
Session 5	Advances in Numerical Solvers for Water Resources Applications
Session 6	Hybrid Multiscale Modelling of Subsurface Flow and Reactive Transport
Session 7	Novel Developments and Data-Integration in Complex Biogeochemical and Hydrological Process Models
Session 8	Hydro-Mechanical and Thermo-Hydro-Mechanical Modelling of Subsurface Processes
Session 9	Integrated Hydrologic Models: Advancements and Applications
Session 10	Reusable Software for Accurate, Efficient, and Reproducible Water Resources Simulation
Session 11	Computational Ecohydrology
Session 12	Modelling and Computational Aspects of Coupled Porous Medium and Free Flow Systems
Session 13	Targeting Evolving Computational Environments to Advance Hydrological Models
Session 14	General Session on Advances in Computational Methods for Subsurface Water Resources
Session 15	Advances in Fluvial Eco-Hydraulics and Morphodynamics
Session 16	Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale
Session 17	Data Assimilation in Water Resources Modelling
Session 18	Data Assimilation in Water Resources Modelling
Session 19	Multiscale Algorithms and Their Applications: From Upscaling to Scalable Solvers and Multiphysics Modelling
Session 20	Computational Developments in Modelling Climate Change and Water Resources
Session 21	Advances in Computational Methods for Surface Hydrological Processes

Keynote 1

Measurements of Three-Phase Flow and How Three-Phase Flow is Both More Complicated and Simpler than Two-Phase Flow

Time: Tuesday, 21/Jun/2016: 8:30am - 9:30am – Location: MSB 3153

David DiCarlo

University of Texas at Austin; dicarlo@mail.utexas.edu

1-1: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media

Time: Tuesday, 21/Jun/2016: 9:40am - 10:40am – Location: MSB 3153

Pore-Scale Simulation of Multiphase Flow and Microbial Organic Carbon Transformation in Soils Using Smoothed Particle Hydrodynamics

Nitin Gawande, Bruce Palmer, Timothy Scheibe

Pacific Northwest National Laboratory, United States of America; tim.scheibe@pnnl.gov

Pore-Scale Simulation of sCO₂/Brine Dissolution

Marguerite Graveleau, Cyprien Soulaire, Hamdi Tchepeli

Stanford University, United States of America; mgravele@stanford.edu

Quick Estimation of Connectivity and Bypassed Volumes after Waterflooding in Geologically Realistic Models of Aquifers/Oil Reservoirs

Paula Alejandra Gago, Ann Muggeridge, Peter King

Imperial College London, United Kingdom; p.gago@imperial.ac.uk

11-1: Computational Ecohydrology

Time: Tuesday, 21/Jun/2016: 9:40am - 10:40am – Location: MSB 2170

Development of an Integrated Eco-Hydrological Model of a Restored Riparian Wetland

Birgitte von Christierson¹, Michael Butts¹, Laura A. Nieuwenhoven¹, Flemming T. Hansen¹, Jannick K. Jensen², Jane B. Poulsen³, Bertel Nilsson⁴

¹DHI, Denmark; ²University of Copenhagen; ³Aarhus University; ⁴Geological Survey of Denmark and Greenland; Denmark; bvc@dhigroup.com

Hydrological Modeling of Ephemeral Catchments with Different Land Uses

Matteo Camporese¹, Joshua F. Dean², Edoardo Daly³

¹Università degli Studi di Padova, Italy; ²Vrije Universiteit Amsterdam, The Netherlands; ³Monash University, Australia; matteo.camporese@unipd.it

Modeling Drought-Related Disturbance in Water-Limited Environments

Christina Tague

University of California Santa Barbara, United States of America; ctague@bren.ucsb.edu

2-1: Mixing and Reaction across Scales in Hydrological Systems

Time: Tuesday, 21/Jun/2016: 9:40am - 10:40am – Location: MSB 3154

Confronting Experimental Measurements and Models for (Reactive) Transport and Mixing in Two-Dimensional Porous Media

Joaquin Jimenez-Martinez^{1,2}, Pietro de Anna³, Régis Turuban¹, Hervé Tabuteau¹, Tanguy Le Borgne¹, Yves Meheust¹

¹Univ. Rennes 1, France; ²Los Alamos National Laboratory, USA; ³Univ. Lausanne, Switzerland; yves.meheust@univ-rennes1.fr

Competition between Mixing and Deformation and Its Role on Reaction Rates in Subsurface Fluid Flows

Nicholas B. Engdahl

Washington State University, United States of America; nick.engdahl@wsu.edu

Applicability Conditions for Sequential Homogenization of Reactive Transport in Bi-disperse Porous Media

Svyatoslav Korneev, Ilenia Battiato

San Diego State University, United States of America; skorneev@mail.sdsu.edu

4-1: Parameter Estimation and Uncertainty Analyses in Water Resource Models

Time: Tuesday, 21/Jun/2016: 9:40am - 10:40am – Location: MSB 2172

Uniqueness, Scale, and Resolution Issues in Groundwater Model Parameter Identification

Tian-chyi Jim Yeh

U of Arizona, United States of America; ybiem@mac.hwr.arizona.edu

Reproducing the Small-Scale Variability of a Transmissivity Field by Embedding Direct-Inversion Methods in Multiple-Point Geostatistics

Alessandro Comunian¹, Mauro Giudici^{1,2,3}

¹Università degli Studi di Milano; ²Consorzio per la Fisica delle Atmosfere e delle Idrosfere; ³Consiglio Nazionale delle Ricerche; Italy; alessandro.comunian@unimi.it

Multi-Objective vs. Single Objective Calibration of a Hydrologic Model Exploring the Benefit of Hydrologic Signatures

Juliane Mai¹, Mahyar Shafii², Matthias Cuntz¹, Bryan Tolson²

¹Helmholtz Centre for Environmental Research- UFZ, Germany; ²University of Waterloo, Canada; juliane.mai@ufz.de

1-2: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media

Time: Tuesday, 21/Jun/2016: 11:00am - 12:20pm – Location: MSB 3153

A Momentum-Based Approach to the Saturation Overshoot

Ivan Lunati¹, Ricardo Ruiz-Baier²

¹University of Lausanne, Switzerland; ²Oxford University; ivan.lunati@unil.ch

A Microfluidic and Numerical Modeling Investigation of the Relationship between Capillary Pressure, Saturation, and Specific Fluid-Fluid Interfacial Area

Mark L. Porter, Jeffrey D. Hyman, Joaquin Jimenez-Martinez

Los Alamos National Laboratory, United States of America; porterma@lanl.gov

Development and Testing of a Hysteresis Modeling Approach for the Two-Phase Flow Capillary Pressure- Saturation-Relative Permeability Relationship: Laboratory-Scale Analyses

Abdullah Cihan¹, Jens Birkholzer¹, Shibo Wang¹, Tetsu Tokunaga¹, Luca Trevisan², Tissa Illangasekare³

¹Lawrence Berkeley National Laboratory; ²University of Texas at Austin; ³Colorado School of Mines; United States of America; acihan@lbl.gov

Stochastic Modelling of Two-Phase Flow in Heterogeneous Porous Media

Markus Koepfel, Christian Rohde

University of Stuttgart, Germany; markus.koepfel@mathematik.uni-stuttgart.de

11-2: Computational Ecohydrology

Time: Tuesday, 21/Jun/2016: 11:00am - 12:20pm – Location: MSB 2170 – NOTE: This session may extend to lunch break.

Soil Moisture Spatio-Temporal Variability: Insights from Mechanistic Ecohydrological Modeling

Simone Fatichi¹, Gabriel G. Katul², Valeriy Y. Ivanov³, Christoforos Pappas⁴, Athanasios Paschalis⁵, Jongho Kim³, Paolo Burlando¹

¹ETH Zurich, Switzerland; ²Duke University, USA; ³University of Michigan, USA; ⁴Université de Montréal, Canada; ⁵University of Southampton, UK; fatichi@ifu.baug.ethz.ch

Non-linear Continuous Time Random Walks for the Evolution of Point Water-Vegetation Dynamics

Marco Dentz¹, Luis Cueto-Felgueroso², Ruben Juanes³

¹IDAEA-CSIC, Spain; ²UPM, Spain; ³MIT, USA; marco.dentz@gmail.com

Evaluating the Impact of Root Hydraulic Traits at the Forest Scale

Elizabeth Agee¹, M. Chase Dwyer¹, Valeriy Ivanov¹, Lingli He¹, Gautam Bisht², Valentin Couvreur³

¹University of Michigan, United States of America; ²Lawrence Berkeley National Laboratory, United States of America; ³Université Catholique de Louvain, Belgium; lizagee@umich.edu

Integrating a Model of Plant Hydraulics with Coordination and Trade-Offs among Plant Trait Spectra in Tropical Forests

Bradley Christoffersen¹, Chonggang Xu¹, Manuel Gloor², Maurizio Mencuccini^{3,4}, Brendan Choat⁵, Rosie Fisher⁶, Patrick Meir^{3,7}, Nate McDowell¹

¹Los Alamos National Laboratory, United States of America; ²University of Leeds, United Kingdom; ³University of Edinburgh, United Kingdom; ⁴ICREA at CREAM, Spain; ⁵University of Western Sydney, Australia; ⁶National Center for Atmospheric Research, United States of America; ⁷Australian National University, Australia; bradleychristo@gmail.com

Simulating Hydraulic Redistribution and its Effects on Land Surface Fluxes in a California Oak Savanna

Gretchen R. Miller¹, Si Gou^{1,2}, Cody Saville¹

¹Texas A&M University, United States of America; ²Sichuan University, China; gmliller@civil.tamu.edu

2-2: Mixing and Reaction across Scales in Hydrological Systems

Time: Tuesday, 21/Jun/2016: 11:00am - 12:20pm – Location: MSB 3154

Pore-Scale Modelling of the Combined Effect of Physical and Chemical Heterogeneity on Dynamics of Reactive Flows

Thomas David Serafini Oliveira^{1,2}, Branko Bijeljic¹, Martin J. Blunt¹

¹Imperial College London, United Kingdom; ²Petrobras, Brazil; thomas.oliveira@centraliens.net

Pore-Scale Modeling of Reactive Flows for Applications in Water Purification and Absorption of Pollutants in Soil

Torben Prill, Oleg Iliev

Fraunhofer Institute for Industrial Mathematics, Germany; Torben.Prill@itwm.fraunhofer.de

Pore Network Modeling of Reactive Transport and Dissolution in Porous Media

Joseph Tansey, Matthew Balhoff

University of Texas at Austin, United States of America; joeftansey@yahoo.com

4-2: Parameter Estimation and Uncertainty Analyses in Water Resource Models

Time: Tuesday, 21/Jun/2016: 11:00am - 12:20pm – Location: MSB 2172

Assessing the Impact of Model Structure Uncertainty on Coupled 1D-2D Flood Models

Michael B Butts¹, Birgitte von Christiernson¹, Craig Mackay², Terry van Kalken³, Simon G Funder¹, Keiko Yamagata²

¹DHI Denmark; ²DHI, Australia; ³DHI Malaysia; mib@dhigroup.com

Bayesian Calibration of Groundwater Models with Structural Error

Albert J. Valocchi, Tianfang Xu

University of Illinois at Urbana-Champaign, United States of America; valocchi@illinois.edu

Good Data, Bad Models? Inverting the Paradigm for Hydrogeologic Inverse Problems

Scott Hansen, Velimir Vesselinov

Los Alamos National Laboratory, United States of America; skh3@lanl.gov

On the Importance of Geological Data for Three-Dimensional Steady State Hydraulic Tomography at a Highly Heterogeneous Aquifer-Aquitard System

Zhanfeng Zhao, Walter A. Illman

University of Waterloo, Canada; z58zhao@uwaterloo.ca

Keynote 2

Efficient Surrogate Methods for Global Optimization and Uncertainty Quantification of Computationally Expensive Nonconvex Models of Hydrogeologic Systems

Time: Tuesday, 21/Jun/2016: 1:20pm - 2:20pm – Location: MSB 3153

Christine A. Shoemaker

Cornell University; CAS12@cornell.edu

1-3: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media

Time: Tuesday, 21/Jun/2016: 2:30pm - 3:30pm – Location: MSB 3153

Applicability of Vertically Integrated Models for Carbon Storage Modeling in Structured Heterogeneous Domains

Karl W Bandilla, Bo Guo, Michael A Celia

Princeton University, United States of America; bandilla@princeton.edu

Multiscale Vertically-Integrated Models with Vertical Dynamics for CO₂ Migration in Heterogeneous Geologic Formations

Bo Guo¹, Karl Bandilla¹, Jan Nordbotten², Michael Celia¹, Eirik Keilegavlen², Florian Doster³

¹Princeton University, United States of America; ²University of Bergen, Norway; ³Heriot-Watt University, UK; boguo@princeton.edu

2-3: Mixing and Reaction across Scales in Hydrological Systems

Time: Tuesday, 21/Jun/2016: 2:30pm - 3:30pm – Location: MSB 3154

Twisting Groundwater Flow in Anisotropic Geological Media and its Effects on Solute Transport, Mixing, and Reactions

Olaf A. Cirpka¹, Jeremy P. Bennett¹, Claus Haslauer¹, Yu Ye¹, Massimo Rolle², Gabriele Chiogna³

¹University of Tübingen, Germany; ²Technical University of Denmark, Denmark; ³Technical University of Munich, Germany; olaf.cirpka@uni-tuebingen.de

Reactive Mixing in Heterogeneous Porous Media Flows: Scalar Gradient Distribution, Spatial Intermittency and Temporal Scaling of Effective Reaction Kinetics

Tanquy Le Borgne¹, Marco Dentz², Tim Ginn³, Emmanuel Villermaux⁴

¹University of Rennes 1, France; ²IDAEA-CSIC, Spain; ³Washington State University, USA; ⁴Université Aix-Marseille, France; Tanquy.Le-Borgne@univ-rennes1.fr

On the Kinematics of Tracer Particles in Natural Porous Media

Daniel W. Meyer¹, Branko Bijeljic²

¹ETH Zürich, Switzerland; ²Imperial College London, UK; meyerda@ethz.ch

4-3: Parameter Estimation and Uncertainty Analyses in Water Resource Models

Time: Tuesday, 21/Jun/2016: 2:30pm - 3:30pm – Location: MSB 2172

Efficient Quantification of Uncertainty in Integrated Surface and Subsurface Hydrologic Simulations

Killian L. Miller, Young-Jin Park, Edward A. Sudicky

Aquanty Inc., Canada; kmiller@aquanty.com

Let the Data Speak: Polynomial Chaos Expansion Toolbox for Uncertainty Quantification, Sensitivity Analysis and Risk Assessment in Environmental Modeling

Sergey Oladyshkin, Wolfgang Nowak

University of Stuttgart, Germany; Sergey.Oladyshkin@iws.uni-stuttgart.de

Uncertainty Quantification for Pore-Scale Simulation on Random Samples

Matteo Icardi¹, Gianluca Boccardo², Raul Tempone³

¹University of Warwick, United Kingdom; ²Politecnico di Torino; ³King Abdullah University of Science and Technology; matteo.icardi@warwick.ac.uk

1-4: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media

Time: Tuesday, 21/Jun/2016: 3:50pm - 5:30pm – Location: MSB 3153

An Original and Useful Approach to Mesh a Discrete Fracture Network Using a Delaunay Triangulation: Application on Flow and Transport Upscaling From Characterization Scale to Reservoir Scale

André Fourné¹, Benoit Noetinger¹, Christian La Borderie²

¹IFP Energies Nouvelles, France; ²Pau University, France; andre.fourné@ifp.fr

The Effect of Fracture-Matrix Interactions on Multiphase Flow in Fractured Reservoirs: Development of a Discrete Fracture Model

Yue Hao, Randolph R. Settgast, Andrew F. B. Tompson, Pengcheng Fu, Joseph P. Morris, Frederick J. Ryerson

Lawrence Livermore National Laboratory, United States of America; hao1@llnl.gov

A Lattice Boltzmann Approach to Model Radionuclides Diffusion through Unsaturated Argillite Micro-Fractures

Alain Genty¹, Soukaina Gueddani², Magdalena Dymitrowska²

¹Commissariat à l'Energie Atomique et aux Energies Alternatives, France; ²Institut de Radioprotection de de Sûreté Nucléaire, France; alain.genty@cea.fr

Pore-Scale Studies of Moisture Transport in Highly Swelling Porous Media

S. Majid Hassanizadeh

Utrecht University, The Netherlands; S.M.Hassanizadeh@uu.nl

Numerical Study of Biofilm Growth in Porous Media

Marbe Benioug¹, Tidjani Bahar²

¹National School of Public Works in Aleg, Mauritania; ²Lorraine University, France; benioug@gmail.com

13-1: Targeting Evolving Computational Environments to Advance Hydrological Models

Time: Tuesday, 21/Jun/2016: 3:50pm - 5:30pm – Location: MSB 2170

Building Next-Generation Atmosphere and Land-Ice Models using the Kokkos Trilinos Library

Irina Tezaur, Irina Demeshko, Andrew Salinger, William Spotz
Sandia National Laboratories, United States of America; wfspotz@sandia.gov

Computational and Algorithmic Considerations for Hydrological Models Running on Modern Computers

Matthew Ross Norman
Oak Ridge National Laboratory, United States of America; normanmr@ornl.gov

Hybrid GPU+CPU Modeling of Ecohydrological and Biogeochemical Processes in Intensively Managed Landscapes

Praveen Kumar, Phong V. V. Le, Dong K. Woo
University of Illinois at Urbana-Champaign, United States of America; kumar1@illinois.edu

Multi-GPU Simulation of Tsunamis Generated by Earthquakes Using Nested Meshes

Marc De La Asunción, Manuel J. Castro, José M. González, Jorge Macías
Universidad de Málaga, Spain; marcah@uma.es

2-4: Mixing and Reaction across Scales in Hydrological Systems

Time: Tuesday, 21/Jun/2016: 3:50pm - 5:30pm – Location: MSB 3154

Modeling Single-Phase Fluid-Fluid Reactive Transport at the Pore-Scale

Zaki Alhashmi, Martin J. Blunt, Branko Bijeljic
Imperial College London, United Kingdom; zaki.al-nahari09@imperial.ac.uk

Generalised Mixed-Cell Mass Balance Solute Transport Modelling in Pore-Scale Disordered Networks: A New Semi-Analytical Approach

Mohammed Adil Sbai¹, Toko Kamtchueng^{1,2}, Jean-Louis Rouet²
¹BRGM, ISTO UMR 7327, France; ²University of Orléans, ISTO UMR 7327, France; a.sbai@brgm.fr

Constitutive Relations of Transport in Reacting Porous Media; Evolution in Microscopic Pore Spaces

Amir Raouf¹, Hamid M. Nick²
¹Utrecht University, Netherlands, The; ²Technical University of Denmark; a.raouf@uu.nl

Mixing Dynamics around Flow Stagnation Points

Juan J. Hidalgo, Marco Dentz
IDAEA-CSIC, Spain; juan.hidalgo@idaea.csic.es

Cumulative Relative Reactivity: A Tool for Catchment-Scale Reactive Transport

Matthias Loschko¹, Olaf Cirpka¹, Thomas Wöhling^{2,3}, David Rudolph⁴
¹University of Tübingen, Germany; ²Technische Universität Dresden, Germany; ³Ruakura Research Centre, New Zealand; ⁴University of Waterloo, Canada; matthias.loschko@uni-tuebingen.de

4-4: Parameter Estimation and Uncertainty Analyses in Water Resource Models

Time: Tuesday, 21/Jun/2016: 3:50pm - 5:30pm – Location: MSB 2172

Saltwater Intrusion with Diffuse Front: Wedge Evolution in Heterogeneous vs Homogeneous Media

Giovanna Darvini¹, Paolo Salandin²

¹Università Politecnica delle Marche, Italy; ²University of Padova, Italy; g.darvini@univpm.it

P-1: Poster Session 1

Time: Tuesday, 21/Jun/2016: 6:00pm - 8:00pm – Location: MSB Stone Lobby

Flexible Simulation Framework to Couple Processes in Complex 3D Models for Subsurface Utilization Assessment

Thomas Kempka, Benjamin Nakaten, Marco De Lucia, Natalie Nakaten, Christopher Otto, Maik Pohl, Elena Tillner, Michael Kühn

GFZ German Research Centre for Geosciences, Fluid Systems Modelling, Germany; michael.kuehn@gfz-potsdam.de

Impacts of Climate Change on Electric Power Systems

Dariush Fooladivanda, Joshua Taylor

University of Toronto, Canada; dariush.fooladivanda@utoronto.ca

Performance Evaluation of a Conceptual and a Numerical Integrated Surface-Subsurface Hydrologic Model: A Comparative Study

Mohammad Bizhani-manzar, Robert Leconte, Mathieu Nuth

Université de Sherbrooke, Canada; mohammad.bizhanimanzar@usherbrooke.ca

Numerical Modelling of the Transport of Corrosion Agents in a Geological Repository

Scott Briggs¹, Brent Sleep², Jennifer McKelvie³, Magdalena Krol¹

¹York University, Canada; ²University of Toronto, Canada; ³Nuclear Waste Management Organization; sbriggs@yorku.ca

Inverse Modeling of Saltwater Intrusion in Heterogeneous Coastal Aquifers

Amir Safi¹, Mutasem El-Fadel, Joanna Doummar, Majdi Abou Najm, Ibrahim Alameddine

American University of Beirut; ams92@mail.aub.edu

A Hybrid and Parallelized Advection-Diffusion-Reaction Model for Biofilm Growth in Porous Media

Artin Laleian¹, Albert J. Valocchi¹, Charles J. Werth²

¹University of Illinois, Urbana-Champaign, United States of America; ²University of Texas, Austin; laleian2@illinois.edu

A Hydro-Geochemical Model for Variably Saturated Flow with Multi-Component Gas Diffusion: Application to Predict Pollutant Fate and Transport in Technosols

Hossein Davarzani, Samuel Coussy, Geoffrey Boissard, Philippe Blanc, Philippe Bataillard

French geological survey (BRGM), France; H.Davarzani@brgm.fr

Simulation of Carboxymethyl Cellulose-Modified Nano-scale Zero-Valent Iron (CMC-NZVI) Transport in Porous Media Under Different Scenarios; Effects Of Heterogeneity, Attachment, and Aggregation

Salman Sabahi, Brent Sleep

University of Toronto, Canada; ms.sabahi@mail.utoronto.ca

Parameter Estimation for Modelling Microbial Degradation of Propylene Glycol Following a Monod Kinetics

Annette Dathe¹, Perrine M. Fernandez^{2,1}, Lars Bakken², Esther Bloem¹, Helen K. French^{2,1}

¹Norwegian Institute of Bioeconomy Research (NIBIO), Norway; ²Norwegian University of Life Sciences (NMBU), Norway;
annette.dathe@nibio.no

Multirate Iterative vs Explicit Coupling Schemes for Coupling Flow with Geomechanics in Fractured Reservoirs: Efficiency vs Accuracy

Tameem Almani¹, Kundan Kumar², Gurpreet Singh¹, Mary Wheeler¹

¹The University of Texas at Austin, United States of America; ²Department of Mathematics, University of Bergen, Norway;
tameem@ices.utexas.edu

Modelling of Two-Phase Flow in Rough-Walled Fracture Using Level Set Method

Yunfeng Dai, Zhifang Zhou

Hohai University, China, People's Republic of; daiyunfeng1988@hotmail.com

Modelling and Parametric Study of Kinetic Interface Sensitive Tracer Transport in Laboratory Column Experiments

Alexandru Tatomir¹, Friedrich Maier¹, Alexander Kissinger², Johannes Hommel², Rainer Helmig², Martin Sauter¹

¹University of Göttingen, Germany; ²University of Stuttgart, Germany; alexandru.tatomir@geo.uni-goettingen.de

Modeling of Density-Dependent Flow based on the Thermodynamically Constrained Averaging Theory

Timothy Weigand¹, Pamela Schultz¹, Deena Giffen², Carl Kelley², Cass Miller¹

¹University of North Carolina at Chapel Hill; ²North Carolina State University, United States of America; weigand@live.unc.edu

Improved Flow-Based Capture Zone Delineation using FlowSource

Mashrur Anam Chowdhury

University of Waterloo, Canada; mashrur.chowdhury@gmail.com

Impacts of Soil Heterogeneity on the Transverse Dispersion Related Isotope Fractionation

Bruce S. Xu, Brent E. Sleep, Barbara Sherwood Lollar

University of Toronto, Canada; bruce.xu@mail.utoronto.ca

Impact of the Viscous-Capillary Force Balance on Flow in Layered Porous Media

Yacine Debbabi, Matthew Jackson, Gary Hampson, Peter Fitch, Pablo Salinas

Imperial College London, United Kingdom; y2713@ic.ac.uk

Impact of Fractures on Diffusion Dominated Reactive Transport: Application to Radioactive Waste Storage Studies

Benjamin Delfino¹, Jean Raynald de Dreuzy², Jocelyne Erhel³, Benoit Cochebin⁴, Yves Méheust⁵

¹INRIA Rennes, France; ²Géosciences Rennes; ³Inria, Rennes; ⁴ANDRA; ⁵Géosciences Rennes; benjamin.delfino@inria.fr

DNAPL Modeling with Permeabilities Obtained by Geostatistical Inverse Modeling: How Much Detail is Enough?

Amalia Kokkinaki¹, Jonghyun Lee¹, Peter K Kitanidis¹, Brent E Sleep², Hongkyu Yoon³, Charles J Werth⁴, Albert J Valocchi⁵

¹Stanford University, United States of America; ²University of Toronto, Canada; ³Sandia National Laboratories, United States of America;

⁴University of Texas at Austin, United States of America; ⁵University of Illinois, Urbana-Champaign; amaliak@stanford.edu

dfnWorks: A High-Performance Computing Suite for Subsurface Flow and Transport Modeling Using Discrete Fracture Network

Nataliia Makedonska¹, Satish Karra¹, Jeffrey D. Hyman¹, Hari S. Viswanathan¹, Carl W. Gable¹, Scott L. Painter²
¹Los Alamos National Laboratory; ²Oak Ridge National Laboratory, United States of America; nataliia@lanl.gov

Adaptive Higher Order Discontinuous Galerkin Methods for Strongly Heterogeneous Two-Phase Flow in Porous Media

Birane Kane, Bernd Flemisch, Kunibert Siebert, Rainer Helmig
University of Stuttgart; birane.kane@ians.uni-stuttgart.de

Numerical Simulation of Turbulence and Air Entrainment in a Hydraulic Jump

S. Harada, S.S. Li
Concordia University, Canada; shoharada10@gmail.com

Formulation, Evaluation, and Validation of a Thermodynamically Constrained Averaging Theory Model for Two-Fluid-Phase Flow in Porous Media

Cass T Miller¹, James E McClure², Amanda L Dye¹, William G Gray¹
¹University of North Carolina; ²Virginia Tech; United States of America; casey_miller@unc.edu

Flow Regime Analysis for Geologic CO₂ Sequestration and Other Subsurface Fluid Injections

Bo Guo, Zhong Zheng, Karl Bandilla, Michael Celia, Howard Stone
Princeton University; United States of America; boguo@princeton.edu

Keynote 3

Induced Seismicity in Subsurface Technologies: New Operational Constraints in Need of New Computational Models.

Time: Wednesday, 22/Jun/2016: 8:30am - 9:30am – Location: MSB 3153

Ruben Juanes

Massachusetts Institute of Technology; juanes@mit.edu

5-1: Advances in Numerical Solvers for Water Resources Applications

Time: Wednesday, 22/Jun/2016: 9:40am - 10:40am – Location: MSB 3153

Matrix-Free Block-Jacobi Smoothers for Higher-Order DG Methods

Peter Bastian², Eike Hermann Mueller¹, Steffen Muething², Robert Scheichl¹

¹University of Bath, United Kingdom; ²University of Heidelberg, Germany; e.mueller@bath.ac.uk

New Preconditioning Strategy for Jacobian-Free Solvers for Variably Saturated Flows with Richards' Equation

Daniil Svyatskiy, Konstantin Lipnikov, David Moulton

Los Alamos National Laboratory, United States of America; dasvyat@lanl.gov

Iterative Solution of Coupled Implicit Subsurface and Overland Flow Simulations

Carol S. Woodward¹, Daniel Osei-Kuffuor¹, Reed M. Maxwell², Steven G. Smith¹

¹Lawrence Livermore National Laboratory; ²Colorado School of Mines; United States of America; woodward6@llnl.gov

6-1: Hybrid Multiscale Modelling of Subsurface Flow and Reactive Transport

Time: Wednesday, 22/Jun/2016: 9:40am - 10:40am – Location: MSB 2170

A Multiphysics Framework to Couple Different Scales in Geoenvironmental Applications

Pavel Tomin¹, Ivan Lunati²

¹Stanford University, United States of America; ²University of Lausanne, Switzerland; ptomin@stanford.edu

A Multiphysics Multiscale Framework for Modeling Mass and Heat Flow at Small Scales: Carbonate Dissolution

Cyprien Soulaïne, Hamdi Tchelepi

Stanford University, United States of America; csoulain@stanford.edu

Hybrid Multiscale Simulation of Hydrologic-Biogeochemical Processes in Subsurface Environments

Xiaofan Yang, Tim Scheibe

Pacific Northwest National Laboratory, United States of America; xiaofan.yang@pnnl.gov

7-1: Novel Developments and Data-Integration in Complex Biogeochemical and Hydrological Process Models

Time: Wednesday, 22/Jun/2016: 9:40am - 10:40am – Location: MSB 3154

Development of a Stochastic Genome-Informed Trait Based Model for Biogeochemical Processes

Eric King¹, Sergi Molins¹, Ulas Karaoz¹, Karthik Anantharaman², Nick Bouskill¹, Harry Beller¹, Jillian Banfield^{1,2}, Carl Steefel¹, Eoin Brodie^{1,2}

¹Lawrence Berkeley National Laboratory; ²University of California, Berkeley, USA; eking@lbl.gov

Coupling Reactive Transport, Geochemistry, and Geomechanics to Model Changes in Cement Fracture Permeability Due to Exposure to CO₂-rich Brine

Jaisree Iyer, Stuart D. C. Walsh, Yue Hao, Joseph P. Morris, Pratanu Roy, Susan A. Carroll

Lawrence Livermore National Laboratory, United States of America; iyer5@llnl.gov

8-1: Hydro-Mechanical and Thermo-Hydro-Mechanical Modelling of Subsurface Processes

Time: Wednesday, 22/Jun/2016: 9:40am - 10:40am – Location: MSB 2172

Coupling Stress and Reactive Transport in Fractures: Effects of Mineralogy on the Evolution of Contacting Asperities and Fracture Permeability

Kasparas Spokas, Catherine A. Peters

Princeton University, United States of America; kspokas@princeton.edu

Efficient Solution Algorithms for Mixed Finite Element Coupled Poromechanical Models

Massimiliano Ferronato¹, Nicola Castelletto², Joshua A. White³

¹University of Padova, Italy; ²Stanford University, USA; ³Lawrence Livermore National Laboratory, USA; ferronat@dmsa.unipd.it

1-5: The Pore to Field-Scale Conundrum: Modelling Multiphase Flow and Transport in Porous Media

Time: Wednesday, 22/Jun/2016: 11:00am - 12:20pm – Location: MSB 3153

Complementary Constraints on Componential Multiphase Flow Problems, Should it be Implemented Locally or Globally?

Yonghui Huang^{1,2}, Haibing Shao^{1,3}, Martin Thullner¹, Olaf Kolditz^{1,2}

¹Helmholtz Centre for Environmental Reserach (UFZ), Germany; ²Dresden University of Technology, Germany; ³Freiberg University of Mining and Technology, Germany; yonghui.huang@ufz.de

Modelling of Morphology and Petrophysics of Nummulitic Carbonate Rocks

Zeyun Jiang, Alessandro Mangione, Helen Lewis, Gary Couples

Heriot-Watt University, United Kingdom; Zeyun.Jiang@pet.hw.ac.uk

Impact of the Viscous-Capillary Force Balance on Flow in Layered Porous Media

Yacine Debbabi, Matthew Jackson, Gary Hampson, Peter Fitch, Pablo Salinas

Imperial College London, United Kingdom; yd2713@ic.ac.uk

A Formulation for Non-Isothermal Multiphase Multicomponent Flow with Geochemical Reactions

Fabian Brunner, Peter Knabner, Jens Oberlander

Friedrich-Alexander-University Erlangen-Nürnberg, Germany; knabner@math.fau.de

Numerical Simulation of Thermo-Hydro-Chemical Processes and Multiphase Flow in Porous Media for Efficient In-Situ Remediation of Chlorinated Solvents

Antoine Armandine Les Landes, Anne-Julie Tinet, Constantin Oltean, Michel Buès

University of Lorraine, France; antoine.armandine-les-landes@univ-lorraine.fr

15-1: Advances in Fluvial Eco-Hydraulics and Morphodynamics

Time: Wednesday, 22/Jun/2016: 11:00am - 12:20pm – Location: MSB 2170

The Coupling of Fine Particle and Bedload Transport using Data Integration and Process Modeling

James Robert Hunt¹, Jungsu Park^{1,2}

¹University of California at Berkeley, United States of America; ²KWater, South Korea; hunt@ce.berkeley.edu

Hydrologic Control of Channel Morphology and Organization in Gravel-Bed Streams: Field Studies and Flume Experiments

Gordon E. Grant¹, Laura Hempel², Sarah Lewis²

¹USDA Forest Service; ²Oregon State University; United States of America; Gordon.Grant@oregonstate.edu

Vegetation Against Erosion Downstream of a Hydraulic Structure

Donatella Termini

University of Palermo, Italy; donatella.termini@unipa.it

2-5: Mixing and Reaction Across Scales in Hydrological Systems

Time: Wednesday, 22/Jun/2016: 11:00am - 12:20pm – Location: MSB 3154

Blending as an Effective Option to Reduce the Risk of Water Acidification from Waste Rock Pile: a Stochastic Analysis

Daniele Pedretti, Karl Ulrich Mayer, Roger Daniel Beckie

University of British Columbia, Canada; dpedretti@eos.ubc.ca

Coarsening Dynamics in Partially Miscible Fluids

Xiaojing Fu¹, Luis Cueto-Felgueroso^{1,2}, Ruben Juanes¹

¹MIT, United States of America; ²Technical University of Madrid, Spain; rubyfu@mit.edu

PDF Models for Eulerian Simulation of Pore-Scale Mixing and Dispersion

Matteo Icardi¹, Juan Hidalgo², Marco Dentz²

¹University of Warwick, United Kingdom; ²IDAEA CSIC, Barcelona; matteo.icardi@warwick.ac.uk



8-2: Hydro-Mechanical and Thermo-Hydro-Mechanical Modelling of Subsurface Processes

Time: Wednesday, 22/Jun/2016: 11:00am - 12:20pm – Location: MSB 2172

Studying Long-Term Geochemical Alterations and Geochemically-Induced Stress Changes in Bentonite Using Coupled THMC Models

Liange Zheng, Jonny Rutqvist, Jens Birkholzer

Lawrence Berkeley National Laboratory, United States of America; lzheng@lbl.gov

An Assumed Enhanced Strain Method for Modeling Hydraulic Fracture Propagation with Full Poromechanical Coupling

Joshua Alexander White

Lawrence Livermore National Laboratory, United States of America; jawwhite@llnl.gov

Keynote 4

The Simulation of Droplets, Bubbles and Interfaces

Time: Wednesday, 22/Jun/2016: 1:20pm - 2:20pm – *Location:* MSB 3153

Stéphane Zaleski

University Pierre et Marie Curie; stephane.zaleski@gmail.com

14-1: General Session on Advances in Computational Methods for Subsurface Water Resources

Time: Wednesday, 22/Jun/2016: 2:30pm - 3:30pm – *Location:* MSB 2172

Anomalous Porous-Medium Mass Transport across a Sharp Material Interface

James Montague, George Pinder

University of Vermont, United States of America; jmontagu@uvm.edu

The Application of High-Resolution Schemes In Groundwater Flow and Transport Modeling on Unstructured Polyhedral Grids

Ivan Kapyrin, Fedor Grigoriev

Russian Academy of Sciences, Russian Federation; ivan.kapyrin@gmail.com

5-2: Advances in Numerical Solvers for Water Resources Applications

Time: Wednesday, 22/Jun/2016: 2:30pm - 3:30pm – *Location:* MSB 3153

An Immersed Boundary Method for the Numerical Simulation of Solid Particles Near Fluid-Fluid Interfaces

Markus Bussmann

University of Toronto, Canada; bussmann@mie.utoronto.ca

An Algebraic Multigrid Method for Coupled Linear Systems

Daniel Osei-Kuffuor¹, Lu Wang², Rob Falgout³, Ilya Mishev⁴

¹Lawrence Livermore National Lab, ²Lawrence Livermore National Lab, ³Lawrence Livermore National Lab, United States of America;

⁴ExxonMobil; oseikuffuor1@llnl.gov

6-2: Hybrid Multiscale Modelling of Subsurface Flow and Reactive Transport

Time: Wednesday, 22/Jun/2016: 2:30pm - 3:30pm – *Location:* MSB 2170

Upscaling Reactive Flow and Transport in an Evolving Porous Medium and its Application to Soil Formation

Nadia Ray, Andreas Rupp, Peter Knabner

University of Erlangen, Germany; ray@math.fau.de

Parallelization of MIN3P-THCm: a High Performance Computational Framework for Subsurface Flow and Reactive Transport Simulation

Danyang Su¹, K. Ulrich Mayer¹, Kerry T.B. MacQuarrie²

¹University of British Columbia, Canada; ²University of New Brunswick; dsu@eos.ubc.ca

Hydraulic-Chemical Coupling for Long-Term Prediction of Mineral Reactions in Heterogeneous CO₂ Storage Systems

Marco De Lucia, Thomas Kempka, Michael Kühn

GFZ German Research Centre for Geosciences, Germany; michael.kuehn@gfz-potsdam.de

7-2: Novel Developments and Data-Integration in Complex Biogeochemical and Hydrological Process Models

Time: Wednesday, 22/Jun/2016: 2:30pm - 3:30pm – Location: MSB 3154

Uncertainty Quantification for Discrimination of Nuclear Events as Violations of the Comprehensive Nuclear Test Ban Treaty

Yunwei Sun, Jamison Sloan, Charles Carrigan

Lawrence Livermore National Laboratory, United States of America; sun4@llnl.gov

How Much Detail is Detailed Enough? Assessing the Importance of Flow Field Complexity in Predicting Fractured Rock Property Evolution Induced by Mineral Dissolution

Hang Wen, Li Li

Pennsylvania State University, United States of America; hzw122@psu.edu

Blind Source Separation for Contaminant Source Characterization

Velimir Vesselinov, Boian Alaxandrov, Dan O'Malley

Los Alamos National Laboratory, United States of America; vvv@lanl.gov

14-2: General Session on Advances in Computational Methods for Subsurface Water Resources

Time: Wednesday, 22/Jun/2016: 3:50pm - 5:30pm – Location: MSB 2173

A New Finite Volume Method for the Transport Equation

Xin Kou The University of Vermont, United States of America; xkou@uvm.edu

Preserving Physical and Mathematical Properties under Reduced-Order Modeling for Flow and Transport in Porous Media

Maruti Mudunuru¹, Kalyana Nakshatrala², Satish Karra¹

¹Los Alamos National Laboratory; ²University of Houston; United States of America; maruti.iitm@gmail.com

Approximation of Underground Flows Using a Composite Mixed Finite Element Method on Deformed Hexahedral Meshes

Nabil Birgler¹, Jérôme Jaffré², Jean Roberts²

¹inria sophia antipolis, France; ²inria rocquencourt, France; nabil.birgler@inria.com

Field Application of Source Search Algorithm at a DNAPL-Contaminated Site in Nanjing, China

Shujun Ye

Nanjing University, China, People's Republic of; sjye@nju.edu.cn

Factors Impacting Stable Isotope Fractionation Related to Aqueous Phase Diffusion in the Subsurface

Bruce S. Xu, Brent E. Sleep, Barbara Sherwood Lollar, Elodie Passeport
University of Toronto, Canada; bruce.xu@mail.utoronto.ca

dfnWorks: A High-Performance Computing Suite for Subsurface Flow and Transport Modeling Using Discrete Fracture Network

Nataliia Makedonska¹, Satish Karra¹, Jeffrey D. Hyman¹, Hari S. Viswanathan¹, Carl W. Gable¹, Scott L. Painter²
¹Los Alamos National Laboratory; ²Oak Ridge National Laboratory; United States of America; nataliia@lanl.gov

5-3: Advances in Numerical Solvers for Water Resources Applications

Time: Wednesday, 22/Jun/2016: 3:50pm - 5:30pm – Location: MSB 3153

Total Velocity Discretization in Implicit Hybrid Upwinding for Coupled Flow and Transport with Gravity

Francois P Hamon¹, Bradley T Mallison², Hamdi A Tchelepi¹
¹Stanford University, United States of America; ²Chevron, United States of America; fhamon@stanford.edu

Semi-Implicit Numerical Methods for Advection Dominated Problems

Peter Frolkovic
Slovak University of Technology, Slovak Republic; peter.frolkovic@gmail.com

Reactive Transport Simulations Using a Global Approach

Jocelyne Erhel¹, Tangi Migot²
¹Inria; ²INSA, France; jocelyne.erhel@inria.fr

An Efficient Numerical Solver for Reactive Multiphase Multicomponent Flow in Porous Media

Fabian Brunner, Peter Knabner
Friedrich-Alexander-University Erlangen-Nürnberg, Germany; brunner@math.fau.de

Comparison of Numerical Methods for Reactive Transport Modeling in Porous Media

Thibault Faney, Anthony Michel
IFPEN, France; thibault.faney@ifpen.fr

7-3: Novel Developments and Data-Integration in Complex Biogeochemical and Hydrological Process Models

Time: Wednesday, 22/Jun/2016: 3:50pm - 5:30pm – Location: MSB 3154

Multi-Component Reactive Transport Modeling of Potential Bacteria-Mediated Nitrous Oxide Sinks in Subsurface Environments

Eugene Ma, Jiao Zhao, Radhakrishnan Mahadevan
University of Toronto, Canada; eugene.ma@wspgroup.com

Predictive Modeling of Changes in Riverine Nutrient Fluxes due to Damming

Philippe Van Cappellen, Taylor Maavara
University of Waterloo, Canada; pvc@uwaterloo.ca

Process-Based Modelling of the Formation and Consolidation of Soil Microaggregates

Alexander Prechtel¹, Nadja Ray¹, Andreas Rupp¹, Kai Uwe Totsche²

¹Friedrich-Alexander University of Erlangen-Nürnberg; ²Friedrich-Schiller University of Jena, Germany; prechtel@math.fau.de

Development of RT-Flux-PIHM: Understanding Hydrogeochemical Processes at the Watershed Scale

Chen Bao¹, Li Li¹, Yuning Shi¹, Pamela Sullivan², Chris Duffy¹, Susan Brantley¹

¹Penn State University, United States of America; ²University of Kansas; lili@eme.psu.edu

Electron Transfer in Marine Sediments: New Insights and Model Descriptions for Methane-Oxidizing Microbial Consortia

Christof Meile¹, Xiaojia He¹, Jurjen Rooze¹, Yimeng Shi¹, Grayson Chadwick², Victoria Orphan², Shawn McGlynn³, Chris Kempes⁴

¹University of Georgia, United States of America; ²Caltech, United States of America; ³Tokyo Metropolitan University, Japan; ⁴Santa Fe Institute, United States of America; cmeile@uga.edu

Numerical Modelling of Flow, Transport and Biofilm Development in a Single Rock Fracture

Scott Briggs, Brent Sleep

University of Toronto, Canada; sbriggs@yorku.ca

8-3: Hydro-Mechanical and Thermo-Hydro-Mechanical Modelling of Subsurface Processes

Time: Wednesday, 22/Jun/2016: 3:50pm - 5:30pm – Location: MSB 2170

On the Analysis of Multirate Iterative and Explicit Coupling Schemes for Coupling Flow with Geomechanics: from Rigorous Mathematical Analysis to Validated Numerical Results

Tameem Almani¹, Kundan Kumar², Gurpreet Singh¹, Mary Wheeler¹

¹The University of Texas at Austin, United States of America; ²University of Bergen, Norway; tameem@ices.utexas.edu

Inverse Modeling in Coupled Fluid-Flow and Geomechanics: Assimilating Earthquake Time, Location and Magnitude

David Castineira, Birendra Jha, Ruben Juanes

Massachusetts Institute of Technology, United States of America; davidcas@mit.edu

Ice-Sheet Impacts of Crustal Flexure on the Formation of Abnormal Pore Fluid Pressures in the Geosphere

Stefano D. Normanj, Jonathan F. Sykes

University of Waterloo, Canada; sdnorman@uwaterloo.ca

P-2: Poster Session 2

Time: Wednesday, 22/Jun/2016: 6:00pm - 8:00pm – Location: MSB Stone Lobby

Optimal Estimation and Scheduling in Large Scale Aquifer Management

Hojat Ghorbanidehno, Amalia Kokkinaki, Eric Darve, Peter Kitanidis

Stanford University, United States of America; hojatgh@stanford.edu

Calibrating a Hydrologic Forecasting Model for the Madawaska River Basin

Hongli Liu, Bryan Tolson

University of Waterloo, Canada; hongli.liu@uwaterloo.ca

Study on Stratified Reservoir of Dams Using Numeric Modeling

Redvan Ghasemlounia, M.Sedat Kabdasli

Istanbul Technical University, Turkey; ghasemlounia@itu.edu.tr

Comparing a Ranking and Penalty Approach for Water Allocation Modelling

Bertrand Richaud, Roar Jensen, Eduardo Munoz, Michael Butts

DHI, Denmark; mib@dhigroup.com

GPU-based Modeling of Tsunami Propagation and Inundation

Shuangcai Li

RMS, United States of America; lishuangcai@gmail.com

Virtual Reality Catchment Simulations for Verifying Data Assimilation Methods

Bernd Schalge¹, Jehan Rihani^{1,3}, Gabriele Baroni², Barbara Haese⁷, Daniel Erdal³, Harrie-Jan Hendricks-Franssen⁵, Insa Neuweiler⁴, Gernot Geppert⁶, Felix Ament⁶, Stefan Kollet^{1,5}, Olaf Cirpka³, Pablo Saveedra¹, Xujun Han⁵, Sabine Attinger², Harald Kunstmann^{7,8}, Harry Vereecken⁵, Clemens Simmer¹

¹University of Bonn; ²Helmholtz Institute for Environmental Research; ³University of Tübingen; ⁴University of Hannover; ⁵Forschungszentrum Jülich; ⁶University of Hamburg; ⁷University of Augsburg; ⁸Karlsruhe Institute of Technology; Germany; jrihani@uni-bonn.de

Toward a Joint Assimilation of SMOS Brightness Temperature and GRACE Terrestrial Water Storage Observations for Improved Soil Moisture Estimation

Manuela Giroto, Gabrielle De Lannoy, Rolf Reichle, Matthew Rodell

University of Leuven, Belgium; gabrielle.j.delannoy@nasa.gov

To Study the Effects of the Maximum Scour Depth and Sediment Transport of the Dajia River, Taiwan

Dong-Sin Shih, Yuan-Ya Liao, Hui-Cheng Chang

National Chung Hsing University, Taiwan, Republic of China; dsshih@nchu.edu.tw

Optimization of Bioenergy Crop Selection and Placement Based on a Stream Health Indicator Using an Evolutionary Algorithm

A. Pouyan Nejadhashemi¹, Matthew Herman¹, Fariborz Daneshvar¹, Mohammad Abouali¹, Dennis Ross¹, Sean Woznicki¹, Zhen Zhang²

¹Michigan State University; ²University of Chicago; United States of America; pouyan@msu.edu

Numerical Investigations of Sulfur Water Formation Mechanisms in Sedimentary Basins

Mingliang Xie¹, Danyang Su¹, K. Ulrich Mayer¹, Kerry T.B. MacQuarrie²

¹University of British Columbia; ²University of New Brunswick, Canada; mxie@eos.ubc.ca

Non-Hydrostatic Pressure Shallow Flows: GPU Implementation in 2D-Domains Using Finite-Volume and Finite-Difference Scheme

Cipriano Escalante Sánchez¹, Tomás Morales², Manuel J. Castro¹

¹UMA; ²UCO, Spain; escalante@uma.es

A Nonlinear Second Order in Space Correction Preserving Maximum Principle for Diffusion Operators

Christophe Le Potier

CEA, France; clepotier@cea.fr

The Integrated Hydrologic Model Intercomparison Project, IH-MIP2: A Second Set of Benchmark Results to Diagnose Integrated Hydrology and Feedbacks

Stefan Kollet^{1,2}, Mauro Sulis³, Reed Maxwell⁴, Claudio Paniconi⁵, Mauro Putti⁶, Giacomo Bertoldi⁷, Ethan T. Coon⁸, Emanuele Cordano^{7,9}, Evgeny Kikinzon⁸, Emmanuel Mouche¹⁰, Claude Mügler¹⁰, Young-Jin Park¹¹, Simon Stisen¹², Edward Sudicky¹³

¹Agrosphere Institute, Germany; ²Centre for High-Performance Scientific Computing in Terrestrial Systems, HPSC; ³Bonn University, Germany; ⁴Colorado School of Mines; ⁵Université du Québec; ⁶University of Padova; ⁷European Academy Bolzano; ⁸Los Alamos National Laboratory; ⁹Rendena100; ¹⁰CEA-CNRS-UVSQ, France; ¹¹Aquanty, Inc., Canada; ¹²Geological Survey of Denmark and Greenland; ¹³University of Waterloo; giacomo.bertoldi@eurac.edu

Inter-Particle Effects on the Pore Clogging with Fine Particles

Shinichiro Hirabayashi, Toru Sato

University of Tokyo, Japan; hirabayashi@k.u-tokyo.ac.jp

Comparison of Chemical Exposure in Soil and Groundwater Using a Physics-Based Numerical Model

Soonyoung Yu¹, Sang-II Hwang², Seong-Taek Yun¹, Gitak Chae³

¹Korea University; ²Korea Environment Institute; ³Korean Institute of Geoscience and Mineral Resources, South Korea; s7yu.iamysy@gmail.com

Investigation of the Response of Water and Bubble Motions to a Selection of Spatial Configurations of ports in Eutrophic Lakes

Azita Najafi Nejad Nasser, S.Samuel Li, Catherine Mulligan

Concordia University, Canada; azita.najafi@gmail.com

Seasonal Forecasting of Reservoir Inflows: Case Study Applications of a Decision Support Tool

Michael B Butts, Basel Draw, Bibhab Mani Panthi, Roar A Jensen, Jacob K Larsen

DHI, Denmark; mib@dhigroup.com

A Joint Geophysical and Flow Inversion Framework to Characterize and Constrain Subsurface Fracture Networks

Maruti Mudunuru, Satish Karra, Nataliia Makedonska, Ting Chen

Los Alamos National Laboratory, United States of America; maruti.iitm@gmail.com

Keynote 5

Multi-Scale Tsunami Modeling and Probabilistic Hazard Assessment.

Time: Thursday, 23/Jun/2016: 8:30am - 9:30am – *Location:* MSB 3153

Randall J. LeVeque

University of Washington; rjl@amath.washington.edu

10-1: Reusable Software for Accurate, Efficient, and Reproducible Water Resources Simulation

Time: Thursday, 23/Jun/2016: 9:40am - 10:40am – *Location:* MSB 3153

Efficient Numerical Implementation of a Groundwater Flow Model of the Unstrut Catchment in OpenGeoSys

Dmitri Naumov^{1,2}, Thomas Fischer¹, Marc Walther^{1,3}, Sabine Sattler⁴, Olaf Kolditz^{1,3}

¹Helmholtz Centre for Environmental Research, Germany; ²Leipzig University of Applied Sciences; ³Technische Universität Dresden; ⁴LBEGLandesamt für Bergbau, Energie und Geologie; dmitri.naumov@ufz.de

Interoperable Designs and Community Approaches to Software Productivity in Environmental Applications

David Moulton³, Ethan Coon³, Jeff Johnson², Sergi Molins², Glenn Hammond⁵, Carl Steefel², Scott Painter⁴, Mike Heroux⁵, Lois Curfman McInnes¹, Hans Johansen², David Bernholdt⁴

¹Argonne National Laboratory; ²Lawrence Berkeley National Laboratory; ³Los Alamos National Laboratory; ⁴Oak Ridge National Laboratory; ⁵Sandia National Laboratory; United States of America; moulton@lanl.gov

Using C++ and Object Oriented Design Techniques to Develop the PEST++ Software Suite

David E. Welter

Computational Water Resource Engineering, United States of America; dave@inversemodeler.com

20-1: Advances in Computational Methods for Surface Hydrological Processes

Time: Thursday, 23/Jun/2016: 9:40am - 10:40am – *Location:* MSB 2170

Hydrologic Model Development Based on Diagnostic Data Analysis Utilized to Identify Flow Pathways

Mahyar Shafii, Nandita Basu, James R. Craig, Philippe Van Cappellen

University of Waterloo, Canada; mshafiih@uwaterloo.ca

Parallel Multiresolution Techniques for the Simulation of Rain-Induced Floods on Large-Scale Terrain Data

Roland Wittmann, Hans-Joachim Bungartz

Technische Universität München, Germany; wittmanr@in.tum.de

Modeling Flood Hazard using a GPU-Based 2D Hydraulic Model

Shuangcai Li

RMS, United States of America; lishuangcai@gmail.com

Adding Contaminant Transport Capabilities to a Modular Hydrological Modelling Framework

James R. Craig, Mahyar Shafii, Nandita Basu University of Waterloo, Canada; jrcraig@uwaterloo.ca

3-1: Recent Advances in Coastal Ocean Modelling of Waves, Circulation and Transport

Time: Thursday, 23/Jun/2016: 9:40am - 10:40am – Location: MSB 2172

Application of a New Parametric Wind Field Model for Improving Hurricane Storm Surge Predictions of SLOSH

Talea L. Mayo¹, Ning Lin²

¹University of Central Florida; ²Princeton University; United States of America; talea.mayo@ucf.edu

Influence of Storm Characteristics on Hurricane Surge

Jennifer Proft¹, Clint Dawson¹, J. Nicholas Irza², Benjamin Bass², Jacob Torres², Phil Bedient²

¹The University of Texas at Austin, United States of America; ²Rice University; jennifer@ices.utexas.edu

Improved Efficiency for Wave and Surge Models via Adaptive Domain Decomposition

Joel Casey Dietrich¹, Ajimon Thomas¹, Clint Dawson²

¹North Carolina State University; ²University of Texas at Austin, United States of America; jcdietrich@ncsu.edu

5-4: Advances in Numerical Solvers for Water Resources Applications

Time: Thursday, 23/Jun/2016: 9:40am - 10:40am – Location: MSB 3154

Higher Order Finite Volume Methods for Compositional Flow in Porous Media on Polyhedral Grids

Robert Kloefkorn¹, Anna Kvashchuk²

¹International Research Institute of Stavanger (IRIS); ²University of Stavanger (UIS), Norway; robert.kloefkorn@iris.no

High Performance Simulation of a Hybrid Dimensional Compositional Multiphase Darcy Flow in Fractured Porous Media

Roland Masson¹, Feng Xing², Simon Lopez³

¹LJAD University Nice - Sophia Antipolis, INRIA team COFFEE; ²LJAD University Nice - Sophia Antipolis, INRIA team COFFEE, Institut BRGM; ³Institut BRGM; feng.xing@unice.fr

Flow simulation in 3D Discrete Fracture Networks

Jean-Raynald de Dreuzy¹, Géraldine Pichot², Jocelyne Erhel², Patrick Laug²

¹CNRS, France; ²INRIA, France; jr.dreuzy@gmail.com

10-2: Reusable Software for Accurate, Efficient, and Reproducible Water Resources Simulation

Time: Thursday, 23/Jun/2016: 11:00am - 12:20pm – Location: MSB 3153

Benchmarks and Reusable Interfaces for Efficient Reactive Multicomponent Flow Solvers

Tobias Elbinger¹, Fabian Brunner¹, Joachim Hoffmann², Peter Knabner¹

¹Friedrich-Alexander Universität Erlangen-Nürnberg, Germany; ²InuTech; elbinger@math.fau.de

A Flexible Framework for Process-Based Hydraulic and Water Quality Modeling of BMP Performance

Arash Massoudieh¹, Saba Gharavi¹, Babak Kamrani²

¹The Catholic University of America, ²University of California, Davis; massoudieh@cua.edu

Application of PA-DDS in Solving Bi-Objective Water Distribution Systems Benchmark Design Problems

Mohammadamin Jahanpour¹, Juliane Mai², Thouheed Abdul Gaffoor¹, Bryan Tolson¹

¹University of Waterloo, Canada; ²Helmholtz Centre for Environmental Research, Germany; mjahanpo@uwaterloo.ca

Development of the Operational WRF-Hydro Meteorological Forcing Engine for U.S. National Water Forecasting Capabilities

Wei Yu

NCAR, United States of America; weiyu@ucar.edu

16-1: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale

Time: Thursday, 23/Jun/2016: 11:00am - 12:20pm – Location: MSB 3154

Experimental Investigation of Immiscible Two-Phase Flows in Micromodels for the Validation of Modeling Tools

Sophie Roman, Cyprien Soulaire, Pauline Louazel, Anthony Kovscek

Stanford University, United States of America; sroman@stanford.edu

Magnetic Resonance Imaging of the Effect of Sharp Material Interfaces on Transport in Porous Media

James Montague, George Pinder, Richard Watts, Jay Gonyea, Scott Hipko

University of Vermont; jmontagu@uvm.edu

Simulation of Reactive Transport using CTRW and NMR Validation

Bagus Putra Muljadi, Martin Julian Blunt, Branko Bijeljic

Imperial College London, United Kingdom; b.muljadi@imperial.ac.uk

Micro-PIV Measurements of Multiphase Flow of Water and Supercritical CO₂ in 2D Heterogeneous Porous Micromodels

Yaofa Li^{1,2}, Gianluca Blois^{1,2}, Farzan Kazemifar^{1,2}, Kenneth Christensen^{1,2}

¹University of Notre Dame, United States of America; ²Kyushu University, Japan; christensen.33@nd.edu

9-1: Integrated Hydrologic Models: Advancements and Applications

Time: Thursday, 23/Jun/2016: 11:00am - 12:20pm – Location: MSB 2170

Applications of Watershed-Scale Integrated Modelling in a Canadian Context

E.J. Wexler, Peter John Thompson, Dirk Kassenaar, Michael Takeda

Earthfx Incorporated, Canada; ejw@earthfx.com

Assessing Continental Scale Groundwater Surface Water Interactions with an Integrated Hydrologic Model

Laura E. Condon¹, Reed M. Maxwell²

¹Syracuse University; ²Colorado School of Mines, United States of America; lcondon@mymail.mines.edu

Integrated Hydrological Model of the California Basin

Jason H. Davison¹, Hyoun-Tae Hwang², Edward A. Sudicky¹, Derek V. Mallia³, John C. Lin³

¹University of Waterloo; ²Aquanty Inc.; ³University of Utah; Jason.H.Davison@gmail.com



Impacts of Water Table Configuration on Atmospheric Response over the San Joaquin River Basin

James Matthew Gilbert¹, Reed M. Maxwell¹, David J. Gochis²

¹Colorado School of Mines, United States of America; ²National Center for Atmospheric Research; jagilber@mymail.mines.edu

Keynote 6

Assimilation of SMOS and SMAP Observations into the NASA GEOS-5 Land Surface Model to Improve Global Estimates of Surface and Root-Zone Soil Moisture

Time: Thursday, 23/Jun/2016: 1:20pm - 2:20pm – *Location:* MSB 3153

Gabrielle J. M. de Lannoy

University of Leuven; gabrielle.delannoy@kuleuven.be

12-1: Modelling and Computational Aspects of Coupled Porous Medium and Free Flow Systems

Time: Thursday, 23/Jun/2016: 2:30pm - 4:10pm – *Location:* MSB 2172

Coupled Fluid Flow and Heat Transport in 3D Faulted Hydrothermal Systems: the Tiberias Basin Example

Fabien Magri^{1,2}, Nimrod Inbar³, Christian Siebert⁴, Tino Rödiger⁴, Peter Möller⁵, Eliyahu Rosenthal³, Norihiro Watanabe¹

¹Helmholtz Centre for Environmental Research – UFZ, Germany; ²Freie Universität Berlin, Germany; ³Tel Aviv University, Israel; ⁴Helmholtz Centre for Environmental Research – UFZ, Germany; ⁵Helmholtz Centre Potsdam, Germany; fabien.magri@ufz.de

Coupling Compositional Gas Liquid Darcy and Free Gas Flows at Porous and Free Flow Domains Interface

Roland Masson¹, Laurent Trenty², Yumeng Zhang¹

¹LJAD University Nice Sophia Antipolis and INRIA; ²Andra, Chatenay Malabry, France; roland.masson@unice.fr

SPH Modeling of Multi-Phase Flow over a Porous Layer

Hossein Bassar, Edoardo Daly, Chunhui Lu, Ha Bui

Monash University, Australia; Hossein.Bassar@monash.edu

Coupling Non-Isothermal, Two-Component Darcy and Navier-Stokes Flow to Investigate Evaporation of Soil Water

Christoph Grüninger, Thomas Fetzner, Bernd Flemisch, Rainer Helmig

University of Stuttgart, Germany; christoph.grueninger@iws.uni-stuttgart.de

16-2: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale

Time: Thursday, 23/Jun/2016: 2:30pm - 4:10pm – *Location:* MSB 3154

Generalized Network Modelling – Validation on a Pore-by-Pore Basis

Ali Qaseminejad Raeini

Imperial College London, United Kingdom; a.qaseminejad-raeini09@imperial.ac.uk

Pore-Scale Modeling of Non-Newtonian Fluid Flow in Porous Media

Amanda L Dye, Scott C Hauswirth, Christopher A Bowers, **Cass T Miller**

University of North Carolina at Chapel Hill, United States of America; casey_miller@unc.edu

Two-Phase Displacements in Rough Fractures: Beyond Darcy's Law

Amir Alizadeh Pahlavan, Luis Cueto-Felgueroso, Gareth McKinley, Ruben Juanes
MIT, United States of America; juanes@mit.edu

Local Analysis of Single-Phase Flow through Complex Porous Media Using Flow Propagators

Christoph Hermann Arns
UNSW Australia, Australia; c.arns@unsw.edu.au

3-2: Recent Advances in Coastal Ocean Modelling of Waves, Circulation and Transport

Time: Thursday, 23/Jun/2016: 2:30pm - 4:10pm – Location: MSB 3153

Formulation and Implementation of the 3D Shallow Water Adaptive Hydraulics (AdH) Software

Corey Jason Trahan, Gaurav Savant
Army Corps of Engineers, United States of America; Corey.J.Trahan@erdc.dren.mil

From Creek to Ocean: Seamless Modelling with Unstructured Grids

Yinglong Joseph Zhang
Virginia Institute of Marine Science, United States of America; yjzhang@vims.edu

Hybrid Discontinuous Galerkin Methods for Shallow Water Wave Models

Clint Dawson, Ali Samii
University of Texas at Austin, United States of America; clint@ices.utexas.edu

Projection-Based Model Reduction for Finite Element Approximation of Shallow Water Flows

Matthew W Farthing¹, Alexander Lozovskiy², Christopher Kees¹, Eduardo Gildin³
¹USACE Engineer Research and Development Center; ²Texas A&M University; ³Texas A&M University;
matthew.w.farthing@usace.army.mil

Investigation of the Flow over a Ground Sill Using OpenFOAM

Katharina Teuber, Tabea Broecker, Waldemar Elsesser, Berken Agaoglu, Reinhard Hinkelmann
Technische Universität Berlin, Germany; katharina.teuber@uwi.tu-berlin.de

9-2: Integrated Hydrologic Models: Advancements and Applications

Time: Thursday, 23/Jun/2016: 2:30pm - 4:10pm – Location: MSB 2170

Evaluating the Impact of Landscape Evolution on Soil Carbon and Nutrient Dynamics

Praveen Kumar, Qina Yan, Dong Kook Woo, Phong V. V. Le
University of Illinois; kumar1@illinois.edu

Implementation and Testing of Reactive Transport Processes for a Coupled (Groundwater/Surface Water) Physically Based Model

Laura Gatel¹, Claire Lauvernet¹, Claudio Paniconi², Nadia Carluer¹, Julien Tournebize¹
¹Irstea, France; ²INRS-ETE, Canada; laura.gatel@irstea.fr

Mass Conservative Velocity Reconstruction for Coupled Flow and Transport Simulations

Carlotta Scudeler¹, Mario Putti², Claudio Paniconi¹
¹Université du Québec, Canada; ²University of Padova, Italy; carlotta.scudeler@gmail.com

Keynote 7

High Performance Scientific Computing in terrestrial hydrology: linking data and models

Time: Friday, 24/Jun/2016: 8:30am - 9:30am – *Location:* MSB 3153

Harry Vereecken

Forschungszentrum Jülich,; h.vereecken@fz-juelich.de

10-3: Reusable Software for Accurate, Efficient, and Reproducible Water Resources Simulation

Time: Friday, 24/Jun/2016: 9:40am - 10:40am – *Location:* MSB 3153, *NOTE:* This session may extend to after the coffee break.

Automated System Testing in Scientific Numerical Software Frameworks using the Example of Dune

Timo Koch¹, **Dominic Kempf**², **Bernd Flemisch**¹, **Peter Bastian**²

¹University of Stuttgart; ²University of Heidelberg, Germany; timo.koch@iws.uni-stuttgart.de

An Open-Source Method for Flow and Flood Inundation Estimation at Regional Scales

Michael Lee Follum, **Alan D Snow**, **Ahmad A Tavakoly**, **Mark D Wahl**

U.S. Army Corps of Engineers, United States of America; Michael.L.Follum@usace.army.mil

BET: Software for Measure-Theoretic Stochastic Problems

Steven Mattis¹, **Lindley Graham**²

¹The University of Texas at Austin; ²Florida State University, United States of America; steve.a.mattis@gmail.com

A Python Framework for Laplace-Transform Solutions

Mark Bakker

Delft University of Technology, Netherlands; mark.bakker@tudelft.nl

Development of a Program Data Structure Enabling the Flexible Integration of Effects into a Basis Flow Model

Tatiana Reiche

GRS, Germany; Tatiana.Reiche@grs.de

Verification and Validation of 3D Models for Wave and Current Interactions with Rigid and Erodible Structures

Christopher Kees¹, **Matthew Farthing**¹, **Aggelos Dimakopoulos**², **Tristan de Lataillade**²

¹S Army Engineer Research & Development Center, United States of America; ²HR Wallingford, United Kingdom;
Christopher.E.Kees@erdc.dren.mil

16-3: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale

Time: Friday, 24/Jun/2016: 9:40am - 10:40am – Location: MSB 3154

Modeling Polymer Stabilized Nano-scale Zero Valent Iron Transport Experiments in Variable Aperture Single Fractures

Pulin Mondal¹, Ziteng Cui², Brent Sleep¹

¹University of Toronto, Canada; ²Hohai University, China; puhin.mondal@mail.utoronto.ca

Mineral Dissolution Rates in Physically and Geochemically Heterogeneous Media

Hang Wen, Li Li, Fatemeh Salehikhoo

Pennsylvania State University, United States of America; hzw122@psu.edu

17-1: Data Assimilation in Water Resources Modelling

Time: Friday, 24/Jun/2016: 9:40am - 10:40am – Location: MSB 2170

Assimilation of Soil Moisture Data with the Integrated Terrestrial System Modeling Platform TerrSysMP at the Catchment Scale

Wolfgang Kurtz^{1,2}, Mauro Sulis³, Prabhakar Shrestha³, Guowei He^{1,2}, Stefan Kollet^{1,2}, Harry Vereecken^{1,2}, Harrie-Jan Hendricks Franssen^{1,2}

¹Institute of Bio- and Geosciences, IBG-3 (Agrosphere); ²Centre for High-Performance Scientific Computing in Terrestrial Systems (HPSC-TerrSys), Geoverbund ABC/J; ³University of Bonn; Germany; w.kurtz@fz-juelich.de

Optimal Design of Groundwater-Quality Sampling Networks Using Data Assimilation Methods and Parallel Processing

Graciela S. Herrera¹, Roel Simuta.Champo², Esther Leyva-Suárez¹, Joseph Guarnaccia³, George Francis Pinder⁴

¹Universidad Nacional Autonoma de Mexico; ²Universidad de Ciencias y Artes de Chiapas; ³BASF Corporation; ⁴University of Vermont; ghz@geofisica.unam.mx

18-1: Multiscale Algorithms and Their Applications: From Upscaling to Scalable Solvers and Multiphysics Modelling

Time: Friday, 24/Jun/2016: 9:40am - 10:40am – Location: MSB 2172

A Multiscale Method for Heat Transport in Fractured Geothermal Reservoirs

Anna Nissen^{1,2}, Eirik Keilegavlen¹, Jan Martin Nordbotten^{1,2}, Tor Harald Sandve³

¹University of Bergen, Norway; ²VISTA; ³IRIS; anna.nissen@math.uib.no

Modelling CO₂-Storage in Fractured Porous Media: Early- and Late-Time Behaviour during Imbibition in Dual-Continua Representations

Rafael March, Florian Doster, Sebastian Geiger

Heriot-Watt University, United Kingdom; Rafael.March@pet.hw.ac.uk

Towards Extreme-Scale Applications with EXA-DUNE: Multiscale Methods and Uncertainty Quantification

René Milk, Mario Ohlberger

University of Muenster, Germany; rene.milk@www.de

16-4: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale

Time: Friday, 24/Jun/2016: 11:00am - 12:20pm – Location: MSB 3154

DNAPL Modeling with Permeabilities Obtained by Geostatistical Inverse Modeling: How Much Detail is Enough?

Amalia Kokkinaki¹, Jonghyun Lee¹, Peter K Kitanidis¹, Brent E Sleep², Hongkyu Yoon³, Charles J Werth⁴, Albert J Valocchi⁵

¹Stanford University, United States of America; ²University of Toronto, Canada; ³Sandia National Laboratories, United States of America; ⁴University of Texas at Austin, United States of America; ⁵University of Illinois, Urbana-Champaign; amaliak@stanford.edu

Modeling Contaminant Plumes in Fractured Limestone in 3-D: Comparison of Modeling Approaches

Klaus Mosthaf, Mette M. Broholm, Poul L. Bjerg, Annika S. Fjordbøge, Philip J. Binning

The Technical University of Denmark (DTU), Denmark; pjbi@env.dtu.dk

A Benchmark Laboratory Experiment for Saltwater Intrusion in Coastal Aquifers

Elena Crestani, Matteo Camporese, Paolo Salandin

University of Padova, Italy; elena.crestani@dicea.unipd.it

A Novel Optical Method for Quantifying Geological Properties of Oil Shale across Scales

Yashar Mehmani¹, Alan Burnham¹, Michael Vanden Berg², Francois Gelin³, Hamdi Tchelepi¹

¹Stanford University, United States of America; ²Utah Geological Survey, United States of America; ³TOTAL, Pau, France; yashar.mehmani@gmail.com

17-2: Data Assimilation in Water Resources Modelling

Time: Friday, 24/Jun/2016: 11:00am - 12:20pm – Location: MSB 2170

Land Subsidence Assimilation by a Generalized Polynomial Chaos Expansion-Based Ensemble Smoother

Claudia Zoccarato¹, Massimiliano Ferronato¹, Noemi Friedman², Pietro Teatini¹, Elmar Zander²

¹University of Padova, Italy; ²Technische Universität Braunschweig, Germany; claudia.zoccarato@dicea.unipd.it

Comparison of Eight Different EnKF Variants for Subsurface Data Assimilation: How to Achieve Sound Conclusions?

Johannes Keller¹, Harrie-Jan Hendricks-Franssen¹, Gabriele Marquardt²

¹Forschungszentrum Jülich GmbH, Germany; ²RWTH Aachen, Germany; h.hendricks-franssen@fz-juelich.de

Recent Advances in Hydrologic Data Assimilation

Tara Razavi, Paulin Coulibaly

McMaster University, Canada; razaviz@mcmaster.ca

Multivariate Hydrological Data Assimilation on a Catchment Scale

Marc-Etienne Ridler¹, Henrik Madsen¹, Donghua Zhang², Karsten H. Jensen², Jens C Refsgaard³

¹DHI, Denmark; ²University of Copenhagen; ³Geological Survey of Denmark and Greenland; Denmark; mer@dhigroup.com

18-2: Multiscale Algorithms and Their Applications: From Upscaling to Scalable Solvers and Multiphysics Modelling

Time: Friday, 24/Jun/2016: 11:00am - 12:20pm – Location: MSB 3153

F-AMS: a Flexible Multiscale Framework for Multiphase Flow through Naturally Fractured Porous Media

Matei Tene¹, Mohammed Saad Al Kobaisi², Hadi Hajibeygi¹

¹Delft University of Technology, The Netherlands; ²The Petroleum Institute, UAE; M.Tene@tudelft.nl

Hybrid Mortar Domain Decomposition for Single-Phase Flow and Solute Transport

Yashar Mehmani¹, Matthew Balhoff²

¹Stanford University; ²University of Texas at Austin; United States of America; yashar.mehmani@gmail.com

A Multiscale Method for Reservoir Geomechanics Simulation

Nicola Castelletto¹, Hadi Hajibeygi², Hamdi A. Tchelepi¹

¹Stanford University, CA, USA; ²Delft University of Technology, The Netherlands; ncastell@stanford.edu

Multi-resolution Discontinuous Galerkin Modelling of Shallow Water Flow

Georges Kesserwani¹, Daniel Caviedes-Voullième¹, Nils Gerhard², Siegfried Müller²

¹University of Sheffield, United Kingdom; ²RWTH Aachen, Germany; g.kesserwani@shef.ac.uk

19-1: Computational Developments in Modelling Climate Change and Water Resources

Time: Friday, 24/Jun/2016: 11:00am - 12:20pm – Location: MSB 2173

Seasonal Forecasting for Water Resource Management: Reservoir Inflows and Uncertainties

Michael B. Butts¹, Yuachao Xu¹, Henrik G Mueller¹, Roar A Jensen¹, Jacob K Larsen¹, Peter N Godiksen¹, Bertrand Richaud¹, Peter T Larsen², Miguel Ángel Corcuera Barrera³

¹DHI Denmark; ²DHI Spain; ³Aguas del Añarbe - Añarbeko Urak, Spain; mib@dhigroup.com

The Impact of Changing Weather and Climate on Recharge and Groundwater

Jonathan F. Sykes, Stefano D. Normani, Mikko I. Jyrkama

University of Waterloo, Canada; sykesj@uwaterloo.ca

Evaluating Reliability, Resiliency and Vulnerability of Water Resource System: A Bayesian Approach

Samiha Tahseen, Bryan W. Karney

University of Toronto, Canada; samiha.tahseen@mail.utoronto.ca

Keynote 8

Climate Coupled Hydrology in a Warming World

Time: Friday, 24/Jun/2016: 1:20pm - 2:20pm – Location: MSB 3153

W. Richard Peltier

University of Toronto, Canada; peltier@atmosp.physics.utoronto.ca

16-5: Advances in Experimental Techniques, Validation of Modelling Tools and Uncertainty in Predictions from Pore to Field Scale

Time: Friday, 24/Jun/2016: 2:30pm - 4:10pm – Location: MSB 3154

Wettability Control on Fluid-Fluid Displacements in Porous Media: Patterned Microfluidic Experiments and Dynamic Pore-Scale Model

Benzhong Zhao¹, Christopher MacMinn², Ruben Juanes¹

¹Massachusetts Institute of Technology, United States of America; ²University of Oxford, United Kingdom; zhaob@mit.edu

Multiple Scale Field Experiment to Determine Parameter Values for Modeling Water Transport in Unsaturated Soils

Annette Dathe¹, Matthew Petterson², Attila Nemes¹, Daniel Gimenez², Johannes Koestel³, Mingming Qin², Helen K. French^{4,1}, Esther Bloem¹, Perrine M. Fernandez^{4,1}, Nicholas Jarvis³

¹Norwegian Institute of Bioeconomy Research (NIBIO), Norway; ²Rutgers University, NY, USA; ³Swedish University of Agricultural Sciences, Sweden; ⁴Norwegian University of Life Sciences (NMBU), Norway; annette.dathe@nibio.no

Immiscible Two-Phase Darcy Flow Model Accounting for Vanishing and Discontinuous Capillary Pressure: Application to the Flow in Fractured Porous Media

Kontantin Brenner^{1,2}, Mayya Groza^{1,2}, Roland Masson^{1,2}, Jeanne Pellerin³

¹Université Nice Sophia Antipolis, France; ²Project-Team Coffee INRIA Sophia Antipolis Méditerranée, France; ³Weierstrass Institute, Germany; brenner@unice.fr

Simulating Infiltration of TCE and Water in Unsaturated, Discretely-Fractured, Porous Rock

Kenneth M. Walton¹, Andre J.A. Unger², Marios A. Ioannidis², Beth L. Parker¹

¹University of Guelph, Canada; ²University of Waterloo, Canada; krmwalton@g360group.org

18-3: Multiscale Algorithms and Their Applications: From Upscaling to Scalable Solvers and Multiphysics Modelling

Time: Friday, 24/Jun/2016: 2:30pm - 4:10pm – Location: MSB 3153

Upscaling Reservoir Properties Using Single Well Tracer Tests

Mary Wheeler, Gurpreet Singh

The University of Texas at Austin, United States of America; gurpreet@ices.utexas.edu

Comparison of Minc Modelling Approaches for Two Phase Porous Media Flow

Alexandru Tatomir¹, Nicolas Schwenck², Bernd Flemisch², Holger Class², Rainer Helmig², Martin Sauter¹

¹University of Göttingen, Germany; ²University of Stuttgart, Germany; alexandru.tatomir@geo.uni-goettingen.de

Pore Network Extraction and Upscaling: a Big-Data Approach

Masakazu Gesho¹, Felipe Pereira², Mohammad Piri¹, Arsalan Zolfaghari Shahrak¹

¹University of Wyoming; ²University of Texas, Dallas; United States of America; mgesho@uwyo.edu

Crouzeix-Raviart MsFEM for Stokes-Oseen Problems in Heterogeneous Porous Media

Bagus Putra Muljadi¹, Pierre Degond²

¹Imperial College London; ²Imperial College London; United Kingdom; b.muljadi@imperial.ac.uk

19-2: Computational Developments in Modelling Climate Change and Water Resources

Time: Friday, 24/Jun/2016: 2:30pm - 4:10pm – Location: MSB 2172

Climate Change and the Niagara River: Is Lake Regulation Part of the Broader Solution?

Samiha Tahseen, Bryan W. Karney

University of Toronto, Canada; samiha.tahseen@mail.utoronto.ca

Simulation-Optimization of Multiple LIDs in an Urban Watershed

Kyle Eckart, Tirupati Boliseti

University of Windsor, Canada; tirupati@uwindsor.ca

9-3: Integrated Hydrologic Models: Advancements and Applications

Time: Friday, 24/Jun/2016: 2:30pm - 4:10pm – Location: MSB 2170

Modelling Feedbacks between Vegetation and Soil Moisture in Mountain Grasslands

Giacomo Bertoldi¹, Claudia Notarnicola², Johannes Brenner¹, Felix Greifeneder², Mariapina Castelli², Georg Niedrist^{1,3}, Ulrike Tappeiner^{1,3}

^{1,2}EURAC Accademia Europea Bolzano, Italy; ³Institute of Ecology, University of Innsbruck, Austria; giacomo.bertoldi@eurac.edu

Importance of Incorporating Peatlands and Winter Processes into Integrated Surface-Subsurface Models of the Athabasca River Basin

Hyoun-Tae Hwang, Young-Jin Park, Edward A. Sudicky

Aquanty Inc., Canada; hthwang@aquanty.com

Modelling Free Surface Aquifers to Analyze the Interaction between Groundwater and Sinuous Streams

Nicola Balbarini¹, Wietse Boon², Poul Løgstrup Bjerg¹, Jan Martin Nordbotten², Philip John Binning¹

¹Technical University of Denmark; ²University of Bergen; Norway; nbal@env.dtu.dk

Wetlands and Flood Mitigation in Ontario: Natural Adaptation to a Changing Climate

Mason Marchildon

YPDT-CAMC, Canada; mmarchildon@owrc.ca

Modeling Urban Flood Dynamics Using High-Resolution Topography and Bathymetry

M. Chase Dwelle, Jongho Kim, Valeriy Ivanov

University of Michigan, United States of America; dwellem@umich.edu