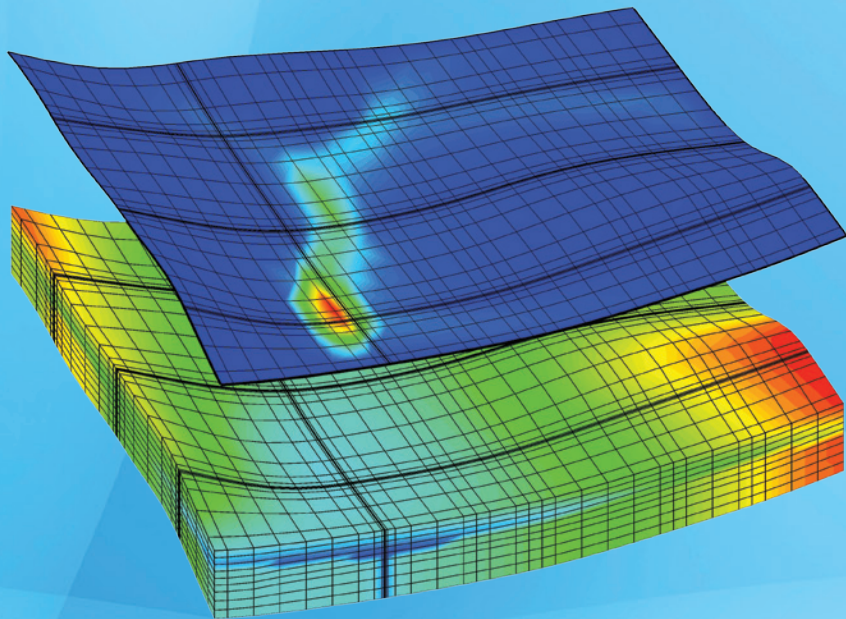


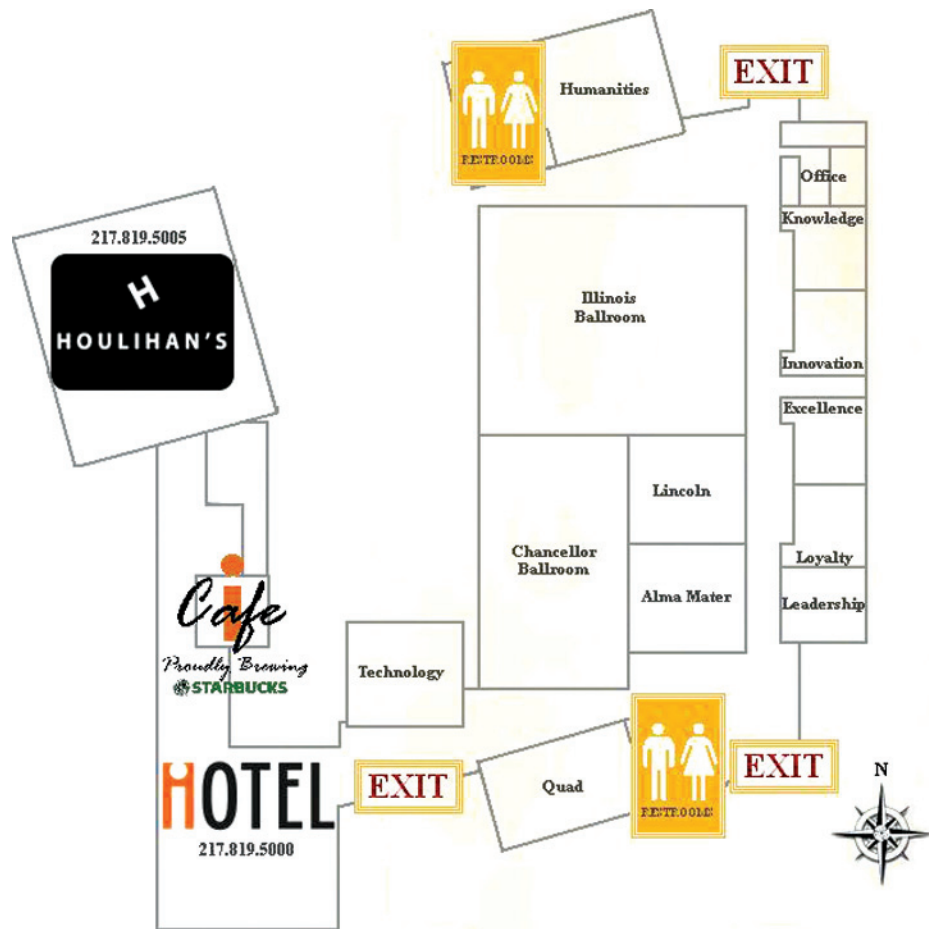
CMWR

XIX International Conference
on Computational Methods
in Water Resources
June 17-21, 2012

Conference Program



University of Illinois
at Urbana-Champaign
I Hotel and Conference Center
Champaign, Illinois



Preface

The University of Illinois at Urbana-Champaign is pleased to host the XIX International Conference on Computational Methods in Water Resources (CMWR 2012), held from June 17–21.

Since its inception in 1976, the conference has served as the premier venue for engineers, geoscientists, hydrologists, computer scientists and applied mathematicians to present and discuss their latest research in the development of advanced computational techniques and their application to problems in water resources and related fields.

The conference venue is always different, traditionally alternating between locations in North America and Europe for the 18 previous biennial meetings. Although the venue for XIX perhaps lacks some of the flair and sophistication of the previous two locations (Barcelona in 2010 and San Francisco in 2008), the University of Illinois at Urbana-Champaign is an ideal location for the conference due to its tradition of excellence in both water resources and advanced scientific computing.

Research in the broad areas of hydrology, hydraulics, and water resources takes place across the campus in many departments and colleges. Within the Civil and Environmental Engineering Department, a focal point is the Ven Te Chow Hydrosystems Laboratory. Our tradition of leadership in computing dates back to the ILLIAC computer in 1952, through establishment of the National Center for Supercomputing Applications (NCSA, in 1985), and up to the present construction of the National Petascale Computing Facility (NPCF). NCSA is a co-sponsor of the conference, and attendees have the opportunity to tour the NPCF. Finally, the University of Illinois is proud to claim Professor George Pinder (Ph.D., Geology, 1968) as one of our alumni. Dr. Pinder is one of the founding figures in the application of computational methods to problems of fluid flow in the subsurface, and an organizer of the very first Computational Methods in Water Resources conference at Princeton University in 1976.

Organizing this major conference required the collaboration and support of the many persons and organizations listed in the following pages. I would like to gratefully acknowledge the financial support of our sponsors. I thank the organizing committee for their overall guidance in planning the conference. I particularly want to thank the organizers of the special sessions, who were largely responsible for soliciting and reviewing papers. In alphabetical order, they are: M. Balhoff, P. Bates, A. Brodtkorb, D. Bolster, M. Celia, H. Class, C. Dawson, M. Dentz, C. Dietrich, A. Ganguly, M. Garcia, I. Gorton, G. Gray, G. Hammond, D. Hill, W. Hwu, V. Ivanov, V. Joekar-Niasar, R. Juanes, Q. Kang, C. Kees, P. Knabner, S. Kollet, M. Kumar, W. Layton, X. Liu, R. Maxwell, D. Moulton, M. Pan, M. Peszynska, M. Putti, K. Reckhow, P. Reed, B. Sanders, T. Scheibe, H. Shao, A. Singh, B. Sleep, E. Vivoni, C. Woodward. Their outstanding efforts have resulted in the excellent quality of the technical program. I thank Laura Hayden in the College of Engineering and Vicki Dixon in the Department of Civil and Environmental Engineering for developing and maintaining the conference web site. Finally, I acknowledge the University of Illinois Conferences and Institutes, particularly Michelle Chappell, and Bridget Haas, for their help planning and managing the conference.

Albert J. Valocchi
May 2012

Organizers and Committees

Albert J. Valocchi, *Conference Chair*

Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign

Organizing Committee

Michael Heath

Department of Computer Science, University of Illinois at Urbana-Champaign

Rainer Helmig

Department of Hydromechanics and Modeling of Hydrosystems, University of Stuttgart

Chris Kees

US Army Corps of Engineers, Coastal & Hydraulics Laboratory

Praveen Kumar

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Department of Civil and Environmental Engineering, National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign

Carol Woodward

Center for Applied Scientific Computing, Lawrence Livermore National Laboratory

Permanent Organizing Committee

Cass T. Miller

Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill

Philip J. Binning

Department of Environmental Engineering, Technical University of Denmark

Conference Sponsors



Office of
Science

US Department of Energy, Office of Science,
Subsurface Biogeochemical Research Program



US National Science Foundation, Hydrologic
Sciences and Computational Mathematics Programs



US Army Research Office



Midwest Geological Sequestration Consortium



National Center for Supercomputing Applications



University of Illinois, Department of Civil &
Environmental Engineering, College of Engineering



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General Information

Registration

All attendees are required to check-in at the registration desk, to pick up their badges and conference materials. Participants are required to wear their name badges at all times while in the conference areas.

Hours of Operation

Sunday, June 17, 5:00–8:00 PM

Monday, June 18, 8:00 AM–5:00 PM

Tuesday, June 19, 8:00 AM–5:00 PM

Wednesday, June 20, 8:00 AM–5:00 PM

Thursday, June 21, 8:00 AM–1:00 PM

Presentation Instructions

Oral Presentations

- Speakers are requested to deliver their presentation to the student volunteer (technician) in charge at the room well before the session starts
- All presentations should be in English
- Contributed talks, including questions and answers, should last 20 minutes maximum

Poster Presentations

- Poster presentation should be in English
- Boards will be available along with the necessary mounting pins
- A numbered sign will indicate where to place your poster
- The poster size should not be larger than 4'x8'
- *Drinks and snacks will be served during each session*

Social Events

Sunday, June 17, **Welcome Reception**, 6:00–8:00 PM, I Hotel and Conference Center

Monday, June 18, **Poster Reception**, 6:00–8:00 PM, National Center for Supercomputing Applications (NCSA) Lobby (*transportation provided*)

Tuesday, June 19, **Poster Reception**, 6:00–8:00 PM, I Hotel and Conference Center–Chancellor Ballroom

Wednesday, June 20, **Reception**, 6:30–7:30, **Banquet** 7:30–9:30 PM, Memorial Stadium, Colonnades Room (3rd floor) (*transportation provided*)

Coffee will be offered to all participants Monday–Thursday according to the conference schedule.

Lunches will be offered Monday–Thursday according to the conference schedule.

Internet Access at I Hotel and Conference Center

1. Find and connect to UIpublicWiFi. (If you have a University NetID or a guest account, use UIUCnet. If you are NOT affiliated with the University, use UIpublicWiFi.)
2. Launch a web browser
3. Fill in the forms and begin surfing!

If you have any trouble connecting, please request assistance at the Conference Center desk.

Transportation

Shuttle service will be available throughout the conference. Bus and/or vans will be scheduled to/from the I Hotel and Conference Center from the following locations: Hawthorn Suites by Wyndham, Hampton Inn, Illinois Street Residence Hall (ISR), and Illini Union. Additional information available at the conference registration desk.

MTD City Bus Information

The Champaign-Urbana Mass Transit District (CU MTD) Yellow Line runs between the I-Hotel and University Bookstore (on Wright and Daniel street, close to the Illini Union) from approx 7 am to 7 PM. The Green Line runs from the Illini Union to downtown Champaign and Urbana until approx 11 PM. One-way fare is \$1.

Tours of the National Petascale Computing Facility (NPCF)

The National Petascale Computing Facility (also known as “The Blue Waters Project”) is a state-of-the-art 88,000-square-foot facility that will house computing, networking, and data systems to support science and engineering research at Illinois and across the U.S. The Blue Waters project will deliver a supercomputer capable of sustained performance of 1 petaflop on a range of real-world science and engineering applications. It is expected to be one of the most powerful supercomputers in the world. Blue Waters is supported by the National Science Foundation and the University of Illinois.

Attendees are invited to sign-up at the registration desk to tour this amazing facility on Wednesday, June 20. Each tour is limited to 30 people at a time.

Tours will be given
at the following times:

- 3:00–3:30 PM
- 3:45–4:15 PM
- 4:30–5:00 PM
- 5:15–5:45 PM
- 6:00–6:30 PM



Poster Sessions

Monday, June 18 • 6:00–8:00 PM • NCSA Lobby

Monday poster presenters need to drop off their poster at the registration desk by 4:00 PM on Monday, and remove the poster after the reception.

Tours of the Ven Te Chow Hydrosystems Lab will be available during this poster session.

Demonstrations of the NCSA Visualization Lab will be available during this poster session and include:

- *Flight to the Center of the Milky Way* (from planetarium show “Black Holes: The Other Side of Infinity”)
- *Formation of an F3 tornado* (featured in NOVA program “Hunt for the Supertwisters”)
- *Orion Nebula with star formation and protoplanetary discs* (from IMAX film “Hubble 3D”)
- *Hurricane Katrina gaining strength over the Gulf of Mexico* (from science film “Dynamic Earth”)
- *Surface of Venus with volcanic activity* (from science film “Dynamic Earth”)
- *Chicago traffic flow, colliding galaxies, Monterey Bay currents, and other selections*

Tuesday, June 19 • 6:00–8:00 PM • Chancellor Ballroom

Tuesday poster presenters need to set up posters on the designated boards 5:00–6:00 PM, and remove the poster after the reception.

Keynote Speakers

Monday, June 18



8:45–9:45 AM • *Illinois Ballroom*

Practical Models for Large-Scale CO2 Sequestration

Mike Celia, Princeton University



1:00–2:00 PM • *Illinois Ballroom*

Environmental Fluid Mechanics in Alpine Environments

Marc Parlange, Ecole Polytechnique Federal de Lausanne

Tuesday, June 19



8:30–9:30 AM • *Illinois Ballroom*

High-Order Accurate Methods for Free Surface Flows Using High-Order Boussinesq Models

Jan Hesthaven, Brown University



1:15–2:15 PM • *Illinois Ballroom*

Advances in Theories of Two-Phase Flow in Porous Media; Theoretical, Computational, and Experimental Studies

S. Majid Hassanizadeh, Utrecht University

Wednesday, June 20



8:30–9:30 AM • *Illinois Ballroom*

Playing the Scales: A View on Upscaling, Multi-Scale Methods and Mesh Adaptation

Margot Gerritsen, Stanford University



1:15–2:15 PM • *Illinois Ballroom*

The Next Generation of High Performance Computing

William Gropp, University of Illinois at Urbana-Champaign

Thursday, June 21



8:30–9:30 AM • *Illinois Ballroom*

An Alternative Blueprint for Hydrologic Modeling and Uncertainty Analysis

Jasper Vrugt, University of California, Irvine



1:15–2:15 PM • *Illinois Ballroom*

Forecasting Hurricane Waves, Storm Surge, and Currents: Physics, Algorithms, Scalability, and Validation

Joannes Westerink, University of Notre Dame

Conference Program at a Glance

Sunday, June 17

5:00–8:00 PM **Registration** • *Conference Center North Lobby*

6:00–8:00 PM **Welcome Reception** • *Illinois Ballroom*

Monday, June 18

8:00 AM **Registration** • *Conference Center North Lobby*

8:30–8:45 AM **Opening** • *Illinois Ballroom*

8:45–9:45 AM **Keynote Address** • *Illinois Ballroom*
Practical Models for Large-Scale CO₂ Sequestration—Mike Celia

9:45–10:00 AM **Distinguished Alumni Award** presented by University of Illinois Department of Geology to *George Pinder*

10:00–10:20 AM **Refreshment Break** • *Hallway*

10:20 AM–12:00 PM **Plenary Session** • Honoring the Career and Contributions of University of Illinois Alumnus, George Pinder • *Illinois Ballroom*

12:00–12:50 PM **Lunch** • *Illinois Ballroom*

1:00–2:00 PM **Keynote Address** • *Illinois Ballroom*
Environmental Fluid Mechanics in Alpine Environments—Marc Parlange

2:10–3:10 PM **Parallel Talks**

1. Advancing the Prediction Skill and Efficiency of Flood Inundation Models in a Data-Rich Environment: Algorithm Design, Meshing, Coupling and Parameter Estimation • *Quad*
2. CO₂ Sequestration • *Lincoln*
3. Coupled Atmosphere-Surface-Subsurface Models • *Alma Mater Room*
4. Optimization and Uncertainty Analysis of Water Resources from a Systems Perspective • *Humanities*

3:10–3:30 PM **Refreshment Break** • *Hallway*

3:30–5:10 PM **Parallel Talks**

1. Advancing the Prediction Skill and Efficiency of Flood Inundation Models in a Data-Rich Environment: Algorithm Design, Meshing, Coupling and Parameter Estimation • *Quad*
2. CO₂ Sequestration • *Lincoln*
3. Coupled Atmosphere-Surface-Subsurface Models • *Alma Mater*
4. Optimization and Uncertainty Analysis of Water Resources from a Systems Perspective • *Humanities*

6:00–8:00 PM **Poster Session I and Reception** • *NCSA lobby*

Tuesday, June 19

8:00 AM	Registration • <i>Conference Center North Lobby</i>
8:30–9:30 AM	Keynote Address • <i>Illinois Ballroom</i> <i>High-Order Accurate Methods for Free Surface Flows Using High-Order Boussinesq Models</i> —Jan Hesthaven
9:40 AM–10:40 PM	Parallel Talks <ol style="list-style-type: none">1. Advances in Nonlinear and Linear Solvers for Water Resources Applications • <i>Technology</i>2. CO2 Sequestration • <i>Lincoln</i>3. Hybrid Multiscale Models in Subsurface Flow and Transport • <i>Quad</i>4. Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information • <i>Alma Mater</i>
10:40–11:00 AM	Refreshment Break • <i>Hallway</i>
11:00 AM–12:20 PM	Parallel Talks <ol style="list-style-type: none">1. Advances in Nonlinear and Linear Solvers for Water Resources Applications • <i>Technology</i>2. CO2 Sequestration • <i>Lincoln</i>3. Hybrid Multiscale Models in Subsurface Flow and Transport • <i>Quad</i>4. Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information • <i>Alma Mater</i>5. Optimization and Uncertainty Analysis of Water Resources from a Systems Perspective • <i>Humanities</i>
12:20–1:10 PM	Lunch Presentation • <i>Illinois Ballroom</i> <i>Introduction to Heterogeneous Computing</i> —Wen-Mei Hwu
1:15–2:15 PM	Keynote Address • <i>Illinois Ballroom</i> <i>Advances in Theories of Two-Phase Flow in Porous Media; Theoretical, Computational, and Experimental Studies</i> —S. Majid Hassanizadeh
2:20–3:20 PM	Parallel Talks <ol style="list-style-type: none">1. Advances in Nonlinear and Linear Solvers for Water Resources Applications • <i>Technology</i>2. CO2 Sequestration • <i>Lincoln</i>3. General Session • <i>Humanities</i>4. High-Dimensional Computational Modeling of Rivers and Streams • <i>Quad</i>5. Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information • <i>Alma Mater</i>
3:20–3:40 PM	Refreshment Break • <i>Hallway</i>

3:40–5:40 PM	Parallel Talks <ol style="list-style-type: none"> 1. Advances in Nonlinear and Linear Solvers for Water Resources Applications • <i>Technology</i> 2. CO2 Sequestration • <i>Lincoln</i> 3. General Session • <i>Humanities</i> 4. High-Dimensional Computational Modeling of Rivers and Streams • <i>Quad</i> 5. Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information • <i>Alma Mater</i>
6:00–8:00 PM	Poster Session II and Reception • <i>Chancellor Ballroom</i>

Wednesday, June 20

8:00 AM	Registration • <i>Conference Center North Lobby</i>
8:30–9:30 AM	Keynote Address • <i>Illinois Ballroom</i> <i>Playing the Scales: A View on Up Scaling, Multi-Scale Methods and Mesh Adaptation</i> —Margot Gerritsen
9:40–10:40 AM	Parallel Talks <ol style="list-style-type: none"> 1. Advances in Heterogeneous Computing for Water Resources • <i>Technology</i> 2. CO2 Sequestration • <i>Lincoln</i> 3. Data-driven Approaches for Water Resources Forecasting and Knowledge Discovery • <i>Humanities</i> 4. Mixing and Reactions across Scales in Porous Media • <i>Alma Mater</i> 5. Multiphase and Pore-Scale Modeling: Challenges and Perspectives • <i>Quad</i>
10:40–11:00 AM	Refreshment Break • <i>Hallway</i>
11:00 AM–12:20 PM	Parallel Talks <ol style="list-style-type: none"> 1. Advances in Heterogeneous Computing for Water Resources • <i>Technology</i> 2. CO2 Sequestration • <i>Lincoln</i> 3. Computational Ecohydrology • <i>Quad</i> 4. Data-driven Approaches for Water Resources Forecasting and Knowledge Discovery • <i>Humanities</i> 5. Mixing and Reactions across Scales in Porous Media • <i>Alma Mater</i>
12:20–1:10 PM	Lunch • <i>Illinois Ballroom</i>
1:15–2:15 PM	Keynote Address —William Gropp <i>The Next Generation of High Performance Computing</i> • <i>Illinois Ballroom</i>
2:20–3:20 PM	Parallel Talks <ol style="list-style-type: none"> 1. Applying High-Performance Computing for Scientific Discovery within Real-World Problems • <i>Technology</i> 2. Computational Ecohydrology • <i>Quad</i>

	3. Mixing and Reactions across Scales in Porous Media • <i>Alma Mater</i>
	4. Multiphase and Pore-Scale Modeling: Challenges and Perspectives • <i>Humanities</i>
3:20–3:40 PM	Refreshment Break • <i>Hallway</i>
3:40–5:20 PM	Parallel Talks
	1. Advances in Algorithms for Three-Dimensional Incompressible Flow • <i>Lincoln</i>
	2. Applying High-Performance Computing for Scientific Discovery within Real-World Problems • <i>Technology</i>
	3. Computational Ecohydrology • <i>Quad</i>
	4. Mixing and Reactions across Scales in Porous Media • <i>Alma Mater</i>
	5. Multiphase and Pore-Scale Modeling: Challenges and Perspectives • <i>Humanities</i>
3:00–6:30 PM	Tours of the National Petascale Computing Facility (Blue Waters)
6:30–7:30 PM	Reception • <i>Memorial Stadium, Colonnades Room</i>
7:30–9:30 PM	Conference Banquet • <i>Memorial Stadium, Colonnades Room</i>

Thursday, June 21

8:00 AM	Registration • <i>Conference Center North Lobby</i>
8:30–9:30 AM	Keynote Address –Jasper Vrugt <i>An Alternative Blueprint for Hydrologic Modeling and Uncertainty Analysis</i> • <i>Illinois Ballroom</i>
9:40–10:40 AM	Parallel Talks
	1. Applying High-Performance Computing for Scientific Discovery within Real-World Problems • <i>Technology</i>
	2. Mixing and Reactions across Scales in Porous Media • <i>Alma Mater</i>
	3. Multiphase and Pore-Scale Modeling: Challenges and Perspectives • <i>Humanities</i>
	4. Subsurface Biogeochemistry and Reactive Transport Modeling • <i>Lincoln</i>
10:40–11:00 AM	Refreshment Break • <i>Hallway</i>
11:00 AM–12:20 PM	Parallel Talks
	1. Modeling and Analytics for Hydrologic Impact Assessments due to Climate Change • <i>Quad</i>
	2. Numerical Methods for Waves, Circulation and Transport in the Coastal Ocean • <i>Alma Mater</i>
	3. Subsurface Biogeochemistry and Reactive Transport Modeling • <i>Lincoln</i>
	4. Transforming Water Resource Management with Open-Source Community Tools • <i>Technology</i>
12:20–1:10 PM	Lunch • <i>Illinois Ballroom</i>

1:15–2:15 PM

Keynote Address • *Illinois Ballroom*
Forecasting Hurricane Waves, Storm Surge, and Currents: Physics, Algorithms, Scalability, and Validation—Joannes Westerink

2:20–3:20 PM

Parallel Talks

1. Modeling and Analytics for Hydrologic Impact Assessments due to Climate Change • *Quad*
2. Numerical Methods for Waves, Circulation and Transport in the Coastal Ocean • *Alma Mater*
3. Subsurface Biogeochemistry and Reactive Transport Modeling • *Lincoln*
4. Transforming Water Resource Management with Open-Source Community Tools • *Technology*

3:20–3:40 PM

Refreshment Break • *Hallway*

3:40–5:20 PM

Parallel Talks

1. Modeling and Analytics for Hydrologic Impact Assessments due to Climate Change • *Quad*
2. Numerical Methods for Waves, Circulation and Transport in the Coastal Ocean • *Alma Mater*
3. Subsurface Biogeochemistry and Reactive Transport Modeling • *Lincoln*

5:20 PM

Conference Adjourns



Parallel Talks

Monday, June 18 • AM Session 1 • Illinois Ballroom

Honoring the Career and Contributions of University of Illinois Alumnus, George Pinder
Convener: *Mike Celia*, Princeton University

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|-------------|--|
| 10:20–10:45 | Attempts at Describing Nonequilibrium Vadose Zone Flow and Transport Processes at the Field Scale— <i>Rien van Genuchten</i> |
| 10:45–11:10 | Coupled Hydrologic and Geophysical Inversion for Characterization of Nonaqueous Phase Source Zones— <i>Linda Abriola</i> |
| 11:10–11:35 | Groundwater Management Models: Balancing Model Sophistication with Practical Application— <i>David Ahlfeld</i> |
| 11:35–12:00 | George F. Pinder— <i>William Gray</i> |
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Monday, June 18 • PM Session 1 • Quad

Advancing the Prediction Skill and Efficiency of Flood Inundation Models in a Data-Rich Environment: Algorithm Design, Meshing, Coupling and Parameter Estimation

Conveners: *Brett Sanders*, UC Irvine, and *Paul Bates*, Bristol University

- | | |
|-----------|---|
| 2:10–2:30 | Assessing Forecast Skill of a Large Scale 2D Inundation Model of the Lower Zambezi River with Multiple Satellite Data Sets— <i>Guy Schumann (invited)</i> |
| 2:30–2:50 | Building Treatments for Urban Flood Inundation Models and Implications for Redictive Skill and Modeling Efficiency— <i>Jochen Schubert</i> |
| 2:50–3:10 | A WAF Scheme for Shallow Water Equations with Source Terms and Pollutant Transport On Unstructured Grids— <i>Riadh Ata</i> |

Monday, June 18 • PM Session 1 • Lincoln

CO2 Sequestration

Conveners: *Ruben Juanes*, MIT, *Holger Class*, University of Stuttgart

- | | |
|-----------|--|
| 2:10–2:30 | Novel Approaches for Modeling Migration and Trapping at Geologic Scale— <i>Jan M. Nordbotten (invited)</i> |
| 2:30–2:50 | Gravity Currents Arrested by Convective Mixing— <i>Christopher MacMinn</i> |
| 2:50–3:10 | CO2 Geological Sequestration: a Numerical Study in a Real Multi-Compartment Reservoir in the Northern Adriatic Sea, Italy— <i>Nicola Castelletto</i> |

Monday, June 18 • PM Session 1 • *Alma Mater*

Coupled Atmosphere-Surface-Subsurface Models

Conveners: *Reed Maxwell*, Colorado School of Mines, and *Stefan Kollet*, Bonn University

- 2:10–2:30 **High-Resolution, Continental-Scale Simulations with an Integrated Hydrologic Model—*Reed Maxwell***
- 2:30–2:50 **The Effect of Two-Way Dynamical Coupling in a Climate-Hydrological Model Setup—*Morten Andreas Dahl Larsen***
- 2:50–3:10 **Applying Land Surface–Atmosphere Interactions to Improving Wind Energy Forecasting Systems—*John Williams***

Monday, June 18 • PM Session 1 • *Humanities*

Optimization and Uncertainty Analysis of Water Resources from a Systems Perspective

Conveners: *Abhishek Singh*, INTERA Incorporated, and *Genetha Gray*, Sandia National Laboratory

- 2:10–2:30 **A Framework for Evaluating the Net Impact of Algorithm Decisions on Hydrological Model Output: Numerical and Conceptual Abstractions—*James Craig (invited)***
- 2:30–2:50 **An Integrated Systems Model for Performance Assessment of a Low-Level Radioactive Waste Disposal Site—*Abhishek Singh***
- 2:50–3:10 **System-Level Modeling to Support Decision Making with Uncertainty in Radiological Performance Assessment—*John Tauxe***
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Monday, June 18 • PM Session 2 • *Quad*

Advancing the Prediction Skill and Efficiency of Flood Inundation Models in a Data-Rich Environment: Algorithm Design, Meshing, Coupling and Parameter Estimation

Conveners: *Brett Sanders*, UC Irvine, *Paul Bates*, Bristol University

- 3:30–3:50 **Structure of Inundation Flow over Complex Topography—*Ryota Tsubaki (invited)***
- 3:50–4:10 **Flood Prediction in an Urbanized Embayment: Advancing the Predictive Skill of Urban Flood Models Through the Integration of Tide, Surge, Wave and Flood Control Processes—*Timu Gallien***
- 4:10–4:30 **GIS-Based Decision Support Systems for Integrated Two-Dimensional Flood Analysis and Consequence Analysis—*Mustafa Altinakar***
- 4:30–4:50 **A Fast Numerical Model for Tsunami Propagation and Inundation—*Shuangcai Li***
- 4:50–5:10 **Analyzing the Uncertainty from using Different Representations of Physical Processes in Inundation—*Nigel Wright***

Monday, June 18 • PM Session 2 • Lincoln

CO₂ Sequestration

Conveners: *Ruben Juanes*, MIT, and *Holger Class*, University of Stuttgart

- | | |
|-----------|---|
| 3:30–3:50 | Convective Mixing at Late Times: Simulations and Experiments—
<i>Michael Szulczewski</i> |
| 3:50–4:10 | Effective Models for CO ₂ Migration in Geological Systems with Varying
Topography— <i>Sarah Gasda</i> |
| 4:10–4:30 | Coupled Multiphase Flow and Geomechanics for Analysis of Caprock Damage
during CO ₂ Sequestration Operations— <i>Mario Martinez</i> |
| 4:30–4:50 | Estimating Wellbore Permeability of Potential CO ₂ Leakage Pathway—
<i>Qing Tao</i> |
| 4:50–5:10 | Modeling Concepts to Address Risk of Brine Infiltration into Shallow
Groundwater Resources— <i>Lena Walter</i> |

Monday, June 18 • PM Session 2 • Alma Mater

Coupled Atmosphere-Surface-Subsurface Models

Conveners: *Reed Maxwell*, Colorado School of Mines, and *Stefan Kollet*, Bonn University

- | | |
|-----------|---|
| 3:30–3:50 | Subsurface-Landsurface-Atmospheric Feedbacks under a Range of Climate
Conditions— <i>Jehan Rihani</i> |
| 3:50–4:10 | Regional and Global Off-Line Evaluation of the ISBA-TRIP Groundwater
Scheme— <i>Jean-Pierre Vergnes</i> |
| 4:10–4:30 | Numerical Simulation of Groundwater-Surface Interactions by External
Coupling of the 3D Richards Equation and the Full 2D Shallow-Water
Equations— <i>Daniel Caviedes-Voullième</i> |
| 4:30–4:50 | Influence of Soil Texture on the First-Order Exchange Coefficient Coupling for
Simulating Surface-Subsurface Water Interactions— <i>Koen Verbist</i> |
| 4:50–5:10 | Coupling Concepts for Multiphase Porous Medium and Free Flow Systems—
<i>Iryna Rybak</i> |

Monday, June 18 • PM Session 2 • Humanities

Optimization and Uncertainty Analysis of Water Resources from a Systems Perspective

Conveners: *Abhishek Singh*, INTERA Incorporated, and *Genetha Gray*, Sandia National Laboratory

- | | |
|-----------|---|
| 3:30–3:50 | Systems-Based Model for Subsurface Aquifer Recharge and Irrigation Management under Conditions of Uncertainty— <i>Souheil Ezzedine</i> |
| 3:50–4:10 | Stochastic Optimization of Irrigation Systems under Water Resource Constraints from Plot to Regional Scale Using Decomposition— <i>Niels Schütze</i> |
| 4:10–4:30 | Joint Experimental Design and Robust Optimization in Water Resources— <i>Matthieu Parno</i> |
| 4:30–4:50 | The Benefit of Deeper Analysis in Simulation-based Groundwater Optimization Problems— <i>Aswin Kannan</i> |
| 4:50–5:10 | A Parallel Markov Chain Monte Carlo Method for Probabilistic Characterization of Pollutant Sources in Groundwater Systems— <i>Kumar Mahinthakumar</i> |
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Tuesday, June 19 • AM Session 1 • Technology

Advances in Nonlinear and Linear Solvers for Water Resources Applications

Conveners: *Carol Woodward*, Lawrence Livermore National Laboratory, and *Mario Putti*, University of Padua

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|-------------|--|
| 9:40–10:00 | Anderson Acceleration: Algorithms and Implementations— <i>Homer Walker</i> |
| 10:00–10:20 | Anderson Acceleration of Modified Picard Iteration for Variably Saturated Flow— <i>Carol Woodward</i> |
| 10:20–10:40 | A Scalable Nonlinear Solver for Modeling Coupled Hydromechanical Processes in Rainfall-Triggered Landslides— <i>Joshua White</i> |

Tuesday, June 19 • AM Session 1 • Lincoln

CO₂ Sequestration

Conveners: *Ruben Juanes*, MIT, and *Holger Class*, University of Stuttgart

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|-------------|---|
| 9:40–10:00 | A Multi-Rate Dual Porosity Model for Improved Simulation of Immiscible Displacement and Component Transfer in Highly Heterogeneous and Fractured Media— <i>Insa Neuweiler</i> |
| 10:00–10:20 | A Multiscale Approach to Upscaling Multi-Species Reactive Transport from Pore to Macro Scale with Applications to CO ₂ Sequestration— <i>Yashar Mehmani</i> |
| 10:20–10:40 | Characterizing Small-Scale Migration Behavior of Sequestered CO ₂ in a Realistic 2D Geological Fabric— <i>Priya Ravi Ganesh</i> |

Tuesday, June 19 • AM Session 1 • Quad

Hybrid Multiscale Models in Subsurface Flow and Transport

Conveners: *Tim Scheibe*, Pacific Northwest National Laboratory, and *Qinjun Kang*, Los Alamos National Laboratory, *Matthew T. Balhoff*, University of Texas

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|-------------|---|
| 9:40–10:00 | Hybrid Models of Reactive Transport in Porous Media—Ilenia Battiato
(invited) |
| 10:00–10:20 | Coupling Lattice Boltzmann and Continuum Equations for the Solution of Multiscale Flow and Reactive Transport in Porous Media—Ethan Coon |
| 10:20–10:40 | A Triple-Porosity Dual-Permeability Model for Assessment of Radionuclide Transport in Transient Variably Saturated Fracture Flow Conditions—Steve Carle |

Tuesday, June 19 • AM Session 1 • Alma Mater

Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information

Conveners: *Patrick Reed*, Penn State University, and *Ming Pan*, Princeton University

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|-------------|---|
| 9:40–10:00 | Multimodel Bayesian Analysis of Data-Worth: Theory and Applications—Ming Ye |
| 10:00–10:20 | Save Now, Pay Later? Multi-Period Many Objective Groundwater Monitoring Design Given Systematic Model Errors and Uncertainty—Patrick Reed |
| 10:20–10:40 | Assessment of Local Hydraulic Parameters by EnKF Data Assimilation in Real Aquifers: A Case Study in Downtown Padova (Italy)—Matteo Camporese |
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Tuesday, June 19 • AM Session 2 • Technology

Advances in Nonlinear and Linear Solvers for Water Resources Applications

Conveners: *Carol Woodward*, Lawrence Livermore National Laboratory, and *Mario Putti*, University of Padua

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|-------------|---|
| 11:00–11:20 | Low Rank Acceleration of Symmetric/Nonsymmetric Preconditioners for the Nonlinear Richards Equation—Mario Putti |
| 11:20–11:40 | Block FSAI Performance with Graph Partitioning in Large Size Subsurface Problems—Nicola Castelletto |
| 11:40–12:00 | The Algebraic Multigrid Method (AMG) for the Acceleration of Advanced Groundwater Simulation—Peter Thum |
| 12:00–12:20 | Adaptive Accuracy Control of Nonlinear Newton-Krylov Methods for Multiscale Groundwater Simulations—Hieu Nguyen |

Tuesday, June 19 • AM Session 2 • Lincoln

CO2 Sequestration

Conveners: *Ruben Juanes*, MIT, and *Holger Class*, University of Stuttgart

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|-------------|--|
| 11:00–11:20 | Laboratory Measurements of Large-Scale Flows in Carbon Sequestration—<i>Scott Backhaus</i> |
| 11:20–11:40 | Three Dimensional High-Resolution Simulation of Convective Mixing—<i>Xiaojing Fu</i> |
| 11:40–12:00 | Impact of Tight Horizontal Layers on Dissolution Trapping in Geological Carbon Storage—<i>Maria Elenius</i> |
| 12:00–12:20 | Natural Convection in Saline Aquifers with Heterogeneous Permeability—<i>Don Daniel</i> |

Tuesday, June 19 • AM Session 2 • Quad

Hybrid Multiscale Models in Subsurface Flow and Transport

Conveners: *Tim Scheibe*, Pacific Northwest National Laboratory, *Qinjun Kang*, Los Alamos National Laboratory, and *Matthew T. Balhoff*, University of Texas

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|-------------|---|
| 11:00–11:20 | MAP: An Analysis Platform for Multiscale Hydrogeologic Modeling with Emphasis on Hybrid Multiscale Methods—<i>Tim Scheibe (invited)</i> |
| 11:20–11:40 | Multiscale Simulation of Non-Darcy Flows—<i>Seregy Alyaev</i> |
| 11:40–12:00 | Multi-Scale Simulation Study: Integrated Coupling of a Steady-State Two-Phase Dynamic Pore-Scale Model with a Reservoir Simulator—<i>Qiang Sheng</i> |
| 12:00–12:20 | Multiscale Simulation via Direct Substitution of Pore-Scale Models for Darcy-Scale Grids Near Wells—<i>Matthew T. Balhoff</i> |

Tuesday, June 19 • AM Session 2 • Alma Mater

Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information

Conveners: *Patrick Reed*, Penn State University, and *Ming Pan*, Princeton University

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|-------------|---|
| 11:00–11:20 | Improving Groundwater Modeling by Coupled HydroGeophysical Data Assimilation—<i>Gabriele Manoli</i> |
| 11:20–11:40 | Data Assimilation of Land Subsidence Measurements for the Estimation of Reservoir Geomechanical Parameters—<i>Domenico Bau</i> |
| 11:40–12:00 | Inverse Modeling for Estimating Parameters of Groundwater Models with Uncertain Forcing Data—<i>Yonas Demissie</i> |
| 12:00–12:20 | Some Inverse Problems for Groundwater—<i>Nicholas Dudley Ward</i> |

Tuesday, June 19 • AM Session 2 • Humanities

Optimization and Uncertainty Analysis of Water Resources from a Systems Perspective

Conveners: *Abhishek Singh*, INTERA Incorporated, and *Genetha Gray*, Sandia National Laboratory

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| 11:00–11:20 | Incorporating Water Management into a Physically-Based Hydrologic Model—<i>Laura Condon (invited)</i> |
| 11:20–11:40 | Flood Feature Identification and Clustering in Wujiang River, South China—<i>Kairong Lin</i> |
| 11:40–12:00 | Towards The Intelligent Control Of River Flooding. Harmonizing Long-Term Objectives (E.G., Irrigation, Hydropower) with the Flooding Objective—<i>Arturo Leon</i> |
| 12:00–12:20 | Hydraulic Modeling and Optimization for Real-Time Combined Sewer Overflow Decision Support—<i>Andrea Zimmer</i> |
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Tuesday, June 19 • PM Session 1 • Technology

Advances in Nonlinear and Linear Solvers for Water Resources Applications

Conveners: *Carol Woodward*, Lawrence Livermore National Laboratory, and *Mario Putti*, University of Padua

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|-----------|---|
| 2:20–2:40 | Solver Strategies to Ameliorate Barriers to Scalable Performance for Subsurface Reacting Flow Simulations on Leadership-Class Supercomputers Using PFLOTRAN—<i>Richard Mills</i> |
| 2:40–3:00 | Numerical Analyses of Nonlinear (Semi) Discrete Richards Equation for Finite Difference Schemes: Effects of Capillary Parameters—<i>Rachid Ababou</i> |
| 3:00–3:20 | Simulating Non-Dilute Transport in Porous Media Using a TCAT-Based Model—<i>Deena Hannoun</i> |

Tuesday, June 19 • PM Session 1 • Lincoln

CO2 Sequestration

Conveners: *Ruben Juanes*, MIT, and *Holger Class*, University of Stuttgart

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|-----------|--|
| 2:20–2:40 | Modeling Fine-Scale Capillary Heterogeneity in Multiphase Flow of CO2 and Brine in Aquifer Cores—<i>Boxiao Li</i> |
| 2:40–3:00 | Counter-Current Relative Permeability and Immobilization of CO2 in Saline Aquifers—<i>Mohammad Javaheri</i> |
| 3:00–3:20 | Capillary Pinning of CO2 Gravity Currents—<i>Benzhong Zhao</i> |

Tuesday, June 19 • PM Session 1 • Humanities

General Session

Convener: *Praveen Kumar*, University of Illinois at Urbana-Champaign

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| 2:20–2:40 | Parameter Estimation and Uncertainty Quantification of Multiphase Subsurface Flow Models by a New Adaptive Delayed Acceptance Metropolis Hastings Algorithm— <i>Tiangang Cui</i> |
| 2:40–3:00 | Analysis of Accuracy in Formation of Reduced Order Model— <i>Corey Winton</i> |
| 3:00–3:20 | Numerical Flow Field Characterization of the Ripple-Dune Amalgamation Process— <i>Christian Frias</i> |

Tuesday, June 19 • PM Session 1 • Quad

High-Dimensional Computational Modeling of Rivers and Streams

Conveners: *Marcelo Garcia*, University of Illinois at Urbana-Champaign, and *Xiaofeng Liu*, University of Texas-San Antonio

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|-----------|---|
| 2:20–2:40 | Modelling Hydro- and Morphodynamic Responses of River Training Structures— <i>Fredrik Huthoff</i> |
| 2:40–3:00 | Simulation of Flow Field around and Inside Porous Scour Protection with Physical and Realistic Particle Configurations from Computer Graphics— <i>Xiaofeng Liu</i> |
| 3:00–3:20 | Investigation of Parallel Scalability and Speedup for Computation of Stream Flow River Networks Made Out of Hundreds of Thousands of Reaches— <i>Ahmad Tavakoly</i> |

Tuesday, June 19 • PM Session 1 • Alma Mater

Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information

Conveners: *Patrick Reed*, Penn State University, and *Ming Pan*, Princeton University

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| 2:20–2:40 | Identifiability of the Soil Hydraulic Parameters from Drainage Experiments— <i>Noura Fajraoui</i> |
| 2:40–3:00 | Bayesian Estimation of Multiscale Structures in a Binary Medium from Sparse Observations— <i>Jaideep Ray</i> |
| 3:00–3:20 | Data Worth and Optimal Sampling Analyses to Reduce Model Prediction Uncertainty for Groundwater Transport— <i>Hongkyu Yoon</i> |

Tuesday, June 19 • PM Session 2 • Technology

Advances in Nonlinear and Linear Solvers for Water Resources Applications

Conveners: *Carol Woodward*, Lawrence Livermore National Laboratory, and *Mario Putti*, University of Padua

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|-----------|--|
| 3:40–4:00 | Mass Conserving Schemes for Saturated Groundwater Flow—<i>Lea Jenkins</i> |
| 4:00–4:20 | Dimensionality Reduction in the Geostatistical Approach for Hydraulic Tomography—<i>Arvind Saibaba</i> |
| 4:20–4:40 | Level Set Immersed Boundary Method for the Solution of Shallow Water Flow—<i>Edie Miglio</i> |
| 4:40–5:00 | Mass Conservative Domain Decomposition for Fractured Porous Media—<i>Tor Harald Sandve</i> |
| 5:00–5:20 | A Novel Procedure for the Solution of Heterogeneous Anisotropic Transport Problems; Part 1: The Diffusion Problem—<i>Tullio Tucciarelli</i> |

Tuesday, June 19 • PM Session 2 • Lincoln

CO2 Sequestration

Conveners: *Ruben Juanes*, MIT, and *Holger Class*, University of Stuttgart

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| 3:40–4:00 | Nonlinear Solver Based on Flux-Function Trust-Regions for Accurate Modeling of CO2 Plume Migration in Aquifers—<i>Xiaochen Wang</i> |
| 4:00–4:20 | Effect of Heterogeneity on the Miscible Displacement of Fluids—<i>Juan Hidalgo</i> |
| 4:20–4:40 | Modeling Flow and Transport during Enhancement in EGS Reservoirs—<i>Dimitrios Karvounis</i> |
| 4:40–5:00 | An Unfitted Method for Two-Phase Flow in Fractured Porous Media—<i>Anna Scotti</i> |
| 5:00–5:20 | Model for CO2 Leakage through a Fault with Multiphase and Non-Isothermal Effects—<i>Chuanhe Lu</i> |
| 5:20–5:40 | Uncertainty Quantification in Three dimensional Flow, Transport and Geomechanical Simulations in Discrete Fracture Network—<i>Souheil Eggzedine</i> |

Tuesday, June 19 • PM Session 2 • Humanities

General Session

Convener: *Praveen Kumar*, University of Illinois at Urbana-Champaign

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| 3:40–4:00 | Analytical-Numerical Solutions for Density Dependent Flow in a Free Flow Media— <i>Ali Zidane</i> |
| 4:00–4:20 | Two-Phase Simulation of a Variable Rate Infiltration Experiment— <i>Gabriele Manoli</i> |
| 4:20–4:40 | Effect of Root Water and Solute Uptake on Solute Transport in Soils: A 3D Simulation Study— <i>Natalie Schröder</i> |
| 4:40–5:00 | Fugacity-Based Modeling of Contaminant Transport during Floods— <i>Marco Massabo</i> |
| 5:00–5:20 | Assessment of Land Use Land Cover Changes In Middle Godavari (G-5) Sub Basin of River Godavari Using RS and GIS— <i>Gorti Kasi Viswanadh</i> |

Tuesday, June 19 • PM Session 2 • Quad

High-Dimensional Computational Modeling of Rivers and Streams

Conveners: *Marcelo Garcia*, University of Illinois at Urbana-Champaign, and *Xiaofeng Liu*, University of Texas-San Antonio

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| 3:40–4:00 | Numerical Investigation of Density Current over Rough and Uneven Bottom— <i>Yijiu Jiang</i> |
| 4:00–4:20 | Lock-Exchange Gravity Currents with Small Volume of Release Propagating Over Bottom-Mounted Obstacles— <i>Talia Tokyay</i> |
| 4:20–4:40 | Application of 3D Numerical Models in Confluence Hydrodynamics Modeling— <i>Dejana Dordevic</i> |
| 4:40–5:00 | A History of Hydraulic Modeling at the Waterways Experiment Station— <i>William Martin</i> |
| 5:00–5:20 | Three Dimensional Hydrodynamic Modeling of the Chicago River: Comparative Study between EFDC and Delft3D— <i>Sumit Sinha</i> |

Tuesday, June 19 • PM Session 2 • *Alma Mater*

Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information

Conveners: *Patrick Reed*, Penn State University, *Ming Pan*, Princeton University

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| 3:40–4:00 | Linearized Functional Minimization for Inverse Modeling— <i>Marco Dentz</i> |
| 4:00–4:20 | Sequential Monte Carlo Methods for the Calibration of Stochastic Rainfall-Runoff Models— <i>Franz Konecny</i> |
| 4:20–4:40 | Integrated Groundwater Quality Monitoring Network Design Case Study: Eocene Aquifer, Palestine— <i>Abdelhaleem Khader</i> |
| 4:40–5:00 | Enhanced Transparency and Refutability in Modeling Environmental Systems— <i>Mary Hill</i> |
| 5:00–5:20 | Bayesian Characterization of the Uncertainty Associated with Geomorphic, Habitat and Water Quality Data in Vermont Streams— <i>Nikolaos Fytillis</i> |
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Wednesday, June 20 • AM Session 1 • *Technology*

Advances in Heterogeneous Computing for Water Resources

Conveners: *André Brodtkorb*, SINTEF, and *Wen-Mei Hwu*, University of Illinois at Urbana-Champaign

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| 9:40–10:00 | Reporting Performance in the Third Age of GPU Computing - How to Optimize, Verify and Validate GPU Codes— <i>André R. Brodtkorb</i> |
| 10:00–10:20 | Multi-GPU Simulation of Tsunamis Generated by Submarine Landslides— <i>Marc De la Asunción</i> |
| 10:20–10:40 | Shallow Water Simulations on Sparse Grids— <i>Martin Lilleeng Sætra</i> |

Wednesday, June 20 • AM Session 1 • *Lincoln*

CO2 Sequestration

Conveners: *Ruben Juanes*, MIT, and *Holger Class*, University of Stuttgart

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|-------------|---|
| 9:40–10:00 | The Hydrogeologic Environment for Carbon Sequestration: An Analysis of Abnormal Pressures— <i>Jon Sykes</i> |
| 10:00–10:20 | Basin-scale Modeling of CO2 Sequestration in the Basal Sandstone Reservoir of the Illinois Basin—Improving the Geologic Model and Evaluating Risk to Groundwater— <i>Ed Mehnert</i> |
| 10:20–10:40 | Uncertainty Quantification of the CO2 Storage System for a Hypothetical GCS Project in the Southern San Joaquin Basin in California— <i>Haruko Wainwright</i> |

Wednesday, June 20 • AM Session 1 • Humanities

Data-driven Approaches for Water Resources Forecasting and Knowledge Discovery

Conveners: *David Hill*, Rutgers University, *Ken Reckhow*, Duke University & RTI International

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|-------------|--|
| 9:40–10:00 | Modeling Stream Flow Extremes under Non-Time Stationary Conditions—<i>Ci Yang</i> |
| 10:00–10:20 | Oscillatory Hydraulic Tomography—<i>Michael Cardiff</i> |
| 10:20–10:40 | Comparison of Machine Learning Techniques for Prediction of Entrainment of Sediment Particles—<i>Manousos Valyrakis</i> |

Wednesday, June 20 • AM Session 1 • Alma Mater

Mixing and Reactions across Scales in Porous Media

Conveners: *Marco Dentz*, Institute of Environmental Assessment and Water Research (IDAEA), Spanish National Research Council (CSIC), and *Diogo Bolster*, Notre Dame University

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|-------------|---|
| 9:40–10:00 | Mixing and Reaction in Heterogeneous Media—<i>Marco Dentz</i> |
| 10:00–10:20 | Modeling of Non-Fickian Transport in Laboratory Sand Columns: The Role of Solute Heterogeneity—<i>Daniel McInnis</i> |
| 10:20–10:40 | Comparison of Chaotic Flows for Plume Spreading in Aquifers—<i>Roseanna Neupauer</i> |

Wednesday, June 20 • AM Session 1 • Quad

Multiphase and Pore-Scale Modeling: Challenges and Perspectives

Conveners: *Malgo Peszynska*, Oregon State University, and *Vahid Joekar-Niasar*, Utrecht University

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| 9:40–10:00 | Pore-Scale Simulations of Gas Displacing Liquid in a Pore Network Micromodel by the Lattice Boltzmann Method—<i>Haihu Liu</i> |
| 10:00–10:20 | Pore-Network Analysis of Effects of Trapping on Hysteresis in Two-Phase Flow in Porous Media—<i>Florian Doster</i> |
| 10:20–10:40 | Lattice-Boltzmann Modeling of Immiscible Displacement Experiments in a Homogeneous Micromodel—<i>Mark Porter</i> |

Wednesday, June 20 • AM Session 2 • Technology

Advances in Heterogeneous Computing for Water Resources

Conveners: *Andre Brodtkorb*, SINTEF, and *Wen-Mei Hwu*, University of Illinois at Urbana-Champaign

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| 11:00–11:20 | Heterogeneous Parallel Implementation of a Semi-Implicit 3D Hydrodynamic Model—<i>Mario Acosta</i> |
| 11:20–11:40 | Advanced, Hardware-Oriented Shallow Water Simulations Based on the Lattice-Boltzmann Method—<i>Markus Geveler</i> |
| 11:40–12:00 | Simulating Dam-Break Flow through Idealized City Layouts with GPU-Based SPH Method—<i>Jiansong Wu</i> |

Wednesday, June 20 • AM Session 2 • Lincoln

CO2 Sequestration

Conveners: *Ruben Juanes*, MIT, and *Holger Class*, University of Stuttgart

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|-------------|--|
| 11:00–11:20 | Development, Verification and Application of a Coupled Multiphase Flow and Reactive Transport Simulator for Simulation of CO2 Storage in Saline Aquifers—<i>Sebastian Bauer</i> |
| 11:20–11:40 | Sensitivity Analysis in Numerical Simulation of Multiphase Flow for CO2 Storage in Saline Aquifers Using the Probabilistic Collocation Approach—<i>Oscar Garcia-Cabrejo</i> |
| 11:40–12:00 | Stochastic Analysis of Factors Affecting the Leakage of CO2 from Injected Geological Basins—<i>Ana Gonzalez-Nicolas</i> |
| 12:00–12:20 | A Global Sampling-Based Method for Integrating Physics-Specific Subsystems and Assessing Uncertainty Propagation of CO2 Geological Sequestration—<i>Yunwei Sun</i> |

Wednesday, June 20 • AM Session 2 • Quad

Computational Ecohydrology

Conveners: *Valeriy Ivanov*, University of Michigan, and *Enrique Vivoni*, Arizona State University

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| 11:00–11:20 | MIKE SHE-ECOLAB—An Integrated Catchment-Scale Eco-Hydrological Modeling Tool—<i>Michael Butts</i> |
| 11:20–11:40 | Modeling the Effects of Fine-Scale Soil Moisture and Canopy Heterogeneities on Energy and Soil Water Fluxes in a Temperate Mixed Forest—<i>Lingli He</i> |
| 11:40–12:00 | Simulating Transient Hydrologic Behaviors during Forest Clearcut and Pine Plantation with Dynamic Vegetation Growth—<i>Taehee Hwang</i> |
| 12:00–12:20 | Expansion of Bioenergy Crops: Comparison of Its Impacts on Hydrologic Cycle for Three Sites in the Midwestern United States—<i>Phong Le</i> |

Wednesday, June 20 • AM Session 2 • *Humanities*

Data-driven Approaches for Water Resources Forecasting and Knowledge Discovery

Conveners: *David Hill*, Rutgers University, and *Ken Reckhow*, Duke University & RTI International

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|-------------|--|
| 11:00–11:20 | Challenges in Modeling Impacts of Water Rights on Ephemeral Streams— <i>Willem Schreuder</i> |
| 11:20–11:40 | Integrated Machine Learning Techniques in Streamflow Forecasting— <i>Keyvan Asghari</i> |
| 11:40–12:00 | A Data Driven Approach for Understanding Dynamics of Regional Water Resources In The Northern Great Plains— <i>Ganming Liu</i> |
| 12:00–12:20 | Bayesian Fusion for High-Resolution Rainfall Mapping— <i>David Hill</i> |

Wednesday, June 20 • AM Session 2 • *Alma Mater*

Mixing and Reactions across Scales in Porous Media

Conveners: *Marco Dentz*, Institute of Environmental Assessment and Water Research (IDAEA), Spanish National Research Council (CSIC), and *Diogo Bolster*, Notre Dame University

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|-------------|--|
| 11:00–11:20 | Transverse Mixing in Heterogeneous Aquifers— <i>Olaf Cirpka</i> |
| 11:20–11:40 | Upscaling of Transport in Correlated Non Gaussian Velocity Fields: Consequences for Modeling Mixing and Reactions in Porous Media— <i>Pietro De Anna</i> |
| 11:40–12:00 | Anomalous Transport as a Driver for Incomplete Mixing and Anomalous Reactions— <i>Diogo Bolster</i> |
| 12:00–12:20 | A Reduced-Order Model of Fluid Mixing in Strongly Heterogeneous Porous Media— <i>Birendea Jha</i> |

Wednesday, June 20 • PM Session 1 • *Technology*

Applying High-Performance Computing for Scientific Discovery within Real-World Problems

Conveners: *Glenn Hammond*, Pacific Northwest National Laboratory, and *Haibing Shao*, Helmholtz Center for Environmental Research - UFZ

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| 2:20–2:40 | MPiTOUGH2-EMGeo—A Massively Parallel Data Inversion Framework for Joint Hydrogeophysical Real-World Applications— <i>Michael Commer</i> |
| 2:40–3:00 | Simulation of Technetium-99 migration at the Hanford BC Cribs Site Using HPC— <i>Vicky Freedman</i> |
| 3:00–3:20 | The role of HPC on Subsurface Simulation of U(VI) Transport at the Hanford 300 Area— <i>Glenn Hammond</i> |

Wednesday, June 20 • PM Session 1 • Quad

Computational Ecohydrology

Conveners: *Valeriy Ivanov*, University of Michigan, and *Enrique Vivoni*, Arizona State University

- 2:20–2:40 Can Submerged Plants in the Littoral Zone of Groundwater-Dominated Lakes Act as Hydraulic Barriers?—*Peter Engesgaard*
- 2:40–3:00 Hydraulic Resistance to Overland Flow on Vegetated Hillslopes with Mobile Bed—*Jongho Kim*
- 3:00–3:20 Simulation of the Thermal and Hydraulic Behavior of an Individual Tree within a Forest—*Stacy Howington*

Wednesday, June 20 • PM Session 1 • Alma Mater

Mixing and Reactions across Scales in Porous Media

Conveners: *Marco Dentz*, Institute of Environmental Assessment and Water Research (IDAEA), Spanish National Research Council (CSIC), and *Diogo Bolster*, Notre Dame University

- 2:20–2:40 Persistence of Incomplete Mixing in Heterogeneous Porous Media—*Tanguy Le Borgne*
- 2:40–3:00 Evaluating Effective Reaction Rates of Kinetically Driven Solutes in Large-Scale, Statistically Anisotropic Media: Implications of Pore Scale Mixing and Preferential Flow Pathways at the Field Scale—*Erica Sirila*
- 3:00–3:20 Global Random Walk Solutions to PDF Evolution Equations—*Peter Knabner*

Wednesday, June 20 • PM Session 1 • Humanities

Multiphase and Pore-Scale Modeling: Challenges and Perspectives

Conveners: *Malgo Peszynska*, Oregon State University, and *Vahid Joekar-Niasar*, Utrecht University

- 2:20–2:40 Macroscopic Phase Field Model of Partial Wetting in Confined Geometries: from Capillaries to Porous Media—*Luis Cueto-Felgueroso*
- 2:40–3:00 Lattice Boltzmann Method for Air-Water Distribution Modeling at the Pore Scale—*Alain Genty*
- 3:00–3:20 Simulation of Capillary-Controlled Displacements in 3D Rock Images by a Variational Level Set Method—*Espen Jøttestuen*

Wednesday, June 20 • PM Session 2 • Lincoln

Advances in Algorithms for Three-Dimensional Incompressible Flow

Conveners: *William Layton*, University of Pittsburgh, and *Chris Kees*, US Army Engineer Research and Development Center

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| 3:40–4:00 | Algorithms for the Simulation of Incompressible Turbulent Mixing— <i>James Glimm</i> |
| 4:00–4:20 | Modern Ideas in Turbulence Confront Legacy Codes— <i>William Layton</i> |
| 4:20–4:40 | A Three-Scale Variational Multiscale Method for Incompressible Turbulent Flows in Domains with Moving Boundaries— <i>Ramon Calderer</i> |
| 4:40–5:00 | Higher Order Methods for Turbulent Air/Water Flow Interacting with Moving Structures— <i>Chris Kees</i> |
| 5:00–5:20 | An Immersed Boundary Model of Swimming Sheets in a Viscoelastic Fluid— <i>John Crispell</i> |

Wednesday, June 20 • PM Session 2 • Technology

Applying High-Performance Computing for Scientific Discovery within Real-World Problems

Conveners: *Glenn Hammond*, Pacific Northwest National Laboratory, and *Haibing Shao*, Helmholtz Center for Environmental Research – UFZ

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| 3:40–4:00 | Modeling Enhanced Geothermal Systems using the Massively Parallel Sub-Surface Reactive Flow and Transport Simulator PFLOTTRAN— <i>Satish Karra</i> |
| 4:00–4:20 | Contaminant Plume Modeling at Oak Ridge Integrated Field Research Challenge Site using High Performance Computing— <i>Jitu Kumar</i> |
| 4:20–4:40 | Metal Release and Transport in Potential Drinking Water Aquifers Impacted by Stored CO ₂ — <i>Alexis Navarre-Sitchler</i> |
| 4:40–5:00 | High-Performance Computing Techniques Applied to the Characterization and Optimization of a Thermochemical Heat Storage System for Concentrated Thermal Solar Power— <i>Haibing Shao</i> |

Wednesday, June 20 • PM Session 2 • Quad

Computational Ecohydrology

Conveners: *Valeriy Ivanov*, University of Michigan, *Enrique Vivoni*, Arizona State University

- 3:40–4:00 A Dynamic Plant Water and Carbon Balance Model for Testing Tree Mortality Mechanisms Under Climate-Driven Disturbances—*Scott MacKay*
- 4:00–4:20 Resilience Induced Sub-Optimal Carbon Allocation in Plants—*Venkat Srinivasan*
- 4:20–4:40 Mechanistic Linking of Stomata Conductance to Soil Moisture Using a Tree Level Hydrodynamic Model—*Ashley Matheny*
- 4:40–5:00 The “Non-Effect” of Grassland Management on Local and Watershed Ecohydrology—*Simone Fatichi*
- 5:00–5:20 Modeling the Role of Solar Radiation on Landscape Ecogeomorphic Development—*Erkan Istanbulluoglu*

Wednesday, June 20 • PM Session 2 • Alma Mater

Mixing and Reactions across Scales in Porous Media

Conveners: *Marco Dentz*, Institute of Environmental Assessment and Water Research (IDAEA), Spanish National Research Council (CSIC), and *Diogo Bolster*, Notre Dame University

- 3:40–4:00 Lagrangian Chaos and Mixing in Porous Media—*Daniel Lester*
- 4:00–4:20 Quantifying Mixing and Subsequent Reactions across a Heterogeneous Porous Interface—*Ricky Villarreal*
- 4:20–4:40 A Novel Computational Framework for Bimolecular Diffusive-Reactive Systems—*Kalyana Nakshatrala*
- 4:40–5:00 Anomalous Transport of Strontium in Reactive Porous Media—*Valentina Prigiobbe*

Wednesday, June 20 • PM Session 2 • Humanities

Multiphase and Pore-Scale Modeling: Challenges and Perspectives

Conveners: *Malgo Peszynska*, Oregon State University, *Vahid Joekar-Niasar*, Utrecht University

- 3:40–4:00 Continuum and Discrete Models of Adsorption at Porescale and Corescale—*Malgorzata Peszynska*
- 4:00–4:20 Numerical Modeling of Flow through Porous Structures and Vegetated Regions—*Steven Mattis*
- 4:20–4:40 Pore-Core Upscaling of Flow and Transport with Inertia and Anisotropy—*Anna Trykozko*
- 4:40–5:00 Numerics of Charged Transport in Porous Media at Pore and Field Scale—*Florian Frank*
- 5:00–5:20 Analysis of Capillary Pressure in a Two-Fluid-Phase Porous Medium System—*Amanda Dye*

Thursday, June 21 • AM Session 1 • *Technology*

Applying High-Performance Computing for Scientific Discovery within Real-World Problems

Conveners: *Glenn Hammond*, Pacific Northwest National Laboratory, and *Haibing Shao*, Helmholtz Center for Environmental Research - UFZ

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|-------------|---|
| 9:40–10:00 | An Asynchronous Solver for Differential Equations Arising from River Basin Models— <i>Scott Small</i> |
| 10:00–10:20 | Agni: Coupling Model Analysis Tools and High-Performance Subsurface Flow and Transport Simulators for Risk and Performance Assessments— <i>Velimir (Monty) Vesselinov</i> |
| 10:20–10:40 | Real-world Hydrologic Assessment of a Fully-Distributed Hydrological Model in a Parallel Computing Environment— <i>Enrique Vivoni</i> |

Thursday, June 21 • AM Session 1 • *Alma Mater*

Mixing and Reactions across Scales in Porous Media

Conveners: *Marco Dentz*, Institute of Environmental Assessment and Water Research (IDAEA), Spanish National Research Council (CSIC), and *Diogo Bolster*, Notre Dame University

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| 9:40–10:00 | The Pruned-Enriched Method for Simulations of Continuous Time Random Walks— <i>Jiang Jianguo</i> |
| 10:00–10:20 | Macroscopic Modeling of Anomalous Transport on Heterogeneous Lattice Networks— <i>Peter Kang</i> |
| 10:20–10:40 | Transverse Mixing Enhancement in Heterogeneous Anisotropic Porous Media— <i>Gabriele Chiogna</i> |

Thursday, June 21 • AM Session 1 • *Humanities*

Multiphase and Pore-Scale Modeling: Challenges and Perspectives

Conveners: *Malgo Peszynska*, Oregon State University, and *Vahid Joekar-Niasar*, Utrecht University

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| 9:40–10:00 | Direct Simulations of Interface Dynamics: Linking Capillary Pressure, Interfacial Area and Surface Energy— <i>Andrea Ferrari</i> |
| 10:00–10:20 | The Effect of Microporosity on Transport Properties of Porous Media— <i>Yashar Mehmani</i> |
| 10:20–10:40 | Representation of Pore-Scale Heterogeneity and Prediction of Multi-Phase Flow Functions in Carbonate Rocks— <i>Zeyun Jiang</i> |

Thursday, June 21 • AM Session 1 • Lincoln

Subsurface Biogeochemistry and Reactive Transport Modeling

Conveners: *Brent Sleep*, University of Toronto, and *Peter Knabner*, University of Erlangen

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|-------------|---|
| 9:40–10:00 | The Role of Microbial Heterogeneity in Pesticide Degradation in Agricultural Soils— <i>Philip Binning</i> |
| 10:00–10:20 | Simulating the Reactive Transport of Selenium in a Regional Irrigated Agricultural Groundwater System— <i>Ryan Bailey</i> |
| 10:20–10:40 | Advection in Bioirrigated Muddy Sediments—Can It Be Relevant? A Model Study— <i>Gunnar Nützmann</i> |
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Thursday, June 21 • AM Session 2 • Quad

Modeling and Analytics for Hydrologic Impact Assessments due to Climate Change

Conveners: *Auroop Ganguly*, Northeastern University, and *Mukesh Kumar*, Duke University

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|-------------|--|
| 11:00–11:20 | Exploring Data Mining and Machine Learning Methods for Hydrology— <i>Karsten Steinhaeuser (invited)</i> |
| 11:20–11:40 | Toward a Bayesian Approach for Quantifying Regional Uncertainty in Precipitation Extremes using Global Climate Models— <i>Evan Kodra</i> |
| 11:40–12:00 | Coupling the MIKE SHE Hydrological Modeling Tool with the HIRHAM Regional Climate Model using OpenMI— <i>Martin Drews</i> |
| 12:00–12:20 | Integrated Flow and Water Quality Modeling for Ecosystem Restoration in the Lake Calumet Area— <i>Yanqing Lian</i> |

Thursday, June 21 • AM Session 2 • Alma Mater

Numerical Methods for Waves, Circulation and Transport in the Coastal Ocean

Conveners: *Clint Dawson*, and *Casey Dietrich*, University of Texas

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| 11:00–11:20 | Non-Gaussian Data Assimilation with Stochastic Boussinesq Equations for Coastal Ocean Dynamics— <i>Pierre Lermusiaux</i> |
| 11:20–11:40 | Modeling Lake Michigan Hydrodynamics: A Parallel Way— <i>Sultan Ahmed</i> |
| 11:40–12:00 | Numerical Modeling of Nonlinear Water Waves with Sigma Coordinate and Layer Thickness Optimization— <i>Ling Zhu</i> |
| 12:00–12:20 | A Boussinesq Scaling Approach to Solving Near Shore Phase Resolving Nonlinear Waves— <i>Aaron Donahue</i> |

Thursday, June 21 • AM Session 2 • *Lincoln*

Subsurface Biogeochemistry and Reactive Transport Modeling

Conveners: *Brent Sleep*, University of Toronto, and *Peter Knabner*, University of Erlangen

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|-------------|---|
| 11:00–11:20 | Pore Network Model Development to Study Dissolution and Precipitation of Carbonate Rocks— <i>Juan Nogues</i> |
| 11:20–11:40 | Using Streamlines for Highly-Resolved, Reactive Transport CO ₂ Leakage Scenarios to Examining the Influence of Uncertain Subsurface Conditions on Probabilistic Risk of Groundwater Contamination— <i>Adam Atchley</i> |
| 11:40–12:00 | A Multiscale Lagrangian Approach for the Numerical Simulation of Solute Mixing in Heterogeneous Porous Media— <i>Paulo Herrera</i> |
| 12:00–12:20 | Hyperbolic Theory for Heterovalent Ion-Exchange— <i>Marc Hesse</i> |

Thursday, June 21 • AM Session 2 • *Technology*

Transforming Water Resource Management with Open-Source Community Tools

Conveners: *David Moulton*, Los Alamos National Laboratory, and *Ian Gorton*, Pacific Northwest National Laboratory

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|-------------|---|
| 11:00–11:20 | Akuna—An Open Environment for Advanced Simulation— <i>Ellen Porter</i> |
| 11:20–11:40 | A Methodology for Management of Heterogeneous Site Characterization and Modeling Data— <i>Deb Agarwal</i> |
| 11:40–12:00 | Amanzi: A Parallel Open-Source Flow and Reactive-Transport Simulator for Environmental Applications— <i>David Moulton</i> |
| 12:00–12:20 | H2OLAB: A Numerical Platform for the Stochastic Modeling of Complex Porous and Fractured Media— <i>Jean-Raynald De Dreuzy</i> |

Thursday, June 21 • PM Session 1 • *Quad*

Modeling and Analytics for Hydrologic Impact Assessments due to Climate Change

Conveners: *Auroop Ganguly*, Northeastern University, and *Mukesh Kumar*, Duke University

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| 2:20–2:40 | Using Observations to Better Assess Climate Change Impacts on Streamflow in the Western U.S.— <i>David Pierce (invited)</i> |
| 2:40–3:00 | Predictive Insights for Precipitation Extremes under Non-Stationary Climate— <i>Debasish Das</i> |
| 3:00–3:20 | Current and Future Assessment of the Main Aquifer Units Contribution to the River Discharge of the Loire Basin during Low Flow— <i>Nicolas Flipo</i> |

Thursday, June 21 • PM Session 1 • *Alma Mater*

Numerical Methods for Waves, Circulation and Transport in the Coastal Ocean

Conveners: *Clint Dawson*, and *Casey Dietrich*, University of Texas

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| 2:20–2:40 | Discontinuous Galerkin Methods for Variable Density Groundwater Flow and Solute Transport— <i>Clint Dawson</i> |
| 2:40–3:00 | Computationally Efficient Numerical Model for the Evolution of Directional Ocean Surface Waves— <i>Matt Malej</i> |
| 3:00–3:20 | Smoothed Particle Hydrodynamics Modeling of Wave Energy Dissipation— <i>Keyvan Asghari</i> |

Thursday, June 21 • PM Session 1 • *Lincoln*

Subsurface Biogeochemistry and Reactive Transport Modeling

Conveners: *Brent Sleep*, University of Toronto, and *Peter Knabner*, University of Erlangen

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| 2:20–2:40 | Identification of Biogeochemical Degradation Parameters of Propylene Glycol by Complex Modeling— <i>Alexander Prechtel</i> |
| 2:40–3:00 | Uncertainty Analysis in Groundwater Dating with Environmental Tracers using Markov Chain Monte Carlo Method— <i>Arash Massoudieh</i> |
| 3:00–3:20 | Modeling Isotope Fractionation Associated with Aqueous Phase Diffusion— <i>Shu Xu</i> |

Thursday, June 21 • PM Session 1 • *Technology*

Transforming Water Resource Management with Open-Source Community Tools

Conveners: *David Moulton*, Los Alamos National Laboratory, and *Ian Gorton*, Pacific Northwest National Laboratory

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| 2:20–2:40 | OpenGeoSys: An Open Source Project for Numerical Simulation of THMC Processes— <i>Reza Zolfaghari</i> |
| 2:40–3:00 | Parallel Computational Methods and Simulation for Coastal and Hydraulic Applications Using the Proteus Toolkit— <i>Matthew Farthing</i> |
| 3:00–3:20 | Proost, an Open Source Framework for Geohydrological Research and Modeling— <i>Luit Jan Slooten</i> |

Thursday, June 21 • PM Session 2 • *Quad*

Modeling and Analytics for Hydrologic Impact Assessments due to Climate Change

Conveners: *Auroop Ganguly*, Northeastern University, and *Mukesh Kumar*, Duke University

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|-----------|--|
| 3:40–4:00 | Assessment of Ecohydrological Impacts Under Climate Change Scenarios from CMIP5— <i>Jitendra Kumar</i> |
| 4:00–4:20 | Estimation of Climate Change Impacts on the Coupled Surface-Subsurface Hydrosystem of the Upper Rhine Graben— <i>Florence Habets</i> |
| 4:20–4:40 | Impact of Climate Change on Canadian Surface Water and Groundwater Resources: A Continental-scale Hydrologic Modeling Study using Multiple High-resolution RCM Projections— <i>Jianming Chen</i> |
| 4:40–5:00 | Evidences and Signals of Climate Change on Tropical Andean Mountain Watersheds: Chinchina River Basin, Colombia— <i>Olga Ocampo</i> |
| 5:00–5:20 | The Climatic Effects of Deforestation in South and Southeast Asia— <i>Rachindra Mawalagedara</i> |

Thursday, June 21 • PM Session 2 • *Alma Mater*

Numerical Methods for Waves, Circulation and Transport in the Coastal Ocean

Conveners: *Clint Dawson*, and *Casey Dietrich*, University of Texas

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| 3:40–4:00 | Aspects of a Hydrologic/Hydrodynamic Coupled Model System with Application to Coastal Inundation in North Carolina— <i>Randall Kolar</i> |
| 4:00–4:20 | A Fully Coupled Unstructured-Grid Model for Wind Wave-Current Interaction in Large-Scale Applications— <i>Joseph Zhang</i> |
| 4:20–4:40 | Development of a Coastal Inundation Model using a Triangular Discontinuous Galerkin Method— <i>Shivasubramanian Gopalakrishnan</i> |
| 4:40–5:00 | ERDC's Coastal Storm Modeling System: Systems Integration— <i>Chris Massey</i> |
| 5:00–5:20 | Surface Trajectories of Oil Transport along the Northern Coastline of the Gulf of Mexico— <i>Casey Dietrich</i> |

Subsurface Biogeochemistry and Reactive Transport Modeling

Conveners: *Brent Sleep*, University of Toronto, and *Peter Knabner*, University of Erlangen

- 3:40–4:00 **Employing Laguerre Function Bases to Extend Analytic Transport Solutions to Arbitrary Boundary Conditions: Mathematical Underpinnings of a New Modelling Technique for Multi-component Dissolution with Reactive Transport—*Scott Hansen***
- 4:00–4:20 **Chemotaxis Modelling in Heterogeneous Porous Media Using Smoothing Particle Hydrodynamics—*Diego Avesani***
- 4:20–4:40 **Use of Messenger RNA to Predict Microbial Degradation Kinetics—Development of a New Conceptual Model for Vinyl Chloride Dechlorination by Dehalococcoides—*Julie Chambon***
- 4:40–5:00 **Flocculation in the Context of the Advection-Diffusion-Reaction Equation—*Oleh Krehel***
- 5:00–5:20 **Insights from Particle Tracking Algorithm on the Effect of Motility on Bacterial Transport in Porous Media—*Nanxi Lv***



Poster Session I

Monday, June 18, 6:00-8:00 PM

National Center for Supercomputing Applications (NCSA) Lobby

Advancing the Prediction Skill and Efficiency of Flood Inundation Models

- P1** A Fast Numerical Model for Tsunami Propagation and Inundation—*Byunghyun Kim*
- P2** GIS Based Adaptive Grid Solution to Flood Inundation—*Shuangcai Li*

High-Dimensional Computational Modeling of Rivers and Streams

- P3** Effects of Self-Stratification on Turbidity Currents: A Large Eddy Simulation Approach—*Som Dutta*
- P4** Validation of a 2D Depth-Averaged Rigid-Lid Model Against Velocity Measurements For A High-Amplitude Meandering Flume—*Roberto Fernandez*
- P5** Three Dimensional Lagrangian Model for Fate and Transport of Silver and Bighead Carp Eggs—*Tatiana Garcia*
- P6** 3D-Numerical Simulation of The Flow in Pool and Weir Fishways—*Shadi Aknooni*
- P7** WITHDRAWN—Using High Performance Computing to Assess the Impact of Climate Change on the Hydrologic Response of the Santa Cruz and San Pedro River Basins—*Enrique Vivoni*

Coupled Atmosphere-Surface-Subsurface Models

- P8** Improving Surface and Subsurface Hydrologic Processes within the Community Land Surface Model (CLM): Coupling PFLOTRAN and CLM—*Gautam Bisht*
- P9** Linking Surface 3H to 3H-3He Groundwater Age by Gas-Liquid Phase Transport Modeling—*Steven Carle*
- P10** Conduit Flow Modeling of Karst Systems in Guilin, China—*Yanqing Lian*
- P11** An Inter-Comparison Of Two Coupled Hydrogeological Models—*Jens-Olaf Delfs*

General Session

- P12** Numerical Flow Experiments on Samples of Heterogeneous Unsaturated Porous Media: Upscaling of Permeability-Pressure Curve—*Rachid Ababou*
- P13** Full Tensor Representation of Anisotropy in Hydraulic Conductivity: Effects on Simulating Discharge of Groundwater to Lakes—*Peter Engesgaard*
- P14** Adjoint Methodology to Simulate Stream Depletion due to Pumping in a Non-linear Coupled Groundwater and Surface Water System—*Scott Griebeling*
- P15** Morphometric Analysis at Miniwatershed Level Using GIS—*Gorti Kasi Viswanadh*

- P16** Region Growing Based Segmentation for the Estimation of Transmissivity Zone Structure—*Georgios Kopsiaftis*
- P17** Numerical Modeling of Ogee Crest Spillway and Tainter Gate Structure of a Diversion Dam on Cañar River, Ecuador—*Viviana Morales*
- P18** The Effect of Macro-Kinetic Solutes on Human Health Risk with Time-Dependent Exposure—*Erica Siirila*
- P19** Effect of Woody Vegetation on Hydraulic Conductivity at Various Levee Systems Using Numerical Models—*Fred Tracy*
- P20** Tabulation of Saturation Models—*Dragan Vidovic*
- P21** The Effect of Mechanical Dispersion on Miscible Density-Driven Instabilities in a Hele-Shaw Cell with Horizontal Flow—*Jean-Régis Angilella*
- P22** 3-D versus 2-D Modeling of Natural Aquifers: The Experimental Site of Settolo, Italy—*Francesco Zovi*
- P23** Hydraulic Performance Graph-Based Model for Unsteady Flow Simulations in Topologically Complex River Networks—*Arturo Leon*
- Optimization and Uncertainty Analysis of Water Resources from a Systems Perspective*
- P24** Evaluation of the Dispersion Processes in Conditioned Transmissivity Field—*Giovanna Darvini*
- P25** Toward Reduction of Uncertainty in Complex Multi-Reservoir River Systems—*Nathan Gibson*
- P26** Delineation of Hydrofacies in Heterogeneous Aquifers using the Truncated Plurigaussian Method: A Field Case Study In Northern Italy—*Raul Perulero Serrano*
- P27** Stochastic System-Level Modeling of a Hydropower System to Inform Operational Decision Making—*John Tauxe*
- P28** A Socioeconomic Framework for Incorporating Stakeholder Preferences in the Optimization of Distributed Best Management Practices—*Adriana Piemonti*

Poster Session II

Tuesday, June 19, 6:00-8:00 PM

I Hotel & Conference Center • Chancellor Ballroom

Advances in Heterogeneous Computing for Water Resources

P1 Shallow Water Simulations on Graphics Processing Units—*André R. Brodtkorb*

Applying High-Performance Computing for Scientific Discovery within Real-World Problems

P2 Comparison of Parallel Solvers for Large-Scale Groundwater Contaminant Transport Simulations—*Kumar Mahinthakumar*

P3 PFLOTRAN: Next-Generation Petascale Subsurface Reactive Flow and Transport Code—*Glenn Hammond*

Advances in Nonlinear and Linear Solvers for Water Resources Applications

P4 Determination of Discharge Storage Relation Using Numerical Models for Homogeneous 2D Vertical Hillslope—*Melkamu Alebachew Ali*

P5 Simulating Groundwater Flow in Fractured Porous Media using the Analytic Element Method—*Ivan Marin*

P6 Performance of Parallel Linear Iterative Preconditioners and Solvers from a Finite Element Model of Woody Vegetation on Levees—*Fred Tracy*

P7 A Novel Procedure for the Solution of the Heterogeneous Anisotropic Transport Problem. Part 2: The Time-Dependent Flow and Convectiondiffusion Problem—*Tullio Tucciarelli*

CO2 Sequestration

P8 Pore-Scale Investigation of Unstable Viscous and Capillary Fluid Displacement Using Smoothed Particle Hydrodynamics—*Uditha Bandara*

P9 Three-Dimensional Gas Migration Model for the Leroy Natural Gas Storage Facility—*Mingjie Chen*

P10 Optimization of Geological Carbon Sequestration using Semi-Analytical Leakage Models linked to a Multi-objective Evolutionary Algorithm—*Brent Cody*

P11 Simulation of Supercritical Carbon Dioxide Leakages in Fractured Porous Reservoir—*Souheil Ezzedine*

P12 Assessing Impact of CO2 Leakage in Groundwater Aquifers in the Presence of Data Uncertainties—*Kayyum Mansoor*

P13 Improvements in Simplified Modeling of CO2 Geologic Sequestration—*Yagnadeepika Oruganti*

P14 Optimization of Geothermal Circulation Coupling Surface Dissolution CO₂ Storage—*Qing Tao*

P15 A Novel Fully Coupled Geomechanical Model for CO₂ Sequestration in Fractured and Porous Brine Aquifers—*Philip Winterfeld*

Multiphase and Pore-Scale Modeling: Challenges and Perspectives

P16 Rate-Dependent Equilibrium Saturation Distributions through Hysteresis in Two-Phase Flow in Porous Media—*Florian Doster*

P17 Semi-Analytical Computation of Three-Phase Capillary Entry Pressures and Arc Menisci Configurations in 2D Rock Images—*Johan Olav Helland*

P18 Coupled Flow and Transport with Additional Electrostatic Interaction—*Matthias Herz*

P19 Simulating Air-Entrapment in Low Permeability Mudrocks using a Macroscopic Invasion Percolation Model—*Abhishek Singh*

P20 Computer Generated Particle Arrangement for Pore Scale Modeling—*Rusen Sinir*

P21 Taxila LBM: A Lattice-Boltzmann Simulator For Single- And Multi-Phase Flow In Complex Porous Media—*Mark Porter*

Mixing and Reactions across Scales in Porous Media

P22 Understanding the Evolution of Miscible Viscous Fingering Patterns—*Jane Chui*

P23 Multicomponent Reactive Transport Modeling in A 1D Column—*Leonardo Donado*

P24 Modeling Bacterial Transport with Horizontal Gene Transfer in Porous Media—*Tamir Kamai*

P25 Agent-Based Simulation of Reactive Solute Transport—*Daniel McInnis*

P26 Incomplete Mixing and Reaction in Heterogeneous Porous Media: A Particle Based Numerical Study—*Amir Paster*

P27 Pore-Scale Determination of Macroscopic Coefficients for Macroscale Modeling of Reactive Transport Flow in Porous Media—*Clément Varloteaux*

P28 Quantifying the Impact of Viscosity Variations Induced by a Chemical Reaction on Mixing Efficiency in Porous Media—*Hongkyu Yoon*

P29 A Novel Transition Rate Transformation Method for Solute Transport—*Jiang Jianguo*

Subsurface Biogeochemistry and Reactive Transport Modeling

P30 Coupled Flow and Contaminant Transport Models for Toxic Elements Associated with the Marcellus Shale Flowback and Produced Water; It's Application to Human Exposure and Risk Assessment—*Sina Arjmand*

P31 Application of Flux Corrected Transport for Multicomponent Reactive Transport Modeling—*Oscar Garcia-Cabrejo*

- P32** The Effect of Soil Heterogeneity on Dissolution and Microbial Kinetics During Enhanced Bioremediation of DNAPL Source Zones—*Amalia Kokkinaki*
- P33** A Massively Parallel Fully-Coupled Fully-Implicit Solution To Reactive Transport in Porous Media Using Preconditioned Jacobian-Free Newton-Krylov (JFNK) Method—*Chuan Lu*
- P34** Multi-component Reactive Transport Modeling of PCE Degradation at the Pilot Scale Constructed Wetland Bitterfeld, Germany—*Reza Zolfaghari*
- P35** Uncertainty Qualification of Biogeochemical Models for Ethanol-Stimulated Uranium (VI) Reduction in Subsurface Sediments—*Ming Ye*
- P36** Simulating Nitrate and Potassium Ion Transport Following the Application of Vinasse to Laboratory Soil Columns—*Jarbas Miranda*
- P37** Transport of *Cryptosporidium Parvum* Oocysts in a Silicon Micromodel—*Yuan Yuan Liu*
- P38** A Generic Reaction-Based BioGeoChemical Simulator—*Matthew Farthing*

General

- P39** A Multi-dimensional Particle Tracking Computer Program for Environmental Research and Study—*Stacy Howington*

Linking Observation and Prediction: Frameworks for Data Assimilation, Uncertainty Analysis and Valuing Information

- P40** Estimating Hydraulic Conductivity Geostatistical Parameters using An Iterative Ensemble Smoother Scheme—*Ryan Bailey*
- P41** Statistical Reconstruction of Subsurface Hydro-Meteorological and Crack Aperture Time Series Based on Residual Auto-Regressive Processes and Other Techniques—*Rachid Ababou*
- P42** Hybrid Uncertainty Quantification Techniques for Reactive Transport Applications—*Xiao Chen*
- P43** Machine Learning Algorithms of Soil Drying—*Evan Coopersmith*
- P44** Model Calibration with External Error Models—*Daniel Erdal*
- P45** Model Analysis and Decision Support (MADS) for Complex Physics Models—*Dylan Harp*
- P46** Sensitivity Analysis of Parameter and State Estimation of Groundwater Flow and Transport Models—*Graciela del Socorro Herrera*
- P47** A Geostatistical Approach to Estimating River Bathymetry in Near Real-Time—*Barbara Minsker*
- P48** Modeling Groundwater Flow through Dikes for Real Time Stability Assessment—*John Van Esch*
- P49** A Dual Strategy for Ensemble Kalman Data Assimilation with a Coupled Subsurface Contaminant Transport Model—*Mohamad El Gharamti*

Data-driven Approaches for Water Resources Forecasting and Knowledge Discover

P50 In-river Rating Curves Interpolation for a Better Assessment of Stream-Aquifer Exchanges in a Regional Distributed Hydro(geo)logical Model: Application to the Central Area of the Seine Basin—*Nicolas Flipo*

P51 Improving Groundwater Flow Model Prediction Using Complementary Data-Driven Models—*Tianfang Xu*

P52 Modeling Stream Flow Extremes under Non-Time-Stationary Conditions—*Ci Yang*

Modeling and Analytics for Hydrologic Impact Assessments due to Climate Change

P53 Theoretical Analysis of Topographical, Geological and Climatic Controls on the Groundwater System—*Etienne Bresciani*

P54 Evaluating and Comparing Current and Next Generation Climate Model-Simulated Precipitation Mean States and Extremes—*Devashish Kumar*

P55 Finite Element Method for Single-phase and Multi-phase Partly Saturated Subsurface Flow—*John Van Esch*

P56 Hydrologic Impact Assessment due to Climate Change at Chinchina River Basin, Colombia—*Olga Ocampo*

Computational Ecohydrology

P57 Use of a Distributed Sensor Network to Parameterize a Model of Flows between the Soil, Vegetation, and Atmosphere in a Mixed Savanna-Agricultural Catchment in South Eastern Burkina Faso—*Natalie Ceperley*

P58 Deciphering the Role of Climate and Land Use on Regional Hydrologic Trends: A Modeling Study of the Upper Mississippi River Basin—*Erkan Istanbuluoglu*

P59 Hydrological Aspects of an Agent-Based Model for Malaria Transmission—*James Gentile*

P60 Emergence of Landscape Ecohydrological Patterns from Merging Remotely-Sensed Vegetation Dynamics and a Parallelized Hydrologic Model—*Tiantian Xiang*

P61 Optimization of Hydrological Parameters of Conifer Trees in the Southern Sierra Nevada—*Jasper Vrugt*

P62 Modeling Soil Moisture and Plant Stress under Irrigated Conditions in Semiarid Urban Areas—*Thomas Volo*

Notes

Campus Map

