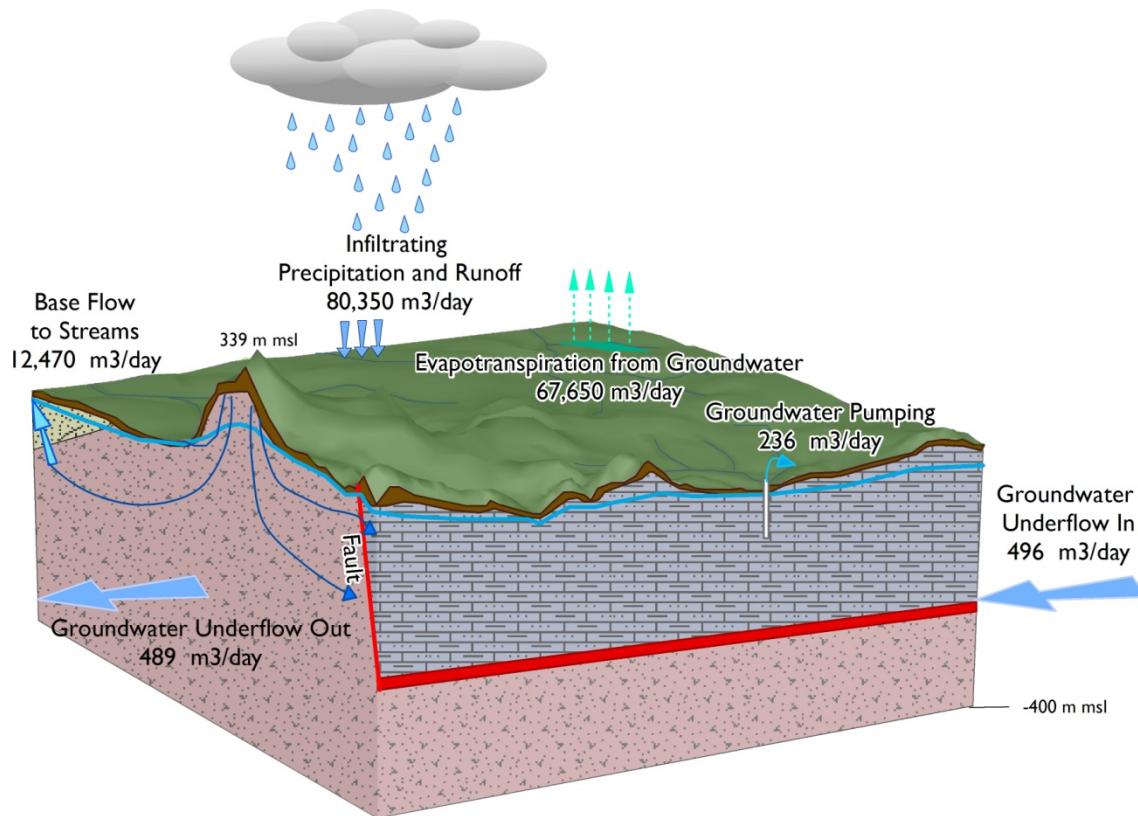


# MODFLOW and More 2011 Integrated Hydrologic Modeling

## Conference Program



### Sponsored by

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June 5-8, 2011

INTERNATIONAL GROUNDWATER MODELING CENTER (IGWMC)

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Many Thanks  
to the Scientific  
Advisory  
Committee!

# Welcome! to MODFLOW and More 2011: Integrated Hydrologic Modeling

The MODFLOW conference series unites cutting-edge developments and practical applications of hydrologic models related to groundwater. The conference series focuses on MODFLOW, presently the most widely used groundwater modeling code, to foster communication among conference participants. MODFLOW, developed by the US Geological Survey, has become an international standard for groundwater modeling. The conference brings together model users and developers to exchange ideas on the latest innovations in model applications, discuss the capabilities and limitations of currently available codes, and explore directions for future developments. The conference series does not stop with MODFLOW, rather the organizing committee needs and encourages participation by developers and users of all types of models in diverse applications, to help evolve the modeling capabilities of our profession. When considering alternate codes, understanding can be enhanced through comparisons to MODFLOW, which is familiar to nearly all participants.

## The conference includes featured presentations by:

**Albert Valocchi**, Improving Prediction of Regional-Scale Groundwater Flow Models through Exploratory Data Analysis and Complementary Modeling

**Christopher Green**, Simulated Travel Time Distributions and Water Quality Trends

**Willem Zaadnoordijk**, Low lying areas: increased seepage due to deterioration of the confining layer

**Sorab Panday**, An Unstructured Grid Version of MODFLOW

**Christian Langevin**, Local Grid Refinement with an Unstructured Grid Version of MODFLOW

**Stefan Kollet**, Cloud computing with ParFlow: Introduction of a newly developed Web interface

**Richard Niswonger**, Using GSFLOW to Assess Climate Change Impacts on Watershed Surface and Groundwater Interactions

**Stefan Finsterle**, Joint Inversion in Hydrogeology: Standing the Test of Practical Application

**Charles Andrews**, How Much Modeling is Enough?

**Prabhakar Clement**, Understanding the Worthiness of Complex Models for Developing Policy Solutions to Historic Groundwater Problems

**Reed Maxwell**, Towards a complete description of the hydrologic cycle: Large scale simulations with parallel, integrated models

**Larry Winter**, Deriving and Evaluating a Reduced Complexity Model for PRA of Groundwater Contamination

**Peter Gijssbers**, Readily available technologies waiting for adopting by the groundwater modeling community: illustrated by real time groundwater level forecasting and other examples

**David Benson**, Eulerian or Lagrangian? How your choice of reactive transport model changes your answer

**Otto Strack**, Improving Parameter Estimation by Optimized Data Use

**Mary Hill**, Sensitivity Analysis for Inverse Problems Solved by Singular Value Decomposition (SVD)

**Timothy Scheibe**, Hybrid Multiscale Modeling: Coupled Pore- and Darcy-Scale Models of Mixing-Controlled Reactions

## And general sessions on the following topics:

- Advances in integrated hydrologic modeling
- Using integrated models to understand and manage water supply, water quality, and ecology
- Accounting for climate and climate change in integrated hydrologic models, including down-scaling and up-scaling
- Issues in development and calibration of site, watershed, or regional scale models
- Effects of biogeochemical processes on local to regional water quality
- Modeling tools and decision support systems for integrated water management
- New techniques and ideas for linking MODFLOW and other models to solve complex problems
- Data collection/monitoring for model development and improved prediction
- Local, global, and combined methods of model calibration, sensitivity analysis and parameter estimation
- Advances and applications in the analysis of sensitivity, uncertainty, and worth of data
- Interpreting geology through groundwater modeling
- Groundwater management and remediation design optimization
- New analytic approaches and applications
- Code testing/performance and innovative case studies
- New developments in graphical user interfaces, visualization and GIS software
- Variable-density flow modeling
- Coupling flow and transport models
- Fracture flow
- Recent Developments for PEST

## Best Student Abstract Award

The MODFLOW and more 2011 Scientific Advisory Committee gave excellent reviews of Rachel Blakers's abstract and the organizing committee has selected her abstract titled "3D Dendrogram Analysis for Mapping Aquifer Connectivity and Flow Model Structure" as the best student abstract. Ms. Blakers will present her work at 10:56 AM on Tuesday morning in Metals Hall.

### Cover Image

Courtesy of Amelia Tallman, "Modeling Groundwater Flow in Tropically Weathered and Fractured Bedrock Using FEFLOW, Equatorial Africa"

## Sunday, June 5

### Ice Breaker

Wine, Beer and Hors D'oeuvres  
Green Center Lobby  
5:30 PM – 7:00 PM

### GSA 2011 Birdsall-Dreiss Lecture

Jeffrey McDonnell  
Where does water go when it rains? Conceptualizing runoff processes in headwater catchments  
Metals Hall  
7:00 PM – 8:15 PM

# Monday, June 6

Time	Metals Hall	Petroleum Hall
8:00	Welcome and Opening Address	Opening in Metals Hall
	<b>Featured Presentation</b>	<b>Featured Presentation in Metals Hall</b>
8:05	<b>Albert J. Valocchi</b> , Yonas K. Demissie, Tianfang Xu Improving Prediction of Regional-Scale Groundwater Flow Models through Exploratory Data Analysis and Complementary Modeling	
8:25	<b>Christopher T. Green</b> , Jeffrey J. Starn Simulated Travel Time Distributions and Water Quality Trends	
8:45	Transition	
	<b>Advances in integrated hydrologic modeling</b> Chaired by: Reed Maxwell and Stefan Kollet	<b>Advances and applications in the analysis of sensitivity, uncertainty, and worth of data</b> Chaired by: Mary Hill and Stefan Finsterle
8:50	<u>Serquei Chmakov</u> , Petr Sychev Building the right models to represent your physical conditions	<u>Linzy K. Brakefield</u> , Christian D. Langevin, and Joseph D. Hughes Estimating well-field contributing areas in the presence of lakes using an unconstrained Monte-Carlo analysis
9:06	<u>Ian M. Ferguson</u> and Reed Maxwell How Much Do Initial Conditions Really Matter? - Effects of Model Spin-Up on Integrated Groundwater-Surface Water Simulations	<u>Ming Ye</u> , Liying Wang, Karl F. Pohlmann Evaluation of Plausibility of Alternative Groundwater Models Using Different Kinds of Observations
9:22	<u>Douglas N. Graham</u> , Michael B. Butts, Torsten V. Jacobsen, Ying Qiao, Patrick Delaney Practical integrated groundwater-surface water modelling	<u>Junqi Huang</u> , Christopher J. Richards, Mary E. Gonsulin Using Genetic Algorithm and MODFLOW to characterize Aquifer System of Northwest Florida
9:38	<u>Jon Fenske</u> , Edward R. Banta, Steven Piper, Gennadii Donchyts, E.J. Wexler Coupling HEC-RAS and MODFLOW using OpenMI	<u>Yong Liu</u> , Keith M. Nelson, Wesley E. Hipke Cyber-enabled MultiModel Computing for Groundwater Risk Analysis on the Windows Azure Cloud
9:54	Coffee Break	
	<b>Featured Presentation</b>	<b>Featured Presentation in Metals Hall</b>
10:14	<b>Willem Zaadnoordijk</b> Low lying areas: increased seepage due to deterioration of the confining layer	
10:34	Transition	
	<b>Advances in integrated hydrologic modeling</b> Chaired by: Reed Maxwell and Stefan Kollet	<b>Advances and applications in the analysis of sensitivity, uncertainty, and worth of data</b> Chaired by: Mary Hill and Stefan Finsterle
10:40	<u>R.T. Hanson</u> , Wolfgang Schmid, S.A. Leake, S.W. Mehl, R.G. Niswonger, Joseph D. Hughes, and Thomas Maddock III Enhancements in MODFLOW with the Farm Process (MF-FMP) for Conjunctive-Use Analysis	<u>Claire R. Tiedeman</u> , Christopher T. Green Comparison of Parameter Estimates and Uncertainty Calculated with a Full Versus a Diagonal Observation Weight Matrix
10:56	<u>Zhonglong Zhang</u> , Jeffrey A. Gerald, Billy E. Johnson, and Mark S. Dortch Multimedia Modeling Tools Within The Training Range Environmental Evaluation And Characterization (TREECS)	<u>Joseph H.A. Guillaume</u> , Suzanne A. Pierce Groundwater Management: What methods have we used to address uncertainty when making decisions?
11:12	<u>Kathleen Smits</u> , Abdullah Cihan, Toshihiro Sakaki, Stacy Howington, John Peters, Tissa Illangasekare Numerical simulation on the effect of heterogeneity on evaporation/condensation in soils	<u>Dan Lu</u> , Mary C. Hill, Ming Ye Analysis of Regression and Bayesian Predictive Uncertainty Measures
11:28	<u>Shawn Leppert</u> , Mike Williams, Arianne Dean Designing an In-Situ Uranium Mine for Peak Efficiency: Coupling an Aqueous Geochemical Reaction Model to an Integrated Subsurface Model	Saleh A. Al-Hassoun, <u>Thamer Ahmad</u> , <u>Mohammad</u> , Abdul Halim Ghazali Prediction of Water Table for Alluvial Aquifer Using MODFLOW
11:44	<u>Joseph A. Hevesi</u> , Linda R. Woolfenden, Richard G. Niswonger, R Steven Regan, Tracy Nishikawa Decoupled application of the integrated hydrologic model, GSFLOW, to estimate agricultural irrigation in the Santa Rosa Plain, California	<u>Peter F. Andersen</u> , Robert M. Greenwald Observations on Calibration of a Model of a Perfectly Understood Aquifer

12:00	<b>Monday, June 6 continued</b> Lunch Friedhoff Hall I			
12:40	Lunch Presentation by <b>Justice Gregory Hobbs</b> Protecting Prior Appropriation Water Rights through Integrating Tributary Groundwater: Colorado's Experience Friedhoff Hall I			
1:10	Transition			
	<b>Featured Presentation</b>		<b>Featured Presentation in Metals Hall</b>	
1:15	<b>Sorab Panday</b> , Richard G. Niswonger, Christian D. Langevin, Motomu Ibaraki An Unstructured Grid Version of MODFLOW			
1:35	<b>Christian D. Langevin</b> , Sorab Panday, Richard G. Niswonger, Joseph D. Hughes, Motomu Ibaraki, Steffen Mehl Local Grid Refinement with an Unstructured Grid Version of MODFLOW			
1:55	Transition			
	<b>Fracture flow</b> Chaired by: Stefan Finsterle and Larry Winter		<b>Coupling flow and transport models</b> Chaired by: Christopher Green and Chunmiao Zheng	
2:00	<u>Donald M. Reeves</u> , Rishi Parashar, Greg Pohl	A Numerical Investigation of Soil-Bedrock Interface Flow Impedance	<u>Tissa H. Illangasekare</u> , V. Ngo, K. Smits, A. Limsuwat and T. Sakaki	Soil Moisture Processes in the Near Surface Unsaturated Zone: Experimental Investigations in Multiscale Test Systems
2:16	<u>Nicole M. DeNovio</u> , William Dershowitz, and Greg Ruskau	Using a Hybrid Discrete Fracture Network/Equivalent Continuum Approach for Fractured Rock for Flow and Transport – Incorporating Site Data	<u>Eric Morway</u> , Rich Niswonger, Ryan Bailey	Modeling Variable Saturated Transport with MODFLOW-UZF and MT3DMS
2:32	Khandaker Ashfaque, Michael Kladias, <u>Dave Lipson</u> , John Cherry, Carol Mowder, Tim Llewellyn	Assessing the Suitability of Simulation Approaches to Evaluate Flow and Transport through Competent and Weathered Bedrock Zones	<u>Eduardo Reckziegel de Sousa</u>	IFMPreeqc - Multicomponent reactive transport model coupling FEFLOW and PHREEQC-2 - Preliminary benchmarking and implementation challenges
2:48	<u>William C. Hutchings</u>	The Effects of Fractures on the Occurrence and Distribution of Arsenic in the Upper Floridan Aquifer During Aquifer Storage and Recovery	<u>Ryan Bailey</u> , Timothy Gates, Richard Niswonger, Eric Morway	Multi-Species Reactive Transport in Agricultural Groundwater Systems
3:04	Refreshment Break			
3:24	<b>Stefan Kollet</b> , Jens Schumacher, Claudius Bürger, Detlef Bösel Cloud computing with ParFlow: Introduction of a newly developed Web interface			
3:44	<b>Richard G. Niswonger</b> , Justin L. Huntington, Sorab Panday, Motomu Ibaraki, Wesley R. Henson Using GSFLOW to Assess Climate Change Impacts on Watershed Surface and Groundwater Interactions			
4:04	Transition			
	<b>Accounting for climate and climate change in integrated hydrologic models, including down-scaling and up-scaling</b> Chaired by: Sorab Panday and Reed Maxwell		<b>New analytic approaches and applications</b> Chaired by: Otto Strack and David Benson	
4:09	<u>Russell Crosbie</u> , Trevor Pickett, Freddie Mpelasoka, Geoff Hodgson, Steve Charles, Olga Barron	A continental scale assessment of the impact of climate change on groundwater recharge	<u>Fredrik Mossmark</u> , Lars O. Ericsson	Modeling Approach for Groundwater Chemistry Related to Underground Constructions
4:25	<u>Taiseer Aljazzar</u> and Stefan Kollet	Assessment of Climate and Land Use Change Impacts on Catchment Hydrodynamics: Large Scale Integrated Modeling of the Luanhe Catchment, China	<u>Alden M. Provost</u> , Christian D. Langevin	Effect of the difference between water-table elevation and hydraulic head on simulation of unconfined aquifers using MODFLOW
4:41	<u>Mimoun Djamel</u> , S. Gaur, and D. Grailot	Biodiversity and Functions of Alluvial System Facing Severe Droughts Induced by Global Change	<u>Mark Bakker</u> , Erik Anderson, Marinko Karanovic, Matt Tonkin, Steve Kraemer	Transient Multi-Layer Modeling with TTim: No Grid or Time-Stepping Needed
4:57	<u>Michelle Walvoord</u> , Clifford Voss, and Tristan Wellman	Impacts of Permafrost Distribution on Groundwater Flow in the Yukon Flats Basin, Alaska	<u>Charlie Fitts</u>	Analytic Element Modeling with Subdomains and Finite-Difference Time Steps
5:20	<b>SOFTWARE DEMOS &amp; POSTERS</b> Wine Beer and Hors D'oeuvres Friedhoff Hall I and II			

**Poster Session**  
**Monday 5:20 – 7:30 PM, June 6**

<b><u>Advances in integrated hydrologic modeling</u></b>	
Deyang Huang, Xinyu Wei, Prashanth Khambhammettu, Jan Kool, and Ming-shu Tsou	A Methodology to Simulate Streamflow Losses and Groundwater – Surface Water Interactions due to Karst Sink Holes
Michael A. Jones	LAK2: A Computer Program to Simulate the Presence of Lakes and Other Open Water Bodies within a Groundwater Flow System
Stephen R. Kraemer	Albemarle-Pamlico Watershed and Estuary Study (APWES): Integrating Hydrospheric Models for Supporting the Evaluation of Ecosystem Services
Steven B. Meyerhoff, Reed M. Maxwell	Reducing hydrograph uncertainty through subsurface characterization
Alden M. Provost, Jeffrey M. McKenzie, Clifford I. Voss	Enhancement of SUTRA to allow simulation of freezing of groundwater and exchange of groundwater and solute or energy with lakes
Linda R. Woolfenden, Joseph A. Hevesi, Richard G. Niswonger, Tracy Nishikawa	Modeling a Complex Hydrologic System with an Integrated Hydrologic Model: Preliminary Results
Feng Yue, Albert J. Valocchi	Fully-Coupled Physically-Based Approach for Modeling Conventional and Managed Subsurface Drainage
<b><u>Accounting for climate and climate change in integrated hydrologic models, including down-scaling and up-scaling</u></b>	
Emiel van Velsen, Joachim Hunink, Wim de Lange	Results of regional and national integrated hydrologic models for consensus on water distribution under climate change
Tristan P. Wellman, Michelle A. Walvoord, Clifford I. Voss, Burke J. Minsely	Examination of Lake Talik Evolution and Recent Lake Drying in Yukon Flats, Alaska, using Coupled Groundwater and Heat Transport Modeling with Freeze-Thaw Capabilities
<b><u>Issues in development and calibration of site, watershed, or regional scale models</u></b>	
Daniel Abrams, Henk Haitjema, Leon Kauffman	The impact of weak sinks on travel times, pathlines, and transit time distributions generated by MODPATH
Omkar Aphale, David Tonjes	Groundwater Flow Simulation Model for a Landfill Site in the Town of Brookhaven, Long Island, New York
Gilbert Barth	Interpreting Synoptic Flow and Water-Quality Data: Developing Groundwater-Seepage or Concentration Bounds as Parameter-Estimation Constraints
John B. Czarnecki	Modeling Groundwater Flow in the Ozark Plateaus Aquifer System
Thomas J. Mack, Philip T. Harte, Michael P. Chornack	Challenges in the Development of Models for Regional Groundwater Resource Appraisal in Southern Afghanistan
Chris Muffels, Graham Stonebridge, Matthew Tonkin, Marinko Karanovic	An Unstructured Version of PATH3D, PATH3DU
Kirstin Neff, Iman Mallakpour, Thomas Meixner, Thomas Maddock III	Incorporating Flood Pulse Recharge and Climate Change Scenarios into a MODFLOW model for the Upper San Pedro Basin (AZ)
Loren North, Dave Lipson, Gaston Leone, Paul Brzozowski, Paul Bluestein	Transient Calibration of a MODFLOW Model to Evaluate Groundwater-Surface Water Interactions at an Environmental Remediation Site
Janet L. Agnoletti, Joy Hoefler, Vladimir M. Prilepin, and Kurt O. Thomsen	Effective Use of GIS to Define MODFLOW Layers and Support Calibration of Regional Model for Water Resource Planning
George S. Roadcap	Modeling the 60-Year Growth of the Cone of Depression at Champaign, Illinois with Increasing Recharge, Steady Baseflow Discharge, and Variable Confining Conditions
Peter Sinton, James Flynn, Ron Dixon, David Banton, Leslie Smith, and Joanna Moreno	Three-Dimensional Groundwater Model of a Gold Mine near Republic, Washington
Michel Tétreault, Michael Hulley	A Regional-Scale Groundwater Model of Barbados
Yuan Zhang, Guomin Li, Yanhui Dong, Yuanfang Zhang	Numerical Simulation on the Impact of South to North Water Transfer Project to Groundwater in the North China Plain

Posters continued on next page.

<b><u>Modeling tools and decision support systems for integrated water management</u></b>	
Willem J. de Lange, Jacco Hoogewoud, Geert Prinsen, Ab Veldhuizen, Timo Kroon	First step in the calibration of the National Hydrological Instrument (NHI) of the Netherlands
Daniel Feinstein and Richard Niswonger	Use of MODFLOW-NWT to overcome dry cell problems in a model focused on groundwater/surface-water interactions
Kristin Flynt, Fred L. Ogden, David P. Ahlfeld	Exploring Parameter Uncertainty using the USGS GWM Model for the Integrated Management of Groundwater and Surface Water Resources
Scott A. Griebing, Roseanna M. Neupauer	Quantification of Stream Depletion Due to Pumping in Coupled Groundwater/Surface Water Systems Using Adjoint Modeling
Karl Pohlmann, Jianting Zhu, John Healy, Paul Matuska, Kenneth Isakson	Development of a Framework for Analysis of Water Accounting in Lower Colorado River Aquifers
Jenifer E. Wehner, Suzanne A. Pierce, Stuart Richardson, Steve Barnett	Informatics Approaches to Bridge Models and Management
<b><u>Advances and applications in the analysis of sensitivity, uncertainty, and worth of data</u></b>	
Jesse E. Dickinson, Ty P. A. Ferré, D. R. Pool	Value of transient electromagnetic, gravity, and well-log data for resolving groundwater flow in alluvial aquifers
Ahmed Hassan, Hesham Bekhit, Yong Zhang, Karl Pohlmann, Jenny Chapman	Propagating conceptual model and parameter uncertainty into groundwater monitoring network design
R. J. Hunt, J. Doherty, M.J. Tonkin, D.E. Welter, W. A. Schreuder, C.T. Muffels	Overview of PEST++: A New Branch of PEST for the 21st Century
Erica R. Siirila, Reed M. Maxwell, Lindsay Bearup, Alexis K. Sitchler, John E. McCray	Effective reaction rates of kinetically driven solutes in large-scale, heterogeneous domains: human health risk implications
Tanya Holtz and Michael Lord	Leveraging the Power of a Database to Develop a GoldSim® Contaminant Inventory Model
John L. Williams, III, and Reed M. Maxwell	Propagating subsurface uncertainty to the atmosphere using fully-coupled, stochastic simulations
<b><u>New analytic approaches and applications</u></b>	
James R. Craig, Sanders Wong	Recent advances in series solution methods for groundwater flow simulation
Shishir Gaur, Didier Graillot and Djamel Mimoun	Analytic Element Method and Particle Swarm Optimization Model for the Management of Groundwater Pumping Wells
Matthew Tonkin, Steven Larson, Mark Bakker, Rachel Shannon, Vanessa Bennett	Application of Analytic Element Method (AEM) and Numerical Axi-Symmetric (RZ) Models to Simulate a Groundwater Circulation Well (GCW)
<b><u>Coupling flow and transport models</u></b>	
Adam L. Atchley, Erica R. Siirila, Reed M. Maxwell, Alexis Navarre-Sitchler, John E. McCray	Using streamlines for highly-resolved, reactive transport for CO <sub>2</sub> risk assessment simulations
Vivek Bedekar, Matthew Tonkin	The Dry Cell Problem: Simulation of Solute Transport with MT3DMS
Yanhui Dong, Guomin Li	Reactive transport modeling of an acid groundwater plume at shutdown uranium in-situ leaching well fields, western China
Hannah Menke, Alexis Navarre-Sitchler, John McCray, Reed Maxwell	Characterizing Leakage Rates of Carbon Dioxide in the Intermediate Zone from Geologic Sequestration
Vincent E.A. Post, Henning Prommer, Janek Greskowiak, Junggho Park, Aaron McDonough	Recent improvements and new features of PHT3D
Ken Rainwater, Jeff Stovall, and John Cuddihee	Coupling MODFLOW and MT3D for Simulation of Nitrate Plume Recovery: Application of Telescopic Mesh Refinement and Calibration Techniques
Mark G. Shupe, Daniel K. Burnell, Thomas A. Schneider	Representation of Rate-Limited Sorption in Model Simulation of Pump-and-Treat Remediation at the Fernald, Ohio DOE Site
<b><u>Fracture flow</u></b>	
Rishi Parashar, Donald M. Reeves	Computation of Flow and Transport in Fracture Networks on a Continuum Grid
Michael J. Ronayne	Numerical evaluation of the relationship between conduit network structure and solute retention in karst and fractured rocks



# Software Demonstration Session

## Monday 5:20 – 7:30 PM, June 6

<p><b>(1) Arc-NLET: Arc-GIS Nitrate Load Estimation Toolkit</b> by Ming Ye          Arc-NLET is an ArcGIS extension for simulating fate and transport of nitrate (or other contaminants) from OWTS (onsite wastewater treatment systems, i.e. septic tanks). The software has three major functions: 1) to estimate groundwater flow field based on which the path of advective flow is determined; 2) to calculate nitrate plumes from a set of OWTS with consideration of advection, dispersion, and denitrification; and 3) to evaluate the amount of nitrate load from the OWTS to surface water bodies. This software has low input data requirements, in comparison with traditional numerical codes of groundwater flow and contaminant transport modeling such as MODFLOW, MODPATH, and MT3D.</p>
<p><b>(2) FEFLOW</b> by Volker Clausnitzer          FEFLOW is a professional finite-element software package for modeling fluid flow and transport of dissolved constituents and/or heat transport processes in the subsurface.</p>
<p><b>(3) ModelMuse</b> by Richard Winston          ModelMuse is a graphical user interface (GUI) for creating the flow and transport input file for PHAST and the input files for MODFLOW 2005. In ModelMuse, the spatial data for the model is independent of the grid, and the temporal data is independent of the stress periods. Being able to input these data independently allows the user to redefine the spatial and temporal discretization at will. ModelMuse has a top, front, and side view for editing the model and a 3 D view of the model that can be used to display properties of the model. ModelMuse has tools to generate and edit the model grid. It also has a variety of interpolation methods and geographic functions that can be used to help define the spatial variability of the model. ModelMuse can be used to execute both MODFLOW 2005 and PHAST and can also display the results of MODFLOW 2005 models.</p>
<p><b>(4) Next Generation of Visual MODFLOW Software</b> by Wayne Hesch          The next generation of Visual MODFLOW software provides an all-in-one conceptual and numerical modeling environment ready to tackle groundwater-surface water projects. Definition of complex geology and layering is not constrained by the grid or mesh. Increased confidence through managed uncertainty: Create, run, and compare multiple scenarios of a conceptual or numerical model in one streamlined 2D/3D environment. Gain credibility by comparing the model grid and results side-by-side with the field data and geologic model. Flexibility to change the simulator (MODFLOW or FEFLOW) or the grid/mesh type during the course of model development. Effective regional-local scale modeling using MODFLOW-LGR (Local Grid Refinement). Build and run bigger models using 64-bit MODFLOW-2000, 2005, LGR, and SEAWAT engines.</p>
<p><b>(5) ModelMate</b> by Edward Banta          ModelMate is a graphical user interface designed to facilitate model analysis by software applications that invoke model simulations as external processes. In the initial release, ModelMate supports the model-analysis software UCODE_2005 and groundwater-flow models based on MODFLOW-2005; however, it is designed to be enhanced to support other model-analysis software and other simulation-model software.</p>
<p><b>(6) Leapfrog Hydro</b> by Richard Lane          Leapfrog Hydro, an integrated 3D software solution for building hydrogeological models, allows the user to rapidly create conceptual models and convert them to quantitative models for MODFLOW, FEFLOW and Groundwater Vistas. The interface clearly separates data, assumptions and model allowing the user to update models automatically when new data becomes available. Unlike other software packages, Leapfrog Hydro lets you develop multiple models in parallel, enabling the testing of alternative hydrogeological interpretations for improved decision making.</p>
<p><b>(7) AnAqSim (Analytic Aquifer Simulator)</b> by Charlie Fitts          AnAqSim is based on an analytic element approach that divides the modeled region into subdomains (Fitts, 2010, Water Resources Research). AnAqSim has extensive and novel capabilities for an analytic element program: 1) Fully transient flow models using finite-difference time steps. 2) Isotropic or anisotropic subdomains, with variable direction and ratio of anisotropy. 3) Multiple layers with spatially-variable vertical leakage between layers (3-D). 4) Transitions in the layering scheme (e.g. a multi-layer area abutting a single layer in the far-field). AnAqSim can model fairly complex aquifer systems, but with the minimal input, high accuracy, and easy modification typical of analytic element programs.</p>
<p><b>(8) GSM</b> by Alan Lemon          GSM is the premier groundwater software solution to develop, characterize and visualize groundwater models in a 3D environment.</p>
<p><b>(9) Triwaco</b> by Willem Jan Zaadnoordijk          Triwaco <a href="http://www.triwaco.com">http://www.triwaco.com</a> is a package for (geo)hydrological simulations. The user-interface TriShell is model independent and features: 1) linking of input parameters to base information or other (output) parameters; 2) allocation of input parameters using a variety of allocators; 3) scenario management (in which inherited parameters also are physically inherited); 4) status checking of output and allocated parameters based on base maps and changes of parameters and settings; 5) a variety of models: Groundwater (Flairs, MODFLOW96, MF2k, SEAWAT), Surface water (Sobek-CF), Rainfall-runoff (Sobek-RR), Unsaturated zone (Fluzo, SWAP), Effect models (Trace, MT3D); 5) linking of models by sharing input, using others output or OpenMI.</p>
<p><b>(10) Arc Hydro Ground Water</b> by Norm Jones          Arc Hydro Ground Water is a data model and accompanying set of tools for managing groundwater data in ArcGIS. The tools are divided into three components: <u>Groundwater Analyst</u>: Tools for importing and managing well and time series data. <u>Subsurface Analyst</u>: Tools for building 3D geology models including cross sections and volumes. <u>MODFLOW Analyst</u>: Tools for importing, modifying, and exporting MODFLOW simulations from a geo-database. Includes fully customizable geo-processing tools that can be used to build custom workflows.</p>
<p><b>(11) FEWS-Water Management</b> by Peter Gijsbers          Application of real time decision support system where real time measurements and weather predictions are applied in combination with an integrated surface water-groundwater - agricultural model to deliver real time forecast products on drought conditions in the Netherlands.</p>
<p><b>(12) Groundwater Vistas 6</b> by Jim Rumbaugh          Groundwater Vistas 6 is a graphical user interface for the MODFLOW-family of codes. The demonstration will show the building of nested unstructured grids for the new MODFLOW-USG version developed by Sorab Panday.</p>
<p><b>(13) IFMPHREEQC</b> by Eduardo De Sousa          A Feflow plug-in (IFMPHreeqc) has been developed in order to couple the multi-component reactive capabilities of PHREEQC-2 (Parkust and Appelo, 1999) and the advanced three-dimensional flow and transport features of FEFLOW. This development aims to add geochemical modelling capabilities to FEFLOW, potentially opening a wide range of applications such as three-dimensional flow under variable density, heat and saturation conditions. Flexibility within the Interface Manager (IFM) of FEFLOW also allows for investigation of feedback loops from geochemical processes into aquifer properties, including effects of dissolution/precipitation on porosity and permeability.</p>
<p><b>(14) PHREEQPY</b> by Mike Müller          Phreeqpy is an Open Source program written in the Python programming language that helps to simplify working with PHREEQC. It uses the new IPHreeqc interface to facilitate coupling with other codes. Furthermore, it offers additional tools such as automated high-volume production of diagrams from model output and template-driven generation of PHREEQC input.</p>



## Tuesday, June 7

Time	Metals Hall	Petroleum Hall	
8:20	Opening Comments	Opening in Metals Hall	
	<b>Featured Presentation</b>	<b>Featured Presentation in Metals Hall</b>	
8:25	<b>Stefan Finsterle</b> Joint Inversion in Hydrogeology: Standing the Test of Practical Application		
8:45	Transition		
	<b><u>Issues in development and calibration of site, watershed, or regional scale models</u></b> Chaired by: Chris Langevin and Otto Strack		<b><u>Modeling tools and decision support systems for integrated water management</u></b> Chaired by: Tim Scheibe and Larry Winter
8:50	<u>Stanley A. Leake</u> , Bruce G. Campbell	Use of the SUB-WT Package to Understand Distributions of Specific Storage in Space and Time	<u>Anker Lajer Højberg</u> , Lars Trolborg
9:06	<u>Frans W. Schaars</u> , Mark Bakker, Joseph D. Hughes, Alyssa M. Dausman, Christian D. Langevin	Modeling Regional Seawater Intrusion with MODFLOW2005 and the SWI package	<u>Marshall W. Gannett</u> , Brian J. Wagner, and Kenneth E. Lite Jr.
9:22	<u>Eve L. Kuniansky</u> , Josue J. Gallegos, and J. Hal Davis	Comparison of Three Deterministic Numerical Models for Simulation of Wakulla and Spring Creek Discharge near Tallahassee, Florida	<u>Brian J. Wagner</u> , Marshall W. Gannett
9:38	<u>Derek J. Blazer</u> , Hale W. Barter, Dwight Smith	Development of a Coupled Pit-Dewatering and Post-Closure Lake-Development Model for Projections of Long-Term Mining Impacts	<u>Joseph D. Hughes</u> , Jeremy T. White, Linzy K. Brakefield, Virginia M. Walsh, Christian D. Langevin
9:54	Coffee Break		
	<b>Featured Presentation</b>	<b>Featured Presentation in Metals Hall</b>	
10:14	<b>Charles Andrews</b> How Much Modeling is Enough?		
10:34	Transition		
	<b><u>Issues in development and calibration of site, watershed, or regional scale models</u></b> Chaired by: Chris Langevin and Otto Strack		<b><u>Modeling tools and decision support systems for integrated water management</u></b> Chaired by: Tim Scheibe and Larry Winter
10:40	<u>Matthew Tonkin</u> , Marinko Karanovic, Chris Muffels, John Porcello, Kevin Lindsey, Terry Tolan	Simulating the Complex Regional Hydrostratigraphy of the Columbia Basin Groundwater Management Area (GWMA)	Kevin Mulligan, <u>David Ahlfeld</u> , Casey Brown
10:56	<u>Rachel S. Blakers</u> , Bryce F.J. Kelly, Robert Anderssen, Gregoire Mariethoz, Wendy Timms	3D Dendrogram Analysis for Mapping Aquifer Connectivity and Flow Model Structure	<u>Xin Song</u> , and Gaston Leone
11:12	<u>Evan G. Christianson</u> , David J. Dahlstrom, Jonathon T.V. Carter	Incorporating Detailed Hydrostratigraphic Information in Groundwater Flow Models Using the HUF Methodology	<u>Rolf Farrell</u> , Mark Whiteman
11:28	<u>Peter A. Mock</u>	The Tule Desert MODFLOW Model, Southeastern Nevada, USA: MODFLOW Meets Complex Structural Geology	<u>D.A. Sampson</u>
11:44	<u>Ralf Brauchler</u> , Rui Hu, Linwei Hu, Thomas Ptak	A field assessment of high resolution aquifer characterization: A combination of three different hydraulic tomographic inversion techniques	<u>Thomas D. Krom</u> , Jacob Birk Jensen

12:00	<b>Tuesday, June 7 continued</b> Lunch Friedhoff Hall I			
12:40	Lunch Presentation by <b>Mazdak Arabi</b> eRAMS: A participatory modeling and optimization platform to protect watershed water quality Friedhoff Hall I			
1:10	Transition			
	<b>PANEL DISCUSSION</b>			
1:15	<b>Prabhakar Clement</b> Understanding the Worthiness of Complex Models for Developing Policy Solutions to Historic Groundwater Problems			
1:35	<b>Reed Maxwell</b> Towards a complete description of the hydrologic cycle: Large scale simulations with parallel, integrated models			
1:55	<b><u>Audience/Panel Discussion</u></b> <b>Topic: Simple and/or complex? What works in groundwater models?</b> The panel discussion will focus on the simplicity/complexity debate from the perspective of how best to use groundwater modeling to understand and manage groundwater flow and transport. <b>Panel moderator : Eileen Poeter</b> <b>Panel members: Charlie Andrews, Mary Hill, Matthew Tonkin, Chunmiao Zheng</b> Each member will make a 4 minute comment before we open to general discussion			
2:55	Refreshment Break			
	<b>Featured Presentation</b>		<b>Featured Presentation in Metals Hall</b>	
3:15	<b>Larry Winter</b> , and Jeffrey Hyman Deriving and Evaluating a Reduced Complexity Model for PRA of Groundwater Contamination			
3:35	<b>Peter Gijbbers</b> Readily available technologies waiting for adopting by the groundwater modeling community: illustrated by real time groundwater level forecasting and other examples			
3:55	Transition			
	<b><u>New techniques and ideas for linking MODFLOW and other models to solve complex problems</u></b> Chaired by: Peter Gijbbers and Sorab Panday		<b><u>New developments in graphical user interfaces, visualization and GIS software</u></b> Chaired by: David Benson and Christopher Green	
4:00	Jihua Wang, Edward Mehnert, <u>Yu-Feng F. Lin</u>	Protecting Drinking Water by Coupling Two Models Associated with Geologic Carbon Sequestration in Deep Saline Aquifers	<u>Norm Jones</u> , Gil Strassberg, Doug Gallup	MODFLOW Scripting via ArcGIS Geoprocessing Tools
4:16	<u>V. Clausnitzer</u> , H.-J. G. Diersch, R. Gründler, W. Rühaak, I. Sass, P. Mielke, W. Heidemann, D. Bauer	Modeling Groundwater Heat Storage for Solar-Assisted District Heating Systems	<u>Alan Lemon</u> , Gil Strassberg, Norm Jones, Tim Whitaker	3D Characterization of Hydrogeology Using ArcGIS
4:32	<u>Vivek Bedekar</u> , Matthew Tonkin, Alexandros Spiliotopoulos	Implementation of a Contaminant Treatment System (CTS) module in MT3DMS	<u>Theo N. Olsthoorn</u> and Philip Nienhuis	mfLab, a flexible, open-source groundwater-modeling environment using Modflow, MT3DMS and Seawat
4:48	<u>Thomas Reimann</u> , Steffen Birk, Tobias Geyer, Rudolf Liedl, Martin Sauter	MODFLOW Based Karst Modeling – Recent Development	<u>Liying Wang</u> , Ming Ye, J. Fernando Rios, Paul Z. Lee	Use of an Arc-GIS Based Software for Estimation of Nitrate Loads from Septic Systems to St. Johns River in Jacksonville, FL
5:04	<u>Prashanth Khambhammettu</u> , Matthew Tonkin, Alex Spiliotopoulos	FIELDGEN_D – A Modified 2D Field Generator for Deterministic and Stochastic Groundwater Modeling	<u>Richard B. Winston</u>	ModelMuse: A Public-Domain Graphical User Interface for MODFLOW and PHAST
5:20	Transition			
5:25	<b>POSTERS – Wine Beer and Hors D'oeuvres</b> <b>Friedhoff Hall II</b> See next three pages			

## Poster Session Tuesday 5:20 – 7:30 PM, June 7

<b><u>Using integrated models to understand and manage water supply, water quality, and ecology</u></b>	
Matt Ely and Sue Kahle	Groundwater and Surface-Water Flow Modeling of Chamokane Creek Basin, Stevens County, Washington
Sachin Karan, Peter Engesgaard, Troels Laier	Characterizing Groundwater-Stream Interaction at Catchment Scale: Holtum Stream, Western Denmark
Tim Lewis, Paul Davison, Will Witterick	Spatio-temporal recharge and runoff estimation for unstructured grids
José F. Muñoz, Bonifacio Fernández, Jorge Gironás, Pablo Rengifo, Eduardo Abujatum	A Regional Coupled Water Resource Model Using MODFLOW and a Conceptual Balance Model of the Aconcagua River Basin, Chile
Jarkko Okkonen, Nina Kortelainen, Tarja Hatakka	Simulating 3D groundwater flow and quality in unconfined esker aquifer in snow dominated region in central Finland
Kristie Raymond, Mazdak Arabi, Mary Hill	Comprehensive Flow and Transport Groundwater/Watershed Modeling Using eRAMS: Overview of the Integrated Framework
Richard Yager, D.K. Maurer and C.J. Mayers	Assessing the impact of water use on groundwater levels and stream flow through groundwater flow simulation of the Carson Valley, Nevada and California
<b><u>Effects of biogeochemical processes on local to regional water quality</u></b>	
Lindsay A. Bearup, Alexis K. Navarre-Sitchler, Reed M. Maxwell, John E. McCray	Modeling Metal Transport after CO <sub>2</sub> Leakage into Aquifers from Carbon Sequestration: Relevance of Desorption and Mineral-Dissolution Kinetics
Shujun Ye , Brent E. Sleep , Calvin Chien	Effect of biofilm growth on flow and transport in porous media
<b><u>New techniques and ideas for linking MODFLOW and other models to solve complex problems</u></b>	
David J. Dahlstrom, Evan G. Christianson, and Jonathon T.V. Carter	Heuristic Constraints for Inverse Groundwater Flow Models
Peter Gijssbers	Improvement of the OpenMI standard for model linkage: version 2.0
W.P. Li, Z.Y. Liu, H.P. Guo, N. Li, W.D. Kang and A.B. Hao	Simulation of Groundwater-fall
Yong Zhang, Eric M. LaBolle	Reaction-RWHet: A fully Lagrangian solver for the direct numerical simulation of microscopic-scale reactive transport in heterogeneous media
Theo N. Olsthoorn and Jos Beemster	Simultaneous Simulation of Large Sets of Cross Sections in MODFLOW
<b><u>Data collection/monitoring for model development and improved prediction</u></b>	
Naveed Alam and Theo N. Olsthoorn	Calibrating the Virgin Chai Doab in the Indus Basin, Pakistan for Better Understanding the Current Situation and Predict Ongoing Groundwater salinization
John H. Guswa, Jonathan R. Bridge, Anne B. Sheehan, and Jeffrey Benegar	Application Of A Regional Groundwater Flow Model To Assist In The Selection, Design, Construction, And Performance Evaluation Of A Tunnel Drain Collection System For PCB-Contaminated Groundwater In Fractured Bedrock
Wenpeng Li, Xiulan Yin, Yuejun Zheng and Haipeng Guo	Sustainable development of groundwater resources based on regional groundwater monitoring, information system and simulation in Beijing Plain
Toshihiro Sakaki, Paul E. Shulte, Abdullah Cihan, John A. Christ and Tissa H. Illangasekare	Air flow pathway dynamics in the vadose zone under land surface climate boundary conditions
Carolyn Sauck, Tissa Illangasekare, Toshihiro Sakaki, Benjamin Petri, John Christ	Understanding and Modeling TCE Vapor Generation from Dissolved Groundwater Plumes under Fluctuating Water Table Conditions
<b><u>Local, global, and combined methods of model calibration, sensitivity analysis and parameter estimation</u></b>	
Ryan Bailey, Domenico Baù	Data Assimilation of Water Table and Stream Flow Data to Estimate Uncertain Spatial Distribution of Hydraulic Conductivity in Catchment Hydrology Systems
Adam Siade	Reduced Order Parameter Estimation using Quasilinearization and Quadratic Programming
M. A. El-Rawy, G. A. Mohammed, W. Zijl, O. Batelaan, F. De Smedt	Inverse Modeling Combined with Kalman Filtering Applied to a Groundwater Catchment

Posters continued on next page.

<b><u>Interpreting geology through groundwater modeling</u></b>	
John Porcello, Kevin Lindsey, Matthew Tonkin, Marinko Karanovic	Numerical Modeling for Resource Characterization in Deep Basalt Aquifers: Columbia Basin Ground Water Management Area (GWMA), Washington
Jordan Ré-Bahuaud, Didier Graillet, Djamel Mimoun, Yvan Rossier	Hydrodynamic Models "2D Section" to Improve Understanding of Transient Flow in Complex Groundwater Systems: The Case of The "Forez" Floodplain (France)
Amelia Tallman, Kate Richards, K. Bill Clark	Modeling Groundwater Flow in Tropically Weathered and Fractured Bedrock Using FEFLOW, Equatorial Africa
<b><u>Groundwater management and remediation design optimization</u></b>	
David Ahlfeld and Paul Barlow	Recent and Ongoing Developments for the Groundwater Management (GWM) Process for MODFLOW
Matthew Baillie and Mike Maley	Groundwater Model of the Arid Twentynine Palms Basin
Bruce G. Campbell and James E. Landmeyer	Development of a Conceptual Model of Ground Water Flow, Chesterfield County, South Carolina
Kathleen Fuller, Roseanna M. Neupauer, David C. Mays	Genetic Algorithm Optimization of Injection and Extraction Patterns for In-situ Remediation of Groundwater
Prashanth Khambhammettu, Christopher Neville, Matthew Tonkin	Analysis of the Migration of Bio-Amended Water through the Vadose Zone for In-Situ Remediation of Hexavalent Chromium
David Li	A Case Study of Remedial Design of a Large Scale Pump-and-Treat System Using MODFLOW, Geologic Framework Model, and 3D Visualization Tools
T.N. Olsthoorn, L.E. Nonnekes and V. de Waard	Leakage and repairing of leaking deep saltwater monitoring wells
Ben Petri, Tissa Illangasekare, Toshihiro Sakaki, John Christ, Carolyn Sauck	Experimental and Numerical Investigation of Mass-Transfer Rates for Prediction of Vapor Generation from NAPLs for Evaluation of the Vapor-to-Indoor Air Exposure Pathway
Federico Pittaluga	Urban Growth and Freshwater Evolution in a Coastal Aquifer
Vladimir M. Prilepin	Combined Use of MODFLOW and MODPATH to Support Model Sensitivity Analysis for Design of Pump-and-Treat System at Former Landfill
Colt Shelton, Michael Barber, Akram Hossain, Cara Poor	Modeling Artificial Groundwater Recharge in an Unconfined Aquifer
Jennifer S. Stanton, Steven M. Peterson, and Michael N. Fienen	Using a Simulation-Optimization Model to Evaluate Effects of Groundwater Withdrawals for Irrigation on Stream Base Flow in the Elkhorn River, Nebraska
<b><u>Code testing/performance and innovative case studies</u></b>	
Alastair Black	Combining the relative strength of graphics cards and CPUs for fast MODFLOW computation
Rosemary W.H. Carroll, Greg Pohl, Donald M. Reeves and Tom Badger	Approach to Developing Design Guidelines for Horizontal Drain Placement to Improve Slope Stability
Josue J. Gallegos, Bill X. Hu	Using the Conduit Flow Process for MODFLOW to simulate a laboratory karst analog model and the Woodville Karst Plain
Thamer Mohammad, Nusari. M.S, Mohd. Amin M. S, Abdul Halim Ghazali	Assessment of Seawater Intrusion Using SEAWAT Model: A Case Study in Lowland of Langat Bain, Malaysia
Kurt Zeiler	Advancements in a Transient 3-D Particle Tracking Tool for Finite-Element Flow Fields
<b><u>Variable-density flow modeling</u></b>	
Eunhee Lee, Jeong-Won Lim, Hee Sun Moon, Kang-Kun Lee	Investigation of Seawater Inflow into the Underground Storage Tunnel in Yosu, Korea
Theo N. Olsthoorn	Stream Function in Modflow, MT3D and Seawat to quantify density-driven flow in heterogeneous cross sections
Luca Trevisan, Tissa H. Illangasekare, Derrick Rodriguez, Toshihiro Sakaki, Abdullah Cihan, Jens Birkholzer, Quanlin Zhou	Improved understanding of migration and entrapment of supercritical CO <sub>2</sub> in deep geologic formations: intermediate scale testing and modeling

Posters continued on next page.

<u>New developments in graphical user interfaces, visualization and GIS software</u>	
Mark Bakker, Vincent Post	FloPy: Free Python Scripts to run MODFLOW and Friends
Edward R. Banta	ModelMate: A Graphical User Interface for Model Analysis
V. Clausnitzer, O. Arndt, R. Gründler, P. Schätzl	Advanced Visualization Improves Groundwater Modeling
Wayne Hesch, Serguei Chmakov	A Unified Modeler's Workbench: Workflow-Driven Conceptual and Numerical Modeling
Thomas D. Krom, Richard Lane	Uncertainty, the Hydrogeological Conceptual Model and Flow Modelling
Chris Muffels, Marinko Karanovic, James Ehrman, Jack Sletteback, Ben Palfi, Matthew Tonkin	BioscreenAT: There's an App for That

“Food for thought” for modelers (from ASCE LinkedIn web site):

Engineering is the art of modelling materials we do not wholly understand, into shapes we cannot precisely analyse so as to withstand forces we cannot properly assess, in such a way that the public has no reason to suspect the extent of our ignorance.

- Dr. A.R. Dykes, British Institution of Structural Engineers

"The engineer calculates to the micrometer; the surveyor marks it with spray paint; then the contractor hits it with a sledge hammer!"

-Author not provided

"Come on class, we're not building watches, we're totin' water!"

-H. Rooney Malcom to his undergraduate hydrology class

"Making the simple complicated is commonplace; making the complicated simple, awesomely simple, that's creativity"

- Charles Mingus, Jazz Musician, Civil Rights Activist

## Wednesday, June 8

Time	Metals Hall	Petroleum Hall	
8:20	Opening Comments	Opening in Metals Hall	
	<b>Featured Presentation</b>	<b>Featured Presentation in Metals Hall</b>	
8:25	<b>David Benson</b> Eulerian or Lagrangian? How your choice of reactive transport model changes your answer.		
8:45	Transition		
	<b><u>Using integrated models to understand and manage water supply, water quality, and ecology</u></b> Chaired by: Rich Niswonger and Al Valocchi	<b><u>Groundwater management and remediation design optimization</u></b> Chaired by: Charles Andrews and Tim Scheibe	
8:50	<u>Steffen Mehl</u> , Jeffrey Davids Analysis of stream restoration efforts in depleted aquifer systems	<u>Frank T.-C. Tsai</u> Scavenger Wells Stop Saltwater Intrusion in Baton Rouge, Louisiana	
9:06	<u>E.J. Wexler</u> , Dirk Kassenaar, Mason Marchildon, Qing Li GSFLOW Modeling of Surface Water And Groundwater Flow	<u>Alexandros Spiliotopoulos</u> , Rachel Shannon, Matthew J. Tonkin, L. Craig Swanson Evaluation of Temporal Variations in Hydraulic Capture due to Changing Flow Patterns using Mapping and Modeling Techniques	
9:22	<u>Claudia C. Faunt</u> , Michelle Sneed, Randall T. Hanson, and Wolfgang Schmid Utilizing MODFLOW to evaluate Groundwater Conditions and Land Subsidence in California's Central Valley	<u>Craig Divine</u> , Gastón Leone, Tracy Roth, Matt Spurlin, Jeff Gillow, and Scott Potter Modeling Analyses of Horizontal Reactive Media Treatment (HRX) Wells; A New Concept for Sustainable Passive In-Situ Remediation	
9:38	<u>Todd G Umstot</u> Application of a distributed parameter land surface-atmosphere model to assess the quantity of mountain-block and mountain front recharge	<u>Maria Herold</u> , <u>Thomas Ptak</u> , Janek Greskowiak, Henning Prommer, Thomas Wendel, Peter Grathwohl From subsurface investigations to reactive transport modelling – a case study at a former gasworks site	
9:54	Coffee Break		
	<b>Featured Presentation</b>	<b>Featured Presentation in Metals Hall</b>	
10:14	<b>Otto D. L. Strack</b> and Randal J. Barnes Improving Parameter Estimation by Optimized Data Use		
	Transition		
	<b><u>Using integrated models to understand and manage water supply, water quality, and ecology</u></b> Chaired by: Rich Niswonger and Al Valocchi	<b><u>Code testing/performance and innovative case studies</u></b> Chaired by: Chris Langevin and Willem Zaadnoordijk	
10:40	<u>Kristin Mikkelsen</u> , Reed Maxwell, Ian Ferguson, John McCray, and Jonathon Sharp The mountain pine beetle infestation of the Rocky Mountain West: Integrated hydrologic modeling of the water and energy budgets	<u>Motomu Ibaraki</u> , Sorab Panday, Richard G Niswonger, and Christian D Langevin Improvement of Performance of MODFLOW: $\chi$ MD Matrix Solver Package	
10:56	<u>Thomas McCarthy</u> , Saeed Jorat, and Cade Coldren A Linked Groundwater and Ecologic Model to Improve Model Accuracy and Evaluate Management Alternatives in the Owens Valley, California	<u>Peter Thum</u> , Wayne Hesch, Klaus Stüben LMG2: Accelerating the SAMG Multigrid-Solver in MODFLOW	
11:12	<u>Paul Davison</u> , Philip Hayes, Rob Soley Defining the catchment to a groundwater-fed stream on the Chalk in Southern England, using a regional MODFLOW model and MODALL	<u>Jeremy T. White</u> , J.D. Hughes An unstructured preconditioned conjugate gradient solver for MODFLOW-2005 with support for general-purpose graphics processing units (GPGPU)	
11:28	<u>Varut Guvanasesan</u> , Xinyu Wei, Deyang Huang, Dilip Shinde, and René M. Price Application of MODHMS to Simulate Integrated Water Flow and Phosphorous Transport in a Highly Interactive Surface Water Groundwater System along the Eastern Boundary of the Everglades National Park, Florida	<u>Mike Müller</u> , David L. Parkhurst, Scott R. Charlton Programming PHREEQC Calculations with C++ and Python A Comparative Study	
11:44	<u>Raymond H. Johnson</u> , Miori E. Yoshino, Susan M. Hall, and Valois R. Shea Predictive Modeling Strategies for Proposed Uranium In-Situ Recovery Mines	<u>Jonathon T.V. Carter</u> , Michael N. Fioren, David J. Dahlstrom Automated launching of remote processors for highly parameterized inverse modeling on a heterogeneous system of Cloud-based and local computers	

12:00	<b>Wednesday, June 8 continued</b> Lunch Friedhoff Hall I			
12:40	Lunch Presentation by <b>Douglas Woodcock</b> The Klamath Basin: Conflict, Cooperation and Water Management Friedhoff Hall I			
1:10	<b>Transition</b>			
	<b>Featured Presentation</b>		<b>Featured Presentation in Metals Hall</b>	
1:15	<b>Mary C. Hill</b> and B. Thomas Nolan Sensitivity Analysis for Inverse Problems Solved by Singular Value Decomposition (SVD)			
1:35	<b>Transition</b>			
	<b>Interpreting geology through groundwater modeling</b> Chaired by: Willem Zaadnoordijk and Charles Andrews		<b>Recent Developments for PEST</b> Chaired by: Peter Gijsbers and Chunmiao Zheng	
1:40	<u>Keith J. Halford</u> , Joseph M. Fenelon, C. Amanda Garcia, Donald S. Sweetkind, and Geoff Phelps	Geologic Heterogeneity of Structural Blocks and Hydraulic Significance, Pahute Mesa, Nevada	<u>David Welter</u> , John Doherty, Chris Muffels, Matt Tonkin, Randy J. Hunt, Willem Schreuder, Marinko Karanovic	Lowering the Barriers of Entry to Inverse Modeling: PEST++
1:56	<u>Peter Scharling</u> , Torben Sonnenborg, Peter Engesgaard, Klaus Hinsby, Roland Purtschert	Groundwater Age Dating of Deep-seated Aquifers Using Environmental Tracers and Age Simulation Approaches	<u>Willem A. Schreuder</u> , Chris Muffels, Matt Tonkin, John Doherty, Randall J. Hunt, Dave Welter	Efficient Use of Parallel Resources using PEST
2:12	<u>Wim J. de Lange</u>	Parsimonious Analytic Element models in expert and contra expert studies	<u>Chris Muffels</u> , Willem A. Schreuder, John Doherty, Marinko Karanovic, Matthew Tonkin, Randall J. Hunt, Dave Welter	Genie - a model-independent TCP/IP run manager
2:28	<b>Transition</b>			
	<b>Featured Presentation</b>		<b>Featured Presentation in Metals Hall</b>	
2:33	<b>Timothy D. Scheibe</b> , Alexandre M. Tartakovsky, Bruce J. Palmer, and Karen L. Schuchardt Hybrid Multiscale Modeling: Coupled Pore- and Darcy-Scale Models of Mixing-Controlled Reactions			
2:53	<b>Closing</b>			
3:00	Coffee Break			
3:30	<b>NGWA 2011 Darcy Lecture</b> <b>Stephen Silliman</b> Characterization of a Complex, Sole-Source Aquifer System in Benin, West Africa Metals Hall			

“Final Food for thought” for modelers (from ASCE LinkedIn web site):

"The problem with engineers today is that they are not lazy enough, you try to do everything the hard way. You guys need to figure out how to do things the easy way. You need to use the Principle of Least Work!"

-Frank Rizzo, Inventor of the Boundary Integral Equation Method (BIE) to his 1972 sophomore statics class



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