Final Program and Abstracts

SIAM Conference on

Mathematical & Computational Issues in the Geosciences

June 17-20, 2013
Department of Mathematics
University of Padua, Italy

Sponsored by the SIAM Activity Group on Geosciences

The SIAM Activity Group on Geosciences provides an interactive environment wherein modelers concerned with problems of the geosciences can share their problems with algorithm developers, applied mathematicians, numerical analysts, and other scientists. Topics of interest include flow in porous media, multiphase flows, phase separation, wave propagation, combustion, channel flows, global and regional climate modeling, reactive flows, sedimentation and diagenesis, and rock fracturing. The activity group organizes a biennial conference.

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The registration desk is located in Atrium - Ground Level. It is open during the following times:

Monday, June 17
8:00 AM – 5:00 PM

Tuesday, June 18
8:00 AM – 5:00 PM

Wednesday, June 19
8:00 AM – 5:00 PM

Thursday, June 20
8:00 AM – 5:00 PM

Conference Venue

Centro Congressi Padova "A. Luciani"
via Forcellini 170/A
I 35128 Padova

Conference Venue Telephone Number

To reach the Centro Congressi Padova "A. Luciani", call +39 049 8033711.

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Funding Agencies

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- Business Meeting (open to SIAG/GS members)
- Coffee breaks daily
- Ice Breaker
- Lunch daily
- Poster Session
- Room set-ups and audio/visual equipment

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The poster session is scheduled for Tuesday, June 18 at 7:30 PM. Poster presenters are requested to set up their poster material on the provided poster boards in the PALAZZO DELLA RAGIONE between the hours of 7:00 PM and 7:30 PM. All materials must be posted by Tuesday, June 18, 7:30 PM, the official start time of the session. Posters will remain on display through June 18, 11:00 PM. Poster displays must be removed by 11:00 PM. Posters remaining after this time will be discarded.

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Table Top Displays

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Comments about SIAM meetings are encouraged! Please send to:

Sven Leyffer, SIAM Vice President for Programs (*vpp@siam.org*)

Get-togethers

- Ice Breaker
  Monday, June 17
  7:30 PM – 9:30 PM
  Caffè Pedrocchi - Center of Town

- Poster Session
  Tuesday, June 18
  7:30 PM – 9:30 PM
  Palazzo della Ragione

- Business Meeting
  (*open to SIAG/GS members*)
  Thursday, June 20
  1:15 PM – 2:00 PM

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www.siam.org/activity/geosciences

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- Biennial conference
- SIAG/Geosciences Career Prize
- SIAG/Geosciences Junior Scientist Prize

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Invited Plenary Speakers

*** All Invited Plenary Presentations will take place in Luciani A - Ground Level.***

Monday, June 17

8:30 AM – 9:15 AM

IP1 Approximation of Transport Processes Using Eulerian-Lagrangian Techniques

Todd Arbogast, *University of Texas at Austin, USA*

9:15 AM – 10:00 AM

IP2 The Spatiotemporal Dynamics of Waterborne Diseases

Marino Gatto, *Politecnico di Milano, Italy*

Tuesday, June 18

8:30 AM – 9:15 AM

IP3 Career Award Lecture: Some Successes and Challenges in Coastal Ocean Modeling

Clint Dawson, *University of Texas at Austin, USA*

9:15 AM – 10:00 AM

IP4 Junior Scientist Award Lecture: Interpreting Geological Observations Through the Analysis of Non-linear Waves

Marc A. Hesse, *University of Texas at Austin, USA*

Invited Plenary Speakers

Wednesday, June 19

8:30 AM – 9:15 AM

IP5 An Unstructured Grid Model Suitable for Flooding Studies with Applications to Mega-tsunamis

Julie Pietrzak, *Delft University of Technology, Netherlands*

9:15 AM – 10:00 AM

IP6 Data Assimilation in Global Mantle Flow Models: Theory, Modelling and Uncertainties to Reconstruct Earth Structure Back in Time

Hans-Peter Bunge, *Ludwig-Maximilians-Universität München, Germany*

Thursday, June 20

8:30 AM – 9:15 AM

IP7 Data Assimilation and Inverse Modeling in Earth System Sciences

Tomislava Vukicevic, *NOAA, AOML Hurricane Research Division, Miami, USA*

9:15 AM – 10:00 AM

IP8 Efficient Numerical Numerical Computation of Multi-Phase Flow in Porous Media

Peter Bastian, *University of Heidelberg, Germany*

Notes

Program and Abstracts

SIAM Conference on

Mathematical & Computational Issues in the Geosciences

June 17-20, 2013

Department of Mathematics

University of Padua, Italy

Monday, June 17

Registration
8:00 AM-5:00 PM

Atrium - Ground Level

Introductory Remarks
8:15 AM-8:30 AM

Room:Luciani A - Ground Level

Monday, June 17

IP1

Approximation of Transport Processes Using Eulerian-Lagrangian Techniques

8:30 AM-9:15 AM

Room:Luciani A - Ground Level

Chair: Luca Formaggia, Politecnico di Milano, Italy

Transport processes are common in geoscience applications, and find their way into models of, e.g., the atmosphere, oceans, shallow water, subsurface, seismic inversion, and deep earth. Our objective is to simulate transport processes over very long time periods, as needed in, e.g., the simulation of geologic carbon sequestration. A good numerical method would be locally mass conservative, produce no or minimal over/under-shoots, produce minimal numerical diffusion, and require no CFL time-step limit for stability. The latter would allow better use of parallel computers, since time-stepping is essentially a serial process. Moreover, it would be good for the methods to be of high order accuracy. Our approach is to develop locally conservative Eulerian-Lagrangian (or semi-Lagrangian) methods combined with ideas from Eulerian WENO schemes, since they have the potential to attain the desired properties.

Todd Arbogast
University of Texas at Austin, USA

Monday, June 17

IP2

The Spatiotemporal Dynamics of Waterborne Diseases

9:15 AM-10:00 AM

Room:Luciani A - Ground Level

Chair: Peter Knabner, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

Dynamics of waterborne diseases in space and time is studied via multi-layer network models, consisting of coupled ODE's. They account for the interplay between epidemiological dynamics, hydrological transport and long-distance dissemination of pathogens due to human mobility, described by gravity models. Conditions for the outbreak of an epidemic are given in terms of the dominant eigenvalue of an appropriate reproduction matrix, while the initial disease distribution is linked to the dominant eigenvector. The theory is tested against epidemiological data of the extensive cholera outbreaks occurred in KwaZulu-Natal (South Africa) during 2000-2001 and in Haiti during 2010-2012.

Marino Gatto
Politecnico di Milano, Italy

Coffee Break

10:00 AM-10:30 AM

Atrium - Ground Level

Monday, June 17

MS1

New Developments in the Modeling, Analysis and Simulation of Oceanic Flows - Part I of IV

10:30 AM-1:00 PM

Room:Luciani A - Ground Level

For Part 2 see MS10

This minisymposium brings together scientists working on modeling, observations and simulation of oceanic flows. All three research directions are of paramount importance for a better understanding and prediction of oceanic flows. One of the main challenges in both numerical simulations and observations is the wide range of spatial and temporal scales that need to be modeled. The topics covered in this minisymposium include the following: modeling strategies, spatial and temporal discretizations, parallel and high-performance computing, mathematically-based novel approaches to observing and sampling systems, error analysis, and mathematical analysis.

Organizer: Traian Iliescu
Virginia Tech, USA

Organizer: Tamay Ozgokmen
University of Miami, USA

10:30-10:55 Large Eddy Simulation of the Quasi-Geostrophic Equations
Traian Iliescu, Virginia Tech, USA

11:00-11:25 Boundary Conditions for the Inviscid Linear and Nonlinear Shallow Water Equations in Space Dimension One and Two
Roger M. Temam, Indiana University, USA; Arthur Bousquet and Aimin Huang, Indiana University, USA; Madalina Petcu, Université de Poitiers, France

11:30-11:55 High-Order and Low-Cost Stabilized Finite Element Solvers of Primitive Equations
Tomas L. Chacon Rebollo, University of Sevilla, Spain

continued in next column

12:00-12:25 Assessments of Discretizations of Convection-Dominated Scalar Problems
Volker John, Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany

12:30-12:55 High Performance Adaptive Finite Element Method for Ocean Models
Kaspar Müller, KTH Royal Institute of Technology, Sweden; Johan Hoffman, Royal Institute of Technology, Sweden

Monday, June 17

MS2

Advances in Pore-scale Modeling and Upscaling - Part I of IV

10:30 AM-1:00 PM

Room:Parco 1 - Ground Level

For Part 2 see MS20

Pore-scale modeling offers a valuable tool to advance the understanding of nonlinear and irreversible transport phenomena in porous media. A non-exhaustive list of applications includes wettability alteration, three- phase fluid configurations, non-Newtonian flow, colloid transport and retention, as well as reactive transport and fluid-solid interactions. Despite the existence of various simulation approaches, several problems remain to guarantee an accurate description of the complex physical processes in a sufficiently large number of pores. Also, the difficulties in upscaling pore-scale behavior to the macro scale remain unresolved. This mini-symposium discusses advances in different modeling approaches, and suggests the future directions.

Organizer: Masa Prodanovic
University of Texas at Austin, USA

Organizer: Ken Sorbie
Heriot-Watt University, United Kingdom

Organizer: Pavel Tomin
University of Lausanne, Switzerland

Organizer: Matthew Balhoff
University of Texas at Austin, USA

Organizer: Malgorzata Peszynska
Oregon State University, USA

Organizer: Timothy D. Scheibe
Pacific Northwest National Laboratory, USA

10:30-10:55 Investigation of Pore-Scale Processes with the Volume of Fluid Method
Andrea Ferrari and Ivan Lunati, University of Lausanne, Switzerland

continued on next page

Monday, June 17

MS2

Advances in Pore-scale Modeling and Upscaling - Part I of IV

continued

11:00-11:25 Pore Scale Modeling of Two and Three Phase Flow and Transport Through Porous Media: Where Are We and What Is to Be Done?
Ken Sorbie, Heriot-Watt University, United Kingdom

11:30-11:55 Pore-Network Modeling of Reactive Transport under (Variably-)Saturated Conditions
Amir Raoof, University of Utrecht, The Netherlands; S. Majid Hassanizadeh and Chris Spiers, Utrecht University, The Netherlands

12:00-12:25 Computation of Three-Phase Fluid Configurations at the Pore Scale by a Variational Level Set Method
Johan Helland and Espen Jettestuen, International Research Institute of Stavanger (IRIS), Norway

12:30-12:55 Kinetic Methods for Pore-Scale Simulations of Coupled Transport Problems
Manfred Krafczyk, Technical University Braunschweig, Germany; Maik Stiebler and Ying Wang, TU Braunschweig, Germany

Monday, June 17

MS3

Discrete-fracture Models for Porous Media Flow.

Part I: Reservoir Simulations - Part I of III

10:30 AM-1:00 PM

Room:Parco 2 - Ground Level

Flow in fractured reservoir is either modeled by a direct representation of fractures and faults or by an equivalent multiporosity continuum. In both cases, Discrete-Fracture Modeling (DFM) might be used. The scope of this symposium is to introduce any innovation related to DFM for reservoir simulation.

Organizer: Gosselin Olivier
Total E&P, France

Organizer: Alexandre Lapene
Total E&P, France

10:30-10:55 An Efficient Finite Volume Discretization to Simulate Flows on 3D Discrete Fracture Network for Transient Flow Analysis and Equivalent Permeability Upscaling
Matthieu Delorme, Nina Khvoenkova, and Benoit Noetinger, IFP Energies nouvelles, France; Michel Quintard, Institut de Mécanique des Fluides de Toulouse, France

11:00-11:25 Discretizing Fractured Porous Media for Multiphase Flow Simulation
Stephan K. Matthai, Montan University of Leoben, Austria

11:30-11:55 Flow Modeling Techniques for Fractured Reservoirs - Gridding, Discretization, and Upscaling
Mohammad Karimi-Fard and Lou J. Durlofsky, Stanford University, USA

12:00-12:25 Is Discrete-Fracture Modeling Helpful for Reservoir Engineer?
Alexandre Lapene, Total E&P, France; Olivier Gosselin, Imperial College London, United Kingdom; Luc Pauget, Total E&P, France

12:30-12:55 An Interface Fault Model for Sedimentary Basin Simulation
Isabelle Faille, Marie Christine Cacas, Sylvain Desroziers, Pascal Havé, françoise Willien, and Sylvie Wolf, IFP Energies nouvelles, France

Monday, June 17

MS4

Theory and Computation of Porous Media Flows - Part I of II

10:30 AM-1:00 PM

Room:Giotto - Ground Level

For Part 2 see MS22

Porous media flows pose challenges of various kinds.Various oil recovery processes, CO2 sequestration and subsurface flows involve multi-phase flows with capillary pressure, wettability, and multi-scale features in permeability. Modeling and accurate computation of fluid flows during such displacement processes has been an important topic of research for quite sometime. These minisymposia will facilitate presentation of recent works by the speakers in areas such as multi-scale modeling, stability of fluid flows, high resolution numerical methods, improved mathematical models, and high performance computing.

Organizer: Prabir Daripa
Texas A&M University, USA

Organizer: Sourav Dutta
Texas A&M University, USA

10:30-10:55 Mixed Mortar Methods for Flow in Heterogeneous Porous Media
Todd Arbogast, Zhen Tao, and Hailong Xiao, University of Texas at Austin, USA

11:00-11:25 Multiphase Flow, Deformation and Wave Propagation in Porous Media
Pierre Adler and Aliaksei Pazdniakou, Université Pierre et Marie Curie, France

11:30-11:55 The Riemann Problem for Three-Phase Flow
Frederico C. Furtado, University of Wyoming, USA; Arthur Azevedo, University of Brasilia, Brazil; Aparecido de Souza, Federal University of Campina Grande, Brazil; Dan Marchesin, Instituto Nacional de Matematica Pura e Aplicada, Brazil

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12:00-12:25 Theoretical and Computational Perspectives on Chemical Enhanced Oil Recovery Processes
Prabir Daripa, Texas A&M University, USA

12:30-12:55 Modelling and Computation of Thermohaline Groundwater Flows
Alfio Grillo, Politecnico di Torino, Italy; Dmitry Logashenko, Sabine Stichel, and *Gabriel Wittum*, Goethe University, Germany

Monday, June 17

MS5

Recent Advances in Computational Seismology - Part I of II

10:30 AM-1:00 PM

Room:Meno Uno 1 - Lower Level

For Part 2 see MS23

Understanding the physics of earthquakes and predicting their impacts on the human and natural environment is of crucial importance for delineating seismic risk reduction strategies. For such a reason computational seismology is an effective tool for the efficient prediction of the seismic response in complex geological environments. The aim of this minisymposium is to discuss recent developments in this area. The proposed topics include (but are not limited to) recent advances on computational seismology with particular attention to numerical methods for seismic wave propagation, challenges in code development, and associated inverse problems.

Organizer: Ilario Mazzieri
Politecnico di Milano, Italy

Organizer: Alfio Quarteroni
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Paola F. Antonietti
Politecnico di Milano, Italy

10:30-10:55 High Order One-Step Pnpm Schemes on Unstructured Meshes for Hyperbolic Balance Laws
Michael Dumbser, University of Trento, Italy

11:00-11:25 High-Order Explicit Local Time-Stepping Methods for Wave Propagation
Marcus J. Grote and Michaela Mehlin, Universität Basel, Switzerland; Teodora Mitkova, University of Fribourg, Switzerland

11:30-11:55 A Unified Fe Approach for Wave Propagation in Elastic Media - from Near Incompressibility to Acoustics
Jacobo Bielak and Haydar Karaoglu, Carnegie Mellon University, USA

continued in next column

12:00-12:25 High-Performance 3D Numerical Simulations for Seismic Scenarios: An Engineering Perspective
Roberto Paolucci, Paola F. Antonietti, Ilario Mazzieri, Roberto Guidotti, and Chiara Smerzini, Politecnico di Milano, Italy; Marco Stupazzini, Munich RE, Germany

12:30-12:55 Large-Scale Bayesian Seismic Inversion
Omar Ghattas, University of Texas at Austin, USA; Carsten Burstedde, Universität Bonn, Germany; Tan Bui-Thanh, James R. Martin, and Georg Stadler, University of Texas at Austin, USA; Lucas Wilcox, Naval Postgraduate School, USA

Monday, June 17

MS6

Multiscale Model Reduction Techniques for Subsurface Flow - Part I of III

10:30 AM-1:00 PM

Room:Meno Uno 2 - Lower Level

For Part 2 see MS24

The detailed numerical simulation of flow and transport in highly heterogeneous porous media can be prohibitively expensive, particularly when geological uncertainty is considered. For this reason, some type of model-order reduction is often required. Many such reduction techniques have been developed and are applied in practice. We plan to bring together researchers applying these and related approaches for model-order reduction. The intent is to facilitate discussion and interaction between researchers working on these various methods, with the eventual goal of developing systematic and improved model-reduction techniques for problems involving heterogeneity and uncertainty.

Organizer: Yalchin Efendiev
Texas A&M University, USA

Organizer: Ivan Lunati
University of Lausanne, Switzerland

Organizer: Seong H. Lee
Chevron Energy Technology Company, USA

10:30-10:55 Dynamic Upscaling/ downscaling for Multi-Phase Flow in a Multiscale Finite Volume Framework

Seong H. Lee, Chevron Energy Technology Company, USA; Hamdi Tchelepi, Stanford University, USA; Ivan Lunati, University of Lausanne, Switzerland; X Wang, Stanford University, USA; Rouven Kunze, University of Lausanne, Switzerland

11:00-11:25 Generalized Multiscale Finite Element Methods.

Yalchin Efendiev, Texas A&M University, USA; Juan Galvis, Universidad Nacional de Colombia, Colombia; Tom Hou, California Institute of Technology, USA

continued in next column

11:30-11:55 Hybrid Multiscale Finite-Volume Galerkin Method for Elliptic and Parabolic Problems

Patrick Jenny and *Davide Cortinovis*, ETH Zürich, Switzerland

12:00-12:25 Multiscale Mortar Methods for Multiphysics Applications

Ivan Yotov, University of Pittsburgh, USA

12:30-12:55 Convergent Non-Linear Upscaling for Multiphase Flow and Transport in Porous Media

Jan Skogestad, Eirik Keilegavlen, and Jan M. Nordbotten, University of Bergen, Norway

Monday, June 17

MS7

Computational Methods in Geophysical Inverse Problems - Part I of II

10:30 AM-12:00 PM

Room:Parco 3 - Ground Level

For Part 2 see MS16

Geophysical inverse problems are solved routinely in seismology, electromagnetics, potential fields and hydrology. The goal is to infer about the earth's physical properties from collected data. In recent years more data with higher resolution is collected which necessitates higher resolution and larger volumes as well as the efficient treatment of noisy data. In this mini we intend to have a number of talks that are geared towards methodologies that enable the inversion of large number of data with very large model parameters.

Organizer: Eldad Haber
University of British Columbia, Canada

10:30-10:55 Inversion of Large Scale Electromagnetic Data

Eldad Haber, University of British Columbia, Canada

11:00-11:25 Full Waveform Inversion of Blended Data: Analysis of Multi-frequency Inversion Strategies

Mauricio D. Sacchi and Amsalu Y. Anagaw, University of Alberta, Canada

11:30-11:55 Applications of Shaping Regularization in Geophysical Inverse Problems

Sergey Fomel, University of Texas at Austin, USA

Monday, June 17

MS8

Coupled Models and Domain Decomposition in Geosciences - Part I of II

10:30 AM-12:30 PM

Room:Foyer - First Level

For Part 2 see MS17

Coupled heterogeneous phenomena and domain decomposition are increasingly important in geosciences. Examples include ground and surface water coupling, dealing with heterogeneity in porous media flow and transport, coupling the flow with geomechanics, and ocean-atmosphere coupling. Physical and mathematical understanding of the proper coupling conditions as well as accurately solving the individual submodels are both essential to fully simulating the coupled problems. The aim of this minisymposium is to bring together scientists working in this field to report on recent advances. Work presented will range from heterogeneous domain decomposition methods, coupling models of various dimensions, multiphysics flow models, optimized space-time methods, domain decomposition for poroelasticity, to real models in climate prediction.

Organizer: Eric Blayo
Université de Grenoble I, France

Organizer: Caroline Japhet
Université Paris XIII, France

Organizer: Michel Kern
INRIA Rocquencourt, France

10:30-10:55 Space-Time Domain Decomposition for Porous Media Flow and Transport

Thi-Thao-Phuong Hoang, INRIA Paris-Rocquencourt, France; Jerome Jaffre, INRIA Rocquencourt, France; *Caroline Japhet*, Université Paris XIII, France; Michel Kern and Jean E. Roberts, INRIA Rocquencourt, France

11:00-11:25 Multidimensional Coupling for Shallow Water Flows

Edie Miglio, Politecnico di Milano, Italy

continued in next column

11:30-11:55 Coupling Two-Phase Compositional Porous-Medium and Free Flow

Rainer Helmig, Klaus Mosthaf, *Katherina Baber*, and Bernd Flemisch, University of Stuttgart, Germany

12:00-12:25 "Heterogeneous Domain Decomposition Methods for Surface and Saturated/unsaturated Ground Water Flow"

Ralf Kornhuber, Freie Universität Berlin, Germany

Monday, June 17

MS9

Compatible Discretization Methods for Nonlinear Models of Surface and Subsurfaces Flows - Part I of II

10:30 AM-1:00 PM

Room:Forcellini - Ground Level

For Part 2 see MS18

Predictive numerical simulations of geoscience processes require not only more sophisticated physical models but also more accurate and reliable discretization methods for these models. Compatible discretizations are those that inherit or mimic fundamental properties of the PDE such as topology, conservation, symmetries, and positivity structures and maximum principles. Nonlinearity of models and coupling between different physical processes introduce additional challenges for discretization methods. In this minisymposium we discuss recent advances and novel approaches to spatial discretization methods for surface and subsurface flows.

Organizer: Daniil Svyatskiy
Los Alamos National Laboratory, USA

Organizer: Gianmarco Manzini
Los Alamos National Laboratory, USA

10:30-10:55 Mimetic Finite Difference Methods and Virtual Element Discretizations for Porous Media Applications

Gianmarco Manzini, Los Alamos National Laboratory, USA

11:00-11:25 Coupling of Stokes and Darcy Flows using Discontinuous Galerkin and Mimetic Finite Difference Method

Konstantin Lipnikov, Los Alamos National Laboratory, USA; *Danail Vassilev*, University of Exeter, United Kingdom; Ivan Yotov, University of Pittsburgh, USA

continued on next page

Monday, June 17

MS9

Compatible Discretization Methods for Nonlinear Models of Surface and Subsurfaces Flows - Part I of II

continued

11:30-11:55 Nonlinear Discretizations for Multi-Phase Flows in Porous Media
Yuri Vassilevski, Kirill Nikitin, and Kirill Terekhov, Institute of Numerical Mathematics, Russian Academy of Sciences, Russia

12:00-12:25 Nonlinear Monotone Finite Volume Method for Richards Equation
Daniil Svyatskiy, Los Alamos National Laboratory, USA

12:30-12:55 A Multiscale Formulation Based on CVD-MPFA Schemes on Structured and Unstructured Grids
Michael G. Edwards and Elliot Parramore, Swansea University of South Wales, United Kingdom

Lunch Break

1:00 PM-2:00 PM

Atrium - Ground Level

Monday, June 17

MS10

New Developments in the Modeling, Analysis and Simulation of Oceanic Flows - Part II of IV

2:00 PM-4:00 PM

Room:Luciani A - Ground Level

For Part 1 see MS1
For Part 3 see MS19
This minisymposium brings together scientists working on modeling, observations and simulation of oceanic flows. All three research directions are of paramount importance for a better understanding and prediction of oceanic flows. One of the main challenges in both numerical simulations and observations is the wide range of spatial and temporal scales that need to be modeled. The topics covered in this minisymposium include the following: modeling strategies, spatial and temporal discretizations, parallel and high-performance computing, mathematically-based novel approaches to observing and sampling systems, error analysis, and mathematical analysis.

Organizer: Traian Iliescu
Virginia Tech, USA

Organizer: Tamay Ozgokmen
University of Miami, USA

2:00-2:25 An Ergodic Theory and Harmonic Analysis Based Method for Analyzing Ocean Flows
Sherry Scott, Marquette University, USA; Irina Rypina and Lawrence Pratt, Woods Hole Oceanographic Institute, USA; Mike Brown, Miami University, USA

2:30-2:55 Equal-order Finite Elements for Hydrostatic Flow Equations of the Ocean
Malte Braack, Universität Kiel, Germany; Madlen Kimmritz, Christian-Albrechts University of Kiel, Germany

3:00-3:25 Recent Results on Inviscid Limits for the Stochastic Navier-Stokes Equations and Related Systems
Nathan Glatt-Holtz, Indiana University, USA

3:30-3:55 Velocity-Pressure Proper Orthogonal Decomposition Methods For Flow Problems
Swetlana Schyschlowa, Weierstrass Institute for Applied Analysis and Stochastics, Germany

Monday, June 17

MS11

Advances in Mathematical and Numerical Methods for Shallow Water Flows and Applications - Part I of III

2:00 PM-4:00 PM

Room:Parco 1 - Ground Level

For Part 2 see MS29
The Shallow Water System (either in 1D, 2D or 3D) is the basis for different application related to surface water modeling: flood control, coastal engineering, sediment transport, etc... Moreover it is also used in climate models. The goal of this minisymposium is to review mathematical and numerical advances related to shallow water equations (SWE). A non-exahustive list of topics is: - multidimensional coupling; - use of GPU for the numerical solution of SWE; - schemes for flows in channels with irregular geometry; - high-order schemes; - applications: sedimentation, climate models.

Organizer: Edie Miglio
Politecnico di Milano, Italy

Organizer: Mustafa Altinakar
University of Mississippi, USA

2:00-2:25 Energy Stable Scheme for Shallow Water Equations
Mustafa Altinakar, University of Mississippi, USA; Edie Miglio, Politecnico di Milano, Italy; Jaswant Singh, University of Mississippi, USA

2:30-2:55 Second-Order Finite Volume Schemes for Geophysical Shallow Water Flows with Dynamic Wet-Dry Front
Frederic Couderc, CNRS, France; Jerome Monnier and Jean-Paul Vila, Institut de Mathématiques de Toulouse, France

3:00-3:25 Comparison Between Sph and Level Set Methods for Free Boundary Problems for Incompressible Euler and Navier-Stokes Equations
Giovanni Russo, University of Catania, Italy; *Armando Coco*, UNIBA, Italy; Giuseppe Bilotta, University of Catania, Italy

3:30-3:55 Modelling Solute Transport in Meandering Channels using a High-order DG Method
Valerio Caleffi and Alessandro Valiani, University of Ferrara, Italy

Monday, June 17

MS12

Parameter Estimation for Heterogeneous Aquifers with Geostatistical Inversion

2:00 PM-4:00 PM

Room:Parco 2 - Ground Level

The spatially resolved estimation of hydraulic conductivity is a crucial part of groundwater flow modelling. As measurements are scarce and expensive an optimal exploitation of the available data and a combination of different data sources is necessary. In the last years much progress has been made in the area of geostatistical inversion. The mini symposium will present contributions about a new approach for parallel estimation of parameters with very small dispersivities based on Discontinuous Galerkin schemes, about geostatistical inversion with transient flow fields, the use of ensemble Kalman filters and the practical application with tomographic surveys.

Organizer: Olaf Ippisch
University of Heidelberg, Germany

2:00-2:25 A Discontinuous Galerkin Based Quasi-Linear Geostatistical Approach
Adrian Ngo, University of Heidelberg, Germany; Ronnie L. Schwede, University of Tübingen, Germany; Peter Bastian, University of Heidelberg, Germany; Olaf A. Cirpka, University of Tuebingen, Germany; Olaf Ippisch, University of Heidelberg, Germany

2:30-2:55 Geostatistical Inversion under Transient Flow Conditions
Ole Klein, University of Heidelberg, Germany; Olaf A. Cirpka, University of Tuebingen, Germany; Olaf Ippisch, University of Heidelberg, Germany

3:00-3:25 Parameter Estimation by Ensemble Kalman Filters with Transformed Data: Approach and Application to Hydraulic Tomography
Wolfgang Nowak, University of Stuttgart, Germany; Anneli Schöniger, University of Tübingen, Germany; Harrie Jan Hendricks Franssen, Forschungszentrum Jülich GmbH, Germany

3:30-3:55 Active and Passive Hydrogeophyscial Tomographic Surveys
Tian-Chyi J. Yeh, University of Arizona, USA

Monday, June 17

MS13

Non-equilibrium Models for Flows in Porous Media

2:00 PM-4:00 PM

Room:Giotto - Ground Level

This mini-symposium will address non-equilibrium models for flow and transport in porous media. When compared to the traditional ones, such models disregard the assumption of having a fixed, strictly medium dependent relationship between quantities like saturation, permeability, or pressure difference. The speakers will address issues related to the mathematical and numerical analysis of non-equilibrium models, as well as underlying modelling ideas.

Organizer: Iuliu Sorin Pop
Eindhoven University of Technology, Netherlands

Organizer: Florin A. Radu
University of Bergen, Norway

2:00-2:25 Non-Equilibrium Capillarity Effect at Different Scales
Majid Hassanizadeh, University of Utrecht, Netherlands; Simona Bottero, Delft University of Technology, Netherlands

2:30-2:55 Phase Transitions Across Scales: Discrete and Continuum Models
Malgorzata Peszynska, Oregon State University, USA

3:00-3:25 Instability Effects in Hysteresis Models for Porous Media Flow
Ben Schweizer, TU Dortmund, Germany

3:30-3:55 Heterogeneous Multiscale Methods for Two-Phase Flow with Rate-Dependent Extension
Christian Rohde, University of Stuttgart, Germany

Monday, June 17

MS14

Numerical Investigations of Convection at High Rayleigh Numbers

2:00 PM-4:00 PM

Room:Meno Uno 1 - Lower Level

Convective fluid motion is prevalent in the natural and physical sciences as well as many fields of engineering. Despite the common occurrence of this phenomenon, and years of careful study, convection driven by a strong driving force (as measured by the non-dimensional Rayleigh number) is not well understood. Improved computational resources in recent years has led to increased understanding, although there is much more work to be done. This mini-symposium will survey some recent advances in the numerical simulation of convection in simple geometries, highlighting similarities and differences between convection in the traditional Rayleigh-Benard configuration and convection driven by other modes of heating or with different boundary conditions.

Organizer: Jared Whitehead
Los Alamos National Laboratory, USA

Organizer: David Goluskin
Columbia University, USA

2:00-2:25 Convection Driven by Internal Heating
David Goluskin and Edward Spiegel, Columbia University, USA

2:30-2:55 High Rayleigh Number 2D Rayleigh-Benard Convection
Erwin van der Poel and Rodolfo Ostilla Monico, University of Twente, Netherlands; Roberto Verzicco, University of Rome I, Italy; Detlef Lohse, University of Twente, Netherlands

continued on next page

Monday, June 17

MS14

Numerical Investigations of Convection at High Rayleigh Numbers

continued

3:00-3:25 Effects of Velocity and Temperature Boundary Conditions in Turbulent Thermal Convection
Hans Johnston, University of Massachusetts, Amherst, USA; David Goluskin, Columbia University, USA; Da Zhu and Glenn Flierl, Massachusetts Institute of Technology, USA; Charles R. Doering, University of Michigan, Ann Arbor, USA

3:30-3:55 Large Scale Patterns in Convection: from Rayleigh-Benard, through Prandtl problem, to moist atmospheric convection
Antonio Parodi, Istituto di Scienze dell'Atmosfera e del Clima, Italy

Monday, June 17

MS15

Modeling and Numerical Aspects of Coupled Surface and Subsurface Flows

2:00 PM-4:00 PM

Room:Meno Uno 2 - Lower Level

Coupled surface and subsurface flows arise routinely in science and engineering. In these flow domains, the processes evolve on different space and time scales that requires an accurate treatment of transitions between the flow systems at the interface. Classical approaches provide reliable results for physically restricted situations. Therefore, both formulation of models and numerical methods for coupled systems is an area in need of advancement. The minisymposium is devoted to modeling the coupling between the free flow and porous medium through the sharp interface and transition region concepts, and solving the coupled problem numerically taking advantages of different discretization techniques.

Organizer: Iryna Rybak
University of Stuttgart, Germany

2:00-2:25 Evaporation from Porous Media Influenced by Atmospheric Processes
Rainer Helmig, Thomas Fetzer, and Klaus Mosthaf, University of Stuttgart, Germany

2:30-2:55 Transition Region Model for Coupling Free Flow and Porous Medium Systems
Iryna Rybak, University of Stuttgart, Germany; William G. Gray and Cass T. Miller, University of North Carolina at Chapel Hill, USA

3:00-3:25 Numerical Assessment of Different Discretizations for Stokes-Darcy Coupling
Ulrich Wilbrandt, Free University of Berlin, Germany

3:30-3:55 Scalable Coupling of Surface-Subsurface Water Flows
Thomas De Maet, Université Catholique de Louvain, Belgium; Emmanuel Hanert, University of Louvain-la-Neuve, Belgium

Monday, June 17

MS16

Computational Methods in Geophysical Inverse Problems - Part II of II

2:00 PM-4:00 PM

Room:Parco 3 - Ground Level

For Part 1 see MS7

Geophysical inverse problems are solved routinely in seismology, electromagnetics, potential fields and hydrology. The goal is to infer about the earth's physical properties from collected data. In recent years more data with higher resolution is collected which necessitates higher resolution and larger volumes as well as the efficient treatment of noisy data. In this mini we intend to have a number of talks that are geared towards methodologies that enable the inversion of large number of data with very large model parameters.

Organizer: Eldad Haber
University of British Columbia, Canada

2:00-2:25 Joint Inversion in Poroelasticty
Georg Stadler, Marc A. Hesse, Noemi Petra, and Omar Ghattas, University of Texas at Austin, USA

2:30-2:55 Regularization for Nonlinear Inverse Problems
Jodi Mead, Boise State University, USA; Chad Hammerquist, Sensty Group, Inc., USA

3:00-3:25 Solution of transient CSEM problems in model reduction framework
Aria Abubakar, Schlumberger-Doll Research, USA; Liliana Borcea, Rice University, USA; *Vladimir L. Druskin* and Tarek Habashy, Schlumberger-Doll Research, USA; Alexander Mamonov, University of Texas at Austin, USA; Valeria Simoncini, Universita' di Bologna, Italy; Mikhail Zaslavsky, Schlumberger-Doll Research, USA

3:30-3:55 3D Forward and Inverse Modeling of Geo-Electromagnetic Fields
Klaus Spitzer, Ralph-Uwe Boerner, Michael Eiermann, and Oliver G. Ernst, TU Bergakademie Freiberg, Germany

Monday, June 17

MS17

Coupled Models and Domain Decomposition in Geosciences - Part II of II

2:00 PM-4:00 PM

Room:Foyer - First Level

For Part 1 see MS8

Coupled heterogeneous phenomena and domain decomposition are increasingly important in geosciences. Examples include ground and surface water coupling, dealing with heterogeneity in porous media flow and transport, coupling the flow with geomechanics, and ocean-atmosphere coupling. Physical and mathematical understanding of the proper coupling conditions as well as accurately solving the individual submodels are both essential to fully simulating the coupled problems. The aim of this minisymposium is to bring together scientists working in this field to report on recent advances. Work presented will range from heterogeneous domain decomposition methods, coupling models of various dimensions, multiphysics flow models, optimized space-time methods, domain decomposition for poroelasticity, to real models in climate prediction.

Organizer: Eric Blayo
Université de Grenoble I, France

Organizer: Caroline Japhet
Université Paris XIII, France

Organizer: Michel Kern
INRIA Rocquencourt, France

2:00-2:25 Mathematical and Numerical Delicacies in Coupled Ocean-atmosphere Simulations
Florian Lemarié, INRIA Grenoble Rhône-Alpes, France

2:30-2:55 Coupling Navier-Stokes and Darcy Equations: Modeling and Numerical Methods
Marco Discacciati, Universidad Politecnica de Catalunya, Spain

continued in next column

3:00-3:25 Domain Decomposition for Poroelasticity and Elasticity with DG Jumps and Mortars
Vivette Girault, University of Paris VI, France; *Gergina Pencheva* and Mary F. Wheeler, University of Texas at Austin, USA; Tim Wildey, Sandia National Laboratories, USA

3:30-3:55 An Overview of Coupling Strategies between Ocean and Atmosphere in Earth System Models
Olivier Marti, Institut Pierre Simon Laplace, Paris, France; Sophie Valcke, Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique, France

Monday, June 17

MS18

Compatible Discretization Methods for Nonlinear Models of Surface and Subsurfaces Flows - Part II of II

2:00 PM-4:00 PM

Room:Forcellini - Ground Level

For Part 1 see MS9

Predictive numerical simulations of geoscience processes require not only more sophisticated physical models but also more accurate and reliable discretization methods for these models. Compatible discretizations are those that inherit or mimic fundamental properties of the PDE such as topology, conservation, symmetries, and positivity structures and maximum principles. Nonlinearity of models and coupling between different physical processes introduce additional challenges for discretization methods. In this minisymposium we discuss recent advances and novel approaches to spatial discretization methods for surface and subsurface flows.

Organizer: Daniil Svyatskiy
Los Alamos National Laboratory, USA

Organizer: Gianmarco Manzini
Los Alamos National Laboratory, USA

2:00-2:25 Soil Moisture Dynamics and Rain Interarrival Times
Stefano Ferraris, University of Turin, Italy

2:30-2:55 A Non Linear Correction and Maximum Principle for Diffusion Operators with Hybrid Schemes and Discrete Dual Finite Volume Schemes
Christophe Le Potier, CEA, France; Konstantin Lipnikov, Los Alamos National Laboratory, USA

3:00-3:25 Comparison of DDFV and DG Methods for Flow in Anisotropic Heterogeneous Porous Media
Vincent Baron, Université de Nantes, France; Yves Coudiere, Université Bordeaux I, France; Pierre Sochala, BRGM, France

3:30-3:55 Non Linear Finite Volume Schemes For the Heat Equation in 1D
Bruno Despres, University of Paris VI, France

Coffee Break

4:00 PM-4:30 PM

Atrium - Ground Level

Monday, June 17

CP1

Coupled Consolidation Models

4:30 PM-6:30 PM

Room:Luciani A - Ground Level

Chair: To Be Determined

4:30-4:45 A Mixed and Galerkin Finite Element Formulation for Coupled Poroelasticity
Nicola Castelletto, Carlo Janna, and Massimiliano Ferronato, University of Padova, Italy

4:50-5:05 Coupled Geomechanics and Flow for Unstructured Naturally Fractured Reservoir Models
Timur T. Garipov, and Hamdi Tchelepi, Stanford University, USA

5:10-5:25 Mechanics of Fluid Injection into Deformable Porous Materials
Christopher W. MacMinn, Eric Dufresne, and John S. Wettlaufer, Yale University, USA

5:30-5:45 A Finite Volume Method for the Solution of Fluid Flows Coupled with the Geomechanics of Compacting Porous Media
Clovis R. Maliska and Alessandro Dal Pizzol, Federal University of Santa Caterina, Brazil

5:50-6:05 Solution Strategies for Coupled Geomechanical and Flow Problems – Recent Experiences
A . (Tony) Settari, University of Calgary, Canada

6:10-6:25 A Fully Coupled Multiphase Flow and Geomechanics Solver for Highly Heterogeneous Porous Media
Daegil Yang, Texas A&M University, USA; George Moridis, Lawrence Berkeley National Laboratory, USA; Thomas Blasingame, Texas A&M University, USA

Monday, June 17

CP2

High Performance Computing

4:30 PM-6:10 PM

Room:Parco 1 - Ground Level

Chair: Serguei Maliassov, ExxonMobil, USA

4:30-4:45 A Domain Decomposition-Based Parallel Software for Data Assimilation in the Mediterranean Sea
Luisa D' Amore, University of Naples "Frederico II", Naples, Italy; *Rossella Arcucci*, Euro Mediterranean Center for Climate Change, Italy; Luisa Carracciuolo, Italian National Research Council, Italy; Livia Marcellino, University of Naples, Italy; Almerico Murli, Euro Mediterranean Center for Climate Change, Italy

4:50-5:05 Scalable Reservoir Simulation on Massively Parallel Computers
Serguei Y. Maliassov, ExxonMobil, USA; Bret Beckner, ExxonMobil Upstream Research Company, USA; Vadim Dyadechko, ExxonMobil, USA

5:10-5:25 Scalable Multi-Level Preconditioning Techniques for Variable Viscosity Stokes Flow Problems Arising from Geodynamic Applications
Dave May, ETH Zürich, Switzerland

5:30-5:45 Sam *oa*^{2}, a Parallel Cache-Efficient Simulation Environment
Kaveh Rahnema, Oliver Meister, and Michael Bader, Technische Universität München, Germany

5:50-6:05 A Parallel Server for Adaptive Geoinformation
Sebastian Rettenberger, Alexander Breuer, Oliver Meister, and Michael Bader, Technische Universität München, Germany

Monday, June 17

CP3

Iterative Solution Models

4:30 PM-6:30 PM

Room:Parco 2 - Ground Level

Chair: Rami Younis, University of Tulsa, USA

4:30-4:45 Some Strategies of Linear and Nonlinear Preconditioning for Reactive Transport Model
Laila Amir, University of Marrakech, Morocco; Michel Kern, INRIA Rocquencourt, France; Abdelaziz taakilli, University of Errachidia, Morrocco

4:50-5:05 High Performance Computing Using Local Time-Stepping Methods for Elastodynamics
Yohann Dudouit, INRIA, France; Jean-Luc Boelle, Total, France; Luc Giraud, INRIA Bordeaux Sud-Ouest, France; Florence Millot, CERFACS, France; Sébastien Pernet, ONERA, France

5:10-5:25 Geosounding Inversion with Bregman Iterative Methods
Hugo Hidalgo and Enrique Gomez-Treviño, CICESE, Mexico

5:30-5:45 Algebraic Multigrid Preconditioner for Numerical Finite-Element Solutions of Electromagnetic Induction Problems
Jelena Koldan, Vladimir Puzyrev, and Jose Maria Cela, Barcelona Supercomputing Center, Spain

5:50-6:05 Unconditionally Stable Transport Solvers for Two Phases Flow with Polymer.
Xavier Raynaud, SINTEF Energy Research, Norway; Knut-Andreas Lie, SINTEF, Norway; Halvor Nilsen and Atgeirr Rasmussen, SINTEF Energy Research, Norway

6:10-6:25 Precisely, How Fast Is Your Fully Implicit Newton-Like Solver?
Rami M. Younis, University of Tulsa, USA

Monday, June 17

CP4

Multiphase Flow in Porous Media

4:30 PM-6:30 PM

Room:Giotto - Ground Level

Chair: To Be Determined

4:30-4:45 A Computational Method for Simulating Immiscible Incompressible Three Phase Flow Model in Heterogeneous Porous Media
Eduardo Abreu, University of Campinas, Brazil

4:50-5:05 Co2 Storage Simulations Using Low Complex Model Geometries
Norbert Böttcher, Wenqing Wang, Björn Zehner, Uwe-Jens Görke, and Olaf Kolditz, Helmholtz - Centre for Environmental Research - UFZ, Germany

5:10-5:25 A Conservative Numerical Methodology for Multiphase Flow in Heterogenous Porous Media Allowing Changes in Porosity
Maicon R. Correa, University of Campinas, Brazil; Marcio Borges, National Laboratory of Scientific Computation LNCC/MCT Petropolis, Brazil; Jesus Obregon, National Laboratory for Scientific Computing, Brazil

5:30-5:45 Using Coupled Implicit and P-Adaptive Discontinuous Galerkin Method to Model Miscible Displacement with Adverse Mobility Ratio
Hao Huang, Huafei Sun, Aruna Mohan, and Jichao Yin, ExxonMobil Upstream Research Company, USA; Guglielmo Scovazzi, Duke University, USA

5:50-6:05 Co2 Vertical Migration Through a Piecewise Homogeneous Porous Medium
Emmanuel Mouche, CEA, DRN, France; Tri Dat Ngo, CEA, France; Pascal audigane, BRGM, France

6:10-6:25 Reservoir Modelling Based on Transmissibility Upscaling
Paola Panfili and Alberto Cominelli, Eni, E&P Division, Italy; *Luca Turconi* and Anna Scotti, Politecnico di Milano, Italy

Monday, June 17

CP5

Transport in Porous Media

4:30 PM-6:30 PM

Room:Meno Uno 1 - Lower Level

Chair: Marc A. Hesse, University of Texas at Austin, USA

4:30-4:45 On the Impact of Anisotropic Mesh Adaptation on Solute Transport Modeling in Porous Media
Bahman Esfandiar Jahromi, Politecnico di Milano, Italy; Alberto Guadagnini, Los Alamos National Laboratory, USA; Giovanni Porta and Simona Perotto, Politecnico di Milano, Italy

4:50-5:05 Simulating Non-Dilute Transport in Porous Media Using a Tcat-Based Model
Deena Hannoun, North Carolina State University, USA

5:10-5:25 Structure of Reaction Fronts in Porous Media
Marc A. Hesse, University of Texas at Austin, USA

5:30-5:45 A Comparison of Closures for Stochastic Transport
Kenneth D. Jarman and Alexandre M. Tartakovsky, Pacific Northwest National Laboratory, USA

5:50-6:05 Large - Time Behavior of the Solution for Nonlinear Random Boussinesq - Glover Equation Driven by Colored Noise
Fejzi Kolaneci, University of New York, Tirana, Albania

6:10-6:25 Multilevel Monte Carlo (MLMC) for Two Phase Flow and Transport in Random Heterogeneous Porous Media
Florian Müller and Patrick Jenny, ETH Zürich, Switzerland; Daniel W. Meyer, Institute of Fluid Dynamics, Switzerland

Monday, June 17

CP6

Multiscale Modeling

4:30 PM-6:30 PM

Room:Meno Uno 2 - Lower Level

Chair: Edie Miglio, Politecnico di Milano, Italy

4:30-4:45 From Nonlinear Adsorption at Microscale to Nonlinear Diffusion at Macroscale.
Harsha Hutridurga Ramaiah and Gregoire Allaire, Ecole Polytechnique, France

4:50-5:05 A Multi-Scale Numerical Simulation of Carbonate Rocks Properties Using 3D Micro-Tomography Images
Mohamed S. Jouini and Sandra Vega, The Petroleum Institute of Abu Dhabi, United Arab Emirates

5:10-5:25 A Multi-Scale Method to Include Analytical Solutions for Multi-Phase Leakage Through Faults in a Numerical Model
Mary Kang, Princeton University, USA; Jan M. Nordbotten, University of Bergen, Norway; Florian Doster, Karl Bandilla, and Michael A. Celia, Princeton University, USA

5:30-5:45 A Multiscale Finite Element Method for Transport Modeling
Franck Ouaki, Guillaume Enchéry, and Sylvain Desroziers, IFP Energies nouvelles, France; Grégoire Allaire, CMAP, Ecole Polytechnique, France

5:50-6:05 Adaptative Multi-Scale Parameterization in Fractured Porous Media
Nicolas Trottier, Commissariat à l'Energie Atomique, France

Monday, June 17

CP7

Novel Discretization

4:30 PM-6:10 PM

Room:Parco 3 - Ground Level

Chair: Peter Frolkovic, Slovak University of Technology, Slovakia

4:30-4:45 Applications of Level Set Methods in Numerical Modelling of Flow and Transport Problems
Peter Frolkovic, Slovak University of Technology, Slovakia

4:50-5:05 A Locally Conservative Eulerian-Lagrangian Finite Volume Weno Scheme for Hyperbolic Conservation
Chieh-Sen Huang, National Sun Yat-Sen University, Taiwan; Todd Arbogast, University of Texas at Austin, USA

5:10-5:25 A Locking-Free Lowest-Order Discretization of Biot's Consolidation Model on General Meshes
Simon Lemaire, IFP Energies nouvelles, France; Daniele Di Pietro, University Montpellier II, France; Robert Eymard, Université Paris-Est, France

5:30-5:45 Space-Time Hybridizable Discontinuous Galerkin Methods for Incompressible Flows
Sander Rhebergen, University of Oxford, United Kingdom; Bernardo Cockburn, University of Minnesota, USA; Jaap van Der Vegt, University of Twente, Netherlands

5:50-6:05 A Cell-Centered Scheme for the Heterogeneous and Anisotropic Diffusion Equations on Distorted Meshes
Qiang Zhao, Institute of Applied Physics and Computational Mathematics, China; Xia Cui and Guangwei Yuan, Institute of Applied Physics and Computational Mathematics, China

Monday, June 17

CP8

Atmosphere-Ocean Interaction

4:30 PM-6:10 PM

Room:Foyer - First Level

Chair: To Be Determined

4:30-4:45 In Search for a Robust Representation of Cloud Microphysics for Aerosol-Cloud-Aerosol Interactions
Sylwester J. Arabas, University of Warsaw, Poland; Miroslaw Andrejczuk, University of Oxford, United Kingdom; Wojciech Grabowski, National Center for Atmospheric Research, USA; Anna Jaruga, University of Warsaw, Poland; Zachary Lebo, National Center for Atmospheric Research, USA; Hanna Pawlowska, University of Warsaw, Poland

4:50-5:05 Asymptotic Modeling of Non-Hydrostatic/Hydrostatic Dynamical Coupling in the Ocean Surface Boundary Layer
Greg Chini, Ziemowit Malecha, and Zhexuan Zhang, University of New Hampshire, USA; Keith Julien, University of Colorado Boulder, USA

5:10-5:25 Weather Models of Anomalous Diffusion
Moreno Concezzi, University of Rome III, Italy

5:30-5:45 Water in the Subducting Oceanic Plate: a Trilogy
Manuele Faccenda, Universita di Padova, Italy; Luigi Burlini, Taras Gerya, and Neil Mancktelow, ETH Zürich, Switzerland

Monday, June 17

CP9

Groundwater Transport and Uncertainty - Part I of II

4:30 PM-6:10 PM

Room:Forcellini - Ground Level

Chair: Filippo Notarnicola, Istituto Applicazioni Calcolo CNR Bari, Italy

4:30-4:45 Perfectly Matched Layers for the Wave Equation in Discontinuous Media
Kenneth Duru, Stanford University, USA

4:50-5:05 Numerical Approximation for a Model of Methane Hydrates
F. Patricia Medina, Nathan L. Gibson, Malgorzata Peszynska, and Ralph E. Showalter, Oregon State University, USA

5:10-5:25 Fast Uncertainty Quantification of Subsurface Flow and Transport with Markovian Velocity Processes
Daniel W. Meyer, Institute of Fluid Dynamics, Switzerland; Hamdi Tchelepi, Stanford University, USA; Patrick Jenny, ETH Zürich, Switzerland

5:30-5:45 A Bioventing Mathematical Model Based on Pure Oxygen Injection
Filippo Notarnicola, Istituto Applicazioni Calcolo CNR Bari, Italy

5:50-6:05 Torsional Wave Dispersion Relation in a Self-Reinforced Layer over a Gravitating Viscoelastic Half Space
Sumit K. Vishwakarma and Shishir Gupta, Indian School of Mines, India

Icebreaker at Caffè Pedrocchi

7:30 PM-9:30 PM

Room: Caffè Pedrocchi - Center of Town

Tuesday, June 18

Registration
8:00 AM-5:00 PM
Atrium - Ground Level

Remarks
8:25 AM-8:30 AM
Room:Luciani A - Ground Level

IP3
Career Award Lecture: Some Successes and Challenges in Coastal Ocean Modeling
8:30 AM-9:15 AM

Room:Luciani A - Ground Level

Chair: Todd Arbogast, University of Texas at Austin, USA

The coastal ocean is rich with physical and biological processes, often occurring at vastly different scales. In this talk, we will outline some of these processes and their mathematical description. We will then discuss the current state of numerical methods for coastal ocean modeling and recent research into improvements to these models, focusing on accuracy and efficiency for high performance computing. We will also highlight some of the successes of these models in simulating complex events, such as hurricane storm surges. Finally, we will outline several interesting challenges which are ripe for future research.

Clint Dawson
University of Texas at Austin, USA

Tuesday, June 18

IP4
Junior Scientist Award Lecture: Interpreting Geological Observations Through the Analysis of Non-linear Waves
9:15 AM-10:00 AM

Room:Luciani A - Ground Level

Chair: Sorin Pop, CASA and Eindhoven University of Technology, The Netherlands

Geological and environmental systems are rich in examples of self-organization and pattern formation. These patterns contain information about processes as diverse as seawater intrusion into coastal aquifers, the long-term safety of geological CO2 storage, and the formation of the oceanic crust. I will discuss how important observations in these three areas can be explained by non-linear waves. This illustrates the potential of the mathematical analysis of non-linear waves to contribute to our understanding of fundamental geological phenomena and applied environmental problems.

Marc A. Hesse
University of Texas at Austin, USA

Coffee Break
10:00 AM-10:30 AM
Atrium - Ground Level

Tuesday, June 18

MS19
New Developments in the Modeling, Analysis and Simulation of Oceanic Flows - Part III of IV
10:30 AM-1:00 PM

Room:Luciani A - Ground Level

For Part 2 see MS10
For Part 4 see MS46

This minisymposium brings together scientists working on modeling, observations and simulation of oceanic flows. All three research directions are of paramount importance for a better understanding and prediction of oceanic flows. One of the main challenges in both numerical simulations and observations is the wide range of spatial and temporal scales that need to be modeled. The topics covered in this minisymposium include the following: modeling strategies, spatial and temporal discretizations, parallel and high-performance computing, mathematically-based novel approaches to observing and sampling systems, error analysis, and mathematical analysis.

Organizer: Traian Iliescu
Virginia Tech, USA

Organizer: Tamay Ozgokmen
University of Miami, USA

10:30-10:55 Grand LAgrangian Deployment (GLAD): Optimal Launch Strategies for Dispersion Near the Deepwater Horizon Oil Spill Site
Tamay Ozgokmen, University of Miami, USA; Andrew Poje, City University of New York, College of Staten Island, USA; Bruce Lipphardt, University of Delaware, USA; Brian Haus, University of Miami, USA; Gregg Jacobs, US Naval Research Laboratory, USA; M. Josefina Olascoaga, Edward Ryan, Guillaume Novelli, and Angelique C. Haza, University of Miami, USA; Denny Kirwan, Jr., University of Delaware, USA

continued on next page

Tuesday, June 18

MS19

New Developments in the Modeling, Analysis and Simulation of Oceanic Flows - Part III of IV

continued

11:00-11:25 Lagrangian Tools and the Assessment of the Predictive Capacity of Geophysical Data Sets
Carolina Mendoza, Universidad Politécnica de Madrid, Spain; *Ana M. Mancho*, Consejo Superior Investigaciones Cientificas, Spain; Denny Kirwan, University of Delaware, USA; Stephen Wiggins, University of Bristol, United Kingdom

11:30-11:55 Multi-Phase Air-Sea Interface Model
Alex Soloviev, Nova Southeastern University, USA

12:00-12:25 The Search for Lagrangian Coherent Structures in Coastal Areas: Results from the Gelato 2012 Experiment in the Gulf of Naples
Enrico Zambianchi, Parthenope University, Napoli, Italy

12:30-12:55 Numerical Analysis of a Smagorinsky LES Model for Primitive Equations
Macarena Gomez Marmol, Universidad de Sevilla, Spain

Tuesday, June 18

MS20

Advances in Pore-scale Modeling and Upscaling - Part II of IV

10:30 AM-1:00 PM

Room:Parco 1 - Ground Level

For Part 1 see MS2
For Part 3 see MS47

Pore-scale modeling offers a valuable tool to advance the understanding of nonlinear and irreversible transport phenomena in porous media. A non-exhaustive list of applications includes wettability alteration, three- phase fluid configurations, non-Newtonian flow, colloid transport and retention, as well as reactive transport and fluid-solid interactions. Despite the existence of various simulation approaches, several problems remain to guarantee an accurate description of the complex physical processes in a sufficiently large number of pores. Also, the difficulties in upscaling pore-scale behavior to the macro scale remain unresolved. This mini-symposium discusses advances in different modeling approaches, and suggests the future directions.

Organizer: Masa Prodanovic
University of Texas at Austin, USA

Organizer: Ken Sorbie
Heriot-Watt University, United Kingdom

Organizer: Pavel Tomin
University of Lausanne, Switzerland

Organizer: Matthew Balhoff
University of Texas at Austin, USA

Organizer: Malgorzata Peszynska
Oregon State University, USA

Organizer: Timothy D. Scheibe
Pacific Northwest National Laboratory, USA

10:30-10:55 Pore Scale Coupling of Fluid and Solid Mechanics for Simulation of Infiltration of Fines in Porous Media
Masa Prodanovic and Maryam Mirabolg, University of Texas at Austin, USA

continued in next column

11:00-11:25 Pore Geometry: Film Menisci Motion and Throats
W. Brent Lindquist, Daesang Kim, and Joo-Won Kim, Stony Brook University, USA

11:30-11:55 Volume of Fluid Direct Numerical Simulations of Invasion of 3D porous media
Stephane Zaleski, Université Pierre et Marie Curie, France; Igor Bondino, Total, France; Bertrand Lagrée, Université Pierre et Marie Curie and Total, France

12:00-12:25 Absolute and Relative Permeability for Water-wet Systems Calculated in the Presence of Micro- (unresolved) Porosity
Christoph Arns, University of New South Wales, Australia

12:30-12:55 Hybrid Multiscale Finite Volume Method for Two-Phase Flow trough Porous Media
Pavel Tomin and Ivan Lunati, University of Lausanne, Switzerland

Tuesday, June 18

MS21

Discrete-fracture Models for Porous Media Flow. Part 2: Reduced Models - Part II of III

10:30 AM-1:00 PM

Room:Parco 2 - Ground Level

For Part 2 see MS48

Numerical simulation of flow in fractured media is of particular importance for environmental applications, CO2 storage and oil and gas exploitation. The aim of this minisymposium is to bring together researchers working on the modelling of flow in fractured media, with in particular an emphasis on techniques based on the coupling of reduced models for flow along the fractures with models for flow in the rock matrix. Both single and multiphase flow will be considered. Among the topics to be addressed are conforming and non-conforming discretization of the fractures and modelling of networks of fractures.

Organizer: Anna Scotti
Politecnico di Milano, Italy

Organizer: Jean E. Roberts
INRIA Rocquencourt, France

Organizer: Luca Formaggia
Politecnico di Milano, Italy

10:30-10:55 A Finite Element Optimization Method for Simulating Discrete Fracture Network Flows
Stefano Berrone, Sandra Pieraccini, and Stefano Scialo`, Politecnico di Torino, Italy

11:00-11:25 A Multiscale Model for Network Flow Embedded in Porous Media
Barbara Wohlmuth, and Tobias Köppl, Technische Universität Müchen, Germany

11:30-11:55 Coupled Flow Model and Simulation in 3D Porous-fractured Media
Thomas Dufaud, INRIA, France; Jocelyne Erhel and Géraldine Pichot, INRIA-Rennes, France

continued in next column

12:00-12:25 Reduced Models for Flow in Networks of Fractures
Luca Formaggia, Alessio Fumagalli, and Anna Scotti, Politecnico di Milano, Italy

12:30-12:55 DFM Modelling for Non-Matching Fracture and Matrix Grids: Pressure Continuity and Boundary Conditions
Nicolas Schwenck and Bernd Flemisch, University of Stuttgart, Germany; Barbara Wohlmuth, Technical University of Munich, Germany; Helmig Rainer, University of Stuttgart, Germany

Tuesday, June 18

MS22

Theory and Computation of Porous Media Flows - Part II of II

10:30 AM-1:00 PM

Room:Giotto - Ground Level

For Part 1 see MS4

Porous media flows pose challenges of various kinds.Various oil recovery processes, CO2 sequestration and subsurface flows involve multi-phase flows with capillary pressure, wettability, and multi-scale features in permeability. Modeling and accurate computation of fluid flows during such displacement processes has been an important topic of research for quite sometime. These minisymposia will facilitate presentation of recent works by the speakers in areas such as multi-scale modeling, stability of fluid flows, high resolution numerical methods, improved mathematical models, and high performance computing.

Organizer: Prabir Daripa
Texas A&M University, USA

Organizer: Sourav Dutta
Texas A&M University, USA

10:30-10:55 A Mixed Approach "Pore-Network Model/Direct Numerical Simulation" to Simulate Multiphase Flow Processes
Pierre Horgue, Institut de Mécanique des Fluides de Toulouse, France; Michel Quintard and Marc Prat, Institut de Mécanique des Fluides, France

11:00-11:25 An Efficient Numerical Method for ASP Flooding in Tertiary Oil Recovery
Sourav Dutta, and Prabir Daripa, Texas A&M University, USA

11:30-11:55 Finite Elements for Reactive Flow in a Fracture and Reaction-induced Boundary Movement
Thomas Wick, Mary F. Wheeler, and Kundan Kumar, University of Texas at Austin, USA

continued on next page

Tuesday, June 18

MS22

Theory and Computation of Porous Media Flows - Part II of II

continued

12:00-12:25 Optimal Flux Allocation and Control of Volume Errors in Streamline-Based Flow Simulation
Anna Nissen, Stanford University, USA; Marco Thiele, Streamsim Technologies/Stanford University, USA; Margot Gerritsen, Stanford University, USA; Gunilla Kreiss, Uppsala University, Sweden

12:30-12:55 Scale Analysis of Miscible Density-Driven Convection in Porous Media
Patrick Jenny, ETH Zürich, Switzerland; Joohwa Lee, Audi Corp., Germany; Hamdi Tchelepi, Stanford University, USA

Tuesday, June 18

MS23

Recent Advances in Computational Seismology - Part II of II

10:30 AM-1:00 PM

Room:Meno Uno 1 - Lower Level

For Part 1 see MS5

Understanding the physics of earthquakes and predicting their impacts on the human and natural environment is of crucial importance for delineating seismic risk reduction strategies. For such a reason computational seismology is an effective tool for the efficient prediction of the seismic response in complex geological environments. The aim of this minisymposium is to discuss recent developments in this area. The proposed topics include (but are not limited to) recent advances on computational seismology with particular attention to numerical methods for seismic wave propagation, challenges in code development, and associated inverse problems.

Organizer: Ilario Mazzieri
Politecnico di Milano, Italy

Organizer: Alfio Quarteroni
École Polytechnique Fédérale de Lausanne, Switzerland

Organizer: Paola F. Antonietti
Politecnico di Milano, Italy

10:30-10:55 Modeling Biot Systems in Porous Media
Mary F. Wheeler, University of Texas at Austin, USA; Andro Mikelic, Université Claude Bernard Lyon 1, France; Bin Wang, University of Texas at Austin, USA

11:00-11:25 A Comparison of Explicit Continuous and Discontinuous Galerkin Methods and Finite Differences for Wave Propagation in 3D Heterogeneous Media
Elena Zhebel and Sara Minisini, Shell Global Solutions International B.V., Rijswijk, Netherlands; Alexey Kononov, Source Contracting BV, Culemborg, Netherlands; Wim A. Mulder, Shell Global Solutions International B.V., Rijswijk, Netherlands and Delft University of Technology, Delft, Netherlands

continued in next column

11:30-11:55 Dispersion Analysis by Rayleigh Quotients: An Efficient Tool for High Order Finite Element Analysis in Wave Modeling
Saulo P. Oliveira, Universidade da Bahia, Brazil; Geza Seriani, Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Italy

12:00-12:25 Lessons Learnt from Recent Earthquakes: the Importance of 3D Physical Modeling in Insurance and Reinsurace Market
Marco Stupazzini, Munich RE, Germany; Roberto Guidotti, Ilario Mazzieri, and Chiara Smerzini, Politecnico di Milano, Italy

12:30-12:55 Seismic Wave Propagation and Earthquake Simulations Based on a 3D Fourier Pseudo-spectral Method
Enrico Priolo and Peter Klin, National Institute of Oceanography and Experimental Geophysics, Italy

Tuesday, June 18

MS24

Multiscale Model Reduction Techniques for Subsurface Flow - Part II of III

10:30 AM-1:00 PM

Room:Meno Uno 2 - Lower Level

For Part 1 see MS6
For Part 3 see MS54

The detailed numerical simulation of flow and transport in highly heterogeneous porous media can be prohibitively expensive, particularly when geological uncertainty is considered. For this reason, some type of model-order reduction is often required. Many such reduction techniques have been developed and are applied in practice. We plan to bring together researchers applying these and related approaches for model-order reduction. The intent is to facilitate discussion and interaction between researchers working on these various methods, with the eventual goal of developing systematic and improved model-reduction techniques for problems involving heterogeneity and uncertainty.

Organizer: Yalchin Efendiev
Texas A&M University, USA

Organizer: Ivan Lunati
University of Lausanne, Switzerland

Organizer: Seong H. Lee
Chevron Energy Technology Company, USA

10:30-10:55 An Adaptive Multiscale Finite Element Method
Patrick Henning, University of Münster, Germany; Mario Ohlberger, Universität Münster, Germany; Ben Schweizer, TU Dortmund, Germany

11:00-11:25 An Approximate Method for Multiphase Scale-Up
Yahan Yang, ExxonMobil Research, USA; Xiaochen Wang, ExxonMobil, USA; Xiao-Hui Wu and Linfeng Bi, ExxonMobil Upstream Research Company, USA

continued in next column

11:30-11:55 Reduced Modeling by Global Transmissibility Upscaling for Optimzation
Halvor M. Nilsen, Stein Krogstad, and Knut-Andreas Lie, SINTEF, Norway

12:00-12:25 TOF-based two-phase Upscaling of Flow and Transport in Subsurface Formations
Yan Li and Yuguang Chen, Chevron Energy Technology Company, USA; Yalchin Efendiev, Texas A&M University, USA

12:30-12:55 Multiscale Finite Volume Method As a Framework for Physically Motivated Model Reduction.
Ivan Lunati and Pavel Tomin, University of Lausanne, Switzerland

Tuesday, June 18

MS25

Physics-based Rupture and Tsunami Simulation - Part I of IV

10:30 AM-12:30 PM

Room:Parco 3 - Ground Level

For Part 2 see MS34

The analyses of recent tsunamogenic earthquakes have raised questions about currently employed assumptions on the source mechanisms leading to devastating inundation events. In order to understand the interaction of complex rupture mechanics and hydrodynamic wave behavior, advanced physics-based models for earthquake and tsunami simulation have been developed. This minisymposium strives to review current development in this field. Furthermore, the synthesis of both - the complex source modeling and the coupled tsunami modeling - will be covered. An emphasis lies on algorithmic approaches and discretization methods for the complex multi-scale characteristic of both geophysical application fields.

Organizer: Jörn Behrens
University of Hamburg, Germany

Organizer: Luis Dalguer
ETH Zürich, Switzerland

Organizer: Martin Kaeser
Ludwig-Maximilians-Universität München, Germany

Organizer: Michael Bader
Technische Universität München, Germany

10:30-10:55 Dynamic Simulation of Tsunamigenic Earthquake Rupture
Jean Paul Ampuero, California Institute of Technology, USA

11:00-11:25 A 3D Dynamic Rupture and See Floor Displacement Simulations of the 2011 Mw9 Tohoku Earthquake
Percy Galvez, ETH Zürich, Switzerland; Luis Dalguer, ETH Zürich, Switzerland

11:30-11:55 Broadband Ground-Motion Simulations from Rupture Dynamics
Martin Mai, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Luis Dalguer, ETH Zürich, Switzerland

12:00-12:25 Recent Advances in Numerical Simulation of Earthquake Rupture Dynamics: Application to the 2011 Tohoku-Ori Earthquake
Jean-Pierre Vilotte, CNRS, France; Gaetano Festa, Università di Napoli Federico II, Italy

Tuesday, June 18

MS26

Dynamics of Non-linear Flows in Porous Media: Analysis and Applications - Part I of III

10:30 AM-12:30 PM

Room:Foyer - First Level

For Part 2 see MS35

This mini-symposium is dedicated to both analytical and numerical aspects of non-linear flows in porous media. Recent advances in engineering and industry related to hydrodynamic and bio-chemical processes in porous media bring new challenging problems in understanding the non-linear phenomena. These processes require better models, more sophisticated analysis and more efficient algorithms. The goal of the mini-symposium is to present and discuss new results in all of theses aspects, particularly, in non-linear pde models, stability analysis, long-time dynamics, numerical simulations, etc.

Organizer: Luan Hoang
Texas Tech University, USA

Organizer: Josef Malek
Charles University, Prague, Czech Republic

Organizer: Magdalena Toda
Texas Tech University, USA

Organizer: Akif Ibraguimov
Texas Tech University, USA

Organizer: Eugenio Aulisa
Texas Tech University, USA

10:30-10:55 On the Development and Generalizations of Cahn--Hilliard Equations within a Thermodynamic Framework
Josef Malek, Charles University, Prague, Czech Republic

11:00-11:25 Combined Finite Volume-Finite Element Scheme for Compressible Two Phase Flow in Porous Media
Mazen Saad, Ecole Centrale de Nantes, France

11:30-11:55 Structural Stability Problems for Nonlinear PDE's of Porous Media
Varga Kalantarov, Koc University, Turkey

12:00-12:25 On the Regularity of Non-Negative Solutions to a Logarithmically Singular Equation
Ugo Gianazza, University of Pavia, Italy

Tuesday, June 18

MS27

Large-scale Compositional Simulation of Gas Injection Processes - Part I of III

10:30 AM-12:30 PM

Room:Forcellini - Ground Level

For Part 2 see MS36

Gas injection processes (such as gas/CO2 EOR, and CO2 sequestration) often involve complex physics, and require fully compositional simulation. Flow simulation of such processes on large-scale models is computationally expensive, and even prohibitive. In gas/CO2 EOR, compositions are driven to critical points to achieve miscibility. That makes phase identifications and property evaluations based on Equation-of-State a very challenging problem. Complexity also lies in interactions between reservoir heterogeneity and unfavorable mobility-ratio displacements. In this minisymposium, we focus on the challenges and solutions related to the large-scale simulation of gas injection.

Organizer: Yuguang Chen
Chevron Energy Technology Company, USA

Organizer: Denis Voskov
Stanford University, USA

10:30-10:55 Accurate and Efficient Modeling of Near-Miscible Gas Injection at Reservoir Scale
Denis Voskov, Stanford University, USA

11:00-11:25 A Multi-Physics Approach to Model Compositional Flow on Adaptive Grids.
Benjamin Faigle and Rainer Helmig, University of Stuttgart, Germany; Ivar Aavatsmark, University of Bergen, Norway; Bernd Flemisch, University of Stuttgart, Germany

11:30-11:55 Application of Saturation Functions and Implication of Representing Complex Dynamical Systems in Up-Scaled Models
Odd Steve Hustad, Statoil-Hydro, Norway

12:00-12:25 Towards Large-Scale Compositional Simulation of CO2 Enhanced Oil Recovery (EOR)
Yuguang Chen and Dengen Zhou, Chevron Energy Technology Company, USA; Huanquan Pan, Stanford University, USA

Lunch Break

1:00 PM-2:00 PM

Atrium - Ground level

Tuesday, June 18

MS28

Computational Challenges in Glacier and Ice-sheet Modeling - Part I of III

2:00 PM-4:00 PM

Room:Luciani A - Ground Level

For Part 2 see MS37

Glacier and ice-sheet models are computationally challenging since they involve complex glacier shapes and nonlinear laws for the viscous and the basal sliding behaviors of ice; these possibly including ice-ocean coupling and glacial hydrology description. In addition, simulating an entire ice-sheet with a good level of accuracy requires adaptive and parallel strategies together with model approximations to reduce computational costs. Moreover, several parameters of the models cannot be directly measured and must be estimated with inverse problems driven by observational data. This mini-symposium will address the computational and modeling aspects associated with reliable simulations of glaciers and ice-sheets.

Organizer: Guillaume Jouvet
Freie Universität Berlin, Germany

Organizer: Mauro Perego
Sandia National Laboratories, USA

2:00-2:25 Advances in Ice-Sheets Simulations, Models Comparison and Parameters Estimation
Matthew Hoffman, Los Alamos National Laboratory, USA; *Mauro Perego*, Sandia National Laboratories, USA; Stephen Price, Los Alamos National Laboratory, USA; Andrew Salinger, Sandia National Laboratories, USA

2:30-2:55 Discretization and Solvers for the Stokes Equations of Ice Sheet Dynamics at Continental Scale
Tobin Isaac, Georg Stadler, and Omar Ghattas, University of Texas at Austin, USA

3:00-3:25 Combing Models of Ice Dynamics and Subglacial Hydrology
Ian Hewitt, University of British Columbia, Canada

3:30-3:55 Modeling the Response of Pine Island Glacier, West Antarctica, for the next 50 years
Helene Seroussi, California Institute of Technology, USA; Mathieu Morlighem, Eric Rignot, and Jeremie Mouginot, University of California, Irvine, USA; Eric Larour and Ala Khazendar, California Institute of Technology, USA

Tuesday, June 18

MS29

Advances in Mathematical and Numerical Methods for Shallow Water Flows and Applications - Part II of III

2:00 PM-4:00 PM

Room:Parco 1 - Ground Level

For Part 1 see MS11
For Part 3 see MS38

The Shallow Water System (either in 1D, 2D or 3D) is the basis for different application related to surface water modeling: flood control, coastal engineering, sediment transport, ecc... Moreover it is also used in climate models. The goal of this minisymposium is to review mathematical and numerical advances related to shallow water equations (SWE). A non-exahustive list of topics is: - multidimensional coupling; - use of GPU for the numerical solution of SWE; - schemes for flows in channels with irregular geometry; - high-order schemes; - applications: sedimentation, climate models.

Organizer: Edie Miglio
Politecnico di Milano, Italy

Organizer: Mustafa Altinakar
University of Mississippi, USA

2:00-2:25 Lateral Coupling of 1D-2D Shallow-Water Equations
Nicole Goutal, EDF R&D & Saint-Venant Hydraulic Lab, France; Martin Parisot, Saint-Venant Hydraulic Laboratory, France; Fabrice Zaoui, EDF R&D & Saint-Venant Hydraulic Lab, France

2:30-2:55 Computational Methods for Coupling 1D channels in Complex Shallow Water Networks
Eleuterio F. Toro, Francesca Bellamoli, and Lucas Mueller, University of Trento, Italy

3:00-3:25 A Mixed Order Scheme for the Shallow Water Equations
André R. Brodtkorb, SINTEF, Norway

3:30-3:55 Coupling 1-D and 2-D Shallow Water Equations for Flood Modelling
André Paquier and Bazin Pierre-Henri, Irstea, France; Gilles Belaud, Ecole Nationale Supérieure d'Agronomie, France

Tuesday, June 18

MS30

Data Assimilation and Dynamical Processes: Ocean, Atmosphere and Climate - Part I of II

2:00 PM-4:00 PM

Room:Parco 2 - Ground Level

For Part 2 see MS39

Mathematical tools from dynamical systems theory can be used to understand a wide range of climate problems from desertification to identification of atmospheric and oceanic structures. Furthermore, the need to assimilate data into geophysical models introduces many interesting mathematical problems incorporating multiscale, nonlinear and Lagrangian dynamics. This minisymposium will bring together experts from the mathematical and climate sciences to examine dynamical processes occurring in the ocean, atmosphere and climate systems. It will look at how data and mathematical techniques may be brought together with observations to better understand these dynamic Earth system processes.

Organizer: Lewis Mitchell
University of Vermont, USA

Organizer: Thomas Bellsky
Arizona State University, USA

Organizer: Elaine Spiller
Marquette University, USA

2:00-2:25 Assimilation and Model Error for a 3D Ocean Process Model
Elaine Spiller, Marquette University, USA; DW Han, University of Massachusetts, USA; Lawrence Pratt, Woods Hole Oceanographic Institute, USA; Tamay Ozgokmen, University of Miami, USA

2:30-2:55 Pseudo-Orbit Gradient Descent for Lagrangian Data Assimilation
Emma Suckling, London School of Economics, United Kingdom

3:00-3:25 En-Route Data Assimilation
Amit Apte, TIFR Centre, Bangalore, India; Elaine Spiller, Marquette University, USA; Christopher Jones, University of North Carolina at Chapel Hill and University of Warwick, United Kingdom

3:30-3:55 Towards Improvement of Climate Models Using Data Assimilation
Lewis Mitchell, University of Vermont, USA

continued in next column

Tuesday, June 18

MS31

Coupled Phenomena and Scales for Greener Energy Sources - Part I of II

2:00 PM-4:00 PM

Room:Giotto - Ground Level

For Part 2 see MS40

Producing energy from sources such as nuclear power, shale gas, geothermal energy sources, coal methane in a green manner involve modeling coupled phenomena over a wide range of scales requires the development of new mathematical models and computational methods. In this session we explore a variety of issues related to producing greener forms of energy.

Organizer: Lynn S. Bennethum
University of Colorado, Denver, USA

Organizer: Malgorzata Peszynska
Oregon State University, USA

Organizer: Rainer Helmig
University of Stuttgart, Germany

2:00-2:25 Modeling Coupled Hydro-Mechanical Phenomena in the Near Field of a High-Level Radioactive Waste Repository in Clay Formations

Jens T. Birkholzer, Daisuke Asahina, James Houseworth, Hui-Hai Liu, and Jonny Rutqvist, Lawrence Berkeley National Laboratory, USA

2:30-2:55 Coupled Thermal Models with Vertical Equilibrium

Sarah Gasda, University of North Carolina, Chapel Hill, USA; Odd Andersen and Halvor Nilsen, SINTEF Energy Research, Norway; Ivar Aavatsmark and Helge Dahle, University of Bergen, Norway

3:00-3:25 Can CCS Find Synergies with Geothermal Energy and Shale Gas Production?

Michael A. Celia, Princeton University, USA

3:30-3:55 Lifetime of Carbon Capture and Storage as a Climate Change Mitigation Technology

Michael Szulczewski, Massachusetts Institute of Technology, USA; Christopher W. MacMinn, Yale University, USA; Howard Herzog and *Ruben Juanes*, Massachusetts Institute of Technology, USA

Tuesday, June 18

MS32

High Performance Computing for Multiphase Flows - Part I of II

2:00 PM-4:00 PM

Room:Meno Uno 1 - Lower Level

For Part 2 see MS41

Simulation of multi-phase flow has been one of the early applications to make use of supercomputers. Applications range from reservoir simulations to nuclear waste disposal, CO2 sequestration and geothermal resource assessment. Recent advances in hardware architectures present great opportunities by enabling field and repository scale simulations, while at the same time presenting challenges for their efficient use. Presentations in this minisymposium will address both the opportunities and the challenges. Bringing together scientist and practitioners from various backgrounds, they will highlight algorithmic as well as implementation level progress. Traditional (CPU based) architectures as well as accelerators (GPU) will be considered.

Organizer: Fabrice Dupros
BRGM/STI, France

Organizer: Michel Kern
INRIA Rocquencourt, France

2:00-2:25 Multicore Aware Parallel Simulations of Co2 Geological Storage

Fabrice Dupros, BRGM/STI, France

2:30-2:55 Improving the Scalability of Reservoir Simulation on Multicore Architecture

Pascal Henon and Corentin Rossignon, Total, France

3:00-3:25 Compositional Two-Phase Flow with Disappearing Nonwetting Phase - Modeling and Numerical Simulation of CO2 Sequestration

Rebecca Neumann, Olaf Ippisch, and Peter Bastian, University of Heidelberg, Germany

3:30-3:55 Assessment of An Hpc Two-Phase Flow Solver in Porous Media for Realistic Cases

Alessio Fumagalli, Antonio Cervone, and Luca Formaggia, Politecnico di Milano, Italy

Tuesday, June 18

MS33

Multiscale Methods - Applications and Numerical Analysis - Part I of II

2:00 PM-4:00 PM

Room:Meno Uno 2 - Lower Level

For Part 2 see MS42

This Minisymposium aims to gather leading researchers in the field of numerical multiscale methods. These methods are constructed to efficiently treat problems that involve a wide range of length and time scales. Examples are porous media flows or properties of composite materials. The speakers have different expertises such as direct applications of the methods as well as pure numerical analysis. The goal is to bring together theoretical and practical aspects of multiscale methods in order to achieve an extensive exchange of ideas resulting in a mutual benefit and a substantial progress in the various methods and approaches.

Organizer: Patrick Henning
University of Münster, Germany

Organizer: Axel Målqvist
Uppsala University, Sweden

2:00-2:25 The Multiscale Finite-Volume Method on Stratigraphic Grids

Knut-Andreas Lie, SINTEF, Norway; Olav Møyner, SINTEF Energy Research, Norway

2:30-2:55 Discontinuous Galerkin Multiscale Methods for Elliptic Problems

Daniel Elfverson and Axel Målqvist, Uppsala University, Sweden; Daniel Peterseim, Humboldt University at Berlin, Germany

3:00-3:25 Discontinuous Galerkin Multiscale Methods for Advection-Diffusion Problems with Highly Heterogeneous Data

Assyr Abdulle and *Martin Huber*, École Polytechnique Fédérale de Lausanne, Switzerland

3:30-3:55 On Oversampling for the Multiscale Finite Element Method

Patrick Henning, University of Münster, Germany; *Daniel Peterseim*, Humboldt University at Berlin, Germany

Tuesday, June 18

MS34

Physics-based Rupture and Tsunami Simulation - Part II of IV

2:00 PM-4:00 PM

Room:Parco 3 - Ground Level

For Part 1 see MS25
For Part 3 see MS43

The analyses of recent tsunamogenic earthquakes have raised questions about currently employed assumptions on the source mechanisms leading to devastating inundation events. In order to understand the interaction of complex rupture mechanics and hydrodynamic wave behavior, advanced physics-based models for earthquake and tsunami simulation have been developed. This minisymposium strives to review current development in this field. Furthermore, the synthesis of both - the complex source modeling and the coupled tsunami modeling - will be covered. An emphasis lies on algorithmic approaches and discretization methods for the complex multi-scale characteristic of both geophysical application fields.

Organizer: Jörn Behrens
University of Hamburg, Germany

Organizer: Luis Dalguer
ETH Zürich, Switzerland

Organizer: Martin Kaeser
Ludwig-Maximilians-Universität München, Germany

Organizer: Michael Bader
Technische Universität München, Germany

2:00-2:25 Modeling Dynamic Rupture with Implications for An Alaskan-Aleutian Megathrust Earthquake and Resulting Tsunami
Kenny J. Ryan and David D. Oglesby, University of California, Riverside, USA; Eric L. Geist, U. S. Geological Survey, USA

2:30-2:55 Probabilistic Models of Earthquake Slip for Tsunami Hazard Assessment
Randall J. LeVeque, University of Washington, USA; Knut Waagan and Frank I. González, University of Washington, USA; Guang Lin, Pacific Northwest National Laboratory, USA

continued in next column

3:00-3:25 Modelling Tsunamis and Problems Constraining the Slip in Mega-Thrust Earthquakes
Julie Pietrzak, H Cui, and G.S. Stelling, Delft University of Technology, Netherlands

3:30-3:55 Effect of Heterogeneous Earthquake Slip on Tsunami Run-Up Uncertainty
Finn Lovholt, Norwegian Geotechnical Institute, Norway

Tuesday, June 18

MS35

Dynamics of Non-linear Flows in Porous Media: Analysis and Applications - Part II of III

2:00 PM-4:00 PM

Room:Foyer - First Level

For Part 1 see MS26
For Part 3 see MS44

This mini-symposium is dedicated to both analytical and numerical aspects of non-linear flows in porous media. Recent advances in engineering and industry related to hydrodynamic and bio-chemical processes in porous media bring new challenging problems in understanding the non-linear phenomena. These processes require better models, more sophisticated analysis and more efficient algorithms. The goal of the mini-symposium is to present and discuss new results in all of theses aspects, particularly, in non-linear pde models, stability analysis, long-time dynamics, numerical simulations, etc.

Organizer: Luan Hoang
Texas Tech University, USA

Organizer: Josef Malek
Charles University, Prague, Czech Republic

Organizer: Magdalena Toda
Texas Tech University, USA

Organizer: Akif Ibraguimov
Texas Tech University, USA

Organizer: Eugenio Aulisa
Texas Tech University, USA

2:00-2:25 Realistic Scale Simulations of Sedimentary Basins
Antonio Cervone, *Nur A. Fadel*, and Luca Formaggia, Politecnico di Milano, Italy

2:30-2:55 A Multilevel Domain Decomposition Algorithm for Fluid-structure Interaction in Porous Media
Giorgio Bornia, Texas Tech University, USA; Sandro Manservisi, University of Bologna, Italy

3:00-3:25 Modeling Mulitscale and Multiphase Flow in Porous Media
Martin Heida, Universität Heidelberg, Germany

3:30-3:55 Water Transport in Partially-molten Ice - A Multi-phase Theory Approach
Ondrej Soucek Soucek, Charles University, Prague, Czech Republic

Tuesday, June 18

MS36

Large-scale Compositional Simulation of Gas Injection Processes - Part II of III

2:00 PM-4:00 PM

Room:Forcellini - Ground Level

For Part 1 see MS27
For Part 3 see MS45

Gas injection processes (such as gas/CO2 EOR, and CO2 sequestration) often involve complex physics, and require fully compositional simulation. Flow simulation of such processes on large-scale models is computationally expensive, and even prohibitive. In gas/CO2 EOR, compositions are driven to critical points to achieve miscibility. That makes phase identifications and property evaluations based on Equation-of-State a very challenging problem. Complexity also lies in interactions between reservoir heterogeneity and unfavorable mobility-ratio displacements. In this minisymposium, we focus on the challenges and solutions related to the large-scale simulation of gas injection.

Organizer: Yuguang Chen
Chevron Energy Technology Company, USA

Organizer: Denis Voskov
Stanford University, USA

2:00-2:25 Calculation of Phase Equilibrium: Status and Perspectives
Michael L. Michelsen, Technical University of Denmark, Denmark

2:30-2:55 Using the Gibbs-Helmholtz Constrained Eos in Reservoir Simulation
Angelo Lucia, University of Rhode Island, USA; Denis Voskov, Stanford University, USA

3:00-3:25 Gibbs Free Energy Minimization for Reactive Flow in Porous Media
Ashwin Venkatraman and Larry Lake, University of Texas at Austin, USA; Russell Johns, Pennsylvania State University, USA

3:30-3:55 Multi-Linear Representation of Phase Behavior for Large Scale Gas Injection Simulation
Rustem Zaydullin, Denis Voskov and Hamdi Tchelepi, Stanford University, USA

Tuesday, June 18

Coffee Break

4:00 PM-4:30 PM

Atrium - Ground Level

MS37

Computational Challenges in Glacier and Ice-sheet Modeling - Part II of III

4:30 PM-6:30 PM

Room:Luciani A - Ground Level

For Part 1 see MS28
For Part 3 see MS55

Glacier and ice-sheet models are computationally challenging since they involve complex glacier shapes and nonlinear laws for the viscous and the basal sliding behaviors of ice; these possibly including ice-ocean coupling and glacial hydrology description. In addition, simulating an entire ice-sheet with a good level of accuracy requires adaptive and parallel strategies together with model approximations to reduce computational costs. Moreover, several parameters of the models cannot be directly measured and must be estimated with inverse problems driven by observational data. This mini-symposium will address the computational and modeling aspects associated with reliable simulations of glaciers and ice-sheets.

Organizer: Guillaume Jouvet
Freie Universität Berlin, Germany

Organizer: Mauro Perego
Sandia National Laboratories, USA

4:30-4:55 Review of Adaptive Methods for Marine Ice Sheet Models
Guillaume Jouvet, Freie Universität Berlin, Germany

5:00-5:25 Block-Structured Adaptive Mesh Refinement in the Bisicles Ice Sheet Model
Stephen Cornford, University of Bristol, United Kingdom; Daniel Martin, Lawrence Berkeley National Laboratory, USA

5:30-5:55 Grounding Line Migration in a Full-Stokes Model: from Processes to Applications
Gael Durand, Olivier Gagliardini, and Lionel Favier, Laboratoire de Glaciologie et de Géophysique de l'Environnement, France; Thomas Zwinger, Finnish IT Center for Science Ltd., Finland; Anne-Sophie Drouet, Jean Krug, and Fabien Gillet-Chaulet, Laboratoire de Glaciologie et de Géophysique de l'Environnement, France

6:00-6:25 Mesh-adaptive Approaches to Numerical Grounding Line Migration
Daniel Goldberg, Massachusetts Institute of Technology, USA

continued in next column

Tuesday, June 18

MS38

Advances in Mathematical and Numerical Methods for Shallow Water Flows and Applications - Part III of III

4:30 PM-6:30 PM

Room:Parco 1 - Ground Level

For Part 2 see MS29

The Shallow Water System (either in 1D, 2D or 3D) is the basis for different application related to surface water modeling: flood control, coastal engineering, sediment transport, etc... Moreover it is also used in climate models. The goal of this minisymposium is to review mathematical and numerical advances related to shallow water equations (SWE). A non-exahustive list of topics is:
- multidimensional coupling;
- use of GPU for the numerical solution of SWE;
- schemes for flows in channels with irregular geometry;
- high-order schemes;
- applications: sedimentation, climate models.

Organizer: Edie Miglio
Politecnico di Milano, Italy

Organizer: Mustafa Altinakar
University of Mississippi, USA

4:30-4:55 2D Depth Integrated Modeling of Morphodynamical Processes: A New Algorithm for Unstructured Grids
Angelo Leopardi, Università di Cassino e del Lazio Meridionale, Italy; Massimo Greco, University of Naples, Italy; Stefania Evangelista, University of Cassino and Southern Lazio, Italy; Michele Iervolino and Andrea Vacca, Second University of Naples, Italy

5:00-5:25 Local Adaptive Mesh Refinement on the GPU
Martin L. Sætra, University of Oslo, Norway

continued in next column

5:30-5:55 One-Dimensional Finite-Volume Modelling of the Flow and Morphological Processes During the 1996 Lake Ha!Ha! Dyke Break Event
Sandra Soares-Frazao, Universite Catholique de Louvain, Belgium; Fabian Franzini, *Olivier Carlier*, and Yves Zech, Ecole Polytechnique, France

6:00-6:25 A GPU Implementation of High-Order PVM Finite Volume Schemes for Shallow Flows on Triangular Meshes
Marc de la Asuncion and Jose M. Mantas, University of Granada, Spain; Manuel J. Castro, University of Malaga, Spain

Tuesday, June 18

MS39

Data Assimilation and Dynamical Processes: Ocean, Atmosphere and Climate - Part II of II

4:30 PM-6:30 PM

Room:Parco 2 - Ground Level

For Part 1 see MS30

Mathematical tools from dynamical systems theory can be used to understand a wide range of climate problems from desertification to identification of atmospheric and oceanic structures. Furthermore, the need to assimilate data into geophysical models introduces many interesting mathematical problems incorporating multiscale, nonlinear and Lagrangian dynamics. This minisymposium will bring together experts from the mathematical and climate sciences to examine dynamical processes occurring in the ocean, atmosphere and climate systems. It will look at how data and mathematical techniques may be brought together with observations to better understand these dynamic Earth system processes.

Organizer: Lewis Mitchell
University of Vermont, USA

Organizer: Thomas Bellsky
Arizona State University, USA

Organizer: Elaine Spiller
Marquette University, USA

4:30-4:55 Targeting Observations and Parameter Estimation Techniques Within Ensemble Data Assimilation
Thomas Bellsky, Eric J. Kostelich, and Alex Mahalov, Arizona State University, USA

5:00-5:25 The Onset of Desertification: the Dynamics of Vegetation Patterns under Slowly Varying Conditions
Arjen Doelman, Leiden University, Netherlands

continued on next page

Tuesday, June 18

MS39

Data Assimilation and Dynamical Processes: Ocean, Atmosphere and Climate - Part II of II

continued

5:30-5:55 Automatic Identification of Oceanic and Atmospheric Coherent Structures As Minimal Flux Regions Using Transfer Operators
Gary Froyland, University of New South Wales, Australia; Christian Horenkamp, University of Paderborn, Germany; Adam Monahan, University of Victoria, Canada; Vincent Rossi, Alex Sen Gupta, and Erik van Sebille, University of New South Wales, Australia

6:00-6:25 Pseudo-Orbit Data Assimilation for Atmospheric Gcms
Hailang Du, London School of Economics, United Kingdom

Tuesday, June 18

MS40

Coupled Phenomena and Scales for Greener Energy Sources - Part II of II

4:30 PM-6:00 PM

Room:Giotto - Ground Level

For Part 1 see MS31

Producing energy from sources such as nuclear power, shale gas, geothermal energy sources, coal methane in a green manner involve modeling coupled phenomena over a wide range of scales requires the development of new mathematical models and computational methods. In this session we explore a variety of issues related to producing greener forms of energy.

Organizer: Lynn S. Bennethum
University of Colorado, Denver, USA

Organizer: Malgorzata Peszynska
Oregon State University, USA

Organizer: Rainer Helmig
University of Stuttgart, Germany

4:30-4:55 Competitive Usage of Sub-Surface Systems: How Can Modeling Help to Quantifiy Potential Impacts and Risks?
Holger Class and *Alexander Kissinger*, Universität Stuttgart, Germany

5:00-5:25 Simulation of Coupled Flow and Reactive Transport in Porous Media by MFEM with Application to Concrete Carbonation
Florin A. Radu, University of Bergen, Norway; Adrian Muntean, Technische Universiteit Eindhoven, The Netherlands; Iuliu Sorin Pop, Eindhoven University of Technology, Netherlands

5:30-5:55 Experimental Investigation of Shale Gas Production Impairment Due to Spontaneous Imbibition of Fracturing Fluid Following Wellbore Stimulation.
Zuleima T. Karpyn and Luis Ayala, Pennsylvania State University, USA

Tuesday, June 18

MS41

High Performance Computing for Multiphase Flows - Part II of II

4:30 PM-6:30 PM

Room:Meno Uno 1 - Lower Level

For Part 1 see MS32

Simulation of multi-phase flow has been one of the early applications to make use of supercomputers. Applications range from reservoir simulations to nuclear waste disposal, CO2 sequestration and geothermal resource assessment. Recent advances in hardware architectures present great opportunities by enabling field and repository scale simulations, while at the same time presenting challenges for their efficient use. Presentations in this minisymposium will address both the opportunities and the challenges. Bringing together scientist and practitioners from various backgrounds, they will highlight algorithmic as well as implementation level progress. Traditional (CPU based) architectures as well as accelerators (GPU) will be considered.

Organizer: Fabrice Dupros
BRGM/STI, France

Organizer: Michel Kern
INRIA Rocquencourt, France

4:30-4:55 Scalability of a Multi-Phase Code for Performance Assessment of a Radioactive Waste Disposal in Porous Media
Bernard Vialay, ANDRA, France

5:00-5:25 Arcfvdsl, a Dsl in C++ to Develop Diffusive Problems in Geoscience for New Hybrid Architecture
Jean Marc Gratien, IFP, France

5:30-5:55 Multi-GPU Parallelization of Nested Factorization Linear Solver
Yifan Zhou, Chevron Energy Technology Company, USA; Hamdi Tchelepi, Stanford University, USA

6:00-6:25 Gampack (gpu Algebraic Multigrid Package)
Vincent Natoli and *Kenneth Esler*, Stone Ridge Technology, USA

Tuesday, June 18

MS42

Multiscale Methods - Applications and Numerical Analysis - Part II of II

4:30 PM-6:30 PM

Room:Meno Uno 2 - Lower Level

For Part 1 see MS33

This Minisymposium aims to gather leading researchers in the field of numerical multiscale methods. These methods are constructed to efficiently treat problems that involve a wide range of length and time scales. Examples are porous media flows or properties of composite materials. The speakers have different expertises such as direct applications of the methods as well as pure numerical analysis. The goal is to bring together theoretical and practical aspects of multiscale methods in order to achieve an extensive exchange of ideas resulting in a mutual benefit and a substantial progress in the various methods and approaches.

Organizer: Patrick Henning
University of Münster, Germany

Organizer: Axel Målqvist
Uppsala University, Sweden

4:30-4:55 The Localized Reduced Basis Multiscale Method
Felix Albrecht, University of Münster, Germany; Bernard Haasdonk and Sven Kaulmann, University of Stuttgart, Germany; Mario Ohlberger, Universität Münster, Germany

5:00-5:25 Analysis of a Control Volume Hmm for Multi-Physics Problems in Porous Media
Sergey Alyaev, Jan M. Nordbotten, and Eirik Keilegavlen, University of Bergen, Norway

5:30-5:55 Coupled Local-Global Model Reduction for Compressible Flows in Highly Heterogeneous Porous Media
Mehdi Ghommem, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Yalchin Efendiev and Michael Presho, Texas A&M University, USA; Victor M. Calo, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

6:00-6:25 Computation of Eigenvalues by Numerical Upscaling
Axel Målqvist, Uppsala University, Sweden; Daniel Peterseim, Humboldt University at Berlin, Germany

Tuesday, June 18

MS43

Physics-based Rupture and Tsunami Simulation - Part III of IV

4:30 PM-6:30 PM

Room:Parco 3 - Ground Level

For Part 2 see MS34
For Part 4 see MS52

The analyses of recent tsunamogenic earthquakes have raised questions about currently employed assumptions on the source mechanisms leading to devastating inundation events. In order to understand the interaction of complex rupture mechanics and hydrodynamic wave behavior, advanced physics-based models for earthquake and tsunami simulation have been developed. This minisymposium strives to review current development in this field. Furthermore, the synthesis of both - the complex source modeling and the coupled tsunami modeling - will be covered. An emphasis lies on algorithmic approaches and discretization methods for the complex multi-scale characteristic of both geophysical application fields.

Organizer: Jörn Behrens
University of Hamburg, Germany

Organizer: Luis Dalguer
ETH Zürich, Switzerland

Organizer: Martin Kaeser
Ludwig-Maximilians-Universität München, Germany

Organizer: Michael Bader
Technische Universität München, Germany

4:30-4:55 Quadrilateral-Based Discontinuous Galerkin Methods with Adaptive Mesh Refinement for the Oceanic Shallow Water Equations
Francis X. Giraldo and Michal A. Kopera, Naval Postgraduate School, USA; *Shivasubramania Gopalakrishnan*, Indian Institute of Technology, India

continued in next column

5:00-5:25 Discontinuous Galerkin Unsteady Discrete Adjoint Method for Real-Time Efficient Tsunami Simulations
Sebastien Blaise, Université Catholique de Louvain, Belgium; Amik St-Cyr, Shell International Exploration and Production, USA; Dimitri Mavriplis and Brian Lockwood, University of Wyoming, USA

5:30-5:55 Modeling of Tsunami Generation by An Underwater Landslide
Natalja Rakowsky, Alexey Androsov, and Sven Harig, Alfred-Wegener-Institute for Polar and Marine Research, Germany

6:00-6:25 Implementation of Triangular Galerkin Type Adaptive Tsunami Propagation and Inundation Schemes
Stefan Vater and Jörn Behrens, University of Hamburg, Germany

Tuesday, June 18

MS44

Dynamics of Non-linear Flows in Porous Media: Analysis and Applications - Part III of III

4:30 PM-6:30 PM

Room:Foyer - First Level

For Part 2 see MS35

This mini-symposium is dedicated to both analytical and numerical aspects of non-linear flows in porous media. Recent advances in engineering and industry related to hydrodynamic and bio-chemical processes in porous media bring new challenging problems in understanding the non-linear phenomena. These processes require better models, more sophisticated analysis and more efficient algorithms. The goal of the mini-symposium is to present and discuss new results in all of theses aspects, particularly, in non-linear pde models, stability analysis, long-time dynamics, numerical simulations, etc.

Organizer: Luan Hoang
Texas Tech University, USA

Organizer: Josef Malek
Charles University, Prague, Czech Republic

Organizer: Magdalena Toda
Texas Tech University, USA

Organizer: Akif Ibraguimov
Texas Tech University, USA

Organizer: Eugenio Aulisa
Texas Tech University, USA

4:30-4:55 The Multidimensional Muskat Inial Boundary Value Problem
Nikolai Chemetov, Universidade de Lisboa, Portugal

5:00-5:25 Geometric PDE Models for Secondary Structure in Proteins
Magdalena Toda, Texas Tech University, USA

5:30-5:55 Blow-up and Vanishing Properties for a Class of Doubly Degenerate Parabolic Equations with Variable Nonlinearity
Sergey Shmarev, Universidad de Oviedo, Spain

6:00-6:25 Regularity of Solutions to Weighted Equations of Porous Medium Type
Mikhail Surnachev, Russian Academy of Sciences, Russia

Tuesday, June 18

MS45

Large-scale Compositional Simulation of Gas Injection Processes - Part III of III

4:30 PM-6:00 PM

Room:Forcellini - Ground Level

For Part 2 see MS36

Gas injection processes (such as gas/CO2 EOR, and CO2 sequestration) often involve complex physics, and require fully compositional simulation. Flow simulation of such processes on large-scale models is computationally expensive, and even prohibitive. In gas/CO2 EOR, compositions are driven to critical points to achieve miscibility. That makes phase identifications and property evaluations based on Equation-of-State a very challenging problem. Complexity also lies in interactions between reservoir heterogeneity and unfavorable mobility-ratio displacements. In this minisymposium, we focus on the challenges and solutions related to the large-scale simulation of gas injection.

Organizer: Yuguang Chen
Chevron Energy Technology Company, USA

Organizer: Denis Voskov
Stanford University, USA

4:30-4:55 Modeling Coupled Gas Compositional Flow, Geochemical, and Thermal in Porous Media
Mojdeh Delshad, University of Texas at Austin, USA

5:00-5:25 Simplified Mineralization Dynamics in Long-Term CO2 Storage
Maria Elenius, University of Bergen, Norway; Helge Hellevang, University of Oslo, Norway; Sarah Gasda, University of North Carolina, Chapel Hill, USA; Ivar Aavatsmark, University of Bergen, Norway

5:30-5:55 A New Flow-Reactive-Transport Numerical Modeling Framework and Application to Co_2 Mineral Carbonation
Yaqing Fan, Shell, USA

Tuesday, June 18

PP1

Poster Session

7:30 PM-9:30 PM

Room:Palazzo della Ragione

A Reduced Fracture Model for Two-Phase Flow with Different Rock Types
Elyes Ahmed, INRIA Paris-Rocquencourt, France; Amel Ben Abda, Lamsin-Enit, Tunisia; Jean E. Roberts, INRIA Paris-Rocquencourt, France; Jerome Jaffre, INRIA Rocquencourt, France

Optimizing a Cartesian Shallow Water Code on Hybrid Architectures
Michael Bader, Alexander Breuer, and Sebastian Rettenberger, Technische Universität München, Germany

Polymer Flooding Techniques in Enhanced Oil Recovery
Dr Sisir Kumar Bhowmick, Gargi Memorial Institute of Technology(GMIT), India

Numerical Modeling of Stress Fields in the Earth's Mantle with Non-Newtonian Viscosity
Alexandr M. Bobrov, Alexey Baranov, and Natalia Bobrova, Schmidt Institute of Physics of the Earth, Russia

A Statistical Subgrid Model for Large Eddy Simulations
Rukiye Kara, Mimar Sinan Fine Arts University, Turkey; Mine Caglar, Koc University, Turkey

Render the Interpolation Library SCRIPP Conservative
Joel Chavas, CEA, France

Inversion for Hydraulic Conductivity Using the Unsaturated Flow Equations
Rowan B. Cockett, University of British Columbia, Canada; Eldad Haber, University of British Columbia, Canada

Transport Upscaling Using Coupled and Correlated Continuous Time Random Walks
Marco Dentz, IDAEA and Spanish National Research Council (CSIC), Spain

Scale Dependent Coupling of Hysteretic Capillary Pressure, Trapping and Fluid Mobilities
Florian Doster and Michael A. Celia, Princeton University, USA; Jan Nordbotten, University of Bergen, Norway

Compressional Seismic Velocity Fields Parameterized by Haar Wavelet
Wilson M. Figueiro, Universidade Federal da Bahia, Brazil; Helcio Perin, Universidade do Estado da Bahia, Portugal; Adriano Martinez, Universidade Federal da Bahia, Brazil; Saulo P. Oliveira and Saulo P. Oliveira, Universidade da Bahia, Brazil; Luiz Guimaraes, Universidade Federal do Rio De Janeiro, Brazil; Paulo Cunha, Universidade Federal de Rio de Janeiro, Brazil

Improvement of Convergence of Multigrid Method in Multiphase Flow Problems.
Maxim Filatov, Lomonosov Moscow State University, Russia; Dmitry Maksimov, Russian Academy of Sciences, Russia

Numerical and Geometric Optimization Techniques for Environmental Prediction Systems
George Galanis, Greek Naval Academy and University of Athens, Greece

Polynomial Interpolation and Quadrature on Subregions of the Sphere
Mariano Gentile, A. Sommariva, and M. Vianello, Unaffiliated

Space-Time Wavelet Techniques in the Reverse-Time Depth Migration
Evgeny Gorodnitskiy and Maria Perel, St. Petersburg University, Russia; Yu Geng and Ru-Shan Wu, University of California, Santa Cruz, USA

A Benchmark for Thermo-Hydrological Codes on Cold Regions Hydrology
Christophe F. Grenier and Nicolas Roux, Laboratoire des Sciences du Climat et l'Environnement, France; François Costard, CNRS, France; Emmanuel Mouche, Laboratoire des Sciences du Climat et l'Environnement, France

Statistical Characteristics, Circulation Regimes and Unstable Periodic Orbits of Simple Atmospheric Model
Andrey Gritsun, Institute of Numerical Mathematics, RAS, Russia

continued in next column

Application of a Fast Algorithm to Solving the Pressure Equation Efficiently
JoungDong Kim, Prabir Daripa, and Craig Gin, Texas A&M University, USA

Comparison Study of Spurious Wave Reflection Response with Staggered Finite-Volume and Unstaggered Element-Based Galerkin Schemes under Mesh-Refinement
Shin-Hoo Kang and Tae-Jin Oh, Korea Institute of Atmospheric Prediction Systems, Korea

Statistical Simlulation of Fault Zone Structures
Dmitriy Kolyukhin and Jan Tveranger, Centre for Integrated Petroleum Research, Norway

New Efficient Numerical Method for Integral Equations in EM Sounding of Inhomogeneous Media
Mikhail Kruglyakov, Lomonosov Moscow State University, Russia

Upscaling of Density-Driven Instabilities Using Countercurrent Flow
Rouven Kuenze and Ivan Lunati, University of Lausanne, Switzerland

Upscaling of Reactive Flows in Domains Having Rough Boundaries
Kundan Kumar, University of Texas, Austin, USA; Iuliu Sorin Pop and Mark van Helvoort, Eindhoven University of Technology, Netherlands; Tycho van Noorden, COMSOL AB, Sweden

Modeling a Stochastic Convective Preciptation Process
Kimberly Leung, San Diego State University, USA; Aneesh Subramanian, University of California, San Diego, USA; Samuel S. Shen, San Diego State University, USA; Guang Zhang, Scripps Institution of Oceanography, USA

Up-scaling Reaction Rates from Pore to Core Scale
W. Brent Lindquist and Daesang Kim, Stony Brook University, USA; Catherine Peters, Princeton University, USA

Systems of Conservation Laws for Thermodynamically Consistent Adsorption with Subscale Diffusion and Memory Terms
F. Patricia Medina and Malgorzata Peszynska, Oregon State University, USA

continued in next column

Geometric Characterization of Strata By Inverse Scattering and Active Contours
Martin Mueller, Francesco Fedele, and Anthony Yezzi, Georgia Institute of Technology, USA

Continuum Darcy Approach for Coupling Surface-Subsurface Flows: Application to Heterogeneous and 3D Configurations
Claude Mügler, CEA, France; Emmanuel Mouche, CEA, DRN, France; Cécile Carrère, CNRS / LSCE, France

Identification of Seismic Quiescence Anomalies in the Seismic Region of the Mexican Pacific Coast
Alejandro Munoz-Diosdado, Unidad Profesional Interdisciplinaria de Biotecnología, Mexico; Adolfo Rudolf-Navarro, Escuela Superior de Física y Matemáticas, Mexico

A Three-Scale Model of Charged Solute Transport in Swelling Clays Including Ion Size Correlations
Dung Le and Christian Moyne, Université de Lorraine, France; *Marcio A. Murad*, LNCC/MCT, Brazil; Sidarta Lima, Federal University Rural of Rio de Janeiro, Brazil

Large Scale Patterns in Convection: from Rayleigh-Benard, Through Prandtl Problem, to Moist Atmospheric Convection
Antonio Parodi, Istituto di Scienze dell'Atmosfera e del Clima, Italy

Multiphysics, Multiscale Network Modeling of Gas Transport in Mudrocks
Masa Prodanovic and Ayaz Mehmani, University of Texas at Austin, USA

Explicit Modeling of Fault Damage Zone Properties
Dongfang Qu, University of Bergen, Norway; Jan Tveranger, Centre for Integrated Petroleum Research, Norway; Per Røe, Norwegian Computing Centre, Norway

Applied Precipitation Nowcast
Thorsten Riess, W3 Data GmbH, Germany

Capillary Fracturing in Granular Media
Mathias Trojer, Michael Szulczewski, and *Ruben Juanes*, Massachusetts Institute of Technology, USA

continued on next page

Tuesday, June 18

PP1

Poster Session

7:30 PM-9:30 PM

continued

Meshless Techniques for Anisotropic Diffusion Problems
Flavio Sartoretto, Universita di Venezia, Italy; Annamaria Mazzia and Giorgio Pini, Universita di Padova, Italy

A Fully Implicit Solver for Geochemical Processes in Compacting Basins.
Anna Scotti, Ilaria Imperiali, and Luca Formaggia, Politecnico di Milano, Italy

Numerical Approximation of Reactive Flow in Porous Media with Discontinuous Reaction.
Anna Scotti, Politecnico di Milano, Italy

Semi Lagrangian Methods in Variable Density Flow
Klara Steklova and Eldad Haber, University of British Columbia, Canada

Investigation of Instability of Displacement Front in Flow Problems
Natalia Syulyukina, Lomonosov Moscow State University, Russia

Pore-Scale Modeling and Experimental Investigations of Mixing-Controlled Geochemical and Biological Reactions
Albert J. Valocchi, Youneng Tang, and Haihu Liu, University of Illinois at Urbana-Champaign, USA; Hongkyu Yoon, Sandia National Laboratories, USA

A Multiscale Time Integrator for Computing Longwave Shallow Water Flows at Low Froude Numbers
Stefan Vater, University of Hamburg, Germany; Rupert Klein, Freie Universität Berlin, Germany

Efficient Solver for Transversely Isotropic Eikonal Equation Using Perturbation Theory
Umair bin Waheed and Tariq Alkhalifah, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Adaptive Multi-Scale/physics Modeling of Two-Phase Flow Including Capillary Pressure
Rainer Helmig, *Markus Wolff*, and Bernd Flemisch, University of Stuttgart, Germany

Wednesday, June 19

Registration

8:00 AM-5:00 PM

Remarks

8:25 AM-8:30 AM

Room:Luciani A - Ground Level

IP5

An Unstructured Grid Model Suitable for Flooding Studies with Applications to Mega-tsunamis

8:30 AM-9:15 AM

Room:Luciani A - Ground Level

Chair: Nadia Pinardi, Istituto Nazionale di Geofisica e Vulcanologia, Italy

Mega-thrust earthquakes and tsunamis cause untold destruction. In this talk a new finite volume unstructured grid tsunami model is presented. The model is a finite volume analogue of the P1nc-P1 finite element, in which mass conservation is guaranteed not only in a global sense, but within each cell. The model conserves momentum, and accurately handles flooding and drying problems. Results from the Indian Ocean and Japanese Tsunami compare well with flooding and run-up data.

Julie Pietrzak
Haiyang Cui
Guus Stelling
Delft University of Technology, Netherlands

Wednesday, June 19

IP6

Data Assimilation in Global Mantle Flow Models:Theory, Modelling and Uncertainties to Reconstruct Earth Structure Back in Time

9:15 AM-10:00 AM

Room:Luciani A - Ground Level

Chair: Guust Nolet, Université de Nice, Sophia Antipolis, France

The ability to extract the history of motion associated with large-scale geologic structures that are now imaged seismically in the Earth's interior, such as plumes and subducting slabs, is crucial to constrain the fundamental deformation processes of mantle convection. Here we show how fluid dynamic inverse theory, based on a variational approach, can be applied in a global circulation model of the mantle to project Earth structure back in time. We present the basic theory of the forward and inverse problem, review geologic constraints, provide computational considerations relevant to the global flow problem with about 1 billion finite elements, and discuss uncertainties. The latter restrict the problem in practice, as our knowledge of deep Earth structure and its interpretation in terms of dynamically relevant buoyancy anomalies is necessarily limited.

Hans-Peter Bunge
Ludwig-Maximilians-Universität München, Germany

Coffee Break

10:00 AM-10:30 AM

Atrium - Ground Level

Wednesday, June 19

MS46

New Developments in the Modeling, Analysis and Simulation of Oceanic Flows - Part IV of IV

10:30 AM-1:00 PM

Room:Luciani A - Ground Level

For Part 3 see MS19

This minisymposium brings together scientists working on modeling, observations and simulation of oceanic flows. All three research directions are of paramount importance for a better understanding and prediction of oceanic flows. One of the main challenges in both numerical simulations and observations is the wide range of spatial and temporal scales that need to be modeled. The topics covered in this minisymposium include the following: modeling strategies, spatial and temporal discretizations, parallel and high-performance computing, mathematically-based novel approaches to observing and sampling systems, error analysis, and mathematical analysis.

Organizer: Traian Iliescu
Virginia Tech, USA

Organizer: Tamay Ozgokmen
University of Miami, USA

10:30-10:55 Central-Upwind Schemes for 2D Shallow Water Equations
Yekaterina Epshteyn, University of Utah, USA

11:00-11:25 On the Transport of Particles in Oceanic Flows: Modeling, Theory, and Experiments
Luigi C. Berselli, Universita di Pisa, Italy; Matteo Cerminara, Istituto Nazionale di Geofisica e Vulcanologia, Italy

11:30-11:55 Progresses and Challenges in Spectral Multidomain Simulations of Small-Scale Oceanic Stratified Flow Processes
Peter Diamessis, Cornell University, USA

12:00-12:25 Reconstruction of the Pressure in Long-Wave Models with Constant Vorticity
Henrik Kalisch, University of Bergen, Norway

12:30-12:55 Numerical Modeling of Oceanic Turbulent Mixing-Layers
Samuele Rubino, Universidad de Sevilla, Spain

Wednesday, June 19

MS47

Advances in Pore-scale Modeling and Upscaling - Part III of IV

10:30 AM-1:00 PM

Room:Parco 1 - Ground Level

For Part 2 see MS20
For Part 4 see MS65

Pore-scale modeling offers a valuable tool to advance the understanding of nonlinear and irreversible transport phenomena in porous media. A non-exhaustive list of applications includes wettability alteration, three- phase fluid configurations, non-Newtonian flow, colloid transport and retention, as well as reactive transport and fluid-solid interactions. Despite the existence of various simulation approaches, several problems remain to guarantee an accurate description of the complex physical processes in a sufficiently large number of pores. Also, the difficulties in upscaling pore-scale behavior to the macro scale remain unresolved. This mini-symposium discusses advances in different modeling approaches, and suggests the future directions.

Organizer: Masa Prodanovic
University of Texas at Austin, USA

Organizer: Ken Sorbie
Heriot-Watt University, United Kingdom

Organizer: Pavel Tomin
University of Lausanne, Switzerland

Organizer: Matthew Balhoff
University of Texas at Austin, USA

Organizer: Malgorzata Peszynska
Oregon State University, USA

Organizer: Timothy D. Scheibe
Pacific Northwest National Laboratory, USA

10:30-10:55 On the Origin of Non-Fickian Transport in Porous Media
Branko Bijeljic and Martin J. Blunt, Imperial College London, United Kingdom

11:00-11:25 Pore-Network Modeling of Electrokinetic Flow and Transport in Microcapillaries
Vahid Joekar-Niasar, University of Utrecht, The Netherlands

11:30-11:55 Adaptive Hybrid Models of Reactive Transport in Porous Media
Ilenia Battiato, Clemson University, USA

12:00-12:25 Multiscale Simulation of Reactive Flow and Transport in Porous Media
Matthew Balhoff, University of Texas at Austin, USA

12:30-12:55 Simulation of Film and Droplet Flow on Smooth and Rough Wide Aperture Fractures using Smoothed Particle Hydrodynamics
Jannes Kordilla, University of Goettingen, Germany; Alexandre M. Tartakovsky, Pacific Northwest National Laboratory, USA; Tobias Geyer, University of Goettingen, Germany

continued in next column

Wednesday, June 19

MS48

Discrete-fracture Models for Porous Media Flow. Part 2: Reduced Models - Part III of III

10:30 AM-1:00 PM

Room:Parco 2 - Ground Level

For Part 1 see MS21

Numerical simulation of flow in fractured media is of particular importance for environmental applications, CO2 storage and oil and gas exploitation. The aim of this minisymposium is to bring together researchers working on the modelling of flow in fractured media, with in particular an emphasis on techniques based on the coupling of reduced models for flow along the fractures with models for flow in the rock matrix. Both single and multiphase flow will be considered. Among the topics to be addressed are conforming and non-conforming discretization of the fractures and modelling of networks of fractures.

Organizer: Anna Scotti
Politecnico di Milano, Italy

Organizer: Jean E. Roberts
INRIA Rocquencourt, France

Organizer: Luca Formaggia
Politecnico di Milano, Italy

10:30-10:55 Modeling Subsurface Fractures Using Enriched Finite Element Method

Hao Huang, Jichao Yin, Rodrick Myers, and Richard Albert, ExxonMobil Upstream Research Company, USA

11:00-11:25 Space-Time Domain Decomposition For Transport In Porous Media With Fractures

Thi Thao Phuong Hoang, INRIA Paris-Rocquencourt, France; Jerome Jaffre, INRIA Rocquencourt, France; Caroline Japhet, Université Paris XIII, France; Michel Kern and Jean E. Roberts, INRIA Rocquencourt, France

continued in next column

11:30-11:55 A Numerical Method for Two-Phase Flow in Fractured Porous Media with Non-Matching Grids

Anna Scotti, Luca Formaggia, and Alessio Fumagalli, Politecnico di Milano, Italy

12:00-12:25 Title Not Available at Time of Publication

Alifio Grillo, Polythecnic of Turin, Italy

12:30-12:55 Multiscale Simulation of Flow and Heat Transport in Fractured Geothermal Reservoirs with Improved Transport Upscaling

Tor Harald Sandve, *Inga Berre*, Eirik Keilegavlen, and Jan M. Nordbotten, University of Bergen, Norway

Wednesday, June 19

MS49

Dynamics of Fluid and Solid Interactions in Porous Media - Part I of II

10:30 AM-1:00 PM

Room:Giotto - Ground Level

For Part 2 see MS67

In a wide range of geoscientific applications, the behaviour of the heterogeneous system depends on the coupled dynamics of fluid and structure. Initially structure drives the fluid which on the other hand feeds back and influences the structure. Examples are the growth of biofilm, swelling of clays and precipitation/dissolution phenomena. Consequently, there is need for sophisticated conceptual models that are capable of coupled processes on a variety of (evolving) spatial and temporal scales and that account for complex multiphase/multiphysics interactions. This section focuses on recent advances in selected key topics and discusses a large spectrum of mathematical and also computational challanging aspects.

Organizer: Maria Neuss-Radu
University of Erlangen-Nuernberg, Germany

Organizer: Nadja Ray
University of Erlangen-Nuremberg, Germany

Organizer: Raphael Schulz
University of Erlangen, Germany

10:30-10:55 Multiscale Modeling of Colloid and Fluid Dynamics in Porous Media including an Evolving Microstructure

Nadja Ray, University of Erlangen-Nuremberg, Germany; Tycho van Noorden and Florian Frank, University of Erlangen, Germany; *Peter Knabner*, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

continued on next page

11:00-11:25 Multiscale Adaptive Simulations of Concrete Carbonation Taking into Account the Evolution of the Microstructure
Claus-Justus Heine, University of Stuttgart, Germany; Christian Moeller and *Malte A. Peter*, University of Augsburg, Germany; Kunibert Siebert, University of Stuttgart, Germany

11:30-11:55 Modeling Transport of Charged Colloids Including Electrochemically Induced Adhesive Interactions
Matthias Herz, University of Erlangen-Nuremberg, Germany

12:00-12:25 Compressibility of Porous Materials with Compressible Fluids Using Thermodynamics
Lynn S. Bennethum, University of Colorado, Denver, USA

12:30-12:55 Conceptual Multiscale Models for Flows in Layered Deforming Media
Eduard Rohan and Vladimir Lukes, University of West Bohemia, Pilsen, Czech Republic

Wednesday, June 19

MS50

The Complex Dynamics of Mixing and Chemical Reactions in Porous Media - Part I of III

10:30 AM-1:00 PM

Room:Meno Uno 1 - Lower Level

For Part 2 see MS59

Porous media are characterized by physical and chemical heterogeneities that range from the pore to the reservoir scale. The dynamics of mixing and chemical reactions are governed by spatial heterogeneity and mass transfer across scales. The challenge consists in identifying the controls on mixing and reaction in the medium and flow properties and their systematic quantification. This special session aims at theoretical, modeling and experimental approaches to shed light on the complex dynamics of mixing and reaction in porous media.

Organizer: Diogo Bolster
University of Notre Dame, USA

Organizer: Marco Dentz
IDAEA and Spanish National Research Council (CSIC), Spain

Organizer: Tanguy Le Borgne
Université de Rennes 1, France

Organizer: Alexandre M. Tartakovsky
Pacific Northwest National Laboratory, USA

Organizer: Jan M. Nordbotten
University of Bergen, Norway

10:30-10:55 Diffusion and Reaction in Heterogeneous Media: A Continuous Time Random Walk Approach
Dentz Marco, Spanish National Research Council, Spain

11:00-11:25 Mixing Entropy and Reactive Solute Transport
Gabriele Chiogna, University of Trento, Italy; David Hochstetler, Stanford University, USA; Alberto Bellin, Universita di Trento, Italy; Peter K. Kitanidis and Massimo Rolle, Stanford University, USA

continued in next column

11:30-11:55 Modelling Chemical Reactions in Porous Media with Particle Based Methods
David A. Benson, Colorado School of Mines, USA

12:00-12:25 The Architecture of Random Mixtures
Emmanual Villermaux, Université de Provence Aix Marseille 1, France

12:30-12:55 Characterization and Modeling Non-Fickian Dispersion Triggered by Matrix-Diffusion in Porous Media
Phillipe Gouze, CNRS & Universite Montpellier 2, France

Wednesday, June 19

MS51

Extended Poroelastic Systems and Related Applications - Part I of II

10:30 AM-1:00 PM

Room:Meno Uno 2 - Lower Level

For Part 2 see MS69

There is great interest in the mathematical modeling of poroelastic systems that describe the interaction between an elastic porous skeleton and the flow of fluids in the pore space. Extensions to these models are being developed to couple with different types of physics such as the Reynolds lubrication and Navier-Stokes equations, as well as considering special circumstances such as thin poroelastic plates. Relevant applications include reservoir engineering, hydraulic fracturing, poroelastic filters, blood flow in the human body, and living tissue modeling.

Organizer: Benjamin Ganis
University of Texas at Austin, USA

Organizer: Gergina Pencheva
University of Texas at Austin, USA

Organizer: Mary F. Wheeler
University of Texas at Austin, USA

Organizer: Iuliu Sorin Pop
Eindhoven University of Technology, Netherlands

Organizer: Jan Nordbotten
University of Bergen, Norway

10:30-10:55 A High-order, Fully-coupled, Upwind, Compact Discontinuous Galerkin Method for Modeling of Viscous Fingering in Compressible Porous Media

Guglielmo Scovazzi, Duke University, USA; Hao Huang, ExxonMobil Upstream Research Company, USA

11:00-11:25 A Rigorous Derivation of the Equations for the Biot-Kirchhoff-Love Poroelastic plate

Andro Mikelic, Université Claude Bernard Lyon 1, France; Anna Marciniak-Czochra, University of Heidelberg, Germany

11:30-11:55 Geomechanical Coupling Between Poroelastic Reservoirs and Viscoelastic Cap Rocks: Application to Pre-Salt Geological Formations

Marcio A. Murad, LNCC/MCT, Brazil; Jesus Obregon, National Laboratory for Scientific Computing, Brazil; Marcio Borges, National Laboratory of Scientific Computation LNCC/MCT Petropolis, Brazil; Maicon R. Correa, University of Campinas, Brazil; Luiz Radtke, National Laboratory of Scientific Computation LNCC/MCT Petropolis, Brazil

12:00-12:25 Modeling Arterial Walls As Multi-Layered Poroelastic Structure and Their Interaction with Pulsatile Blood Flow

Martina Bukac, Ivan Yotov, and Paolo Zunino, University of Pittsburgh, USA

12:30-12:55 Multiscale Modelling and Analysis of Flow, Chemical Reactions and Mechanical Processes in Elastic Porous Media

Maria Neuss-Radu, University of Erlangen-Nuernberg, Germany; Willi Jäger, University of Heidelberg, Germany; Andro Mikelić, University of Lyon 1, France

continued in next column

Wednesday, June 19

MS52

Physics-based Rupture and Tsunami Simulation - Part IV of IV

10:30 AM-12:30 PM

Room:Parco 3 - Ground Level

For Part 3 see MS43

The analyses of recent tsunamogenic earthquakes have raised questions about currently employed assumptions on the source mechanisms leading to devastating inundation events. In order to understand the interaction of complex rupture mechanics and hydrodynamic wave behavior, advanced physics-based models for earthquake and tsunami simulation have been developed. This minisymposium strives to review current development in this field. Furthermore, the synthesis of both - the complex source modeling and the coupled tsunami modeling - will be covered. An emphasis lies on algorithmic approaches and discretization methods for the complex multi-scale characteristic of both geophysical application fields.

Organizer: Jörn Behrens
University of Hamburg, Germany

Organizer: Luis Dalguer
ETH Zürich, Switzerland

Organizer: Martin Kaeser
Ludwig-Maximilians-Universität München, Germany

Organizer: Michael Bader
Technische Universität München, Germany

10:30-10:55 Tsunami Alert and Forecast Using a Massive Parallel Multiscale Model over French Polynesia

Anthony Jamelot, CEA, France; Dominique Reymond, CEA/LDG Pamatai, Tahiti, French Polynesia; Helene Hebert, CEA/DAM/DIF, F-91297, Arpajon, France

continued on next page

11:00-11:25 The SeisSol Software Package for Tsunamigenic Earthquake Simulations
Christian Pelties, Ludwig-Maximilians-Universität München, Germany; Alexander Breuer and Sebastian Rettenberger, Technische Universität München, Germany; Alice A. Gabriel, Ludwig-Maximilians-Universität München, Germany; Alex Heinecke and Michael Bader, Technische Universität München, Germany; Martin Kaeser, Geo Risk Research, Munich Reinsurance, Germany

11:30-11:55 Large-Scale Dynamic Earthquake Rupture Simulations with the Ader-Dg Method: Towards Simulation Based Seismic Hazard Assessment
Alice A. Gabriel and Christian Pelties, Ludwig-Maximilians-Universität München, Germany; Atanas Atanasov, Technical University of Munich, Germany; Vipin Sachdeva, IBM Research, USA; Luca Passone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Kirk E. Jordan, IBM T.J. Watson Research Center, USA; Geoffrey Ely, Argonne National Laboratory, USA; Martin Mai, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

12:00-12:25 Hardware-aware optimization of SeisSol, an unstructured ADER-DG code.
Alexander Breuer, Alexander Heinecke, Sebastian Rettenberger, and Bader Michael, Technische Universität München, Germany; Christian Pelties, Ludwig-Maximilians-Universität München, Germany

Wednesday, June 19

MS53

Open Source Reservoir Simulation Tools - Part I of II

10:30 AM-12:30 PM

Room:Foyer - First Level

For Part 2 see MS62

Open-source code provides a chance for sustainable software development in the geosciences. It is a necessity for reproducible computational sciences, but also offers a natural way to combine methods developed by different research groups, thereby speeding up the process of implementing, verifying and validating new computational codes. For these reasons, open-source tools should be attractive for academic institutions, but will also give industry access to new methods before they become available in commercial simulators. In recent years, several open-source simulators have been developed for flow in porous media. This minisymposium discusses their applicability to academic and industrial reservoir engineering problems.

Organizer: Bernd Flemisch
University of Stuttgart, Germany

Organizer: Knut-Andreas Lie
SINTEF, Norway

Organizer: Kristin Flornes
International Research Institute of Stavanger (IRIS), Norway

10:30-10:55 Comparison of Open Source Porous Media Simulators for Reservoir Engineering Applications
Bernd Flemisch, University of Stuttgart, Germany; Kristin Flornes, International Research Institute of Stavanger (IRIS), Norway; Knut-Andreas Lie, SINTEF, Norway

11:00-11:25 Fully Implicit Solvers for Matlab Reservoir Simulation Toolbox (MRST)
Stein Krogstad, SINTEF, Norway; Olav Møyner, SINTEF Energy Research, Norway

11:30-11:55 Ensemble Kalman Filter Toolbox in Mrst
Olwijn Leeuwenburgh, TNO Built and Environment, The Netherlands

12:00-12:25 Flow Diagnostics on Stratigraphic Grids
Knut-Andreas Lie, SINTEF, Norway

Wednesday, June 19

MS54

Multiscale Model Reduction Techniques for Subsurface Flow - Part III of III

10:30 AM-1:00 PM

Room:Forcellini - Ground Level

For Part 2 see MS24

The detailed numerical simulation of flow and transport in highly heterogeneous porous media can be prohibitively expensive, particularly when geological uncertainty is considered. For this reason, some type of model-order reduction is often required. Many such reduction techniques have been developed and are applied in practice. We plan to bring together researchers applying these and related approaches for model-order reduction. The intent is to facilitate discussion and interaction between researchers working on these various methods, with the eventual goal of developing systematic and improved model-reduction techniques for problems involving heterogeneity and uncertainty.

Organizer: Yalchin Efendiev
Texas A&M University, USA

Organizer: Ivan Lunati
University of Lausanne, Switzerland

Organizer: Seong H. Lee
Chevron Energy Technology Company, USA

10:30-10:55 Conditional Numerical Simulations of Flow and Transport in Porous Media
Veronika S. Vasylkivska, *Mina E. Ossiander*, and Malgorzata Peszynska, Oregon State University, USA

11:00-11:25 Multiscale Parameterization of Geologic Uncertainty
Xiao-Hui Wu, Larisa V. Branets, and Yahan Yang, ExxonMobil Upstream Research Company, USA

11:30-11:55 Multiscale Finite Volume Method For High-Contrast Heterogeneous Media
Hadi Hajibeygi, TU Delft, Netherlands; Yixuan Wang and Hamdi Tchelepi, Stanford University, USA

continued on next page

Wednesday, June 19

MS54

Multiscale Model Reduction Techniques for Subsurface Flow - Part III of III

continued

12:00-12:25 Upscaling of Fine Scale Geological Models for Non-Linear Flow Simulations
Eugenio Aulisa, Lidia Bloshanskaya, and Akif Ibragimov, Texas Tech University, USA; Yalchin Efendiev, Texas A&M University, USA

12:30-12:55 Theory and Software Concepts
Sven Kaulmann, University of Stuttgart, Germany

Lunch Break

1:00 PM-2:00 PM

Atrium - Ground Level

Wednesday, June 19

MS55

Computational Challenges in Glacier and Ice-sheet Modeling - Part III of III

2:00 PM-4:00 PM

Room:Luciani A - Ground Level

For Part 2 see MS37

Glacier and ice-sheet models are computationally challenging since they involve complex glacier shapes and nonlinear laws for the viscous and the basal sliding behaviors of ice; these possibly include ice-ocean coupling and glacial hydrology description. In addition, simulating an entire ice-sheet with a good level of accuracy requires adaptive and parallel strategies together with model approximations to reduce computational costs. Moreover, several parameters of the models cannot be directly measured and must be estimated with inverse problems driven by observational data. This mini-symposium will address the computational and modeling aspects associated with reliable simulations of glaciers and ice-sheets.

Organizer: Guillaume Jouvet
Freie Universität Berlin, Germany

Organizer: Mauro Perego
Sandia National Laboratories, USA

2:00-2:25 A Finite-volume Approach for Coupled Simulations of Ice, Sediment, and Melt-water Transport
David Lundbek Egholm, Christian Braedstrup, and Anders Christensen, Aarhus University, Denmark

2:30-2:55 Estimating the Ice Thickness of Mountain Glaciers with An Inverse Approach Using Surface Topography and Mass-Balance
Laurent Michel and Marco Picasso, École Polytechnique Fédérale de Lausanne, Switzerland; Daniel Farinotti, Andreas Bauder, Martin Funk, and Heinz Blatter, ETH Zürich, Switzerland

3:00-3:25 Inverse Modeling of the Greenland Ice Sheet Flow Dynamics: from Local Sensitivity to Large-Scale Model Initialisation
Fabien Gillet-Chaulet, Laboratoire de Glaciologie et de Géophysique de l'Environnement, France; Olivier Gagliardini, Laboratory of Glaciology and Environmental Geophysics, France; Jerome Monnier, Institut de Mathématiques de Toulouse, France; nathan martin, CNRS, France; Catherine Ritz, Laboratory of Glaciology and Environmental Geophysics, France; Maelle Nodet, Université Joseph Fourier and INRIA, France

3:30-3:55 Ice Sheet Properties Inferred by Combining Numerical Modeling and Remote Sensing Data
Mathieu Morlighem, University of California, Irvine, USA; Helene Seroussi, California Institute of Technology, USA; Eric Rignot, University of California, Irvine, USA; Eric Larour, California Institute of Technology, USA

continued in next column

Wednesday, June 19

MS56

Flow in Porous Media Beyond Darcy: Modeling and Numerical Challenges

2:00 PM-3:30 PM

Room:Parco 1 - Ground Level

Despite its economic relevance and several decades of intensive research the modeling of multiphase multicomponent fluids flow in a porous medium remains a challenge. It is well accepted that the standard model has limitations. Extensions and alternative approaches are available to take into account additional physics, e.g. compositional flow, elastic porous media as well as extending the domain of validity by accounting for additional variables. These extensions come along with significant mathematical and numerical challenges. The goal of this minisymposium is to address some of them.

Organizer: Florian Doster
Princeton University, USA

2:00-2:25 Hysteresis and Trapping in Two-Phase Flow in Porous Media
Florian Doster, Princeton University, USA

2:30-2:55 Dynamic Effects and Hysteresis in Two-Phase Flow in Porous Media
Xiulei Cao, Eindhoven University of Technology, Netherlands

3:00-3:25 A Componnt-Based Eulerian-Lagrangian Formulation for Multiphase Multicomponent Flow in Porous Media
Hong Wang, University of South Carolina, USA

Wednesday, June 19

MS57

Data Assimilation and Large-scale Geological Structures

2:00 PM-4:00 PM

Room:Parco 2 - Ground Level

Spatial fields with dominant large-scale geological features, like lithofacies in a reservoir, or geological layers in the overburden, are integral parts of a realistic subsurface property description. Such property fields are challenging to update with ensemble-based data-assimilation methods, since these methods rely on Gaussian assumptions. This minisymposium addresses various improvements and extensions of existing updating techniques, aiming at large-scale geological structures. Applications will cover reservoir history matching with production data as well as reservoir exploration with electromagnetic data.

Organizer: Rolf Lorentzen
International Research Institute of Stavanger (IRIS), Norway

Organizer: Trond Mannseth
University of Bergen, Norway

Organizer: Randi Valestrand
International Research Institute of Stavanger (IRIS), Norway

2:00-2:25 Updating Large-Scale Geological Structures and Application to Shallow-Marine Environments
Rolf Lorentzen and Geir Naevdal, International Research Institute of Stavanger (IRIS), Norway; Ali Shafieirad, Statoil-Hydro, Norway

2:30-2:55 Channelized Reservoir Estimation using EnKF. A Probabilistic Approach
Bogdan Sebacher and Remus Hanea, TU Delft, Netherlands; Arnold Heemink, Delft University of Technology, Netherlands

continued in next column

3:00-3:25 Multi-Level Estimation of a Layered Subsurface from Sea Floor Electromagnetic Data
Svenn Tveit, University of Bergen, Norway; Shaaban Ali Bakr and Martha Lien, Centre for Integrated Petroleum Research, Norway; Trond Mannseth, University of Bergen, Norway

3:30-3:55 Estimation of Discrete Geologic Facies Distributions from Production Data Using Probability Maps
Behnam Jafarpour, University of Southern California, USA; Morteza Khodabakhshi, Texas A&M University, USA

Wednesday, June 19

MS58

Modelisation and Discretization of Multiphase Darcy Flows with Discontinuous Capillary Pressures

2:00 PM-4:00 PM

Room:Giotto - Ground Level

The modelization and simulation of multiphase Darcy flows play a crucial role in many applications like for example in basin modelling, reservoir simulation, CO2 sequestration, hydrogeology. The geology requires to take into account different type of rocks which involves discontinuities in the hydrodynamics Darcy laws at the interfaces between different rock types. This in turn raise serious difficulties in terms of modelling, mathematical analysis and discretization. This minisymposium aims to give an overview of the most recent advances of the applied mathematics community in these directions as well as to discuss new incoming challenges for this type of problems.

Organizer: Roland Masson
Université de Nice, Sophia Antipolis, France

Organizer: Clement Cances
Laboratoire Jacques-Louis Lions, France

Organizer: Konstantin Brenner
Université de Nice, Sophia Antipolis, France

2:00-2:25 Finite Volume Discretizations of Two Phase Darcy Flows with Discontinuous Capillary Pressures
Roland Masson, Université de Nice, Sophia Antipolis, France; Robert Eymard, Université Paris-Est, France; Cindy Guichard, Université de Nice, Sophia Antipolis, France; Raphaele Herbin, University of Aix-Marseille, France

continued in next column

2:30-2:55 Discontinuous Galerkin Method for Two-phase Flows in Heterogeneous Porous Media with Capillary Barriers
Igor Mozolevski, Santa Catarina State University, Brazil; Alexandre Ern, Université Paris-Est, France; Luciane Schuh, Federal University of Santa Caterina, Brazil

3:00-3:25 Multi-Phase Multi-Component Flow in Heterogeneous Porous Media
Olaf Ippisch, Rebecca Neumann, and Peter Bastian, University of Heidelberg, Germany

3:30-3:55 Vanishing Capillarity Solutions of Buckley-Leverett Equation in Multi-Layer Porous Medium and Their Approximation by a Convergent Phase-by-phase Upstream Scheme.
Boris Andreianov, Université de Franche-Comté, France; Konstantin Brenner, Université de Nice, France; Clément Cancès, Laboratoire Jacques-Louis Lions, France

Wednesday, June 19

MS59

The Complex Dynamics of Mixing and Chemical Reactions in Porous Media - Part II of III

2:00 PM-4:00 PM

Room:Meno Uno 1 - Lower Level

For Part 1 see MS50
For Part 3 see MS68

Porous media are characterized by physical and chemical heterogeneities that range from the pore to the reservoir scale. The dynamics of mixing and chemical reactions are governed by spatial heterogeneity and mass transfer across scales. The challenge consists in identifying the controls on mixing and reaction in the medium and flow properties and their systematic quantification. This special session aims at theoretical, modeling and experimental approaches to shed light on the complex dynamics of mixing and reaction in porous media.

Organizer: Diogo Bolster
University of Notre Dame, USA

Organizer: Marco Dentz
IDAEA and Spanish National Research Council (CSIC), Spain

Organizer: Tanguy Le Borgne
Université de Rennes 1, France

Organizer: Alexandre M. Tartakovsky
Pacific Northwest National Laboratory, USA

Organizer: Jan M. Nordbotten
University of Bergen, Norway

2:00-2:25 Nonlinear and Nonlocal: Combined Effects on Reactions
Diogo Bolster, University of Notre Dame, USA

2:30-2:55 Quantifying Mixing of Passive Scalars in Heterogeneous Porous Media Flow using Lagrangian Statistics
Felipe de Barros, University of Southern California, USA; Tanguy Le Borgne, Université de Rennes 1, France; Marco Dentz, IDAEA and Spanish National Research Council (CSIC), Spain

continued on next page

3:00-3:25 Langevin Model for Anomalous Reactive Transport
Alexandre M. Tartakovsky, Pacific Northwest National Laboratory, USA

3:30-3:55 Multiscale Methods for Fluid-Structure Interaction with Applications to Poroelasticity
Donald Brown, Texas A&M University, USA; Victor Calo, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Yalchin Efendiev, Texas A&M University, USA; Peter Popov, Bulgarian Academy of Science, Bulgaria

Wednesday, June 19

MS60

Complementarity Problems for Flow in a Porous Medium

2:00 PM-4:00 PM

Room:Meno Uno 2 - Lower Level

Complementarity formulations are used for modeling systems which have to choose between different states. They provide elegant formulations to complex problems, and there exist efficient solution methods to solve them numerically. They have been applied in other fields like solid and fluid mechanics, economics, and they are equivalent to formulations with variational inequalities. Recently they have been applied to problems arising in flow in porous media. This minisymposium gives a sample of how complimentarity formulations can be used in this area of application.

Organizer: Jerome Jaffre
INRIA Rocquencourt, France

Organizer: Peter Knabner
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

2:00-2:25 A Water-Hydrogen Gas-Liquid Flow Formulated As a Complementarity Problem
Ibtihel Ben Gharbia, Jean Charles Gilbert, and Jerome Jaffre, INRIA Rocquencourt, France

2:30-2:55 A General Model for Two-Phase Flow in Terms of Multiple Complementarity Conditions
Estelle Marchand and Peter Knabner, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; Torsten Müller, Universität Erlangen-Nürnberg, Germany

3:00-3:25 Presence of Fluid Phases as a Non-Linear Complementarity Problem
Andreas Lauser, Universität Stuttgart, Germany

3:30-3:55 Analysis and Numerical Approximation of Methane Hydrates Model
Ralph Showalter, Malgorzata Peszynska, Nathan L. Gibson, and F. Patricia Medina, Oregon State University, USA

Wednesday, June 19

MS61

Adaptive, Multi-resolution Numerics for the Ocean and Atmosphere - Part I of IV

2:00 PM-4:00 PM

Room:Parco 3 - Ground Level

For Part 2 see MS70

Numerical simulation of the ocean and atmosphere requires careful handling of the disparate scales present in the physical phenomena. Solvers can take advantage of statically or adaptively refined meshes to resolve important local flow features, but then questions arise about which problems benefit from multiresolution modeling, which refinement criteria to use, whether solvers are robust in the adaptive setting, and so on. The Newton Institute (Cambridge, England) recently hosted a four month program 'Multiscale Numerics for the Ocean and Atmosphere' addressing these issues. Each of the minisymposium speakers participated in this program and will highlight dominant themes from the program.

Organizer: Donna Calhoun
Boise State University, USA

Organizer: Jörn Behrens
University of Hamburg, Germany

Organizer: Francis X. Giraldo
Naval Postgraduate School, USA

2:00-2:25 Adaptive Discontinuous Galerkin Simulations of Shallow Water Flow
Nicole Beisiegel and Jörn Behrens, University of Hamburg, Germany

2:30-2:55 A Semi-Implicit, Semi-Lagrangian, P-Adaptive Discontinuous Galerkin Method for the Rotating Shallow Water Equations on the Sphere
Giovanni Tumolo, International Centre for Theoretical Physics, Trieste, Italy

3:00-3:25 Discontinuous Galerkin Methods for Adaptive Atmospheric Flow
Robert Kloefkorn, National Center for Atmospheric Research, USA

Wednesday, June 19

MS62

Open Source Reservoir Simulation Tools - Part II of II

2:00 PM-4:00 PM

Room:Foyer - First Level

For Part 1 see MS53

Open-source code provides a chance for sustainable software development in the geosciences. It is a necessity for reproducible computational sciences, but also offers a natural way to combine methods developed by different research groups, thereby speeding up the process of implementing, verifying and validating new computational codes. For these reasons, open-source tools should be attractive for academic institutions, but will also give industry access to new methods before they become available in commercial simulators. In recent years, several open-source simulators have been developed for flow in porous media. This minisymposium discusses their applicability to academic and industrial reservoir engineering problems.

Organizer: Bernd Flemisch
University of Stuttgart, Germany

Organizer: Knut-Andreas Lie
SINTEF, Norway

Organizer: Kristin Flornes
International Research Institute of Stavanger (IRIS), Norway

2:00-2:25 DuMux As a Versatile Tool for Special Core Analysis
Jos G. Maas, TNO Built and Environment, The Netherlands; Bernd Flemisch, University of Stuttgart, Germany; Albert Hebing, PanTerra GeoConsultants, the Netherlands

2:30-2:55 Multiscale Simulation of Flow in Fractured Porous Media using MRST
Tor Harald Sandve, University of Bergen, Norway

3:00-3:25 Opm Simulation of Polymer Injection
Ove Sævareid, International Research Institute of Stavanger (IRIS), Norway; Atgeirr F. Rasmussen, SINTEF Energy Research, Norway; Kristin M. Flornes, International Research Institute of Stavanger (IRIS), Norway

3:30-3:55 MPFA on Adaptive Parallel Grids with Applications to Reservoir Engineering
Markus Wolff and Benjamin Faigle, University of Stuttgart, Germany

Wednesday, June 19

MS63

Multiphysics Model Intercomparison: From Bedrock to the Atmosphere

2:00 PM-4:00 PM

Room:Forcellini - Ground Level

This minisympoisum will focus on recent efforts to intercompare integrated models. As with many multiphysics applications, either no, or only very simple analytical solutions exist, providing very little model verification. A growing, community effort to intercompare complex, multi physics models to provide verification and an understanding of the differences that numerical model formulations impart on solution. This minisymposium will highlight recent inter comparison efforts that span surface-subsurface hydrology, coupled hydrologic-atmospheric models and geochemical reactive transport simulations.

Organizer: Reed M. Maxwell
Colorado School of Mines, USA

Organizer: Stefan Kollet
University of Bonn, Germany

2:00-2:25 Intercomparison Efforts: An Overview
Stefan Kollet, University of Bonn, Germany

2:30-2:55 Intercomparison of Integrated Hydrologic Models
Reed M. Maxwell, Colorado School of Mines, USA

3:00-3:25 Intercomparison of Coupled Hydrologic Atmospheric Models
Mauro Sulis, Bonn University, Germany

3:30-3:55 Intercomparison of Geochemical Reactive Transport Models
Carl Steefel, Lawrence Berkeley National Laboratory, USA

Coffee Break

4:00 PM-4:30 PM

Atrium - Ground Level

Wednesday, June 19

CP10

Geophysical Modeling

4:30 PM-6:10 PM

Room:Luciani A - Ground Level

Chair: To Be Determined

4:30-4:45 A Fourier Finite Element Method for the Simulation of 3D Csem Measurements
Shaaban A. Bakr, Centre for Integrated Petroleum Research, Norway; David Pardo, University of the Basque Country, Spain; Trond Mannseth, University of Bergen, Norway

4:50-5:05 Expected Value Estimators in Nuclear Well-Logging Simulations
Bair Banzarov, Baker Hughes Inc., Russia

5:10-5:25 Seismic Stratigraphic Modelling Through Computing in Bengal Basin at Higher Depths
Dr Sisir Kumar Bhowmick, Gargi Memorial Institute of Technology(GMIT), India

5:30-5:45 Inexact Interior Point Algorithms for Seismic Imaging
Drosos Kourounis, Universita' della Svizzera Italiana, Italy; Johannes Huber and Marcus J. Grote, Universität Basel, Switzerland; Olaf Schenk, Università della Svizzera Italiana, Switzerland

5:50-6:05 Mathematical Techniques for Very Large Scale Tomographic Inversion
Sergey Voronin and Guust Nolet, Université de Nice, Sophia Antipolis, France; Dylan Mikesell, Universite de Nice Sophia-Antipolis and CNRS, France; Jean Charléty, Université de Nice, Sophia Antipolis, France

Wednesday, June 19

CP11

Data Assimilation

4:30 PM-6:30 PM

Room:Parco 1 - Ground Level

Chair: To Be Determined

4:30-4:45 Gradient-Based Techniques for Data Assimilation in Reservoir Simulation
Vladislav Bukshtynov, Oleg Volkov, Lou J. Durlofsky, and Khalid Aziz, Stanford University, USA

4:50-5:05 Geodetical Data Assimilation with Ensemble Kalman Filter
Silvia Monaco, Francesca Bottazzi, Marco Sciortino, and Laura Dovera, Eni, E&P Division, Italy

5:10-5:25 Dual States Estimation Using Ensemble Kalman Filtering for Subsurface Flow-Transport Coupled Models
Mohamad El Gharamti and Ibrahim Hoteit, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Johan Valstar, Deltares, Netherlands

5:30-5:45 Polymer Injection Optimization Using the Ensemble Kalman Filter
Laura Dovera, Stefano Raniolo, Alberto Cominelli, Chiara Callegaro, and Franco Masserano, Eni, E&P Division, Italy

5:50-6:05 Impact of Model Order Reduction to Hydrological Data Assimilation.
Damiano Pasetto and Mario Putti, Universita di Padova, Italy; William W-G. Yeh, University of California, Los Angeles, USA

6:10-6:25 Improved Estimation of the Stochastic Gradient with Quasi-Monte Carlo Methods
Pallav Sarma and Wen Chen, Chevron Energy Technology Company, USA

Wednesday, June 19

CP12

Glacier Dynamics

4:30 PM-5:50 PM

Room:Parco 2 - Ground Level

Chair: To Be Determined

4:30-4:45 Towards a New Marine Ice-Sheet Model
Marc Boutounet and *Jérôme Monnier*, Institut de Mathématiques de Toulouse, France

4:50-5:05 Subglacial Water Flow Beneath Ice Streams
Teresa M. Kyrke-Smith, University of Oxford, United Kingdom

5:10-5:25 Control Method Inversions for Ice Stream Bed Conditions Using a Higher-Order Glacier Model
Daniel Shapero, University of Washington, USA

5:30-5:45 A Conceptual Model for Permafrost-Climate Feedback.
Ivan A. Sudakov, University of Utah, USA; Sergey Vakulenko, Russian Academy of Sciences, Russia

Wednesday, June 19

CP13

Modeling of Mixing and Turbulence

4:30 PM-6:30 PM

Room:Giotto - Ground Level

Chair: Keith A. Julien, University of Colorado Boulder, USA

4:30-4:45 Scale-Aware Parametrization of Eddy Transport
Qingshan Chen, Los Alamos National Laboratory, USA

4:50-5:05 Approximate Deconvolution for Large-Eddy Simulation (LES) of the Atmospheric Boundary Layer (ABL) on Adaptive Grids
Lauren Goodfriend and Fotini K. Chow, University of California, Berkeley, USA; Marcos Vanella and Elias Balaras, George Washington University, USA

5:10-5:25 Hypothesizing and Testing Causal Relationships in Correlated Time-Series Observations
Gary B. Hughes, California Polytechnic State University, San Luis Obispo, USA

5:30-5:45 Asymptotic Approaches for Rotationally Constrained Flows
Keith A. Julien, University of Colorado Boulder, USA

5:50-6:05 A Stochastic Hydrodynamic Model for Biogenic Mixing
Zhi George Lin, Zhejiang University, P.R. China

6:10-6:25 A Thermostat Approach to Correction of Kinetic Energy Spectra
Keith Myerscough, Delft University of Technology, Netherlands; Jason Frank, CWI, Amsterdam, Netherlands; Benedict Leimkuhler, University of Edinburgh, United Kingdom

Wednesday, June 19

CP14

Shallow Water Modeling

4:30 PM-6:30 PM

Room:Meno Uno 1 - Lower Level

Chair: Alina Chertock, North Carolina State University, USA

4:30-4:45 Central-Upwind Schemes for Shallow Water Models
Alexander Kurganov, Tulane University, USA

4:50-5:05 Central-Upwind Schemes for the System of Shallow Water Equations with Horizontal Temperature Gradients
Alina Chertock, North Carolina State University, USA; Alexander Kurganov and Yu Liu, Tulane University, USA

5:10-5:25 Goal-Oriented Adaptive Meshing for the Shallow Water Equations
Susanne Beckers, Jörn Behrens, and Winnifried Wollner, University of Hamburg, Germany

5:30-5:45 Robust Code-to-Code Validation by Means of Parameter Uncertainty Propagation and Anova
Pietro M. Congedo, INRIA Bordeaux Sud-Ouest, France; Anargyros Delis, Technical University of Crete, Greece; Mario Ricchiuto, INRIA, France

5:50-6:05 Shallow Water Simulations with the Source Term by the Depth Gradient and Weighted Average Flux Methods
Lanchakorn Kittiratanawasin, Kasetsart University, Thailand; Anand Pardhanani, Earlham College, USA; Montri Maleewong, Kasetsart University, Thailand

6:10-6:25 Total Least-Squares Adjustment for Various Forms of Coordinate Transformations: A Comparison
Burkhard Schaffrin and *Kyle Snow*, Ohio State University, USA; Frank Neitzel, Berlin University of Technology, Germany

Wednesday, June 19

CP15

Hydrology and Geomorphology

4:30 PM-6:10 PM

Room:Meno Uno 2 - Lower Level

Chair: Markus Burkow, University of Bonn, Germany

4:30-4:45 A Numerical Approach to Fluid Induced Sediment Processes
Markus Burkow and Michael Griebel, University of Bonn, Germany

4:50-5:05 Numerical Modeling of Flow Over Flexible Vegetation
Steven A. Mattis and Clint Dawson, University of Texas at Austin, USA; Christopher Kees and Matthew Farthing, U.S. Army Engineer Research and Development Center, USA

5:10-5:25 A Residual Based Approach for the Madsen and Sorensen Boussinesq Model
Mario Ricchiuto and Andrea Filippini, INRIA, France

5:30-5:45 Pebble Shape Evolution Along the Williams River, Australia: a Numerical Abrasion Model
Tímea Szabó, Budapest University of Technology and Economics, Hungary; Stephen Fityus, University of Newcastle, Australia; Gábor Domokos, Budapest University of Technology and Economics, Hungary

5:50-6:05 Interval Output of a {SISO} Linear System with Known Impulse Response for Incompletely Described Input
Ronald R. Van Nooijen, Delft University of Technology, Netherlands; Alla Kolechkina, Aronwis, Netherlands

Wednesday, June 19

CP16

Ocean Wave Modeling

4:30 PM-6:30 PM

Room:Parco 3 - Ground Level

Chair: Loyce Adams, University of Washington, USA

4:30-4:45 Incorporating Tidal Uncertainty Into Probabilistic Tsunami Hazard Assessment (ptha)
Loyce Adams, Randall J. LeVeque, and Frank I. González, University of Washington, USA

4:50-5:05 Strongly Nonlinear Internal Wave Models for Two Layer Fluids
Tae-Chang Jo, Inha University, Korea; Roberto Camassa, University of North Carolina at Chapel Hill, USA

5:10-5:25 Generation of Provably Correct Curvilinear Meshes
Jonathan Lambrechts, Jean-François Remacle, Thomas Toulorge, and Vincent Legat, Université Catholique de Louvain, Belgium

5:30-5:45 Unsteady Nonlinear Gravity Waves in Water of Finite Depth
Montri Maleewong, Kasetsart University, Thailand

5:50-6:05 An Efficient Parallel Implementation of Multirate Schemes for Ocean Modeling
Bruno Seny, Jonathan Lambrechts, Vincent Legat, and Jean-François Remacle, Université Catholique de Louvain, Belgium

6:10-6:25 An Unstructured Approach to Ocean Wave-Generation Modeling.
Adrean Webb, University of Colorado Boulder, USA

Wednesday, June 19

CP17

Groundwater Transport and Uncertainty - Part II of II

4:30 PM-6:30 PM

Room:Foyer - First Level

Chair: David C. Mays, University of Colorado, Denver, USA

4:30-4:45 Synthetic Wavelet Using a Hydrographic Data: Comparing Methods to Solve It

Ana M. Gonzalez-Orduno, Jaime Urrutia Fucugauchi, Maria Adela Monreal-Gomez, Guillermo Perez-Cruz, and David Alberto Salas-De-Leon, UNAM, Mexico

4:50-5:05 Using Chaos in Groundwater Remediation

David C. Mays, University of Colorado, Denver, USA; Roseanna Neupauer and James D. Meiss, University of Colorado Boulder, USA

5:10-5:25 Uncertainty Quantification for Transport Problems in the Shallow Subsurface

Anna Meade and Tim Kelley, North Carolina State University, USA; Owen Eslinger, U.S. Army Engineer Research and Development Center, USA

5:30-5:45 Optimizing In Situ Groundwater Remediation with Engineered Injection and Extraction

Amy N. Piscopo, University of Colorado Boulder, USA; Joseph R. Kasprzyk, Pennsylvania State University, USA; Roseanna Neupauer, University of Colorado Boulder, USA; David C. Mays, University of Colorado, Denver, USA

5:50-6:05 Homogenization in Case of Transient Motion of a Fluid Through a Porous Medium.

Viktoria Savatorova, National Research Nuclear University, Russia; Alexander Vlasov, Russian Academy of Sciences, Russia; Alexey Talonov, National Research Nuclear University, Russia

6:10-6:25 Uncertainty Quantification in Subsurface Flows with Stochastic Hydrological Laws

Pierre Sochala, BRGM, France; Olivier P. Le Maitre, LIMSI-CNRS, France

Wednesday, June 19

CP18

Geomechanical Modeling

4:30 PM-6:30 PM

Room:Forcellini - Ground Level

Chair: Ernesto E. Prudencio, University of Texas at Austin, USA

4:30-4:45 Shear Banding in a Partially Molten Mantle

Laura Alisic, John Rudge, and Garth Wells, University of Cambridge, United Kingdom; Richard F. Katz and Sander Rhebergen, University of Oxford, United Kingdom

4:50-5:05 Fracture Indicators for the Localization of Fractures in Porous Medium

Fatma Cheikh, INRIA Paris-Rocquencourt, France; Hend Ben Ameur, ENIT, Italy; Guy Chavent, INRIA, Universite Paris-Dauphine, France; François Clément, INRIA Paris-Rocquencourt, France; Vincent Martin, Université de Technologie de Compiègne, France; Jean E. Roberts, INRIA Rocquencourt, France

5:10-5:25 Heterogeneous Material Properties and Off-Fault Plastic Response in Earthquake Cycle Simulations

Brittany A. Erickson and Eric M. Dunham, Stanford University, USA

5:30-5:45 Variational Methods for a Problem of Rate- and State-Dependent Friction

Elias Pipping, Free University of Berlin, Germany

5:50-6:05 Bayesian Selection of Models for the Near Real-Time Earthquake Source Inversion

Martin Mai, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; *Ernesto E. Prudencio*, University of Texas at Austin, USA; Olaf Zielke, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

6:10-6:25 An Immersed Interface Method for a 1D Poroelasticity Problem with Discontinuous Coefficients

Son-Young Yi, University of Texas at El Paso, USA; Maranda Bean, University of Texas, El Paso, USA

Forward Looking Session

6:30 PM-7:30 PM

Room:Luciani A - Ground Level

Thursday, June 20

Registration

8:00 AM-5:00 PM

Atrium - Ground Level

Closing Remarks

8:25 AM-8:30 AM

Room:Luciani A - Ground Level

IP7

Data Assimilation and Inverse Modeling in Earth System Sciences

8:30 AM-9:15 AM

Room:Luciani A - Ground Level

Chair: Hans G. Kaper, Argonne National Laboratory and Georgetown University, USA

Physical theories in the Earth System sciences are designed to explain and possibly predict natural phenomena. Both, the explanation and prediction necessarily include a quantitative representation of the natural system state. Quantitative assessment of the actual, true, state is fundamentally achievable only by measurements. The theories and models based on them are consequently designed to explain and predict the measurements. A synergy of the models and measurements is necessary for achieving such goal. Methodology of data assimilation and inverse modeling provides objective means for that purpose. An overview of the currently used methodology will be presented, including examples of application in atmospheric sciences in domain of cloud analysis and modeling and tropical cyclone modeling and prediction.

Tomislava Vukicevic
NOAA, AOML Hurricane Research Division, Miami, USA

Thursday, June 20

IP8

Efficient Numerical Numerical Computation of Multi-Phase Flow in Porous Media

9:15 AM-10:00 AM

Room:Luciani A - Ground Level

Chair: Sabine Attinger, Helmholtz - Centre for Environmental Research - UFZ, Germany

Appropriate models, accurate discretization schemes and efficient solvers for the arising linear systems are the basis for any numerical simulation. In this talk I will address these aspects by first considering a model for compositional two-phase flow with equilibrium phase exchange that is able to handle phase appearance/ disapperance properly. Then a new fully-coupled discontinuous Galerkin scheme for two-phase flow with heterogeneous capillary pressure will be presented. The third part of the talk is devoted to the efficient solution of the arising linear systems by means of algebraic multigrid methods. All numerical schemes have been implemented in the Distributed and Unified Numerics Environment and have been scaled up to 300000 cores. This is joint work with Olaf Ippisch and Rebecca Neumann.

Peter Bastian
University of Heidelberg, Germany

Coffee Break

10:00 AM-10:30 AM

Atrium - Ground Level

Thursday, June 20

MS64

Weak Galerkin Finite Element Methods and Applications - Part I of II

10:30 AM-12:30 PM

Room:Luciani A - Ground Level

For Part 2 see MS73

The weak Galerkin finite element methods (WGFEMs) are new numerical methods that rely on the novel concepts of weak derivatives. These parameter independent methods are highly flexible by using discontinuous piecewise polynomials and general partitions with arbitrary shape of polygons/polyhedra. WGFEMs offer accurate numerical solutions and ease of implementation. WGFEMs open a new research front for the finite element community and can be applied to a variety of partial differential equations, e.g., elliptic, biharmonic, Maxwell, and Stokes equations.
This minisymposium brings together researchers who will discuss WGFEMs theoretical results, implementation issues, and applications including, but not limited to, elastic mechanics, interface problems, and porous media flow.

Organizer: Xiu Ye
University of Arkansas at Little Rock, USA

10:30-10:55 Title Not Available at Time of Publication
Guowei Wei, Michigan State University, USA

11:00-11:25 Connection and Differences of WGFEMs and Other Finite Element Methods
James Liu, Colorado State University, USA

11:30-11:55 Weak Galerkin Finite Element Methods for Helmholtz Equations
Shan Zhao, University of Alabama, USA

12:00-12:25 Weak Galerkin Methods for Darcian flow: Heterogeneity and Anisotropy
Guang Lin, Pacific Northwest National Laboratory, USA

Thursday, June 20

MS65

Advances in Pore-scale Modeling and Upscaling - Part IV of IV

10:30 AM-1:00 PM

Room:Parco 1 - Ground Level

For Part 3 see MS47

Pore-scale modeling offers a valuable tool to advance the understanding of nonlinear and irreversible transport phenomena in porous media. A non-exhaustive list of applications includes wettability alteration, three- phase fluid configurations, non-Newtonian flow, colloid transport and retention, as well as reactive transport and fluid-solid interactions. Despite the existence of various simulation approaches, several problems remain to guarantee an accurate description of the complex physical processes in a sufficiently large number of pores. Also, the difficulties in upscaling pore-scale behavior to the macro scale remain unresolved. This mini-symposium discusses advances in different modeling approaches, and suggests the future directions.

Organizer: Masa Prodanovic
University of Texas at Austin, USA

Organizer: Ken Sorbie
Heriot-Watt University, United Kingdom

Organizer: Pavel Tomin
University of Lausanne, Switzerland

Organizer: Matthew Balhoff
University of Texas at Austin, USA

Organizer: Malgorzata Peszynska
Oregon State University, USA

Organizer: Timothy D. Scheibe
Pacific Northwest National Laboratory, USA

10:30-10:55 Large-Scale Computations of Flows with Inertia and Anisotropy Based on Micro-Imaging Data
Anna Trykozko, University of Warsaw, Poland; Malgorzata Peszynska, Oregon State University, USA

continued on next page

11:00-11:25 Pore Scale and Multiscale Modeling Using LBM
Jun Li and Victor M. Calo, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Yalchin Efendiev, Texas A&M University, USA; Oleg Iliev, Fraunhofer Institute for Industrial Mathematics, Germany

11:30-11:55 Accounting for Saturation History in Image-Based Pore-Scale Modeling of Two-Phase Flow
Karsten Thompson, Louisiana State University, USA

12:00-12:25 Hybrid Multiscale Methods in Porous Media
Timothy D. Scheibe, Pacific Northwest National Laboratory, USA

12:30-12:55 Pore-Scale Modeling of Multiphase Reactive Transport with Phase Transitions and Dissolution/ precipitation Reactions
Qinjun Kang, and Bruce Robinson, Los Alamos National Laboratory, USA; Li Chen, Xi'an Jiaotong University, P.R. China

Thursday, June 20

MS66

Efficient Elastic Wave Equation Simulation for Hydrocarbon Exploration and Production - Part I of III

10:30 AM-12:00 PM

Room:Parco 2 - Ground Level

For Part 2 see MS75

Since most of the easy hydrocarbon reservoirs have been found, a step change in the quality of subsurface imaging is crucial. Current compute power allows for seismic imaging and processing with the acoustic wave equation. The challenge is an elastic wave propagator for better accuracy and resolution. With today's algorithms, this will increase the computational cost by at least a factor 40 and in some cases 100,000. The goal of the mini-symposium is to identify potential algorithms that will enable the replacement of the commonly used constant-density acoustic kernel by an elastic one at an affordable cost.

Organizer: Elena Zhebel
Shell Global Solutions International B.V., Rijswijk, Netherlands

Organizer: Sara Minisini
Shell Global Solutions International B.V., Rijswijk, Netherlands

10:30-10:55 Seismic Elastic Modeling for Seismic Imaging
Jean Virieux and Romain Brossier, ISTerre, University Joseph Fourier, France; Stephanie Chaillat, ENSTA ParisTech, France; Anton A. Duchkov, IPGG SB RAS and Novosibirsk State University, Russia; Vincent Etienne, University of Nice, France; Bruno Lombard, Laboratoire de Mécanique et d'Acoustique, France; Stéphane Operto, CNRS, France; Aleksander Serdyukov, IPGG, Russia

11:00-11:25 High-Order High-Throughput Numerical Methods for High-Contrast Seismic Imaging
Timothy Warburton and David Medina, Rice University, USA; Amik St-Cyr, Shell International Exploration and Production, USA

11:30-11:55 Local Time-Stepping and High-Order Discretization for Wave Propagation
Loredana Gaudio and Marcus J. Grote, Universität Basel, Switzerland

Thursday, June 20

MS67

Dynamics of Fluid and Solid Interactions in Porous Media - Part II of II

10:30 AM-1:00 PM

Room:Giotto - Ground Level

For Part 1 see MS49

In a wide range of geoscientific applications, the behaviour of the heterogeneous system depends on the coupled dynamics of fluid and structure. Initially structure drives the fluid which on the other hand feeds back and influences the structure. Examples are the growth of biofilm, swelling of clays and precipitation/ dissolution phenomena. Consequently, there is need for sophisticated conceptual models that are capable of coupled processes on a variety of (evolving) spatial and temporal scales and that account for complex multiphase/multiphysics interactions. This section focuses on recent advances in selected key topics and discusses a large spectrum of mathematical and also computational challanging aspects.

Organizer: Maria Neuss-Radu
University of Erlangen-Nuernberg, Germany

Organizer: Nadja Ray
University of Erlangen-Nuremberg, Germany

Organizer: Raphael Schulz
University of Erlangen, Germany

10:30-10:55 Remediation in Porous Media by Bacterial Chemotaxis and Bioclogging
Raphael Schulz, University of Erlangen-Nuernberg, Germany

11:00-11:25 Interaction of Reactive Flow with Solid Phase, Leading to Changes in Volume and Mechanical Properties - Mathematical Modelling and Simulation
Yifan Yang, University of Heidelberg, Germany; Maria Neuss-Radu, University of Erlangen-Nuernberg, Germany

continued on next page

Thursday, June 20

MS67

Dynamics of Fluid and Solid Interactions in Porous Media - Part II of II

continued

11:30-11:55 Modeling of Bacterial Growth, Adhesion and Transport in Porous Media
Pavel Hron, Peter Bastian, and Olaf Ippisch, University of Heidelberg, Germany; Daniel Jost, Karlsruhe Institute of Technology, Germany

12:00-12:25 Modeling Biofilm Formation Within Microfluidic Channels
Matthew Donahue and Nick Cogan, Florida State University, USA; Leonardo de La Fuente, Auburn University, USA; Mark E. Whidden, Florida State University, USA

12:30-12:55 Upscaling of Thin Layer Flows Involving Reactions at Moving Solid-Fluid Interfaces
Iuliu Sorin Pop, Eindhoven University of Technology, Netherlands; Kundan Kumar, University of Texas at Austin, USA; Tycho van Noorden, COMSOL AB, Sweden

Thursday, June 20

MS68

The Complex Dynamics of Mixing and Chemical Reactions in Porous Media - Part III of III

10:30 AM-1:00 PM

Room:Meno Uno 1 - Lower Level

For Part 2 see MS59

Porous media are characterized by physical and chemical heterogeneities that range from the pore to the reservoir scale. The dynamics of mixing and chemical reactions are governed by spatial heterogeneity and mass transfer across scales. The challenge consists in identifying the controls on mixing and reaction in the medium and flow properties and their systematic quantification. This special session aims at theoretical, modeling and experimental approaches to shed light on the complex dynamics of mixing and reaction in porous media.

Organizer: Diogo Bolster
University of Notre Dame, USA

Organizer: Marco Dentz
IDAEA and Spanish National Research Council (CSIC), Spain

Organizer: Tanguy Le Borgne
Université de Rennes 1, France

Organizer: Alexandre M. Tartakovsky
Pacific Northwest National Laboratory, USA

Organizer: Jan M. Nordbotten
University of Bergen, Norway

10:30-10:55 Probability Density Function of Concentration in Porous Media
Tanguy Le Borgne, Université de Rennes 1, France

11:00-11:25 Magnetic Resonance Measurement of Transport Dynamics and Mixing in Biogeochemical Precipitation
Joseph D. Seymour, Montana State University, USA

continued in next column

11:30-11:55 Scaling of Convective Mixing in Porous Media
Juan J. Hidalgo, Massachusetts Institute of Technology, USA

12:00-12:25 Anomalous Kinetics of Reactive Fronts in Porous Media
Pietro de Anna, Massachusetts Institute of Technology, USA

12:30-12:55 Miscemetry in Reactive Transport
Tim Ginn, University of California, Davis, USA

Thursday, June 20

MS69

Extended Poroelastic Systems and Related Applications - Part II of II

10:30 AM-1:00 PM

Room:Meno Uno 2 - Lower Level

For Part 1 see MS51

There is great interest in the mathematical modeling of poroelastic systems that describe the interaction between an elastic porous skeleton and the flow of fluids in the pore space. Extensions to these models are being developed to couple with different types of physics such as the Reynolds lubrication and Navier-Stokes equations, as well as considering special circumstances such as thin poroelastic plates. Relevant applications include reservoir engineering, hydraulic fracturing, poroelastic filters, blood flow in the human body, and living tissue modeling.

Organizer: Benjamin Ganis
University of Texas at Austin, USA

Organizer: Gergina Pencheva
University of Texas at Austin, USA

Organizer: Mary F. Wheeler
University of Texas at Austin, USA

Organizer: Iuliu Sorin Pop
Eindhoven University of Technology, Netherlands

Organizer: Jan Nordbotten
University of Bergen, Norway

10:30-10:55 Coupling Biot and Navier-Stokes Equations for Modelling Fluid-Poroelastic Media Interaction

Santiago Badia, Universitat Politecnica de Catalunya, Spain; *Annalisa Quaini*, University of Houston, USA; Alfio Quarteroni, École Polytechnique Fédérale de Lausanne, Switzerland

11:00-11:25 Darcy vs Brinkman

Eduard Marusic-Paloka, University of Zagreb, Croatia

11:30-11:55 Domain Decomposition for Poroelasticity-Elasticity Systems

Benjamin Ganis, University of Texas at Austin, USA; Ivan Yotov, University of Pittsburgh, USA; Mary F. Wheeler, University of Texas at Austin, USA

continued in next column

12:00-12:25 Full Finite Volume Discretization for Poroelasticity

Jan M. Nordbotten, University of Bergen, Norway

12:30-12:55 Hierarchical Multiscale Method for Elastic Mechanical Deformation of Naturally Fractured Rocks

Karine Levonyan and *Hamdi Tchelepi*, Stanford University, USA

Thursday, June 20

MS70

Adaptive, Multi-resolution Numerics for the Ocean and Atmosphere - Part II of IV

10:30 AM-12:30 PM

Room:Parco 3 - Ground Level

For Part 1 see MS61
For Part 3 see MS79

Numerical simulation of the ocean and atmosphere requires careful handling of the disparate scales present in the physical phenomena. Solvers can take advantage of statically or adaptively refined meshes to resolve important local flow features, but then questions arise about which problems benefit from multiresolution modeling, which refinement criteria to use, whether solvers are robust in the adaptive setting, and so on. The Newton Institute (Cambridge, England) recently hosted a four month program 'Multiscale Numerics for the Ocean and Atmosphere' addressing these issues. Each of the minisymposium speakers participated in this program and will highlight dominant themes from the program.

Organizer: Donna Calhoun
Boise State University, USA

Organizer: Jörn Behrens
University of Hamburg, Germany

Organizer: Francis X. Giraldo
Naval Postgraduate School, USA

10:30-10:55 Hybrid Tree-Based Approach to Block-Structured AMR for Finite Volume Methods on the Sphere

Donna Calhoun, Boise State University, USA; Carsten Burstedde, Universität Bonn, Germany

11:00-11:25 Hybrid Tree-based Approach to Block-structured AMR for Finite Volume Methods

Carsten Burstedde, Universität Bonn, Germany; Donna Calhoun, Boise State University, USA

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Thursday, June 20

MS70

Adaptive, Multi-resolution Numerics for the Ocean and Atmosphere - Part II of IV

10:30 AM-1:00 PM

continued

12:00-12:25 Imex Methods for Continuous and Discontinuous Galerkin Methods for the Compressible Euler Equations: Applications to Nonhydrostatic Atmospheric Modeling
Francis X. Giraldo, Naval Postgraduate School, USA

11:30-11:55 Wavelet-Based Dynamic Adaptivity for the Shallow-Water Equations on Staggered Meshes
Thomas Dubos, Ecole Polytechnique, France; Nicholas Kevlahan, McMaster University, Canada

Thursday, June 20

MS71

Unstructured Coastal and Deep Ocean Modeling: Advances, Problems, Outlook - Part I of III

10:30 AM-12:30 PM

Room:Foyer - First Level

For Part 2 see MS80

In coastal and basin scale ocean modeling of currents, waves and transport, methodologies based on unstructured and locally adaptive meshes are gaining acceptance and represent the state of the art of the modeling skill in the field. However a number of important research issues remain to be addressed, both in the methodologies and in the physical applications of these models. Over the past few years, several community codes based on various finite element and finite volume discretizations entered the phase of active development. The focus of this mini-symposium is to discuss recent advances in unstructured coastal and deep ocean modeling and a discussion of still unsolved problems connected with these schemes.

Organizer: Clint Dawson
University of Texas at Austin, USA

Organizer: Vadym Aizinger
University of Erlangen-Nürnberg, Germany

10:30-10:55 Title Not Available at Time of Publication
Ethan Kubatko, Ohio State University, USA

11:00-11:25 A Discontinuous Galerkin Scheme for a 2-Equation Vertical Eddy Viscosity Parameterization
Vadym Aizinger, University of Erlangen-Nürnberg, Germany

11:30-11:55 Adaptive Galerkin Type Methods for Inundation Computations
Jörn Behrens, University of Hamburg, Germany

12:00-12:25 Green-Naghdi solutions to the Pressure Poisson equation with Boussinesq-type scaling
Aaron Donahue, Joannes Westerink, and Andrew Kennedy, University of Notre Dame, USA

Thursday, June 20

MS72

Geodynamics Modeling: Mathematics, Numerics and HPC - Part I of III

10:30 AM-12:30 PM

Room:Forcellini - Ground Level

For Part 2 see MS81

The main objective of this mini-symposium is to collect contributions from applied mathematicians, physicists and geophysicists working on geodynamics modeling. In this sense the mini-symposium will cover all the aspects related to this field: study of mathematical and physical models (mantle circulation, rift and subduction processes, crustal and lithosperic deformation), development of numerical methods (based either on Finite Difference, Finite Element, Finite Volume or other suitable methods) and efficient implementation of High Performance Computers. The mini-symposium will also highlight some possible applications of geodynamcis modeling (e.g. in petroleum system modeling).

Organizer: Edie Miglio
Politecnico di Milano, Italy

Organizer: Carlo Doglioni
Università La Sapienza, Rome, Italy

10:30-10:55 From a Geological to a Numerical Model for Earthquake Generation (and fluids reaction)
Eugenio Carminati and Carlo Doglioni, Università La Sapienza, Rome, Italy; Salvatore Barba and Federica Riguzzi, Istituto Nazionale di Geofisica e Vulcanologia, Italy

11:00-11:25 Improved Rheological Models for the Description of Rift Dynamics
Marco Cuffaro, CNR, Italy; Edie Miglio, *Mattia Penati*, and Marco Viganò, Politecnico di Milano, Italy

11:30-11:55 Surface Water Enables Subduction on Earth: Predictions from Self-Consistent Models
Taras Gerya, ETH Zürich, Switzerland

12:00-12:25 Consequences of Viscous Anisotropy in Partially Molten Rocks
Richard F. Katz, University of Oxford, United Kingdom; Yasuko Takei, University of Tokyo, Japan

Thursday, June 20

Lunch Break

1:00 PM-2:00 PM

Atrium - Ground Level

SIAG/GS Business Meeting

1:15 PM-2:00 PM

Room:Luciani A - Ground Level

Thursday, June 20

MS73

Weak Galerkin Finite Element Methods and Applications - Part II of II

2:00 PM-4:00 PM

Room:Luciani A - Ground Level

For Part 1 see MS64

The weak Galerkin finite element methods (WGFEMs) are new numerical methods that rely on the novel concepts of weak derivatives. These parameter independent methods are highly flexible by using discontinuous piecewise polynomials and general partitions with arbitrary shape of polygons/polyhedra. WGFEMs offer accurate numerical solutions and ease of implementation. WGFEMs open a new research front for the finite element community and can be applied to a variety of partial differential equations, e.g., elliptic, biharmonic, Maxwell, and Stokes equations. This minisymposium brings together researchers who will discuss WGFEMs theoretical results, implementation issues, and applications including, but not limited to, elastic mechanics, interface problems, and porous media flow.

Organizer: Xiu Ye
University of Arkansas at Little Rock, USA

2:00-2:25 Wgfem for Biharmonic Problems
Xiu Ye, University of Arkansas at Little Rock, USA

2:30-2:55 Weak Galerkin Finite Element Methods for Elliptic Problems
Junping Wang, National Science Foundation, USA

3:00-3:25 Wgfem for Elliptic Interface Problems
Lin Mu, Michigan State University, USA

3:30-3:55 Title Not Available at Time of Publication
Knut Waagan, University of Washington, USA

Thursday, June 20

MS74

Uncertainty Quantification and Optimization for Subsurface Flow Models - Part I of II

2:00 PM-4:00 PM

Room:Parco 1 - Ground Level

For Part 2 see MS83

Subsurface flow models rely on many parameters that cannot be measured directly. Instead, a sparse set of measurements may exist at the location of wells or from low quality distributed measurements from seismic surveys. The complete distributions of these unknown parameters are commonly inferred by a model calibration process that takes into account historical records of the input-output of the model. The focus of this minisymposia is to discuss recent developments of efficient methods for model calibration and uncertainty quantification of subsurface flow models, including: Bayesian inference methods, ensemble Kalman filtering methods, decision-making approaches, and optimization under geological uncertainties.

Organizer: Ahmed H. ElSheikh
University of Texas at Austin, USA

Organizer: Ibrahim Hoteit
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

2:00-2:25 Bayesian Uncertainty Quantification of Subsurface Flow Models Using Nested Sampling and Sparse Polynomial Chaos Surrogate
Ahmed H. ElSheikh and Mary F. Wheeler, University of Texas at Austin, USA; Ibrahim Hoteit, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

2:30-2:55 Toward An Expectation-Maximization Method for Parameter Estimation and Its Application to Rate Estimation in Oil Wells
Xiaodong Luo, Rolf Johan Lorentzen, Andreas Stordal, and Geir Naevdal, International Research Institute of Stavanger (IRIS), Norway

continued on next page

Thursday, June 20

MS74

Uncertainty Quantification and Optimization for Subsurface Flow Models - Part I of II

continued

3:00-3:25 Multilevel Monte Carlo for Groundwater Flow Problems in Random Media
Elisabeth Ullmann, University of Bath, United Kingdom

3:30-3:55 Multiple Criteria Optimization of CO2 Sequestration Strategy Under Geological Uncertainty Using Adaptive Sparse Grid Surrogates
Rachares Petvipusit, Imperial College London, United Kingdom; Ahmed H. ElSheikh, University of Texas at Austin, USA; Martin Blunt and Peter King, Imperial College London, United Kingdom

Thursday, June 20

MS75

Efficient Elastic Wave Equation Simulation for Hydrocarbon Exploration and Production - Part II of III

2:00 PM-4:00 PM

Room:Parco 2 - Ground Level

For Part 1 see MS66
For Part 3 see MS84

Since most of the easy hydrocarbon reservoirs have been found, a step change in the quality of subsurface imaging is crucial. Current compute power allows for seismic imaging and processing with the acoustic wave equation. The challenge is an elastic wave propagator for better accuracy and resolution. With today's algorithms, this will increase the computational cost by at least a factor 40 and in some cases 100,000. The goal of the mini-symposium is to identify potential algorithms that will enable the replacement of the commonly used constant-density acoustic kernel by an elastic one at an affordable cost.

Organizer: Elena Zhebel
Shell Global Solutions International B.V., Rijswijk, Netherlands

Organizer: Sara Minisini
Shell Global Solutions International B.V., Rijswijk, Netherlands

2:00-2:25 An Adaptive Fast Multipole Accelerated Boundary Element Method for 3D Elastodynamics
Stephanie Chaillat, ENSTA ParisTech, France; Adrien Loseille, INRIA Paris-Rocquencourt, France

2:30-2:55 Dicontinuous Galerkin Approximation of Seismic Wave Propagation Problems
Ilario Mazzieri and Paola F. Antonietti, Politecnico di Milano, Italy; Alfio Quarteroni, École Polytechnique Fédérale de Lausanne, Switzerland

3:00-3:25 Forward and Inverse Problems in Acoustics and Seismic Modeling: An Optimized-Spectral Element Approach
Dimitri Komatitsch and Zhinan Xie, CNRS & Universite de Marseille, France

3:30-3:55 Up-scaling 3D Complex Geological Media for the Elastic Wave Equation
Paul Cupillard, IPG Paris, France

Thursday, June 20

MS76

Numerical Methods and Simulations for Reactive Transport Problems

2:00 PM-4:00 PM

Room:Giotto - Ground Level

The computation of numerical solutions of reactive transport problems in porous media is very demanding, in particular for 3D simulations, but already for 2D scenarios, if a large number of species and reactions is involved. In this minisymposium state-of-the-art numerical methods for this kind of problems will be discussed and new developments and computational results will be presented. Accuracy, but also certain properties of the numerical solutions, and the efficiency of the schemes will be addressed. Applications vary from single fluid phase with reactions involving the immobile phase to multi-phase problems with mass exchange between the fluid phases.

Organizer: Serge Krautle
University of Erlangen-Nuremberg, Germany

Organizer: Peter Knabner
Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

2:00-2:25 Efficient Numerical Simulation of 2D and 3D Multicomponent Reactive Transport
Serge Krautle, Alexander Vibe, and Joachim Hoffmann, University of Erlangen-Nuremberg, Germany; Peter Knabner, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

2:30-2:55 An Efficient Numerical Approach for Reactive Multiphase Multicomponent Flow in Porous Media
Fabian Brunner, University of Erlangen-Nuernberg, Germany; Peter Knabner, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

continued on next page

3:00-3:25 Importance of Non-Negative Numerical Solution for Mixing-Controlled Reactive Transport
Albert J. Valocchi, University of Illinois at Urbana-Champaign, USA; Kalya Nakshatrala, University of Houston, USA

3:30-3:55 Isotopic Management in the Reactive Transport Code Hytec : Isotopic Fractionation and Radioactive Decay
Caroline de Dieuleveult and Vincent Lagneau, Mines ParisTech, France

Thursday, June 20

MS77

Multiple Scattering Imaging and Inversion

2:00 PM-4:00 PM

Room:Meno Uno 1 - Lower Level

The subsurface of the Earth is a medium with complex inhomogeneity at all scales. The single scattering assumption restricts the ability of standard imaging algorithms to form an image of complicated geological structures. Multiply-scattered waves create a complex wavefield that is challenging to interpret. However, waves that bounce multiple times offer great insights into the structure of the subsurface and illuminate reflectors not sensed by singly-scattered waves. We consider the state of the art in imaging and inversion with multiply scattered waves, identify challenges, and explore potential applications. The speakers have recently experimented with benefits and virtue of predicting and including multi-scattered energy in imaging and inversion.

Organizer: Filippo Broggini
Colorado School of Mines, USA

Organizer: Ru-Shan Wu
University of California, Santa Cruz, USA

Organizer: Tariq Alkhalifah
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

2:00-2:25 Wavefield Tomography Based on Local Image Correlations
Francesco Perrone and Paul C. Sava, Colorado School of Mines, USA

2:30-2:55 Autofocusing of Internal Multiples and Application to Multidimensional Deconvolution
Filippo Broggini and Roel Snieder, Colorado School of Mines, USA; Kees Wapenaar and Joost van der Neut, Delft University of Technology, Netherlands

3:00-3:25 Interferometric Imaging of the Leading-order Internal Multiples
Mohammad A. Zuberi and Tariq Alkhalifah, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

3:30-3:55 Renormalization of Scattering Series and the Improvement of Convergence Property
Ru-Shan Wu and Lingling Ye, University of California, Santa Cruz, USA

Thursday, June 20

MS78

Recent Advances in Inexact Solvers in Geosciences

2:00 PM-4:00 PM

Room:Meno Uno 2 - Lower Level

Numerical simulation of flow in geological porous media is typically in the context of highly uncertain physical parameters and coarse numerical resolution. This motivates the consideration of linear and non-linear solvers of comparable accuracy, where computational savings may be gained relative to standard solvers of high accuracy. Such solvers are referred to as inexact. A key challenge in this context is preserving qualitative features of the solution, such as conservation, which are essential for the stability of coupled problems. Furthermore, reliable error estimates are required. This minisymposium will consider recent developments in inexact solvers for applications in the geosciences.

Organizer: Eirik Keilegavlen
University of Bergen, Norway

Organizer: Jan M. Nordbotten
University of Bergen, Norway

2:00-2:25 Inexact Linear Solvers for Control Volume Discretizations
Eirik Keilegavlen and Jan M. Nordbotten, University of Bergen, Norway

2:30-2:55 A Posteriori Error Estimates, Stopping Criteria, and Adaptivity for Two-Phase Flows
Martin Vohralik, INRIA Paris-Rocquencourt, France; Mary F. Wheeler, University of Texas at Austin, USA; Clement Cances, Laboratoire Jacques-Louis Lions, France; Sorin Pop, CASA and Eindhoven University of Technology, The Netherlands

3:00-3:25 Multiscale Methods: Tools to Balance Accuracy and Efficiency
Ivan Lunati, Laureline Josset, and *Rouven Kuenze*, University of Lausanne, Switzerland

3:30-3:55 A Numerical Study of Splitting Schemes and Implicit Solution Methods for Biot's Equation
Joachim B. Haga and Kent Mardal, Simula Research Laboratory, Norway; Jan M. Nordbotten and Eirik Keilegavlen, University of Bergen, Norway

Thursday, June 20

MS79

Adaptive, Multi-resolution Numerics for the Ocean and Atmosphere - Part III of IV

2:00 PM-3:30 PM

Room:Parco 3 - Ground Level

For Part 2 see MS70
For Part 4 see MS88

Numerical simulation of the ocean and atmosphere requires careful handling of the disparate scales present in the physical phenomena. Solvers can take advantage of statically or adaptively refined meshes to resolve important local flow features, but then questions arise about which problems benefit from multiresolution modeling, which refinement criteria to use, whether solvers are robust in the adaptive setting, and so on. The Newton Institute (Cambridge, England) recently hosted a four month program 'Multiscale Numerics for the Ocean and Atmosphere' addressing these issues. Each of the minisymposium speakers participated in this program and will highlight dominant themes from the program.

Organizer: Donna Calhoun
Boise State University, USA

Organizer: Jörn Behrens
University of Hamburg, Germany

Organizer: Francis X. Giraldo
Naval Postgraduate School, USA

2:00-2:25 Comparison of Adaptive and Uniform DG Simulations
Andreas Mueller, Naval Postgraduate School, USA

2:30-2:55 A Multilevel Time Integrator for Large-scale Atmospheric Flows
Tommaso Benacchio and Rupert Klein, Freie Universität Berlin, Germany

3:00-3:25 Exponential Integrators for Applications to Environmental Fluid Dynamics
Luca Bonaventura, Politecnico di Milano, Italy

Thursday, June 20

MS80

Unstructured Coastal and Deep Ocean Modeling: Advances, Problems, Outlook - Part II of III

2:00 PM-4:00 PM

Room:Foyer - First Level

For Part 1 see MS71
For Part 3 see MS89

In coastal and basin scale ocean modeling of currents, waves and transport, methodologies based on unstructured and locally adaptive meshes are gaining acceptance and represent the state of the art of the modeling skill in the field. However a number of important research issues remain to be addressed, both in the methodologies and in the physical applications of these models. Over the past few years, several community codes based on various finite element and finite volume discretizations entered the phase of active development. The focus of this mini-symposium is to discuss recent advances in unstructured coastal and deep ocean modeling and a discussion of still unsolved problems connected with these schemes.

Organizer: Clint Dawson
University of Texas at Austin, USA

Organizer: Vadym Aizinger
University of Erlangen-Nürnberg, Germany

2:00-2:25 Local Timestepping in the Discontinuous Galerkin Method for Shallow Water Systems
Clint Dawson and Corey Trahan, University of Texas at Austin, USA

2:30-2:55 Pressure Forcing and Dispersion Analysis for Discontinuous Galerkin Approximations to Oceanic Fluid Flows
Robert L. Higdon, Oregon State University, USA

3:00-3:25 Adaptive Vertical Coordinates for Modeling Stratified, Coastal Seas
Richard Hofmeister, Helmholtz Zentrum Geesthacht, Germany; Jean-Marie Beckers, University of Liege, Belgium; Ulf Gräwe and Hans Burchard, Leibniz Institut for Baltic Sea Research, Warnemünde, Germany

3:30-3:55 Multiresolution Ocean Simulations with Fesom
Sergey Danilov, Alfred Wegener Institute, Germany

Thursday, June 20

MS81

Geodynamics Modeling: Mathematics, Numerics and HPC - Part II of III

2:00 PM-4:00 PM

Room:Forcellini - Ground Level

For Part 1 see MS72
For Part 3 see MS90

The main objective of this mini-symposium is to collect contributions from applied mathematicians, physicists and geophysicists working on geodynamics modeling. In this sense the mini-symposium will cover all the aspects related to this field: study of mathematical and physical models (mantle circulation, rift and subduction processes, crustal and lithosperic deformation), development of numerical methods (based either on Finite Difference, Finite Element, Finite Volume or other suitable methods) and efficient implementation of High Performance Computers. The mini-symposium will also highlight some possible applications of geodynamcis modeling (e.g. in petroleum system modeling).

Organizer: Edie Miglio
Politecnico di Milano, Italy

Organizer: Carlo Doglioni
Università La Sapienza, Rome, Italy

2:00-2:25 Aspect: An Advanced Solver for Problems in Earth Convection
Wolfgang Bangerth and Timo Heister, Texas A&M University, USA

2:30-2:55 Simulating Mantle Convection, Plate Tectonics and the Thermo-Chemical Evolution of Planetary Interiors in a 3-D Spherical Shell on High-Performance Computers
Paul Tackley, ETH Zürich, Switzerland

3:00-3:25 Flexible Finite Element Methods for Geodynamics
Stuart R. Clark and Lyudmyla Vynnytska, Simula Research Laboratory, Norway

3:30-3:55 Improved Thermo-Tectonic Basin Reconstruction with P-T Dependent Gravimetric Calibration
Dani Schmid and Lars Ruepke, Geomodelling Solutions Gmbh Zurich, Switzerland; Matilde Dalla Rosa and Matteo Gilardi, ENI, Italy

Thursday, June 20

Coffee Break

4:00 PM-4:30 PM

Atrium - Ground Level

MS82

Using Test Cases in the Development of Dynamical Cores

4:30 PM-6:30 PM

Room:Luciani A - Ground Level

The dynamical core of an (ocean or atmosphere) general circulation model is the component that discretizes the underlying fluid dynamics equations of motion. The variety of choices available in the design of a dynamical core have led to numerous different solutions, each with particular strengths and weaknesses. Key to the improvement of these models, is the use of test cases that rely on simplified reductions in the underlying system to highlight deficiencies in the model design. This mini-symposium will consider how these test cases are used to assess and improve the design of dynamical cores.

Organizer: James Kent
University of Michigan, USA

Organizer: Jared Whitehead
Los Alamos National Laboratory, USA

4:30-4:55 Methods to Determine the Effective Resolution of Dynamical Cores
James Kent, University of Michigan, USA

5:00-5:25 The Endgame Dynamical Core: Test Results Using a Switchable Discretisation
Thomas Melvin, Met Office, United Kingdom

5:30-5:55 Adaptive Mesh Refinement for the Non-Hydrostatic Unified Model of the Atmosphere (NUMA)
Michal A. Kopera and Francis X. Giraldo, Naval Postgraduate School, USA

6:00-6:25 Potential Vorticity Anomalies: Dynamic Or Numerical Artifact?
Jared Whitehead, Los Alamos National Laboratory, USA

Thursday, June 20

MS83

Uncertainty Quantification and Optimization for Subsurface Flow Models - Part II of II

4:30 PM-6:30 PM

Room:Parco 1 - Ground Level

For Part 1 see MS74

Subsurface flow models rely on many parameters that cannot be measured directly. Instead, a sparse set of measurements may exist at the location of wells or from low quality distributed measurements from seismic surveys. The complete distributions of these unknown parameters are commonly inferred by a model calibration process that takes into account historical records of the input-output of the model. The focus of this minisymposia is to discuss recent developments of efficient methods for model calibration and uncertainty quantification of subsurface flow models, including: Bayesian inference methods, ensemble Kalman filtering methods, decision-making approaches, and optimization under geological uncertainties.

Organizer: Ahmed H. ElSheikh
University of Texas at Austin, USA

Organizer: Ibrahim Hoteit
King Abdullah University of Science & Technology (KAUST), Saudi Arabia

4:30-4:55 Combining Multidimensional Scaling (MDS) with Ensemble-Based Algorithms for Automatic History Matching
Reza Tavakoli, Sanjay Srinivasan, Ahmed H. ElSheikh, and Mary F. Wheeler, University of Texas at Austin, USA

5:00-5:25 Iterative Smoothers for Subsurface Reservoir Flow History Matching
Andreas Stordal, International Research Institute of Stavanger (IRIS), Norway

5:30-5:55 Dual Ensemble Filtering for States Estimation of Coupled Subsurface Transport Models
Mohamad El-Gharamti and Ibrahim Hoteit, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

6:00-6:25 Well Placement Optimization Using Stochastic Approximated-Gradient Methods
Yuqing Chang and Deepak Devegowda, University of Oklahoma, USA

continued in next column

Thursday, June 20

MS84

Efficient Elastic Wave Equation Simulation for Hydrocarbon Exploration and Production - Part III of III

4:30 PM-6:30 PM

Room:Parco 2 - Ground Level

For Part 2 see MS75

Since most of the easy hydrocarbon reservoirs have been found, a step change in the quality of subsurface imaging is crucial. Current compute power allows for seismic imaging and processing with the acoustic wave equation. The challenge is an elastic wave propagator for better accuracy and resolution. With today's algorithms, this will increase the computational cost by at least a factor 40 and in some cases 100,000. The goal of the mini-symposium is to identify potential algorithms that will enable the replacement of the commonly used constant-density acoustic kernel by an elastic one at an affordable cost.

Organizer: Elena Zhebel
Shell Global Solutions International B.V., Rijswijk, Netherlands

Organizer: Sara Minisini
Shell Global Solutions International B.V., Rijswijk, Netherlands

4:30-4:55 Geological Complexity, Topography and Seismic Wave Modelling: Are Finite-Differences Up to the Challenge?
Josep de La Puente, Miguel Ferrer, and José María Cela, Barcelona Supercomputing Center, Spain

5:00-5:25 The Interior-Penalty Discontinuous Galerkin Method for Elastic Wave Propagation in Fractured Media
Jonas D. De Basabe, CICESE, Mexico; Mrinal Sen and Mary F. Wheeler, University of Texas at Austin, USA

continued in next column

5:30-5:55 Exact Boundary Conditions for Modelling and Inversion of Elastic Wave Propagation
Marlies Vasmel and Johan Robertsson, ETH Zürich, Switzerland; Dirk-Jan van Manen, Schlumberger Gould Research, United Kingdom

6:00-6:25 Higher Order Summation-by-parts Methods for Seismic Wave Propagation
Anders Petersson, Lawrence Livermore National Laboratory, USA; Bjorn Sjogreen, Lawrence Livermore National Laboratory, USA

Thursday, June 20

MS85

Reliable Simulation of Reactive Transport in Porous Media

4:30 PM-6:30 PM

Room:Giotto - Ground Level

This mini-symposium is devoted to reliable numerical schemes for flow and reactive solute transport in saturated/unsaturated porous media. Typically, the mathematical models for reactive transport consist of coupled nonlinear partial and ordinary differential equations which may even degenerate. The set up and analysis of numerical methods for such problems is therefore very challenging. The presentations in this mini-symposium will address important issues related to the numerical simulation of coupled reactive flow in porous media. Different discretization techniques will be presented, including mass conservative ones. A special attention will be given to the analysis of the presented schemes.

Organizer: Florin A. Radu
University of Bergen, Norway

Organizer: Florin A. Radu
University of Bergen, Norway

Organizer: Rainer Helmig
University of Stuttgart, Germany

4:30-4:55 Analysis of Mixed Finite Element Discretization for Crystal Precipitation and Dissolution Model
Kundan Kumar, University of Texas, Austin, USA; Iuliu Sorin Pop, Eindhoven University of Technology, Netherlands; Florin A. Radu and Florin A. Radu, University of Bergen, Norway

5:00-5:25 Locally Mass Conservative Methods with Discontinuous Galerkin in Time for Miscible Displacement in Porous Media
Beatrice Riviere, Rice University, USA

5:30-5:55 Formulation for Multiphase Multicomponent Flows and Stopping Criteria for Two-phase Flows
Carole Heinry, Universite Pierre et Marie Curie (Paris 6), Paris and IFP Energies nouvelles, France

6:00-6:25 Effective Upscaling of Kinetics in Simulation of in-Situ Combustion Processes
Margot Gerritsen and Anna Nissen, Stanford University, USA

Thursday, June 20

MS86

Recent Regularization Methods for Subsurface Prospection and Remote Sensing

4:30 PM-6:30 PM

Room:Meno Uno 1 - Lower Level

Inverse problems can be still considered an emerging and challenging research fields in the Geosciences, ranging form civil and environmental engineering to archeology. Imaging of buried objects and remote sensing applications, just to cite a few, require the developments and the implementation of numerical algorithms suitable to efficiently deal with the large scale and the severe ill-posedeness of the problem. The session will be focused on discussing about recent mathematical developments for microwave borehole subsurface prospection, soil investigation by ground penetrating radars and ground conductivity meters, as well as earth observation from space-borne radiometers.

Organizer: Claudio Estatico
University of Genoa, Italy

4:30-4:55 Regularization in Banach Spaces for Microwave Borehole Subsurface Prospection
Claudio Estatico, Matteo Pastorino, and Andrea Randazzo, University of Genoa, Italy

5:00-5:25 The Cylindrical Wave Approach and the Electromagnetic Scattering by Buried Objects
Fabrizio Frezza, Università di Roma "La Sapienza", Italy; *Lara Pajewski*, Cristina Ponti, and Giuseppe Schettini, Università degli Studi Roma Tre, Italy; Nicola Tedeschi, Università di Roma "La Sapienza", Italy

5:30-5:55 Lp-Penalized Methods for Spatial Resolution Enhancement of Microwave Radiometer Data
Flavia Lenti, University of Insubria, Como, Italy; Ferdinando Nunziata, University of Naples, Italy; Claudio Estatico, University of Genoa, Italy; Maurizio Migliaccio, University of Naples, Italy

6:00-6:25 Regularized Solution of Linear and Nonlinear Problems in Electromagnetic Sounding
Giuseppe Rodriguez and Caterina Fenu, University of Cagliari, Italy

Thursday, June 20

MS87

Modelling and Simulation for Volcanic Hazards Assessment

4:30 PM-6:30 PM

Room:Meno Uno 2 - Lower Level

The volcanic eruptions are the major concern for people living in proximity of volcanos that can be directly threatened by the devastating phenomena such as lava and pyroclastic flows. Although it is not possible, to date, to perform deterministic prediction of eruptions, accurate forecasting of the effects of an eruptive event is within the reach of nowadays numerical simulation. The purpose of the minisymposium is to present some of the state- of-the-art tools in the modeling of pre-eruptive and eruptive phenomena for volcanic hazards assessment.

Organizer: Ciro Del Negro
Istituto Nazionale di Geofisica e Vulcanologia, Italy

Organizer: Alexis Herault
CNAM, Paris, France

4:30-4:55 A Second Order Finite-Difference Ghost-Cell Method for Volcano Deformation Modelling
Armando Coco, UNIBA, Italy; Gilda Currenti, Istituto Nazionale di Geofisica e Vulcanologia, Italy; Giovanni Russo, University of Catania, Italy; Ciro Del Negro, Istituto Nazionale di Geofisica e Vulcanologia, Italy

5:00-5:25 Lava Flow Simulation with Smoothed Particle Hydrodynamics on GPU
Giuseppe Bilotta, University of Catania, Italy; Alexis Herault, CNAM, Paris, France; Eugenio Rustico, Istituto Nazionale di Geofisica e Vulcanologia, Italy; Giovanni Russo, University of Catania, Italy; Ciro Del Negro, Istituto Nazionale di Geofisica e Vulcanologia, Italy

continued in next column

5:30-5:55 A Discontinuous Galerkin Method for the Simulation of Multiphase Pyroclastic Flows
Susanna Carcano and Luca Bonaventura, Politecnico di Milano, Italy

6:00-6:25 Analysis of Non Equilibrium Effects in the Decompression Structure of Multiphase Underexpanded Volcanic Jets
Tomaso Esposti Ongaro and Augusto Neri, Istituto Nazionale di Geofisica e Vulcanologia, Italy

Thursday, June 20

MS88

Adaptive, Multi-resolution Numerics for the Ocean and Atmosphere - Part IV of IV

4:30 PM-6:00 PM

Room:Parco 3 - Ground Level

For Part 3 see MS79

Numerical simulation of the ocean and atmosphere requires careful handling of the disparate scales present in the physical phenomena. Solvers can take advantage of statically or adaptively refined meshes to resolve important local flow features, but then questions arise about which problems benefit from multiresolution modeling, which refinement criteria to use, whether solvers are robust in the adaptive setting, and so on. The Newton Institute (Cambridge, England) recently hosted a four month program 'Multiscale Numerics for the Ocean and Atmosphere' addressing these issues. Most of the minisymposium speakers participated in this program and will highlight dominant themes from the program.

Organizer: Donna Calhoun
Boise State University, USA

Organizer: Jörn Behrens
University of Hamburg, Germany

Organizer: Francis X. Giraldo
Naval Postgraduate School, USA

4:30-4:55 Mimetic Finite Element Methods for Ocean/atmosphere Modelling
Colin Cotter, Imperial College London, United Kingdom

5:00-5:25 Simulation of Tropical-Cyclone-Like Vortices in Shallow-Water ICON-Hex Using Goal-Oriented R-Adaptivity
Werner Bauer, University of Hamburg, Germany

5:30-5:55 An Edge-Based Model for Mesoscale Atmospheric Dynamics
Joanna Szmelter, Loughborough University, United Kingdom; Piotr Smolarkiewicz, National Center for Atmospheric Research, USA

Thursday, June 20

MS89

Unstructured Coastal and Deep Ocean Modeling: Advances, Problems, Outlook - Part III of III

4:30 PM-6:30 PM

Room:Foyer - First Level

For Part 2 see MS80

In coastal and basin scale ocean modeling of currents, waves and transport, methodologies based on unstructured and locally adaptive meshes are gaining acceptance and represent the state of the art of the modeling skill in the field. However a number of important research issues remain to be addressed, both in the methodologies and in the physical applications of these models. Over the past few years, several community codes based on various finite element and finite volume discretizations entered the phase of active development. The focus of this mini-symposium is to discuss recent advances in unstructured coastal and deep ocean modeling and a discussion of still unsolved problems connected with these schemes.

Organizer: Clint Dawson
University of Texas at Austin, USA

Organizer: Vadym Aizinger
University of Erlangen-Nürnberg, Germany

4:30-4:55 Efficient and Elegant Numerical Tools for Ocean Flows
Vincent Legat, Université Catholique de Louvain, Belgium

5:00-5:25 Title Not Available at Time of Publication
J. Casey Dietrich, University of Texas at Austin, USA

continued in next column

5:30-5:55 SLIM, A Baroclinic Discontinuous Galerkin Finite Element Model for Marine Flows: Validation on Academic and Real Applications
Philippe Delandmeter, Jonathan Lambrecht, Jean-Francois Remacle, and Vincent Legat, Université Catholique de Louvain, Belgium

6:00-6:25 Modeling Three-Dimensional Processes in Coastal Engineering Applications
Chris Kees, Matthew Farthing, and Matt Malej, U.S. Army Engineer Research and Development Center, USA; Roham Bakhtyar, University of North Carolina at Chapel Hill, USA; Steve Mattis and Clint Dawson, University of Texas at Austin, USA

Thursday, June 20

MS90

Geodynamics Modeling: Mathematics, Numerics and HPC - Part III of III

4:30 PM-6:30 PM

Room:Forcellini - Ground Level

For Part 2 see MS81

The main objective of this mini-symposium is to collect contributions from applied mathematicians, physicists and geophysicists working on geodynamics modeling. In this sense the mini-symposium will cover all the aspects related to this field: study of mathematical and physical models (mantle circulation, rift and subduction processes, crustal and lithosperic deformation), development of numerical methods (based either on Finite Difference, Finite Element, Finite Volume or other suitable methods) and efficient implementation of High Performance Computers. The mini-symposium will also highlight some possible applications of geodynamcis modeling (e.g. in petroleum system modeling).

Organizer: Edie Miglio
Politecnico di Milano, Italy

Organizer: Carlo Doglioni
Università La Sapienza, Rome, Italy

4:30-4:55 Inverse Retrospective Problems in Geodynamics
Alik Ismail-Zadeh, Karlsruhe Institute of Technology, Germany

5:00-5:25 Multipole Boundary Element Method in Geodynamics
Gabriele Morra, Seoul National University, Korea

5:30-5:55 Simulations of Thermal Convection in Rotating Spherical Shells
Ferran Garcia, Universitat Politècnica de Catalunya, Spain; Luca Bonaventura, Politecnico di Milano, Italy; Marta Net and Juan Sanchez, Universitat Politècnica de Catalunya, Spain

6:00-6:25 Mantle Convection Modelling
Hans-Peter Bunge, Ludwig-Maximilians-Universität München, Germany

Notes

GS13 Abstracts

SIAM Conference on

Mathematical & Computational Issues in the Geosciences

June 17-20, 2013

Department of Mathematics
University of Padua, Italy

Abstracts are printed as submitted by the authors.

last page of abstracts

Organizer and Speaker Index

SIAM Conference on

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University of Padua, Italy

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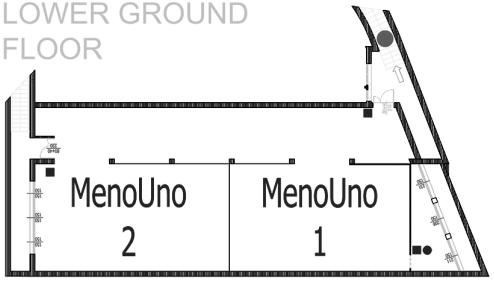
Conference Center Floor Plans

LOWER GROUND FLOOR



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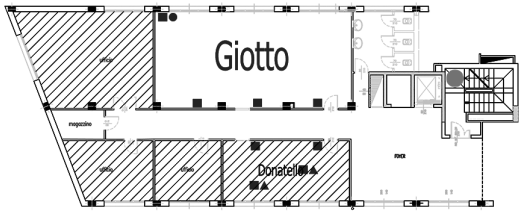

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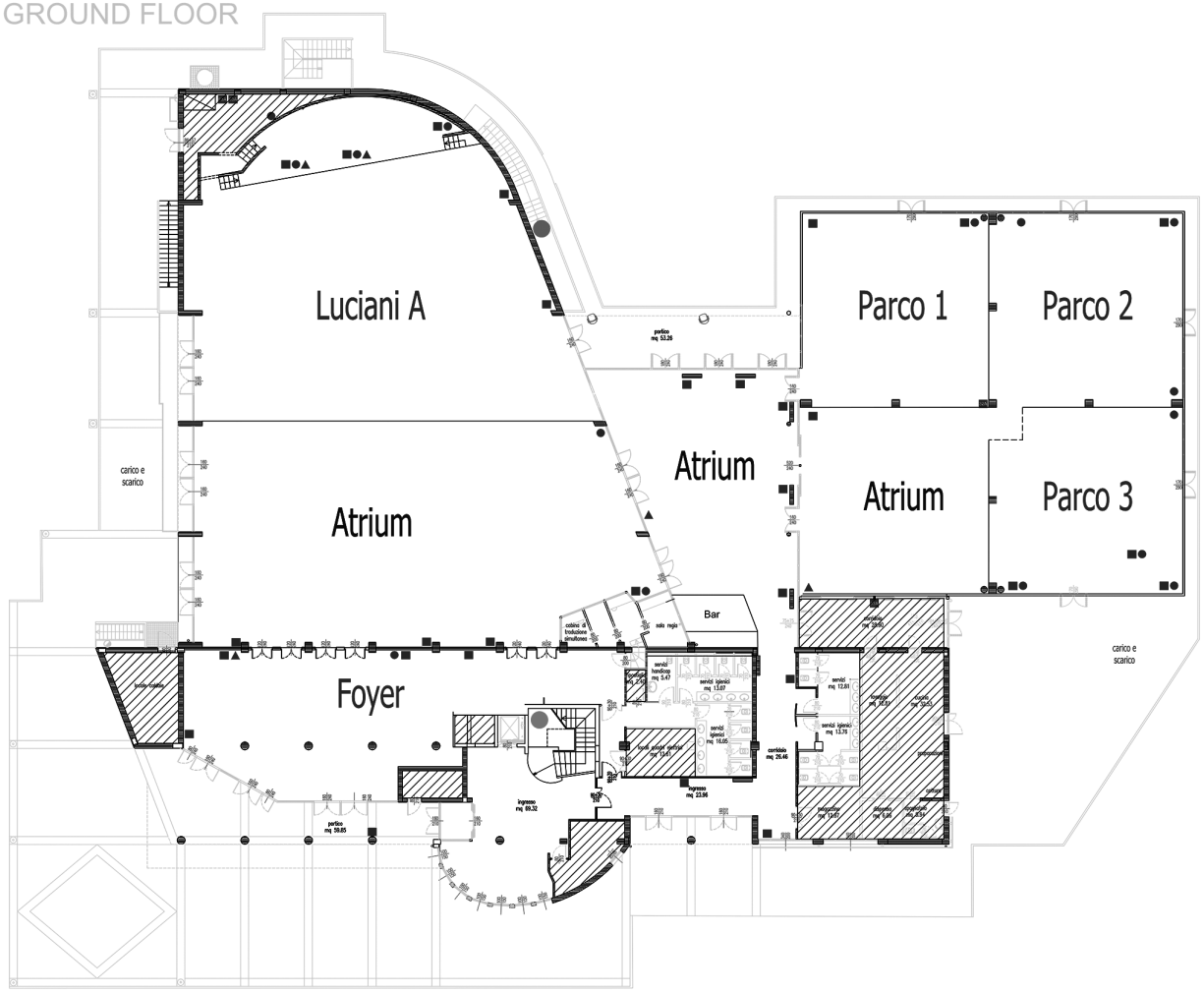
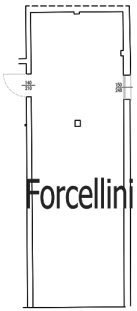


To Forcellini

GROUND FLOOR

From Congress Centre (80 m.)



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SIAM GS 2013
June 17th-20th, 2013

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