

Kyle T. Mandli

CONTACT INFORMATION

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EDUCATION

Ph.D., University of Washington, Applied Mathematics, June 2011

- Advisor: Randall J. LeVeque
- Thesis: “Finite Volume Methods for the Multilayer Shallow Water Equations with Applications to Storm Surges”

M.Sc., University of Washington, Applied Mathematics, June 2005

B.S. Applied Mathematics, Engineering and Physics, University of Wisconsin, May 2004

POSITIONS

Department of Applied Physics and Applied Mathematics, Columbia University

- Assistant Professor, July 2014 - Present.

Institute for Computational and Engineering Science, University of Texas at Austin

- Research Associate, September 2013 - August 2014.
- JTO Fellow, September 2012 - September 2013.
- ICES Postdoctoral Research Fellow, September 2011 - September 2012.

Applied Mathematics Department, University of Washington

- Research Assistant, 2004-2011.
- Teaching Assistant, 2004-2010.

AMANDA (IceCube) project, University of Wisconsin

- Undergraduate research assistant, 2001-2004.

RESEARCH INTERESTS

Numerical methods for hyperbolic PDEs

Numerical methods for hazardous geophysical flow problems

Modeling of hazardous geophysical flows incorporating computational efficiency

Uncertainty quantification for geophysical flow problems

Software development practices in scientific software such as reproducibility and V&V

HONORS AND AWARDS

NSF Vigre Graduate Fellow, University of Washington, 2008-2009

Boeing Award for Service, University of Washington, 2007

ARCS Graduate Fellowship, University of Washington, 2004-2007

Top Scholar Award, University of Washington, 2004-2005

Applied Math, Engineering and Physics Leadership Prize, University of Wisconsin, 2003

GRANTS AWARDED

NSF DMS 1720288 “Multi-Scale Computational Methods for Coastal Flooding Events”, 2017 (PI).

NSF OAC 1735609 “CRISP Type 1: Protecting Coastal Infrastructure in a Changing Climate by Integrating Optimization Modeling and Stakeholder Observations”, 2017 (PI).

DARPA Small Business Technology Transfer, “Hybrid Analog-Digital Co-Processor for Scientific Computation”, 2016 (co-PI).

PGIF, “Storm surge risk to Mumbai: a challenge to urban sustainability in India’s largest city”, 2016 (co-PI).

Hybrid Learning Course Redesign and Delivery, “Incorporating Active Learning and Group Coding Projects for Computational Courses in Applied Mathematics”, 2016 (PI).

KAUST Competitive Research Grant Program, 2015 (co-PI).

AMS-MRC Travel award, 2012 (PI).

TEACHING EXPERIENCE

Assistant Professor -

- **APMA 4301** - Numerical Methods for PDEs
- **APMA 4300** - Introduction to Numerical Methods
- **APMA 3102** - Applied Mathematics II - Partial Differential Equations

Postdoctoral Lecturer -

- **Gene Golub Summer School 2012** - Simulation and Supercomputing in the Geosciences.

Predoctoral Lecturer - Gave lectures, wrote exams and homework, organized class with teaching assistants.

- **Amath 301** - Beginning scientific computing (Spring 2008)
- **Amath 574** - Finite volume methods (Winter 2007)
- **Short Course at Schlumberger** - Finite volume methods and conservation laws (Winter 2008)

Teaching Assistant - Ran discussion sections, held office hours, ran review sessions and graded exams.

- **Amath 301** - Beginning scientific computing (Fall 2008)
- **Math 120** - Precalculus (Fall 2005)
- **Math 124,125,126** - Calculus sequence (Fall 2004, Spring 2005 and 2006, Winter 2010)

OPEN SOURCE SOFTWARE DEVELOPMENT

PyClaw - A scalable nonlinear wave propagation solver in Python.

Available from <http://www.github.com/clawpack/pyclaw>.

GeoClaw - A Clawpack based shallow water solver employing adaptive mesh refinement.

Available from <http://www.github.com/clawpack/geoclaw>.

Clawpack - Conservation Laws Package, a nonlinear wave propagation solver.

Available from <http://www.github.com/clawpack/>.

ManyClaw - Research into exploitation of intra-node parallelism for hyperbolic PDE solvers via Clawpack like interfaces. Available from <http://www.github.com/manyclaw/>

SERVICE AND
LEADERSHIP

Habanero Operating Committee Chair
Faculty RFP representative for Terremoto
APAM faculty representative to the SRCPAC training sub-committee
Organized local SCUDEM 2018 competition
Served on the Community Advisory Committee for Water Prediction (CAC-WP) for the National Weather Service Office of Water Prediction (NOAA) (January 2018)
Theme leader for the National Water Center's Summer Institute 2018
Academic review committee for the International Conference on Sustainable Cities (May 2018)
Organized and ran a Center for the Integration of Research and Teaching (CIRTL) workshop on open source principles and education (Fall 2018)
Columbia SIAM chapter faculty advisor
Organizer of IMA hot topics workshop "Impact of Waves Along Coastlines", 2014
Birds of a Feather Co-Chair, SciPy 2013-2015.
Co-organized [HPC]³ 2012 and 2014.
Organized the High Performance Computing Seminar (Spring 2009)
Graduate student representative, 2006-2007
Organizer of the Numerical Analysis Research Club
Organized reading groups on discontinuous Galerkin methods, finite element methods, and conservation laws
Vice President, SIAM student chapter at the University of Washington (2009-2010)

PROFESSIONAL
AFFILIATIONS

Society for Industrial and Applied Mathematics (2004-Present)
American Geophysical Union (2010-Present)
American Mathematical Society (2010-Present)
United States Association of Computational Mechanics (2018-Present)

CONSULTING

KatRisk LLC, May 2013 - 2014

OTHER
PROFESSIONAL
ACTIVITY

Referee for Advances in Computational Mathematics (ACOM), Applied Numerical Mathematics (APNUM), Current Climate Change Reports (CCLR), Computing in Science and Engineering (CiSE), Computational Geosciences (COMG), Computer Physics Communications (CPC), Engineering and Computational Mechanics (EACM), Euro-Par, Finite Volumes for Complex Applications (FVCA), Geophysical Journal International (GJI) Journal of Applied Mathematics and Computing (JAMC), Journal of Computational Physics (JCP), Journal of Nonlinear Science (JNS), Marine Geodesy (UMG) Numerical Algorithms (NUMA), Ocean Modelling (OCEMOD), Ocean Dynamics (OCDYN), Pure and Applied Geophysics (PAAG), Platform for Advanced Scientific Computing (PASC), Science, SIAM Journal of Scientific Computing (SISC), Transport in Porous Media (TIPM), and Journal of Waterway, Port, Coastal, and Ocean Engineering (WWENG).
NSF panelist

INVITED
PRESENTATIONS

University of Alabama, January 29, 2018,
Virginia Tech University, October 27, 2017,
NCAR Workshop on Multiscale Geoscience Numerics, May 16-19, 2017,
Purdue University, May 1, 2017,
Tulane University - Clifford Lectures, April 14, 2017,
Temple University, February 1, 2017,
New York University, February 10, 2017,
India Institute of Technology - Bombay, January 9, 2017,
Boise State, November 3, 2016,
HPC for Water Related Hazards, June 30, 2016,
Fields Institute, May 25, 2016,
Stevens Institute Davidson Lab Seminar, March 9, 2016,
New Jersey Institute of Technology, Mathematics Seminar, February 19, 2016,
Lamont-Doherty, Ocean and Climate Physics Seminar, October 9, 2015,
Frontiers in Applied and Computational Mathematics Conference, June 6, 2015,
University of Notre Dame Environmental Dynamics Seminar, December 9, 2014.
Universitt Hamburg, May 26, 2014.
ASCETE Workshop, May 21, 2014.
Technische Universitt Mnchen Seminar, May 19, 2014.
Seattle University Mathematics Colloquium, May 15, 2014.
Iowa State University Mathematics Colloquium, April 21, 2014.
Texas A&M Oceanography Seminar, March 31, 2014.
Columbia University Applied Mathematics Colloquium, March 6, 2014.
MSU Mathematics Seminar, July 11th 2013.
UNC Applied Mathematics Seminar, April 26th, 2013.
Gene Golub Summer School, Monterey, CA. July 29-August 10 2012.

PUBLICATIONS

“Fractally homogeneous, air-sea turbulence with Frequency-integrated, wind-driven gravity waves”, Colton J. Conroy, Kyle T. Mandli, Ethan J. Kubatko. In prep (2018).
“Vectorization of Riemann solvers for the single- and multil-layer shallow water equations”, Chaulio R. Ferreira, Kyle T. Mandli, Michael Bader. Submitted to HPCS 2018.
“Evolution and controls of large glacial lakes in the Nepal Himalaya”, Umesh K. Haritashya, Jeffrey S. Kargel, Dan H. Shugar, Gregory J. Leonard, Katherine Strattman, C. Scott Watson, David Shean, Stephan Harrison, Kyle T. Mandli, Dhananjay Regmi. Submitted to Remote Sensing (2018).
“hp discontinuous Galerkin methods for parametric, wind- driven water wave models”, Colton J. Conroy, Ethan J. Kubatko, A. Nappi, R. Sebian, D. West, Kyle T. Mandli. Under Review to Advances in Water Resources (2018).
“Dynamically adaptive data-driven simulation of extreme hydrological flows”, Kumar Jain, P., Mandli, K., Hoteit, I., Knio, O. Dawson, C., Ocean Modelling 122, 85103 (2018).
“Quantifying uncertainties in Fault Slip Distribution During the Tohoku Tsunami using Polynomial Chaos”, Ihab Sraj, Kyle T. Mandli, Omar M. Knio, Clint N. Dawson, and Ibrahim Hoteit. Ocean Dynamics (2017) 67:1535.

“*Hybrid Analog-Digital Solution of Nonlinear Partial Differential Equations*” Huang, Y. et al. MICRO 2017.

“*Baysian inference of earthquake parameters from buoy data using a polynomial chaos-based surrogate.*” Giraldi, L., Le Maître, O. P, Mandli, K.T., Dawson, C.N., Hoteit, I., Knio, O.M. Comput Geosci 21, 683-699 (2017).

“*Clawpack: building an open source ecosystem for solving hyperbolic PDEs*”, Kyle T. Mandli, Aron J. Ahmadi, Marsha J. Berger, Donna A. Calhoun, David L. George, Yiannis Hadjimichael, David I. Ketcheson, Gray I. Lemoine, and Randall J. LeVeque. PeerJ Comput. Sci. 2, e68 (2016).

“*Visualizing Uncertainties in a Storm Surge Ensemble Data Assimilation and Forecasting System*”, Thomas Hilt, M. Umer Altaf, Kyle T. Mandli, Markus Hadwiger, Clint N. Dawson, and Ibrahim Hoteit. Natural Hazards 120 (2015).

“*Uncertainty quantification and inference of Mannings friction coefficients using DART buoy data during the Thoku tsunami.*” Sraj, I., Mandli, K. T., Knio, O. M., Dawson, C. N. and Hoteit, I. ,Ocean Modelling 83, 8297 (2014).

“*Adaptive Mesh Refinement for Storm Surge*”, Kyle T. Mandli, Clint N. Dawson, Ocean Modelling, Volume 75, March 2014, Pages 36-50.

“*Forestclaw: Hybrid forest-of-octrees AMR for hyperbolic conservation laws*”, Carsten Burstedde, Donna Calhoun, Kyle Mandli, and Andy R. Terrel. Accepted to ParCo 2013.

“*A Numerical Method for the Multilayer Shallow Water Equations with Dry States*”, Kyle T. Mandli. Ocean Modelling 72, 8091 (2013).

“*ManyClaw: Slicing and dicing Riemann solvers for next generation highly parallel architectures*”, A.R. Terrel and K. T. Mandli, TACC-Intel Symposium on Highly Parallel Architectures (2012).

“*PyClaw: Accessible, Extensible, Scalable Tools for Wave Propagation Problems*”, David I. Ketcheson, Kyle T Mandli, Aron Ahmadi, Amal Alghamdi, Manuel Quezada, Matteo Parsani, Matthew G. Knepley, and Matthew Emmett. SIAM J. Sci. Comput., 34(4), C210C231, (2012).

“*The GeoClaw software for depth-averaged flows with adaptive refinement*”, M.J. Berger, D.L. George, R.J. LeVeque and K. T. Mandli. Advancement in Water Resources Volume 34, Issue 9, Pages 1195-1206, September 2011.

“*Finite Volume Methods for the Multilayer Shallow Water Equations with Applications to Storm Surges*”, Ph.D. Thesis, July 2011.

“*PetClaw: A Scalable Parallel Nonlinear Wave Propagation Solver for Python*”, with Amal Alghamdi, Aron Ahmadi, David I. Ketcheson, Matthew G. Knepley, and Lisandro Dalcin. 19th High Performance Computing Symposium, 2011.