Kyle T. Mandli

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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.

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

High performance computing

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

Honors and Awards

Elected Sigma XI Full Fellow, 2020

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

Teaching Experience

Columbia Faculty

- **APMA 6901** - Uncertainty Quantification
- **APMA 6901** - Finite Volume Methods for Hyperbolic PDEs
- **APMA 4302** - Methods in Computational Science
- **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 Schlumburger** - Finite volume methods and conservation laws (Winter 2008)

Teaching Assistant

- **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

Numerical Methods Course Notes - Open source teaching materials developed as interactive Jupyter notebooks for teaching numerical methods courses.
Available from `https://github.com/mandli/intro-numerical-methods` and `https://github.com/mandli/numerical-methods-pdes`.

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

Departmental:

Masters Student Advisor

CVN student advisor

Undergraduate student advisor

Faculty secretary 2014-2016

Columbia SIAM chapter faculty advisor, 2014-present

School:

Organized local SCUDEM mathematics competition, 2018

Egleston Scholar Mentor

Inside Engineering presenter

Engineering Exploration Experience (EEE) presenter

University:

Climate School Coastal Viability Committee member 2020

Columbia Operating Committee Chair for High Performance Computing

Bridge to the Ph.D. Faculty Council Member

Foundations for Research Computing advisory committee member

Faculty RFP representative for Terremoto

APAM faculty representative to the SRCPAC training sub-committee

Faculty Advising Board for Columbia Undergraduate Science Journal

Columbia family weekend speaker, 2016 and 2018

Service to the Field:

Program committee for the 20th International Symposium on Parallel and Distributed Computing, 20-23 June, 2021

ENVISION Women in STEM competition judge 2021

Bergen County Academy research mentor 2019-2021

Convener of "Convergence Research in Climate Science: How to Move Beyond Disciplinary Silos" AGU Fall Meeting 2020

Lead organizer of the 2019 "Future Directions for Enabling Coastal Storm Flooding Prediction for High-Resolution Forecasts and Climate Scenarios" workshop 2019

Theme leader for the National Water Center's Summer Institute, 2018-2020 run by NOAA and the National Weather Service

Program committee for NY Scientific Data Summit 2019

Academic review committee for the International Conference on Sustainable Cities, 2018

University Corporation for Atmospheric Research (UCAR) Congressional Briefing Panelist, 2018

Organized and ran a Center for teaching (CIRTL) workshop on open source principles and education, 2018

Birds of a Feather Co-Chair, SciPy, 2013-2015

Organizer of IMA hot topics workshop "Impact of Waves Along Coastlines", 2014

Co-organized $[HPC]^3$, 2012 and 2014

Funding Agencies:

NSF panelist

DOE panelist

NSF GRFP Reviewer, 2016, 2018, and 2020

NSF site reviewer for NanoHub, 2018, 2020

NSF CRISP PI Meeting Organizing Committee, 2018

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)

Journals: Referee for Science Advances (AAAS), 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), Journal of Scientific Computing (JOMP), Mathematical Communications (MATCOM), Natural Hazards (NHAZ), 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), Marine Geodesy (UMG), and Journal of Waterway, Port, Coastal, and Ocean Engineering (WWENG).

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)

Invited Presentations

Resilient Coastlines Seminar, January 31, 2022.

Columbia Undergraduate Scholars Program, October 26, 2021.

Program on Numerical Methods for Nonlinear Hyperbolic PDEs in Fall 2021, SUSTech International Center for Mathematics.

U.S. National Congress on Computational Mechanics, Chicago, IL (virtual), July 25-29, 2021.

2021 Managed Retreat Conference, June 2021.

SIAM GeoSciences, Milan, Italy (virtual), June 21-24, 2021.

SIAM Computational Science and Engineering, Fort Worth, TX (virtual), March 3, 2021.

AGU Invited Talk, San Francisco, CA. December 7, 2020.

Brigham Young University, Utah State Mathematics Seminar, November 9, 2020.

New York Scientific Data Summit, October 20, 2020.

University of Delaware Numerical Analysis Seminar, October 9, 2020.

University of Texas Oden Institute Colloquium, October 8, 2020.

Tulane University, New Orleans, AL. January 15, 2020.

AGU Invited Talk, San Francisco, CA. December 9, 2019.
AGU Invited Workshop Talk, San Francisco, CA. December 8, 2019.
Teaching and Learning with Jupyter, New York University, New York, NY. October 31, 2019.
University of Durham, Durham U.K., September 26th, 2019.
USCACM 2019 Mini-Symposium Keynote Presentation, Austin, July 31, 2019.
ITN Workshop on Shocks and Interfaces, Oxford U.K., July 4, 2019.
U.S. Naval Academy, Annapolis, June 6, 2019.
SIAM Computational Science and Engineering, Spokane, WA, February 27, 2019.
AGU Fall Meeting 2019 Invited Talk, Washington D.C., December 12, 2018.
WCCM 2018 Mini-symposium Keynote Presentation, New York, July 24, 2018.
SIAM Annual Meeting, Portland, OR, July 11, 2018.
University of Alabama, January 29, 2018,
Virginia Tech University, October 27, 2017,
NCAR Worshop on Multiscale Geoscience Numerics, May 16-19, 2017,
Purdue University, May 1, 2017,
Tulane University - Clifford Lectures, April 14, 2017,
SIAM Computational Science and Engineering, Atlanta, GA, March 1, 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
SIAM Mathematics of Planet Earth, Philadelphia, PA, September 30, 2016.
HPC for Water Related Hazards, Münich, 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,
SIAM Geosciences, Stanford, CA, July 1, 2015.
Frontiers in Applied and Computational Mathematics Conference, June 6, 2015,
SIAM Computational Science and Engineering, Salt Lake City, UT, March 18, 2015.
University of Notre Dame Environmental Dynamics Seminar, December 9, 2014.
SIAM Annual Meeting, Chicago, IL, July 7, 2014.
Universität Hamburg, May 26, 2014.
ASCETE Workshop, May 21, 2014.
Technische Universität München 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.
SIAM Parallel Computing, Portland, OR, February 19, 2014.
MSU Mathematics Seminar, July 11th 2013.

UNC Applied Mathematics Seminar, April 26th, 2013.

SIAM Computational Science and Engineering, Boston, MA, February 26, 2013.

Gene Golub Summer School, Monterey, CA. July 29-August 10 2012.

SIAM Parallel Computing, Savannah, GA, February 16, 2012.

SIAM Geosciences, Long Beach, CA, March 22, 2011.

SIAM Computational Science and Engineering, Reno, NV, March 1, 2011.

SIAM Annual Meeting, Pittsburgh, PA, July 15, 2010

SIAM Annual Meeting, San Diego, CA, July ,2008.

SIAM Computational Science and Engineering, Costa Mesa, CA, February 21, 2007.

Publications

Submitted

1. Rim, D., B. Peherstorfer & Mandli, K. T. Manifold Approximations via Transported Subspaces: Model reduction for transport-dominated problems. Submitted for second review to SIAM Journal on Scientific Computing (2020).

Published Refereed Journal Papers

1. T. Chegini & G. Coelho & J. Ratliff, C. Ferriera & K. T. Mandli & P. Burke, H. Li. A Novel Framework for Parametric Analysis of Coastal Transition Zone Modeling. JAWRA (2022).
2. Miura, Y., & Dinenis, P. C., & Mandli, K. T., & Deodatis, G., & Bienstock, D. (2021). Optimization of Coastal Protections in the Presence of Climate Change. Frontiers in Climate, 3, 613293 (2021).
3. T. Chegini, G. Coelho, J. Ratliff, C. Ferriera, K. T. Mandli P. Burke, H. Li. Model-Based Parametric Analysis of Total Water Prediction in Coastal Transition Zones of the US East and Gulf Coasts. JAWRA (2021).
4. A. Raney & Y. Feng & D. Blodgett & K. T. Mandli. An open-source Python library for varying model parameters and automating concurrent simulations of the National Water Model. American Water Resources Association (2021).
5. Yin, D., Muñoz, D.F., Bakhtyar, R., Xue, Z.G., Moftakhari, H., Ferreira, C., and Mandli, K. T. " Extreme Water Level Simulation and Component Analysis in Delaware Estuary during Hurricane Isabel." Journal of the American Water Resources Association 1–15 (2021).
6. D. Muñoz, D. Yin, R. Bakhtyar, H. Moftakhari, G. Xue, K. T. Mandli, C. Ferreira. Inter-model comparison of Delft3D-FM and 2D HEC-RAS for Total Water Level Prediction in Coastal to Inland Transition Zones. Journal of the American Water Resources Association (2021).
7. Islam, M.R., Lee, CY., Mandli, K.T. et al. A new tropical cyclone surge index incorporating the effects of coastal geometry, bathymetry and storm information. Sci Rep 11, 16747 (2021).
8. C. J. Conroy, K. T. Mandli, E. J. Kubatko. Numerical Considerations for Quantifying Air–Water Turbulence with Moment Field Equations. Water Waves (2021)
9. Miura, Y., Deodatis, G. Mandli, K.T. High-Speed GIS-Based Simulation of Storm Surge–Induced Flooding Accounting for Sea Level Rise. Natural Hazards Review, 22(3) (2021).
10. Conroy, C.J., Mandli, K.T. & Kubatko, E.J. Fractally homogeneous, air-sea turbulence with Frequency-integrated, wind-driven gravity waves. Journal of Fluid Mechanics, 917, A39 (2021).
11. Miura, Y., Qureshi, H. Chanyang, R., Dinenis, P. C., Li, J., K.T. Mandli, Deodatis, G/, Bienstock, D., Lazrus, H., and Morss, R.. "A Methodological Framework for Determining an Optimal Coastal Protection Strategy against Storm Surges and Sea Level Rise." Natural Hazards, March 8, 2021. https://doi.org/10.1007/s11069-021-04661-5.
12. Li, J., and Mandli, K.T.. "An h-Box Method for Shallow Water Equations Including Barriers." SIAM Journal on Scientific Computing 43, no. 2 (January 2021): B431–54. https://doi.org/10.1137/19M12

13. S. Marras, K. T. Mandli. Towards the Next Generation of Tsunami Impact Simulations. MDPI GeoSciences (2020).
14. E. Meselhe & M. Asgari & K. Flint & S. Matus & K. T. Mandli & E. White. Continental Scale Heterogenous Channel Routing Strategy for Operational and Forecast Models. Journal of the American Water Resources Association (2020).
15. Sobel, A.H., Lee, C., Camargo, S., Qureshi, H., Mandli, K.T., Emmanuel, K. Mukhopadhyay, P. & Mahakur, M. Tropical cyclone hazard to Mumbai. Monthly Weather Review (2019).
16. Rim, D. & Mandli, K. T. Displacement Interpolation Using Monotone Rearrangement. SIAM/ASA Journal on Uncertainty Quantification 6, 1503–1531 (2018).
17. Conroy, C.J., Kubatko, E. J., Nappi, A., Sebian, R., West, D., Mandli, K. T. hp discontinuous Galerkin methods for parametric, wind-driven water wave models. Advances in Water Resources 119, 70–83 (2018).
18. Navarro, M., Le Maître, O. P., Hoteit, I., George, D. L., Mandli, K. T., Knio, O. M. Surrogate-based parameter inference in debris flow model. Computational Geosciences 50, 306 (2018).
19. Haritashya, U. K., Kargel, J.S., Shugar, D.H., Leonard G.J., Strattman, K., Watson, C.S., Shean, D., Harrison, S., Mandli, K.T., Regmi, D. Evolution & Controls of Large Glacial Lakes in the Nepal Himalaya. Remote Sensing 10(5), 798 (2018).
20. Kumar Jain, P., Mandli, K., Hoteit, I., Knio, O. & Dawson, C. Dynamically adaptive data-driven simulation of extreme hydrological flows. Ocean Modelling 122, 85-103 (2018).
21. Giraldi, L., Le Maître, O.P, Mandli, K.T., Dawson, C.N., Hoteit, I., Knio, O.M. Bayesian inference of earthquake parameters from buoy data using a polynomial chaos-based surrogate. Computational Sciences 21, 683-699 (2017).
22. Sraj, I., Mandli, K. T., Knio, O. M., Dawson, C. N. & Hoteit, I. Quantifying uncertainties in fault slip distribution during the Tohoku tsunami using polynomial chaos. Ocean Dynamics 67:9, 1535-1551 (2017).
23. Mandli, K.T., Ahmadia, A.J., Berger, M.J., Calhoun, D.A., George, D.L. Hadjimichael, Y., Ketcheson, D.I., Lemoine, G.I., & LeVeque, R. J.. Clawpack: building an open source ecosystem for solving hyperbolic PDEs. PeerJ Computer Science 2, e68 (2016).
24. Höllt, T., Altaf, M.U., Mandli, K.T., Hadwiger, M., Dawson, C.N., & Hoteit, I. Visualizing uncertainties in a storm surge ensemble data assimilation and forecasting system. Natural Hazards 77, (2015).
25. Sraj, I., Mandli, K. T., Knio, O. M., Dawson, C. N. & Hoteit, I. Uncertainty quantification and inference of Manning's friction coefficients using DART buoy data during the Tohoku tsunami. Ocean Modelling 83, 82-97 (2014).
26. Mandli, K. T. & Dawson, C. N. Adaptive Mesh Refinement for Storm Surge. Ocean Modelling 75, 36–50 (2014).
27. Mandli, K. T. A Numerical Method for the Two Layer Shallow Water Equations with Dry States. Ocean Modelling 72, 80-91 (2013).
28. Ketcheson, D.I., Mandli, K.T., Ahmadia, A., Alghamdi, A., Quezada, M., Parsani, M., Knepley, M.G., & Emmett, M. PyClaw: Accessible, Extensible, Scalable Tools for Wave Propagation Problems. SIAM Journal on Scientific Computing, 34(4), C210-C231, (2012).
29. Berger, M. J., George, D. L., LeVeque, R. J. & Mandli, K. T. The GeoClaw software for depth-averaged flows with adaptive refinement. Advances in Water Resources, 34, 1195–1206 (2011).
30. Mandli, K. T. Finite Volume Methods for the Multilayer Shallow Water Equations with Applications to Storm Surges. (University of Washington, 2011).

Peer Reviewed Conference Proceedings

1. Ferreira, C. R., Mandli, K. T. & Bader, M. Vectorization of Riemann solvers for the single- and multi-layer shallow water equations. International Conference on High Performance Computing and Simulation (2018). doi:10.1109/HPCS.2018.00073.
2. Huang, Y., Guo, N., Seok, M., Tsividis, Y., Mandli, K., Sethumadhavan, S. Hybrid analog-digital solution of nonlinear partial differential equations. In conference proceedings of MICRO, 665-678 (ACM, 2017).
3. Burstedde, C., Calhoun, D. A., Mandli, K. & Terrel, A. R. ForestClaw: Hybrid forest-of-octrees AMR for hyperbolic conservation laws. in ParCo 2013 (eds. Bader, M. et al.) 25, 253-262, (2013)
4. Terrel, A. R. & Mandli, K. T. ManyClaw: Slicing and dicing Riemann solvers for next generation highly parallel architectures. in Proceedings of TACC-Intel Symposium on Highly Parallel Architectures, arXiv:1308.1464 [cs.CE] (2012).

Published Books

1. "Teaching and Learning with Jupyter" by Lorena A. Barba, Lecia J. Barker, Douglas S. Blank, Jed Brown, Allen B. Downey, Timothy George, Lindsey J. Heagy, Kyle T. Mandli, Jason K. Moore, David Lippert, Kyle E. Niemeyer, Ryan R. Watkins, Richard H. West, Elizabeth Wickes, Carol Willing, and Michael Zingale. `https://jupyter4edu.github.io/jupyter-edu-book/`, 2018.

Google Scholar (February 18, 2022).

	All	Since 2016
Citations	836	676
h-index	13	13
i10-index	19	18