Marc Kjerland, PhD

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Computational scientist with experience in modeling real-world multiscale systems and applying novel quantitative techniques in a variety of fields.

Research interests

- Nonlinear and multiscale systems
- Computational fluid dynamics
- Machine Learning
- Applied linear algebra
- Geophysical modeling
- Numerical methods for ODEs and PDEs
- High-performance computing
- Peer-reviewed publication

Education

2010 – 2015   **PhD**, *Applied Mathematics*, University of Illinois at Chicago.
Thesis: *Linear response closure approximations for multiscale systems*

2007 – 2009   **M.S.**, *Applied Mathematics*, University of Illinois at Chicago.

2002 – 2005   **B.S.**, *Mathematics*, University of Minnesota, Twin Cities.

Publications and Proceedings

- Kjerland, M., and Mori, N. (2017). Estimating climate change impacts on storm surge using adaptive mesh refinement. *Proceedings of Coastal Dynamics 2017*, Helsingør, Denmark, p. 158-167.
- Mori, N., Kjerland, M., Nakajo, S., Shibutani, Y., Shimura, T. (2016). Impact assessment of climate change on coastal hazards in Japan. *Hydrological Research Letters*, Vol. 10, No. 3, p. 101-105.
- Abramov, R. & Kjerland, M. (2016). The response of reduced models of multiscale dynamics to small external perturbations. *Communications in Mathematical Sciences*, Vol 14, No 3.
- Christodoulides, P., Dias, F., Ghidaglia, J.-M., & Kjerland, M. (2010). On the Effect of Compressibility on the Impact of a Falling Jet. *Proceedings of the 20th International Offshore and Polar Engineering Conference*, Vol. III, Beijing, China.

Research experience

Oct 2017 – Jan 2018   **Freelance**.
Researcher

- Computed storm surge flooding levels for Hurricanes Harvey, Irma, and Maria
- Co-authored and submitted grant proposal for DoE initiative

Aug – Sep 2017   **Institute for Environmental Science and Policy**, *University of Illinois at Chicago*.
Postdoctoral fellow

- Evaluated institutional performance in data-driven urban sustainability framework
- Develop new applications and methodologies and write technical reports
- Implemented multivariate regression models with cross-validation, data imputation, and trend analysis

July 2015 – July 2017	**Disaster Prevention Research Institute**, *Kyoto University*, Uji, Japan. Postdoctoral researcher ○ Developed and validated coastal hazard simulations with adaptive mesh refinement ○ Quantified impacts of changing typhoon distributions on storm surge risks ○ Contributed module to open source package incorporating atmospheric data
Nov 2014 – June 2015	**Institute for Environmental Science and Policy**, *University of Illinois at Chicago*. Research assistant ○ Evaluated institutional performance from data-driven urban metabolism framework ○ Implemented regression models, data imputation, and trend analysis
Aug 2010 – May 2014	**Department of Mathematics**, *University of Illinois at Chicago*. Research assistant ○ Examined dynamics of approximations to two-timescale systems in chaotic and periodic regimes ○ Generated ensemble solutions to estimate statistics and perturbation response of reduced-dimension systems
Sep 2009 – March 2010	**Centre de Mathématiques et de leurs applications**, *École Normale Supérieure de Cachan*, France. Research assistant *(Stage de recherche)* ○ Improved boundary conditions for multiphase compressible fluid solver using a finite volume discretization with Lagrangian interface tracking ○ Compared solutions of faucet flow for compressible and ideal fluids
Aug 2007 – Aug 2009	**Department of Mathematics**, *University of Illinois at Chicago*. Teaching assistant ○ Led discussion sections, wrote quizzes, graded assignments, and tutored students in Calculus I, Finite Math for Business, and Business Calculus
Spring 2006	**Minnesota Supercomputing Institute**, *University of Minnesota, Twin Cities*. Research assistant ○ Tested and documented the Co-Array Fortran extension.

Technical skills

Programming languages: C/C++, Python, Fortran, Matlab

Python packages: numpy, scipy, scikit-learn, pandas, matplotlib, jupyter, gdal

Operating systems: GNU/Linux, Mac OS X, Windows

Other: LaTeX, Bash scripting, OpenMP, GitHub, QGIS, Excel, Photoshop

Natural languages: English, French, German, Japanese

Awards

September 2016	**SIAM poster prize**, *SIAM Conference on Mathematics of Planet Earth*. Title: *Simulating storm surge of [Tropical Cyclone] Haiyan in a future climate condition using adaptive mesh refinement*
March – June 2010	**NSF visiting fellowship**, *Institute for Pure and Applied Mathematics*, University of California, Los Angeles. Long program: Model and Data Hierarchies for Simulating and Understanding Climate
April 2009	**Graduate Student Teaching Award**, *Dept of Mathematics, UIC*. Awarded for exceptional teaching and strong academic progress

Workshops

August 2016 **Clawpack Developers' Workshop and Hackathon**, *University of Washington*, Seattle, WA.
- Workshop for developments of open source hyperbolic PDE solver. Emphasis on GeoClaw package for depth-averaged flows with adaptive mesh refinement
- Lightning talk: *Hazard assessment of storm surge*

June 2016 **The Burgers Program Research School on Fluid Dynamics**, *University of Maryland*, College Park, MD.
- Series of tutorial sessions on topics in nonlinear waves
- Poster: *Storm surge simulation using adaptive mesh refinement*

November 2013 **Predictability in Earth System Processes**, *Institute for Mathematics and its Applications*, Minneapolis, MN.
- Workshop on data assimilation, model parametrization, and model validation
- Invited talk: *Model reduction and fluctuation-dissipation for two-timescale systems*

October 2013 **Mathematics and Climate Research Network (MCRN) Annual Meeting**, *Renaissance Computing Institute*, Chapel Hill, North Carolina.
- Focus group meetings and discussion of future initiatives for a National Science Foundation (NSF) funded network of mathematicians and geoscientists
- Poster: *Linear response closure approximation for two-timescale systems*

July – Aug 2013 **Mathematics of Climate Change, Related Natural Hazards and Risks**, *Centro de Investigación en Matemáticas, A.C.*, Guanajuato, Mexico.
- Satellite meeting of the 2013 Mathematical Congress of the Americas
- Poster: *Linear response closure approximation for systems with two timescales*

2010 – 2012 **Model and Data Hierarchies for Simulating and Understanding Climate**, *Institute for Pure and Applied Mathematics*, University of California, Los Angeles.
- Series of workshops and residency for geophysicists and applied mathematicians (NSF support)
- Invited talk: *Linear response closure approximation for two-timescale systems*
- Junior session talk: *Multi-material compressible flow in a finite volume framework*

July 2008 **Climate change summer school**, *Mathematical Sciences Research Institute*, University of California, Berkeley.
- Graduate student summer school on mathematical topics for climate change research
- Conducted independent research on parameter regimes of Lorenz '63 system

Other presentations

November 2017 **Argonne National Laboratory**, Argonne, IL.
- Environmental Sciences Division seminar: *Storm Surge Modeling with Adaptive Mesh Refinement*

September 2016 **SIAM Conference on Mathematics of Planet Earth**, Philadelphia, PA.
- Poster: *Simulating storm surge of TC Haiyan in a future climate condition using adaptive mesh refinement*
- Minisymposium talk in session *Methodologies for Probabilistic Hazard Assessment*

CLIVAR Open Science Conference, *Simulating storm surge of TC Haiyan in a future climate condition using adaptive mesh refinement*, Poster session, Qingdao, China.

March 2016	**Inver Hills Community College**, *Mathematical modeling of the earth's climate*, Invited lecture, Inver Grove, MN.
February 2016	**MCRN**, *Storm surge modeling using adaptive mesh refinement with application to Typhoon Haiyan*, MCRN Colloquium Webinar.
	AGU Ocean Sciences Meeting, *Storm surge modeling using adaptive mesh refinement with application to Typhoon Haiyan*, Oral Presentation, New Orleans, LA.
April 2014	**Minneapolis Community and Technical College**, *Celestial motion and the three-body problem*, Math club guest lecture.
November 2013	**MCRN**, *Model reduction and response for two-timescale systems with nonlinear coupling*, Data Assimilation for Model Parameterization webinar.
April 2013	**UIC**, *Mathematical Modeling of the Earth's Climate*, Undergraduate Math Club.
March 2013	**UIC**, *Chaos and perturbations in nonlinear systems*, Graduate student seminar.
January 2013	**Joint Mathematics Meetings**, *Linear response closure approximation for multiscale systems*, AMS Special Session on Challenges in Data Assimilation and the Mathematics of Planet Earth and its Climate, San Diego, CA.
	Dynamics Days US, *Linear response closure approximation for multiscale systems*, Contributed talk, Denver, CO (Univ of Colorado travel award).
December 2012	**Science Day**, *Modeling Climate Change*, General audience talk, Minnehaha Free Space, Minneapolis, MN.
	University of La Verne, *The Mathematics of Climate Change*, Invited lecture, La Verne, CA.
November 2012	**Drexel University**, *Linear response closure approximation for multiscale systems*, Graduate student seminar, Philadelphia, PA.
	New Jersey Institute of Technology, *Linear response closure approximation for multiscale systems*, Fluids seminar, Newark, NJ.
July 2012	**Society for Industrial & Applied Mathematics (SIAM) Annual Meeting**, *Linear response closure approximation for multiscale systems*, Poster session, Minneapolis, MN (SIAM Student travel award).
June 2012	**International Union of Geodesy and Geophysics (IUGG) Conference on Mathematical Geophysics**, *Linear response closure approximation for multiscale systems*, Contributed talk, Edinburgh, Scotland (NSF travel award).
February 2011	**UIC**, *Finite volume method for hyperbolic PDEs*, Graduate applied math seminar.
October 2010	**UIC**, *Multi-material compressible flow in a finite volume framework*, SIAM student seminar.

Service

2016	**GeoClaw**, *Contributing developer*, GitHub.
	○ Added module to include forcing from atmospheric model output for storm surge modeling. https://github.com/MarcKjerland/geoclaw
2013 – 2014	**Ocean biogeochemistry focus group**, *Organizer*, MCRN.
	○ Organized webinars for mathematicians and geoscientists. Topics included biogeochemical process models and techniques for coupled nonlinear systems
April 2013	**Chicago-Area SIAM Student Conference**, *Co-organizer*, UIC.
	○ Conference for graduate and undergraduate students in applied mathematics and related disciplines

	○ Hosted at UIC, jointly organized with Northwestern University and Illinois Institute of Technology.
2010 – 2013	**SIAM student chapter at UIC**, *Organizing committee*.
2009 – 2013	**UIC Graduate Employees Organization (Local 6297)**, *Steering committee*.
	○ Served on several committees of labor union representing over 1400 teaching assistants and graduate assistants at UIC
December 2012	**Science Day**, *Organizer*, Minnehaha Free Space, Minneapolis, MN.
	○ General audience event featuring science and mathematics presentations at a progressive community space
Spring 2011	**Graduate applied math seminar**, *Organizer*, UIC.
	○ Organized and presented seminars on numerical methods for PDEs

Other Interests

I greatly enjoy traveling, bicycling, cooking & baking, live music, board games, and do-it-yourself culture.