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Marc Kjerland, PhD

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

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

2015 – 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

2014 – 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

2010 – 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

2007 – 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**, *Rennaissance 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

2017 **ChiPy ScienceSIG**, *Co-organizer*, Chicago Python User Group.

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.

Updated November 17, 2017