

Samuel N. Stechmann

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Madison, WI 53706 Web: <http://www.math.wisc.edu/~stechmann/>

RESEARCH INTERESTS Applied math, computational math, pde, multiscale modeling, stochastic processes
Data science, data assimilation, inverse problems, scientific machine learning
Waves in random media, optical communications
Climate science, atmospheric science, convection and clouds, sea ice

EMPLOYMENT **University of Wisconsin–Madison, Department of Mathematics**

Professor, 2018–
Associate Professor, 2015–2018
Assistant Professor, 2010–2015
Affiliated Faculty, Dept of Atmospheric & Oceanic Sciences, 2011–
Affiliated Faculty, Center for Climatic Research, 2011–

UCLA, Department of Mathematics

NSF Mathematical Sciences Postdoctoral Research Fellowship, 2008, 2010
NOAA Climate and Global Change Postdoctoral Fellowship, 2009–2010

EDUCATION **Courant Institute, New York University**

Ph.D., Mathematics, May 2008

University of St. Thomas (Minnesota)

B.A., Mathematics, May 2003
B.S., Physics, May 2003
B.A., Chemistry, May 2003

HONORS AND AWARDS 2023 Van Vleck Research Award, UW–Madison
2018 Vilas Associates Award, UW–Madison
2014 Sloan Research Fellowship
2012–2015 ONR Young Investigator Award
2012 Honored Instructor Award (2nd time), UW–Madison University Housing
2009–2010 NOAA Climate and Global Change Postdoctoral Fellowship
2008, 2010 NSF Mathematical Sciences Postdoctoral Research Fellowship
2008 Moses A. Greenfield Award for Outstanding Interdisciplinary Research,
Courant Institute of Mathematical Sciences
2003–2007 DOE Computational Science Graduate Fellowship
2003–2008 Henry MacCracken Fellowship, New York University
2003 Summa cum laude, University of St. Thomas
2002–2003 Barry M. Goldwater Scholarship
1999–2003 Science, Mathematics, and Engineering Scholarship,
University of St. Thomas

GRANTS Sandia National Lab, LDRD, University Supplement for ‘A Machine-Learned Corrective Model for 3D Cloud Radiative Effects in 1D Radiative Transfer Codes - ML3DRT’ \$195,000 at UW (2024–2026).

NSF (PI) (DMS-2324368): Breaking the 1D Barrier in Radiative Transfer: Fast, Low-Memory Numerical Methods for Enabling Inverse Problems and Machine Learning Emulators, \$498,832 total, \$350,000 at UW (2023–2026).

NSF (PI) (AGS-2326631): Convective Processes in the Tropics Across Scales, \$768,471 total, \$471,155 at UW (2024–2026).

ONR MURI (co-PI) (N00014-19-1-2421): Mathematics and Data Science for Improved Physical Modeling and Prediction of Arctic Sea Ice, \$7,500,000 total, \$1,760,628 at UW–Madison (2019–2024).

ONR (PI) (N00014-21-1-2119): Parameter Estimation for the Paraxial Wave Equation in a Turbulent Medium, \$250,000 (2020–2023).

ONR DURIP (PI) (N00014-20-1-2495): High-Performance Computing Cluster for Modeling Cloudy Atmosphere–Ocean Dynamics and Sea Ice, \$225,003 (2020).

NSF (co-PI) (DMS-1907667): Atmospheric Dynamics with Phase Changes and Extreme Rainfall Events, \$400,000 (2019–2022).

NSF (co-PI) (AGS-1443325): Minimal Models for Investigating the Influence of Latent Heat Release on Midlatitude Dynamics, \$750,000 total, \$503,304 in Math Department (2015–2018).

Sloan Research Fellowship (PI), \$50,000 (2014).

ONR Young Investigator Award (PI) (N00014-12-1-0744): Stochastic Models and Theory-Based Data Analysis for Tropical Weather and Climate, \$487,273 (2012–2015).

ONR DURIP (PI) (N00014-14-1-0251): High-Performance Computing Cluster for Tropical Marine Meteorological Modeling, \$230,325 (2013).

ONR MURI (co-PI) (N00014-12-1-0912): Physics Constrained Stochastic-Statistical Models for Extended Range Environmental Prediction, \$7,586,562 total, \$793,904 at UW–Madison (2012–2017).

NSF (PI) (DMS-1209409): Multiscale Modeling of Cloud Dynamics, \$137,468 (2012–2015).

JOURNAL
ARTICLES

2025:

85. Du S, Stechmann S N, 2025: Element learning: a systematic approach of accelerating finite element-type methods via machine learning, with applications to radiative transfer. *J. Comput. Math.*, in press. <https://arxiv.org/abs/2308.02467> in 2023.
84. Jin R, Li Q, Nair A, Stechmann S N, 2025: Unique reconstruction for discretized inverse problems: a random sketching approach via subsampling. *Inverse Problems* **41**, 045010. (21 pages)
83. Mou C, Stechmann S N, Chen N, 2025: Simulation and data assimilation in an idealized coupled atmosphere-ocean-sea ice floe model with cloud effects. *Nonlin. Processes Geophys.* **32**, 329–351.
82. Deng Q, Chen N, Stechmann S N, Hu J, 2025: LEMDA: A Lagrangian-Eulerian multiscale data assimilation framework. *J. Adv. Model. Earth Systems* **17**, e2024MS004259. (28 pages)
81. Ogrosky H R, Wetzel A N, Smith L M, Stechmann S N, 2025: Data assimilation errors due to incomplete accounting of balanced versus unbalanced moisture. *Q. J. Roy. Met. Soc.* **151**, e4942. (22 pages)

2024:

80. Remond-Tiedrez A, Smith L M, Stechmann S N, 2024: A nonlinear elliptic PDE from atmospheric science: well-posedness and regularity at cloud edge. *J. Math. Fluid Mech.* **26**, 30. (31 pages)
79. Kooloth P, Smith L M, Stechmann S N, 2024: Non-conservation and conservation for different formulations of moist potential vorticity. *Atmos. Sci. Lett.* **25**, e1237. (12 pages)
78. Deng Q, Stechmann S N, Chen N, 2024: Particle–continuum multiscale modeling of sea ice floes. *Multiscale Modeling & Simulation* **22**, 230–255.
77. Nair A, Li Q, Stechmann S N, 2024: Estimating the time-evolving refractivity of a turbulent medium using optical beam measurements: a data assimilation approach. *J. Opt. Soc. Am. A* **41**, B73–B84.
- 2023:
76. Du S, Stechmann S N, 2023: Inverse radiative transfer with goal-oriented hp-adaptive mesh refinement: adaptive-mesh inversion. *Inverse Problems* **39**, 115002. (27 pages)
75. Du S, Stechmann S N, 2023: Fast, low-memory numerical methods for radiative transfer via hp-adaptive mesh refinement. *J. Comput. Phys.* **480**, 112021. (21 pages)
74. Nair A, Li Q, Stechmann S N, 2023: Scintillation minimization versus intensity maximization in optimal beams. *Optics Letters* **48**, 3865–3868.
73. Torchinsky J L, Stechmann S N, 2023: Mitigating model error via a multi-model method and application to tropical intraseasonal oscillations. *SIAM J. Appl. Dyn. Syst.* **22**, 3025–3058.
72. Du S, Stechmann S N, 2023: A universal predictor-corrector approach for minimizing artifacts due to mesh refinement. *J. Adv. Model Earth Syst.* **15**, e2023MS003688. (25 pages)
71. Hottovy S, Stechmann S N, 2023: Rain process models and convergence to point processes. *Nonlin. Processes Geophys.* **30**, 85–100.
70. Kooloth P, Smith L M, Stechmann S N, 2023: Hamilton’s principle with phase changes and conservation principles for moist potential vorticity. *Q. J. Roy. Met. Soc.* **149**, 1056–1072.
- 2022:
69. Kooloth P, Smith L M, Stechmann S N, 2022: Conservation laws for potential vorticity in a salty ocean or cloudy atmosphere. *Geophys. Res. Lett.* **49**, e2022GL100009. (8 pages)
68. Chen N, Deng Q, Stechmann S N, 2022: Superfloe parameterization with physics constraints for uncertainty quantification of sea ice floes. *SIAM/ASA J. Uncertain. Quantif.* **10**, 1384–1409.
67. Neelin J D, Martinez-Villalobos C, Stechmann S N, Ahmed F, Chen G, Norris J M, Kuo Y-H, Lenderink G, 2022: Precipitation extremes and water vapor: Relationships in current climate and implications for climate change. *Curr. Clim. Change Rep.* **8**, 17–33.
66. Li Q, Nair A, Stechmann S N, 2022: Computation of optimal beams in weak turbulence. *Optics Continuum* **1**, 1867–1887.
65. Li Y, Stechmann S N, 2022: Systematic assessment of the effects of space averaging and time averaging on weather forecast skill. *Forecasting* **4**, 949–968.

64. Huang T, Stechmann S N, Torchinsky J L, 2022: Framework for idealized climate simulations with spatiotemporal stochastic clouds and planetary-scale circulations. *Phys. Rev. Fluids* **7**, 010502. (28 pages)
63. Zhang Y, Smith L M, Stechmann S N, 2022: Convergence to precipitating quasi-geostrophic equations with phase changes: asymptotics and numerical assessment. *Phil. Trans. R. Soc. A* **380**, 20210030. (19 pages)
- 2021:
62. Zhang Y, Smith L M, Stechmann S N, 2021: Effects of clouds and phase changes on fast-wave averaging: A numerical assessment. *J. Fluid Mech.* **920**, A49. (40 pages)
61. Zhang Y, Smith L M, Stechmann S N, 2021: Fast-wave averaging with phase changes: Asymptotics and application to moist atmospheric dynamics. *J. Nonlin. Sci.* **31**, 38. (46 pages)
60. Hu R, Edwards T K, Smith L M, Stechmann S N, 2021: Initial investigations of precipitating quasi-geostrophic turbulence with phase changes. *Res. Math. Sci.* **8**, 6. (25 pages)
- 2020:
59. Marsico D H, Stechmann S N, 2020: Expanding grids for efficient cloud dynamics simulations across scales. *Math. Clim. Weather Forecast.* **6**, 38–49.
58. Stechmann S N, Hottovy S, 2020: Asymptotic models for tropical intraseasonal oscillations and geostrophic balance. *J. Climate* **33**, 4715–4737.
57. Mueller E A, Stechmann S N, 2020: Shallow-cloud impact on climate and uncertainty: A simple stochastic model. *Math. Clim. Weather Forecast.* **6**, 16–37.
56. Li Y, Stechmann S N, 2020: Predictability of tropical rainfall and waves: Estimates from observational data. *Q. J. Roy. Met. Soc.* **146**, 1668–1684.
55. Edwards T K, Smith L M, Stechmann S N, 2020: Atmospheric rivers and water fluxes in precipitating quasi-geostrophic turbulence. *Q. J. Roy. Met. Soc.* **146**, 1960–1975.
54. Edwards T K, Smith L M, Stechmann S N, 2020: Spectra of atmospheric water in precipitating quasi-geostrophic turbulence. *Geophys. Astrophys. Fluid Dyn.* **114**, 715–741.
53. Wetzel A N, Smith L M, Stechmann S N, Martin J E, Zhang Y, 2020: Potential vorticity and balanced and unbalanced moisture. *J. Atmos. Sci.* **77**, 1913–1931.
- 2019:
52. Marsico D H, Smith L M, Stechmann S N, 2019: Energy decompositions for moist Boussinesq and anelastic equations with phase changes. *J. Atmos. Sci.* **76**, 3569–3587.
51. Tzou C-N, Stechmann S N, 2019: Simple second-order finite differences for elliptic PDEs with discontinuous coefficients and interfaces. *Comm. App. Math. and Comp. Sci.* **14**, 121–147.
50. Ogrosky H R, Stechmann S N, Hottovy S, 2019: Instability and nonlinear dynamics of the MJO in a tropical channel model with vertically varying convective adjustment. *Theor. Comput. Fluid Dyn.* **33**, 307–323.
49. Hernandez-Duenas G, Smith L M, Stechmann S N, 2019: Weak- and strong-friction limits of parcel models: Comparisons and stochastic convective initiation time. *Q. J. Roy. Met. Soc.* **145**, 2272–2291.

48. Wetzel A N, Smith L M, Stechmann S N, 2019: Discontinuous fronts as exact solutions to precipitating quasi-geostrophic equations. *SIAM J. Appl. Math.* **79**, 1341–1366.
47. Wetzel A N, Smith L M, Stechmann S N, Martin J E, 2019: Balanced and unbalanced components of moist atmospheric flows with phase changes. *Chin. Ann. Math. Ser. B* **40**, 1005–1038. Special issue in honor of Andrew J. Majda’s 70th birthday.
46. Chen Y, Stechmann S N, 2019: Multi-model communication and data assimilation for mitigating model error and improving forecasts. *Chin. Ann. Math. Ser. B* **40**, 689–720. Special issue in honor of Andrew J. Majda’s 70th birthday.
45. Ogrosky H R, Stechmann S N, Chen N, Majda A J, 2019: Singular spectrum analysis with conditional predictions for real-time state estimation and forecasting. *Geophys. Res. Lett.* **46**, 1851–1860.
- 2018:
44. Li Y, Stechmann S N, 2018: Spatial and temporal averaging windows and their impact on forecasting: Exactly solvable examples. *Math. Clim. Weather Forecast.* **4**, 23–49.
- 2017:
43. Stechmann S N, Hottovy S, 2017: Unified spectrum of tropical rainfall and waves in a simple stochastic model. *Geophys. Res. Lett.* **44**, 10,713–10,724.
42. Smith L M, Stechmann S N, 2017: Precipitating quasigeostrophic equations and potential vorticity inversion with phase changes. *J. Atmos. Sci.* **74**, 3285–3303.
41. Wetzel A N, Smith L M, Stechmann S N, 2017: Moisture transport due to baroclinic waves: Linear analysis of precipitating quasi-geostrophic dynamics. *Math. Clim. Weather Forecast.* **3**, 28–50.
40. Ogrosky H R, Stechmann S N, Majda A J, 2017: Boreal summer intraseasonal oscillations in the MJO skeleton model with observation-based forcing. *Dyn. Atmos. Oceans* **78**, 38–56.
39. Neelin J D, Sahany S, Stechmann S N, Bernstein D N, 2017: Global warming precipitation accumulation increases above the current-climate cutoff scale. *Proc. Natl. Acad. Sci.* **114**, 1258–1263.
- 2016:
38. Thual S, Majda A J, Chen N, Stechmann S N, 2016: Simple stochastic model for El Niño with westerly wind bursts. *Proc. Natl. Acad. Sci.* **113**, 10245–10250.
37. Abbott T H, Stechmann S N, Neelin J D, 2016: Long temporal autocorrelations in tropical precipitation data and spike train prototypes. *Geophys. Res. Lett.* **43**, 11,472–11,480.
36. Stechmann S N, Hottovy S, 2016: Cloud regimes as phase transitions. *Geophys. Res. Lett.* **43**, 6579–6587.
35. Ogrosky H R, Stechmann S N, 2016: Identifying convectively coupled equatorial waves using theoretical wave eigenvectors. *Mon. Wea. Rev.* **144**, 2235–2264.
34. Chen S, Stechmann S N, 2016: Nonlinear traveling waves for the skeleton of the Madden–Julian oscillation. *Comm. Math. Sci.* **14**, 571–592.
33. Chen S, Majda A J, Stechmann S N, 2016: Tropical–extratropical interactions with the MJO skeleton and climatological mean flow. *J. Atmos. Sci.* **73**, 4101–4116.
- 2015:

32. Chen S, Majda A J, Stechmann S N, 2015: Multiscale asymptotics for the skeleton of the Madden–Julian oscillation and tropical–extratropical interactions. *Math. Clim. Weather Forecast.* **1**, 43–69.
 31. Hottovy S, Stechmann S N, 2015: A spatiotemporal stochastic model for tropical precipitation and water vapor dynamics. *J. Atmos. Sci.* **72**, 4721–4738.
 30. Hottovy S, Stechmann S N, 2015: Threshold models for rainfall and convection: Deterministic versus stochastic triggers. *SIAM J. Appl. Math.* **75**, 861–884.
 29. Ogrosky H R, Stechmann S N, 2015: Assessing the equatorial long-wave approximation: asymptotics and observational data analysis. *J. Atmos. Sci.* **72**, 4821–4843.
 28. Ogrosky H R, Stechmann S N, 2015: The MJO skeleton model with observation-based background state and forcing. *Q. J. Roy. Met. Soc.* **141**, 2654–2669.
 27. Hernandez-Duenas G, Smith L M, Stechmann S N, 2015: Stability and instability criteria for idealized precipitating hydrodynamics. *J. Atmos. Sci.* **72**, 2379–2393.
 26. Stachnik J P, Waliser D E, Majda A J, Stechmann S N, Thual S, 2015: Evaluating MJO event initiation and decay in the skeleton model using an RMM-like index. *J. Geophys. Res.-Atmos.* **120**, 11,486–11,508.
 25. Frenkel Y, Majda A J, Stechmann S N, 2015: Cloud–radiation feedback and atmosphere–ocean coupling in a stochastic multicloud model. *Dyn. Atmos. Oceans* **71**, 35–55.
 24. Thual S, Majda A J, Stechmann S N, 2015: Asymmetric intraseasonal events in the stochastic skeleton MJO model with seasonal cycle. *Clim. Dyn.* **45**, 603–618.
 23. Stechmann S N, Majda A J, 2015: Identifying the skeleton of the Madden–Julian oscillation in observational data. *Mon. Wea. Rev.* **143**, 395–416.
- 2014:
22. Stechmann S N, Ogrosky H R, 2014: The Walker circulation, diabatic heating, and outgoing longwave radiation. *Geophys. Res. Lett.* **41**, 9097–9105.
 21. Stechmann S N, Neelin J D, 2014: First-passage-time prototypes for precipitation statistics. *J. Atmos. Sci.* **71**, 3269–3291.
 20. Stechmann S N, 2014: Multiscale eddy simulation for moist atmospheric convection: Preliminary investigation. *J. Comput. Phys.* **271**, 99–117.
 19. Thual S, Majda A J, Stechmann S N, 2014: A stochastic skeleton model for the MJO. *J. Atmos. Sci.* **71**, 697–715.
 18. Hernandez-Duenas G, Smith L M, Stechmann S N, 2014: Investigation of Boussinesq dynamics using intermediate models based on wave-vortical interactions. *J. Fluid Mech.* **747**, 247–287.
- 2013:
17. Hernandez–Duenas G, Majda A J, Smith L M, Stechmann S N, 2013: Minimal models for precipitating turbulent convection. *J. Fluid Mech.* **717**, 576–611.
 16. Khouider B, Majda A J, Stechmann S N, 2013: Climate science in the tropics: waves, vortices, and PDEs. *Nonlinearity* **26**, R1–R68. Invited review.
 15. Stechmann S N, Majda A J, Skjorshammer D, 2013: Convectively coupled wave–environment interactions. *Theor. Comput. Fluid Dyn.*, **27**, 513–532.
- 2012:
14. Khouider B, Han Y, Majda A J, Stechmann S N, 2012: Multiscale waves in an MJO background and convective momentum transport feedback. *J. Atmos. Sci.*, **69**, 915–933.

2011:

13. Majda A J, Stechmann S N, 2011: Nonlinear dynamics and regional variations in the MJO skeleton. *J. Atmos. Sci.*, **68**, 3053–3071.
12. Stechmann S N, Neelin J D, 2011: A stochastic model for the transition to strong convection. *J. Atmos. Sci.*, **68**, 2955–2970.

2010:

11. Stechmann S N, Stevens B, 2010: Multiscale models for cumulus cloud dynamics. *J. Atmos. Sci.*, **67**, 3269–3285.
10. Neelin J D, Lintner B R, Tian B, Li Q, Zhang L, Patra P K, Chahine M T, Stechmann S N, 2010: Long tails in deep columns of natural and anthropogenic tropospheric tracers. *Geophys. Res. Lett.* **37**, L05804, doi:10.1029/2009GL041726.

2009:

9. Majda A J, Stechmann S N, 2009: The skeleton of tropical intraseasonal oscillations. *Proc. Natl. Acad. Sci.* **106**, 8417–8422.
8. Stechmann S N, Majda A J, 2009: Gravity waves in shear and implications for organized convection. *J. Atmos. Sci.* **66**, 2579–2599.
7. Majda A J, Stechmann S N, 2009: A simple dynamical model with features of convective momentum transport. *J. Atmos. Sci.* **66**, 373–392.

2008:

6. Majda A J, Stechmann S N, 2008: Stochastic models for convective momentum transport. *Proc. Natl. Acad. Sci.* **105**, 17614–17619.
5. Stechmann S N, Majda A J, Khouider B, 2008: Nonlinear dynamics of hydrostatic internal gravity waves. *Theor. Comput. Fluid Dyn.* **22**, 407–432.

2007:

4. Majda A J, Stechmann S N, Khouider B, 2007: Madden–Julian Oscillation analog and intraseasonal variability in a multicloud model above the equator. *Proc. Natl. Acad. Sci.* **104**, 9919–9924.

2006:

3. Stechmann S N, Majda A J, 2006: The structure of precipitation fronts for finite relaxation time. *Theor. Comput. Fluid Dyn.* **20**, 377–404.

2004:

2. Holm D D, Putkaradze V, Stechmann S N, 2004: Rotating concentric circular peakons. *Nonlinearity* **17**, 2163–2186.

2002:

1. Jasper A W, Stechmann S N, Truhlar D G, 2002: Fewest-switches with time uncertainty: A modified trajectory surface-hopping algorithm with better accuracy for classically forbidden electronic transitions. *J. Chem. Phys.* **116**, 5424–5431.

BOOKS

- Majda A J, Stechmann S N, Chen S, Ogrosky H R, Thual S, 2019: Tropical Intraseasonal Variability and the Stochastic Skeleton Method. Springer Briefs in Mathematics of Planet Earth. 123 pages.

- BOOK CHAPTERS
- Majda A J, Stechmann S N, 2016: Models for Multiscale Interactions, II: Madden–Julian Oscillation, Moisture, and Convective Momentum Transport. In *Multiscale Convection–Coupled Systems in the Tropics: A Tribute to Michio Yanai*. American Meteorological Society Monographs. Tung W-W, Fovell R, Matsuno T (editors). Chapter 10. Pages 10.1–10.5.
- Majda A J, Stechmann S N, 2015: Madden–Julian Oscillation: Skeleton and Conceptual Models. In: *Encyclopedia of Atmospheric Sciences*, 2nd edition. Elsevier. North G R (editor-in-chief), Pyle J, and Zhang F (editors). Vol 6, Pages 137–145.
- Stechmann S N, 2015: Multiscale multi-cloud modeling and the tropics. In *Encyclopedia of Applied and Computational Mathematics*. Engquist B (editor), Springer. Pages 992–1002.
- Holm D D, Munn J, Stechmann S N, 2013: Singular solutions of Euler–Poincaré equations on manifolds with symmetry. In *Recent Trends in Dynamical Systems*, Springer Proceedings in Mathematics & Statistics, Volume 35, Springer Basel. Johann A, Kruse H-P, Rupp F and Schmitz S (editors). Pages 267–316.
- Majda A J, Stechmann S N, 2012: Multiscale theories for the MJO. In *Intraseasonal Variability in the Atmosphere–Ocean Climate System*, 2nd edition. Lau W K M, Waliser D E (editors), Springer. Pages 549–568.
- OTHER PUBLICATIONS
- Deng Q, Stechmann S N, Chen N, 2025: A particle-continuum framework for sea ice floe dynamics. *SIAM News*, Volume 58, Issue 6.
- Engquist B, Souganidis P, Stechmann S N, Vicol V, 2023: In Memory of Andrew J. Majda. *Notices Amer. Math. Soc.* **70**, 1648–1666.
- Stechmann S N, 2016: Stochastic PDEs for tropical weather and climate. *Notices Amer. Math. Soc.* **63**, 1016.
- INVITED TALKS
- 2025:
- Conference on Multiscale Modeling of Complex Systems. Johannes Gutenberg Univ. of Mainz, Germany. (September 2025)
- Peking University, Summer School/Workshop in Applied Mathematics. (July 2025)
- Peking University, Seminar, Dept. of Atmospheric and Oceanic Sciences. (July 2025)
- Oberwolfach Math Research Institute, Germany. Workshop on Mathematical Advances in Geophysical Fluid Dynamics. (May 2025)
- SIAM Conference on Computational Science & Engineering, Minisymposium on Inference of constitutive relations from simulation or data. Dallas. (March 2025)
- University of Waterloo, Canada, Applied Math Colloquium. (January 2025)
- 2024:
- American Geophysical Union, Annual Meeting, Session on Multiscale observations, modeling & prediction of sea ice dynamics. Washington, D.C. (December 2024)
- American Mathematical Society, Fall Central Sectional Meeting, Session On the many scales of mathematical analysis of fluids. San Antonio, Texas. (September 2024)
- UW-Madison, Workshop on Data-driven PDE-based inverse problems. (August 2024)
- University of Notre Dame, PDE Seminar. (April 2024)
- Simon Fraser University, Seminar on Mathematics of Computation, Application and Data. Vancouver, Canada. (March 2024)
- Univ. of British Columbia, Institute of Applied Math, Colloquium. (March 2024)

National University of Singapore, Scientific Computing Seminar. (January 2024)

2023:

Columbia University, Applied Math Colloquium. (September 2023)

International Union of Geodesy and Geophysics (IUGG), 28th General Assembly, Symposium on Tropical Meteorology. (July 2023)

APS March Meeting, Session on Statistical and Nonlinear Physics of Earth and its Climate. Las Vegas, Nevada. (March 2023)

MIT Atmospheres, Oceans, and Climate Seminar. (February 2023)

2022:

Oberwolfach Math Research Institute, Germany. Workshop on Mathematical Advances in Geophysical Fluid Dynamics. (November 2022)

One World Mathematics of Climate Seminar. Virtual. (September 2022)

British Antarctic Survey, University of Cambridge. (June 2022)

Johannes Gutenberg Univ. of Mainz, Atmos. Physics Colloquium. (June 2022)

Isaac Newton Institute for Mathematical Sciences, University of Cambridge. Programme on Mathematical Aspects of Turbulence. Workshop on Advances in Geophysical and Astrophysical Turbulence. (May 2022)

Isaac Newton Institute for Mathematical Sciences, University of Cambridge. Programme on Frontiers in Kinetic Theory. (May 2022)

Centre International de Rencontres Mathematiques (CIRM), Program on Nonlinear PDEs in Fluid Dynamics. Research School on Mathematical Advances in Geophysical Flows. Luminy, France. (April 2022)

Purdue Univ., Applied Math (CCAM) Seminar. Virtual. (January 2022)

Univ. of Hamburg, Germany. Atmos. Dyn. Seminar. Virtual. (January 2022)

2021:

Casa Matematica Oaxaca (CMO), Mexico. Workshop on Bound-preserving space and time discretizations for convection-dominated problems. Virtual. (August 2021)

UW-Madison, Applied and Computational Math Seminar. Virtual. (April 2021)

Texas A&M, Nonlinear PDEs Seminar. Virtual. (March 2021)

2019:

Dynamics, Equations, and Applications: an international conference to celebrate the 100th anniversary of the founding of the AGH University of Science and Technology. Keynote speaker. Kraków, Poland. (September 2019)

Scientific Grand Challenges and New Perspectives in Applied Mathematics: Ocean, Atmosphere and Climate Sciences. A Conference to Celebrate the 70th Birthday of Andrew Majda. University of Victoria, Canada. (July 2019)

International Congress on Industrial and Applied Mathematics (ICIAM). Minisymposium on Data Assimilation, Prediction, and Uncertainty Quantification for Complex Systems. Valencia, Spain. (July 2019)

Courant Institute, NYU. Nonlinear Dynamics and Data: Prediction, State Estimation, and Uncertainty Quantification in Complex Systems. A Conference to Celebrate the 70th Birthday of Andrew Majda. (March 2019)

Dartmouth College, Math Colloquium. Hanover, New Hampshire. (February 2019)

Oberwolfach Math Research Institute, Germany. Workshop on Moist Processes in the Atmosphere. (February 2019)

Duke University, Math Colloquium. Durham, North Carolina. (February 2019)

2018:

Caltech, Computing & Mathematical Sciences. Pasadena, Calif. (November 2018)

Dartmouth College, Applied and Computational Mathematics Seminar. Hanover, New Hampshire. (November 2018)

Virginia Commonwealth University. Department of Mathematics, Seminar. Richmond, Virginia. (November 2018)

Univ. of Chicago, Computational & Applied Math & PDE Seminar. (October 2018)

UW–Madison, Department of Atmospheric and Oceanic Sciences. Colloquium. (October 2018)

Peking University. Applied Math Seminar. Beijing, China. (May 2018)

American Meteorological Society, Annual Meeting, Conference on Climate Variability and Change, Session on “The Role of Water” Austin, Texas. (January 2018)

2017:

Annual Meeting of the APS Division of Fluid Dynamics. Mini-Symposium on Fluid Dynamics of Atmospheric Clouds. Denver, Colorado. (November 2017)

Wolfgang Pauli Institute, Univ. of Vienna, Austria. Workshop on Mathematics of Moist Atmospheric Dynamics: Modeling, Analysis & Computations. (June 2017)

SIAM Conference on Applications of Dynamical Systems. Minisymposium on Waves, Scales, and Balances in Geophysical Fluid Flow. Snowbird, Utah. (May 2017)

Oberwolfach Math Research Institute, Germany. Workshop on Geophysical Fluid Dynamics. (May 2017)

University of St. Thomas, Center for Applied Mathematics, Colloquium. St. Paul, MN. (February 2017)

2016:

American Mathematical Society, Fall Central Sectional Meeting, Invited Address. Minneapolis, Minnesota. (October 2016)

US Naval Academy, Annapolis, Maryland. Mathematics Colloquium. (October 2016)

Oberwolfach Math Research Institute, Germany. Workshop on Multiscale Interactions in Geophysical Fluids. (August 2016)

IMA Summer School on Mathematics and Climate. University of Kansas. (July 2016)

Shanghai Jiao Tong University, Institute of Natural Sciences, Applied Math Seminar. Shanghai, China. (May 2016)

American Meteorological Society, Annual Meeting, Symposium on Prediction of the Madden-Julian Oscillation. New Orleans, Louisiana. (January 2016)

2015:

American Geophysical Union, Fall Meeting, Session on Equatorial Dynamics of the Oceans and Atmosphere. San Francisco. (December 2015)

ICIAM Minisymposium on Mathematics of Climate: From the Tropics to Antarctica. Beijing, China. (August 2015)

UW–Madison, Workshop on Turbulent and Coherent Convection. (May 2015)

Banff International Research Station, Canada. Workshop on Stochasticity and Organization of Tropical Convection. (April 2015)

Florida State Univ., Geophysical Fluid Dynamics Institute Colloquium. (March 2015)

UW–Madison, Probability Seminar. (March 2015)

American Physical Society, March Meeting, Invited session on Stochastic Effects in Atmospheric and Oceanic Dynamics. San Antonio, Texas. (March 2015)

American Physical Society, March Meeting, Tutorials on Climate Physics. San Antonio, Texas. (March 2015)

2014:

American Geophysical Union, Fall Meeting, Minisymposium on Organized Convection Across Scales. San Francisco, California. (December 2014)

American Geophysical Union, Fall Meeting, Minisymposium on Madden-Julian Oscillation: Observations, Modeling, and Prediction. San Francisco. (Dec. 2014)

Courant Institute, New York University. Atmosphere–Ocean Science Colloquium. (October 2014)

UW–Madison, Center for Climate Research. Climate, People, and the Environment Program. Seminar. (March 2014)

U. of North Carolina at Chapel Hill, Applied Math Colloquium. (March 2014)

National Weather Service. Central Region Headquarters, Scientific Services Division. Webinar. (January 2014)

2013:

Argonne National Laboratory. Workshop on Atmospheric Modeling at LES Scales: Opportunities and Challenges. (September 2013)

Mathematical Congress of the Americas, Guanajuato, Mexico. Special session on Mathematical Modelling in Geophysical Fluid Dynamics. (August 2013)

Institute for Mathematics and its Applications, University of Minnesota. Workshop on Stochastic Modeling of the Oceans and Atmosphere. (March 2013)

Indian Institute of Science, Bangalore. Workshop on Mathematical Perspectives on Clouds, Climate, and Tropical Meteorology. (January 2013)

Joint Math Meetings, San Diego. Special session on Environmental Mathematics: Evaluate the Past Climate Changes and Model the Future Climate Variations. (January 2013)

2012:

1st International Conference on Frontiers in Computational Physics: Modeling the Earth System. Topical session on Multiple Scales in Meteorology with Cloud Dynamics. Boulder, Colorado. (December 2012)

U. of Illinois at Urbana–Champaign, Atmos. Sci. Colloquium. (September 2012)

Max Planck Institute for Meteorology, Hamburg, Germany. Seminar. (August 2012)

AIMS 9th Conf. on Dynamical Systems, Differential Equations & Applications. Special session on Stochastic-Statistical Modeling of Climate. Orlando (July 2012)

NYU–Abu Dhabi, Center for Prototype Climate Modeling. Workshop on Climate Change in the Subtropics. (March 2012)

Mathematics and Climate Research Network. Webinar. (March 2012)

Joint Math Meetings, Boston. Special session on Climate Modeling and Geophysical Fluid Dynamics. (January 2012)

2011:

UW–Madison, Department of Atmospheric and Oceanic Sciences. Colloquium. (September 2011)

University of St. Thomas, St. Paul, Minnesota. Symposium in honor of Kurt Scholz’s retirement. (September 2011)

China Meteorological Administration, Beijing. Year of Tropical Convection (YOTC) International Science Symposium. (May 2011)

Banff Int'l Research Station, Canada. Workshop on Organized Tropical Convection and Large-Scale Circulation: Theory, Modeling, and Observations. (May 2011)

Kavli Institute for Theoretical Physics, University of California–Santa Barbara. Program on The Nature of Turbulence. (April 2011)

2010:

American Institute of Mathematics, Palo Alto, California. Workshop on Waves and Multiscale Processes in the Tropics. (December 2010)

Fudan University, Shanghai, China. International Workshop on Modern Applied Mathematics. (October 2010)

UW–Madison Joint Math/AOS Informal Seminar. (October 2010)

Oberwolfach Math Research Institute, Germany. Workshop on Mathematical Theory and Modeling in Atmosphere–Ocean Science. (August 2010)

APEC Climate Center, Busan, Korea. Workshop on Modelling Monsoon Intraseasonal Variability. (June 2010)

Jet Propulsion Lab, Pasadena, California. Science Visitor and Colloquium Program. (April 2010)

IPAM, UCLA. Workshop: Equation Hierarchies for Climate Modeling. (March 2010)

2009:

Courant Institute, New York University. Modern Perspectives in Applied Math: A Meeting in Honor of Andrew J. Majda on his 60th Birthday. (May 2009)

UC Davis, Applied Math & PDE Seminar. (May 2009)

Banff International Research Station, Canada. Workshop on Multiscale Processes in the Tropics. (April 2009)

U. of Victoria, Canada. Atmospheric Convection Group Seminar. (April 2009)

University of Colorado at Boulder. Applied Mathematics Colloquium. (March 2009)

Max Planck Institute for Meteorology, Hamburg, Germany. Seminar. (February 2009)

UCLA Applied Math/Crime Group Seminar. (February 2009)

UCLA, Dept of Atmospheric and Oceanic Sciences, Seminar. (February 2009)

2008:

University of Wisconsin–Madison, Mathematics Colloquium. (November 2008)

Pacific Inst for Math Sci. Univ of Victoria, Canada. Workshop on Stochastic and Probabilistic Methods for Atmos., Ocean, and Climate Dynamics. (July 2008)

National Center for Atmospheric Research, Boulder, Colorado. Summer School on Geophysical Turbulence. (July 2008)

SIAM Annual Meeting. Minisymposium on Tropical Convection, Waves, and Large-Scale Circulation. San Diego, California. (July 2008)

Courant Institute, New York University. Atmosphere–Ocean Science Colloquium. (April 2008)

2007:

Pacific Inst for Math Sci. University of Victoria, Canada. Summer School on Tropical Multiscale Convective Systems. (August 2007)

SIAM Conf. on Applications of Dynamical Systems, Snowbird, Utah. (May 2007)

CONFERENCE
TALKS

- 28th General Assembly of the International Union of Geodesy and Geophysics (IUGG), Session on Data-Driven Cryospheric Sciences, and Session on Advances in Atmospheric Radiation. Berlin, Germany. (July 2023)
- 16th Conf. on Cloud Physics, Madison, Wisconsin. (August 2022)
- Imaging and Applied Optics Congress. Vancouver, Canada. (July 2022)
- 18th International Conf. on Hyperbolic Problems, Malaga, Spain. (June 2022)
- 33rd Conf. on Hurricanes & Tropical Meteorology, Ponte Vedra Beach, Florida. (April 2018)
- 32nd Conf. on Hurricanes & Tropical Meteorology, Puerto Rico. (April 2016)
- 20th Conf. on Atmospheric & Oceanic Fluid Dynamics, Minneapolis. (June 2015)
- 1st World Weather Open Science Conference, Montreal, Canada. (August 2014)
- 31st Conf. on Hurricanes & Tropical Meteorology, San Diego, Calif. (March 2014)
- 66th Annual Meeting of the American Physical Society's Division of Fluid Dynamics, Pittsburgh, Pennsylvania. (November 2013)
- 30th Conf. on Hurricanes and Tropical Meteorology, Ponte Vedra Beach, Florida. (April 2012)
- 29th Conf. on Hurricanes and Tropical Meteorology, Tucson, Arizona. (May 2010)
- 17th Conf. on Atmospheric & Oceanic Fluid Dynamics, Stowe, Vermont. (June 2009)
- 12th International Conf. on Hyperbolic Problems, University of Maryland, College Park. (June 2008)
- 28th Conf. on Hurricanes and Tropical Meteorology, Orlando, Florida. (April 2008)

CONFERENCE
POSTERS

- Isaac Newton Institute for Mathematical Sciences, University of Cambridge. Programme on Frontiers in Kinetic Theory. Workshop on Frontiers in Numerical Analysis of Kinetic Equations. (May 2022)
- 102nd Annual Meeting of the American Meteorological Society, 10th Symposium on the Madden-Julian Oscillation and Sub-Seasonal Monsoon Variability. The Andy Majda Memorial Session on Tropical Convection and Waves. Virtual/Hybrid Meeting. (January 2022)
- American Geophysical Union, Fall Meeting, Minisymposium on Advances in Computational Analysis in Geophysical Processes: Applied Math Perspectives on Prediction, Uncertainty Quantification, and State Estimation. A special session to honor the memory of Andrew Majda. Virtual/Hybrid Meeting. (December 2021)
- 101st Annual Meeting of the American Meteorological Society, 9th Symposium on the Madden-Julian Oscillation and Sub-Seasonal Monsoon Variability. Virtual Meeting. (January 2021)
- 16th International Conf. on Clouds & Precipitation, Leipzig, Germany. (August 2012)
- 30th Conf. on Hurricanes and Tropical Meteorology, Ponte Vedra Beach, Florida. (April 2012)
- 13th Conf. on Cloud Physics, Portland, Oregon. (June 2010)
- 29th Conf. on Hurricanes and Tropical Meteorology, Tucson, Arizona. (May 2010)
- 16th Conf. on Atmospheric and Oceanic Fluid Dynamics, Santa Fe, New Mexico. (June 2007)
- 15th Conf. on Atmospheric and Oceanic Fluid Dynamics, Cambridge, Massachusetts. (June 2005)

SERVICE

To the Profession:

- Member, International Commission on Tropical Meteorology (ICTM), of the International Union of Geodesy and Geophysics (IUGG). (2025-present)
- Member, International Commission on Dynamic Meteorology (ICDM), of the International Union of Geodesy and Geophysics (IUGG). (2023-present)
- Associate Editor for the journal ‘Mathematics of Climate and Weather Forecasting’. (2016–2020)
- Guest Editor for the journal ‘Research in the Mathematical Sciences’ for a special issue ‘Modern Applied Mathematics and Scientific Grand Challenges: Special Collection in Honor of Andrew J. Majda on the Occasion of His 70th Birthday’. (2019–2021)
- Organizer for workshops, mini-symposia, etc. (see list below)
- Reviewer for over 20 journals

To the University:

- Chair of Review Committee of Academic Programs in the Department of Atmospheric and Oceanic Sciences. College of Letters & Science, UW–Madison. (2024)
- Co-creator with Nan Chen of new class, Math 616, Data-Driven Dynamical Systems, Stochastic Modeling and Prediction. UW-Madison. (2023)
- Reviewer for the Research Forward initiative, Office of the Vice Chancellor for Research and Graduate Education (OVCRGE), UW–Madison. (2022)
- Member of the Review Committee for Sophomore Research Fellowship proposals, Undergraduate Academic Awards Office, UW–Madison. (2021)
- Member of the Research Committee for the Physical Sciences, under the Vice Chancellor for Research and Graduate Education, for review of Fall Research Competition applications. College of Letters & Science, UW–Madison. (2017–2020)
- Member of the Review Committee of the Academic Program in the Department of Atmospheric and Oceanic Sciences. College of Letters & Science, UW–Madison. (2014–2015)

ACTIVITIES ORGANIZED

- International Virtual Seminar on Mathematics and Atmospheric Physics. Co-organized with Peter Spichtinger (JGU Mainz). (April 2021 to present)
- International Association of Meteorology and Atmospheric Sciences, Joint Assembly of IAMAS-IACS-IAPSO, Session on Tropical Meteorology. Busan, South Korea. (July 2025)
- SIAM Conference on Computational Science and Engineering, Mini-symposium on Computational Methods for Radiative Transfer. Dallas, Texas. (March 2025)
- Oberwolfach Math Research Institute, Germany. Workshop on Model Hierarchies in Atmosphere, Ocean, and Climate Sciences. (July 2024)
- Courant Institute, New York University, Memorial Conference in Honor of Andrew J. Majda. (May 2023)
- American Meteorological Society, Annual Meeting, Symposium on the Madden-Julian Oscillation and Sub-Seasonal Monsoon Variability, The Andy Majda Memorial Session on Tropical Convection and Waves. Virtual/Hybrid Meeting. (January 2022)

American Geophysical Union, Fall Meeting, Minisymposium on Advances in Computational Analysis in Geophysical Processes: Applied Math Perspectives on Multi-scale and Stochastic Models. A special session to honor the memory of Andrew Majda. Virtual/Hybrid Meeting. (December 2021)

SIAM Conference on Mathematics of Planet Earth. Mini-symposium on Moisture-Driven Flows, Clouds, and Convection. Garden Grove, California. Virtual format, due to COVID-19. (August 2020)

Dynamics, Equations, and Applications: an international conference to celebrate the 100th anniversary of the founding of the AGH University of Science and Technology. Mini-symposium on Mathematics of weather, climate, and prediction. Kraków, Poland. (September 2019)

International Congress on Industrial & Applied Mathematics (ICIAM). Minisymposium on Data Assimilation, Prediction, and Uncertainty Quantification for Complex Systems. Valencia, Spain. (July 2019)

Courant Institute, NYU. Nonlinear Dynamics and Data: Prediction, State Estimation, and Uncertainty Quantification in Complex Systems. A Conference to Celebrate the 70th Birthday of Andrew Majda. (March 2019)

American Meteorological Society, Annual Meeting, Session on The Role of Water in Shaping Features of the Weather/Climate System, Conference on Climate Variability and Change. Austin, Texas. (January 2018)

AMS Fall Central Sectional Meeting. Special session on Modeling and Predicting the Atmosphere, Oceans, and Climate. Minneapolis, Minnesota. (October 2016)

International Congress on Industrial & Applied Mathematics (ICIAM). Minisymposium on Mathematics of Climate: From the Tropics to Antarctica. Beijing, China. (August 2015)

Applied and Computational Mathematics Seminar, UW–Madison. (2011–2012)

Joint Math/AOS Informal Seminar, UW–Madison. (2011–2012)

AIMS 9th Int'l Conference on Dynamical Systems, Differential Equations & Applications. Special session on Waves & Convection. Orlando, Florida. (July 2012)

International Congress on Industrial and Applied Mathematics (ICIAM). Satellite Workshop on Applied Math and Applied PDE, University of Victoria, Canada. (July 2011)

MENTORING ACTIVITIES

Postdoctoral researchers, UW–Madison, Dept of Mathematics: Yassine Tissaoui (2024–present), Thu Le (2024–present), Jiuhua Hu (2021–2024), Antoine Remond–Tiedrez (2020–2024), Shukai Du (2020–2024), Quanling Deng (2020–2021), Chung-Nan Tzou (2015–2019), Alfredo Wetzel (2015–2019), Shengqian Chen (2013–2016), H. Reed Ogrosky (2013–2016), Scott Hottovy (2013–2016), Gerardo Hernandez–Duenas (2011–2014).

PhD students, UW–Madison, Dept of Mathematics: Jason Torchinsky (DOE Computational Science Graduate Fellowship, 2018–2023), Tianhong Huang (2017–2023), David Marsico (2017–2020), Ying Li (2016–2020), Tom Edwards (2015–2019).

PhD student research collaborations, UW–Madison, Dept of Mathematics: Anjali Nair (2020–2023), Parvathi Madathil Kooloth (Dissertation Prize of the Association for Women in Mathematics, 2019–2022), Yeyu Zhang (2017–2020).

PhD students, UW–Madison, Dept of Physics: Bradley Kumm (2020–2024).

PhD thesis committees, UW–Madison, Dept of Mathematics: 17 from 2012–2023.

PhD thesis committees, UW–Madison, Dept of Atmospheric and Oceanic Sciences: Yingshun Sun (2022–present), and 14 others from 2012–2025.

PhD thesis committees, UW–Madison, Dept of Civil and Environmental Engineering: Alvaro Linares (2018), Adam Bechle (2013–2015).

PhD thesis committees, UW–Madison, Dept of Mechanical Engineering: Hongjiang Li (2017–2019), Guangfei Zhu (2016–2018), Chi-Wei Tsang (2015–2017).

PhD thesis committees, New York University, Courant Institute of Mathematical Sciences, Center for Atmosphere–Ocean Science: Marguerite Brown (2023), Noah Brenowitz (2016–2017).

Masters student research, UW–Madison: Jinbo Zhang (2024–present), Yining Yang (2024), Chuanqi Zhang (2019), Yian Chen (2017–2018), Mao Hong (2017–2018), Tianhong Huang (2017), Qichen Liu (2017).

Undergraduate research, UW–Madison: Manasvi Khandelwal (2025), Ethan Xiao (2025), Richmond Boahene (2025), Achintya Krishnan (2021–2024), Melisa Erman (2023), Evelyn Tollar (2023), Marissa Zhang (2023), Mengze Li (2019–2022), Yixian Gan (2019–2020), Kangqi Fu (2019–2021), James Hu (2019–2020), Eli Mueller (2017–2018), Tristan Abbott (2014–2016).

High school student research, UW–Madison: Vaidehi Ramachandrula (2024–present)

Undergraduate research, UCLA: Applied Math REU, Stephen Lee, Russell Melick, Dmitri Skjorshammer, undergraduates from Harvey Mudd College. (2009 Summer)

Mentor for the Wisconsin Science and Computing Emerging Research Stars (WISCERS) Program. (2023, 2025)

Panel member for STEM majors and careers. PEOPLE Program: Precollege Enrichment Opportunity Program for Learning Excellence. UW-Madison, Division of Diversity, Equity, and Educational Achievement. (2020)

OUTREACH

2021 Speaker at Math Club/Engineering Club (NSBE Jr, SHPE Jr), Madison East High School.

2019 Honors Day. Speaker. Wisconsin Math Talent Search, a math contest for high school and middle school students.

2018 Why Math Matters. Speaker. Outreach event, UW Math Dept.

2012–2015 Math Week at Madison East High School. Lecturer.

2006–2008 cSplash (a math festival for high school students, held each year at the Courant Institute). Lecturer.

PROFESSIONAL MEMBERSHIPS

Society for Industrial and Applied Mathematics
 American Mathematical Society
 American Physical Society
 American Meteorological Society
 American Geophysical Union