Pedram Hassanzadeh

Rice University
6100 Main Street, MEB 222
Houston, TX 77005

Phone: 713-348-5269
Email: pedram@rice.edu
Webpage: link

Research Expertise & Interests

i) Extreme weather; ii) Climate change; iii) Scientific machine learning; iv) Geophysical fluid dynamics; v) Climate dynamics; vi) Computational physics

Appointments

Rice University

Assistant Professor (July 2016-present)

Department of Mechanical Engineering

Department of Earth, Environmental & Planetary Sciences

PI: The Environmental Fluid Dynamics Group

Harvard University

Associate, Department of Earth and Planetary Sciences (2016)

Postdoctoral Fellow, Department of Earth and Planetary Sciences (2015–2016), *Mentor: Zhiming Kuang*

Ziff Environmental Fellow, Center for the Environment (2013–2015), *Hosts: Zhiming Kuang & Brian Farrell*

University of California, Berkeley

Graduate Student Researcher, Computational Fluid Dynamics Lab (2008–2013), *Advisor: Phil Marcus*

Woods Hole Oceanographic Institution (WHOI)

Geophysical Fluid Dynamics Program

PhD Student Fellow (summer 2012), *Supervisors: Charlie Doering & Greg Chini*

Staff Member (summers of 2014, 2017, 2018, 2022)

Education

University of California, Berkeley

PhD, Mechanical Engineering (2013)

Advisor: Phil Marcus

Thesis: *Baroclinic vortices in rotating stratified shearing flows: cyclones, anticyclones, and zombie vortices*

MA, Mathematics (2012)

Advisor: Jon Wilkening (based on work with Charlie Doering, University of Michigan)

Thesis: *Optimal transport from wall to wall*

University of Waterloo

MASc, Mechanical Engineering (2007)

Advisor: George Raithby

Thesis: *An efficient computational method for thermal radiation in participating media*

University of Tehran

BSc, Mechanical Engineering, Fluid Mechanics concentration (2005)

Selected Honors & Awards

CAREER Award, National Science Foundation (NSF), Climate & Large-Scale Dynamics program, 2021

Young Investigator Award, Office of Naval Research (ONR), Applied & Computational Analysis program, 2020

Early-Career Research Fellow, The National Academy of Sciences Gulf Research Program, 2018

Paper in Physical Review Fluids was selected for Editors' Suggestions, 2018

Ziff Environmental Fellowship, Harvard University Center for the Environment, 2013–2015

Paper in Geophysical Research Letters was selected for AGU Research Spotlight & Editor's Highlights, 2014

Geophysical Fluid Dynamics Fellowship, Woods Hole Oceanographic Institution, 2012

NSERC Postgraduate Scholarship, Natural Sciences & Engineering Research Council of Canada, 2009–2011

Outstanding Preliminary Examination Award, ME Department, UC Berkeley, 2009

Jonathan Laitone Memorial Scholarship, ME Department, UC Berkeley, 2009

Published & Submitted Peer-Reviewed Journal Papers

Google scholar: `link to profile`
Six major publications from our group since 2016 are highlighted in blue
* (†) indicates postdocs/grad (undergrad) students in my group

Submitted:

i. Lubis* S. & Hassanzadeh P., The intrinsic 150-day periodicity of the Southern Hemisphere extratropical large-scale atmospheric circulation, under review (`link`)

ii. Sun* Y., Hassanzadeh P., Kruse C & Alexander J., Quantifying 3D gravity wave drags in a library of tropical convection-permitting simulations for data-driven parameterizations, submitted to *J. Advances in Earth Systems Modeling*

iii. Pathak J., Subramanian S., Harrington P., Raja S., Chattopadhyay* A., Mardani M., Kurth T., Hall D., Li Z., Azizzadenesheli K., Hassanzadeh P., Kashinath K. & Anandkumar A., FourCastNet: A global data-driven high-resolution weather model using adaptive Fourier neural operators, under review (`link`)
- Preliminary findings were presented (poster) at the *AI for Earth and Space Science* workshop at ICLR2022

iv. Connolly C., Barnes E. A., Hassanzadeh P. & Pritchard M., Using neural networks to learn the jet stream forced response from natural variability, in revision

Published since joining Rice University (July 2016):

45. Subel† A., Guan* Y., Chattopadhyay* A. & Hassanzadeh P., Explaining the physics of transfer learning in data-driven turbulence modeling, *Proceedings of the National Academy of Sciences Nexus*, 2023 (`link`)

44. Chattopadhyay* A., Nabizadeh* E., Bach E. & Hassanzadeh P., Deep learning-enhanced ensemble-based data assimilation for high-dimensional nonlinear dynamical systems, in press at *J. Computational Physics* (`link`)
- Preliminary results were highlighted in SIAM News (`link`)

43. Maurice* M., Dasgupta R. & Hassanzadeh P., Redox evolution of the terrestrial magma oceans and its influence on atmosphere outgassing, in press at the *Planetary Science Journal*

42. Guan* Y., Chattopadhyay* A., Subel† A. & Hassanzadeh P., Stable a posteriori LES of 2D turbulence using convolutional neural networks: Backscattering analysis and generalization to higher Re via transfer learning, *J. Computational Physics*, 458, 2022 (`link`)

41. Mojgani* R., Chattopadhyay* A. & Hassanzadeh P., Discovery of interpretable structural model errors by combining Bayesian sparse regression and data assimilation: A chaotic Kuramoto-Sivashinsky test case, *Chaos*, 32, 2022 (link)
    - More recent results are presented at the *Tackling Climate Change with ML* workshop at NeurIPS2022

40. Chattopadhyay* A., Mustafa M., Hassanzadeh P., Bach E. & Kashinath K., Towards physics-inspired data-driven weather forecasting: Integrating data assimilation with a deep spatial transformer-based U-NET in a case study with ERA5, *Geoscientific Model Development*, 15, 2022 (link)
    - Preliminary findings were presented at the *AI for Earth Sciences* workshop at NeurIPS2020

39. Guan* Y., Subel† A., Chattopadhyay* A. & Hassanzadeh P., Learning physics-constrained subgrid-scale closures in the small-data regime for stable and accurate LES, in press at *Physica D: Nonlinear Phenomena* (link)

38. Chattopadhyay* A., Pathak J., Nabizadeh* E., Bhimji W. & Hassanzadeh P., Long-term stability and generalization of observationally-constrained stochastic data-driven models for geophysical turbulence, in press at *Environmental Data Science* (link)

37. Mojgani* R., Balajewicz M. & Hassanzadeh P., Kolmogorov n–width and Lagrangian physics–informed neural networks: A causality–conforming manifold for convection–dominated PDEs, in press at *Computer Methods in Applied Mechanics and Engineering*

36. Nabizadeh* E., Lubis* S. & Hassanzadeh P., The summertime Pacific-North American weather regimes and their predictability, *Geophysical Research Letters*, 49, 2022 (link) (link)

35. Nabizadeh* E., Lubis* S. & Hassanzadeh P., The 3D structure of Northern Hemisphere blocking events: Climatology, role of moisture, and response to climate change, *J. Climate*, 34, 2021 (link)

34. Kashinath K., M. Mustafa, A. Albert, J-L. Wu, C. Jiang, S. Esmaeilzadeh, K. Azizzadenesheli, R. Wang, A. Chattopadhyay*, A. Singh, A. Manepalli, D. Chirila, R. Yu, R. Walters, B. White, H. Xiao, H.A. Tchelepi, P.S. Marcus, A. Anandkumar, P. Hassanzadeh & Prabhat, Physics-informed machine learning: Case studies for weather and climate modeling, *Philosophical Transactions of the Royal Society A*, 379, 2021 (link)

33. Lubis* S. & P. Hassanzadeh, An eddy-zonal flow feedback model for propagating annular modes, *J. Atmospheric Sciences*, 78, 2021 (link)

32. Subel† A., A. Chattopadhyay*, Y. Guan* & P. Hassanzadeh, Data-driven subgrid-scale modeling of forced Burgers turbulence using deep learning with generalization to higher Reynolds numbers via transfer learning, *Physics of Fluids*, 33, 2021 (link)

31. Khodkar* M. A. & Hassanzadeh P., A data-driven, physics-informed framework for forecasting the spatiotemporal evolution of chaotic dynamics with nonlinearities modeled as exogenous forcings, *J. Computational Physics*, 440, 2021 (link)

30. Chan P., Hassanzadeh P. & Kuang Z., Eddy length scale response to static stability change in an idealized dry atmosphere: A linear response function approach, *J. Atmospheric Sciences*, 78, 2021 (link)

29. Chattopadhyay* A., E. Nabizadeh* & P. Hassanzadeh, Analog forecasting of extreme-causing weather patterns using deep learning, *J. Advances in Modeling Earth Systems*, 2020 (link)
    (**Highlighted in AGU's EOS Magazine. Journal's top** 10% **most downloaded papers in 2020**)

28. P. Hassanzadeh, C.-Y. Lee, E. Nabizadeh*, S. J. Camargo, D. Ma & L. Yeung, Effects of climate change on the movement of future landfalling Texas tropical cyclones, *Nature Communications*, (11) 2020 (link)
    (**featured in NSF Research News & NASA MAPP Research Highlights**)

27. Chattopadhyay* A., P. Hassanzadeh & D. Subramanian, Data-driven prediction of a multi-scale Lorenz 96 chaotic system using machine learning methods: Reservoir computing, artificial neural network, and long short-term memory network, *Nonlinear Processes in Geophysics*, (27) 2020 (link)
    – Preliminary findings were presented (poster) at ICML workshop *Climate Change: How Can AI Help*?

26. Chattopadhyay* A., A. Subel† & P. Hassanzadeh, Data-driven super-parameterization using deep learning: Experimentation with a multi-scale Lorenz 96 system and transfer-learning, *J. Advances in Modeling Earth Systems*, (12) 2020 (link)

25. Chattopadhyay* A., P. Hassanzadeh & S. Pasha, Predicting clustered weather patterns: A test case for applications of convolutional neural networks to spatio-temporal climate data, *Scientific Reports*, (10) 2020 (link)

24. Ebad Sichani M., K.A. Anarde, K.M. Capshaw, J.E. Padgett, R.A. Meidl, P. Hassanzadeh, T.P. Loch-Temzelides & P.B. Bedient, Hurricane risk assessment of petroleum infrastructure in a changing climate, *Frontiers in Built Environment* (Special topic: Worsening Tropical Cyclone Impact in Cities), (6) 2020 (link)

23. Nabizadeh* E., P. Hassanzadeh, D. Yang & E. A. Barnes, Size of the atmospheric blocking events: Scaling law and response to climate change, *Geophysical Research Letters*, (46) 2019 (link)
(**featured in NSF Research News & NASA MAPP Research Highlights**)

22. P. Hassanzadeh & Z. Kuang, Quantifying the annular mode dynamics in an idealized atmosphere, *J. Atmospheric Sciences*, (76) 2019 (link)

21. Chan P., P. Hassanzadeh & Z. Kuang, Evaluating indices of blocking anticyclones in terms of their linear relations with surface hot extremes, *Geophysical Research Letters*, (46) 2019 (link)

20. Khodkar* M. A., P. Hassanzadeh, N. Nabi & P. Grover, Reduced-order modeling of fully turbulent buoyancy-driven flows using the Green's function method, *Physical Review Fluids*, (4) 2019 (link)
(**selected for Editors' Suggestions**)

19. Pasha S. & P. Hassanzadeh, A hierarchical 3D classification of adolescent idiopathic scoliosis: Identifying the distinguishing features in 3D spinal deformities, *PLoS One*, (14) 2019 (link)

18. Khodkar* M. A. & P. Hassanzadeh, Data-driven reduced modelling of turbulent Rayleigh-Bénard convection using DMD-enhanced Fluctuation-Dissipation Theorem, *J. Fluid Mechanics*, (852) 2018 (link)

17. Ronalds B., E. A. Barnes & P. Hassanzadeh, A barotropic mechanism for the response of jet stream variability to Arctic Amplification and sea ice loss, *J. Climate* (17) 2018 (link)

16. Anderson B. T., P. Hassanzadeh & R. Caballero, Persistent anomalies of the extratropical Northern Hemisphere wintertime circulation as an initiator of El Nino/Southern Oscillation events, *Scientific Reports*, (9) 2017 (link)

15. Jeevanjee N., P. Hassanzadeh, S. Hill & A. Sheshdari, A perspective on climate model hierarchies, *J. Advances in Modeling Earth Systems*, (7) 2017 (link)

14. Mahdinia M., P. Hassanzadeh, P. S. Marcus & C.-H. Jiang, Stability of 3D Gaussian vortices in rotating stratified Boussinesq flows: Linear analysis, *J. Fluid Mechanics*, (824) 2017 (link)

13. Ma D., P. Hassanzadeh & Z. Kuang, Quantifying the eddy-jet feedback strength of the annular mode in an idealized GCM and reanalysis data, *J. Atmospheric Sciences*, (74) 2017 (link)

Published before joining Rice University:

12. Hassanzadeh P. & Z. Kuang, The linear response function of an idealized atmosphere. Part II: Implications for the practical use of the Fluctuation-Dissipation Theorem and the role of operator's nonnormality, *J. Atmospheric Sciences*, (79) 2016

11. Hassanzadeh P. & Z. Kuang, The linear response function of an idealized atmosphere. Part I: Construction using Green's functions and applications, *J. Atmospheric Sciences*, (79) 2016

10. Hassanzadeh P. & Z. Kuang, Blocking variability: Arctic Amplification versus Arctic Oscillation, *Geophysical Research Letters*, (42) 2015

9. Marcus P. S., S. Pei, C.-H. Jiang, J. Barranco, P. Hassanzadeh & D. Lecoanet, Zombie vortex instability. I. A purely hydrodynamic instability to resurrect the dead zones of protoplanetary disks, *Astrophysical J.*, (808) 2015

8. Hassanzadeh P., Z. Kuang & B. F. Farrell, Responses of midlatitude blocks and wave amplitude to changes in the meridional temperature gradient in an idealized dry GCM, *Geophysical Research Letters*, (41) 2014 (**selected for AGU Research Spotlight & GRL Editor's Highlights**)

7. Hassanzadeh P., G. P. Chini & C. R. Doering, Wall to wall optimal transport, *J. Fluid Mechanics*, (751) 2014

6. Marcus P. S., S. Pei, C.-H. Jiang & P. Hassanzadeh, Three-dimensional vortices generated by self-replication in stably stratified rotating shear flows, *Physical Review Letters*, (111) 2013

5. Hassanzadeh P., P. S. Marcus & P. Le Gal, The universal aspect ratio of vortices in rotating stratified flows: theory and simulation, *J. Fluid Mechanics*, (706) 2012

4. Hassanzadeh P. & G. D. Raithby, Efficient iterative solution of the P1 equation, *J. Heat Transfer*, (131) 2008

3. Hassanzadeh P., G. D. Raithby & E. H. Chui, Efficient calculation of radiation heat transfer in anisotropically scattering media using the QL method, *J. Computational Thermal Sciences*, (1) 2009

2. Hassanzadeh P. & G.D. Raithby, Application of the finite volume method to the second-order radiative transfer equation: accuracy and solution cost, *J. Numerical Heat Transfer-B*, (53) 2008

1. Hassanzadeh P., G. D. Raithby & E. H. Chui, The efficient calculation of radiation heat transfer in participating media, *J. Thermophysics and Heat Transfer*, (22) 2008

Funded & Pending Grant Proposals

Funded: as Sole or Lead PI

NSF Climate and Large-Scale Dynamics Program: CAREER: Quantifying the dynamics and spatiotemporal variability of blocking events using linear response functions and the Buckingham-Pi theorem, AGS-2046309, PI: Hassanzadeh, $735K (2021-2026)

ONR Young Investigator Award, Applied & Computational Analysis program: Using artificial intelligence and inexact computing to improve modeling of multi-scale, multi-physics, chaotic dynamical systems with applications to weather/climate predictions, PI: Hassanzadeh, $400K (2020-2023)

NSF Cyberinfrastructure for Sustained Scientific Innovation (CSSI) Program: Collaborative Research: Framework: Improving the understanding and representation of atmospheric gravity waves using high-resolution observations and machine learning, OAC-2005123, Lead PI: Hassanzadeh, $1.1M (total: $4.6M); Other PIs: Alexander (NWRA), Gerber (NYU) & Sheshadri (Stanford U) (2020–2025)

NSF Climate and Large-Scale Dynamics Program: Collaborative research: Revisiting the low-frequency variability of the extratropical circulation using non-EOF modes and linear response functions, AGS-1921413, PI: Hassanzadeh, $400K (2019-2023)

NASA Modeling, Analysis and Prediction Program: Understand predictability and improve prediction of atmospheric blocking and associated extreme weather, 80NSSC17K0266, PI: Hassanzadeh, $300K (2017–2022)

Accenture Labs: Earth digital twins, PI: Hassanzadeh, $50K unrestricted gift (2022)

Funded: as Co-PI

Schmidt Futures Virtual Earth System Research Institute (VESRI): A data-informed framework for the representation of sub-grid scale gravity waves to improve climate prediction, Coordinating PI: Aditi Sheshadri (Stanford U), total $5.9M; Other PIs: Hassanzadeh ($900K), Achatz (U Frankfurt), Gerber (NYU), Lott (CNRS), Scaife (UK Met Office) & Stephan (Max Planck Institute) (2020-2025)

NASA Nexus of Exoplanet Systems Science (NExSS): Origin and cycles of life-essential ingredients in young rocky planets, 80NSSC18K0828, PI: Raj Dasgupta (Rice U), total $6.7M, Co-PIs: Hassanzadeh (15%), Isella, Lee, Lenardic & Yeung (2018–2023)

C3.ai Digital Transformation Institute: Interpretable machine learning models to improve forecasting of extreme-weather-causing tropical monster storms, PI: Da Yang (UC Davis/LBNL), total $250K; Co-PIs: Hassanzadeh (20%), Bhimji (LBNL), Yu (UC Berkeley) (2021–2023)

Pending grants

DOE Regional & Global Model Analysis Program: Understanding and Projecting Changes in Orographic Precipitation Throughout the Seasonal Cycle in the Americas, PI Bill Boos (UC Berkeley), $900K; Co-PIs: Hassanzadeh (20%), Kruse (NWRA), Leung (PNNL) & Simpson (NCAR)

Completed grants

Early-Career Research Fellowship Award from the The National Academy of Sciences Gulf Research Program: Weather extremes, climate change, and the Gulf, Awardee: Hassanzadeh, $75K (2018–2020)

NSF Climate and Large-Scale Dynamics Program: Atmospheric blocking: dynamics and responses to climate change, AGS-1552385, PI Zhiming Kuang (Harvard U), total $540K. Subcontract to Rice: PI: Hassanzadeh, $150K (2016-2020)

Selected Invited Talks (since 2018)

Integrating the spectral analyses of neural network and nonlinear physics for Stability, extrapolation & interpretation
2022: MIT PAOC Colloquium, Harvard University Clima Tea, Columbia University LEAP Seminar, Penn State Math Colloquium, MFO Multiscale Wave-Turbulence Dynamics in the Atmosphere and Ocean Workshop, UC Santa Cruz Applied Math Colloquium, US Naval Academy Math Colloquium, AAAI Symposium on Knowledge-guided Machine Learning

Lack of change in the average duration of atmospheric blocking events in a warming climate
2022: Stanford University ESS Colloquium, AGU Fall Meeting

Data-driven subgrid-scale modeling using neural networks & transfer learning: Stability, extrapolation & interpretation
2022: Scripps Institution of Oceanography CASPO Colloquium, Johns Hopkins University Center for Environmental and Applied Fluid Mechanics, SIAM Conference on Mathematics of Planet Earth
2021: KITP Machine Learning for Climate Physics workshop, Columbia University, SIAM Annual Meeting, NVIDIA, IS-ENES3/ESiWACE2 ML-AI Workshop, University of Frankfurt Atmospheric Dynamis Group
2020: Courant Institute CAOS Colloquium, SIAM Conference on Mathematics of Planet Earth, US Naval Academy Math Colloquium

Data-driven forecasting of weather and extreme weather
2022: Transformers for Environmental Science Workshop (keynote)
2020: AGU Fall Meeting

Building physical consistencies into neural networks for weather/climate & turbulence modeling
2021: 2nd Workshop on Knowledge Guided Machine Learning, 16^{th} National Congress on Computational Mechanics

Data-driven forecasting of multi-scale dynamical systems using deep learning & applications to data assimilation
2021: Caltech CliMA seminar
2020: NRL/ONR Data Assimilation Workshop
2019: International Congress on Industrial and Applied Mathematics, University of Houston Math Colloquium

Propagation, periodicity & reduced-order modeling of the Southern Annular Mode
2021: AGU Fall Meeting, Yale University Climate Science Colloquium
2020: University of Washington Atmospheric Sience Colloquium

Size of atmospheric blocking: Scaling law, response to climate change and implications for extreme weather events
2022: SFSU
2020: Stanford University Climate Dynamics Colloquium, UC Davis Climate Science Colloquium, UC Irvine ESS Colloquium, Purdue University Earth Science Colloquium
2019: Texas A&M

Wall to wall optimal transport
2021 Charlie at GFD: An Appreciation, A symposium honoring Charlie Doering's contributions to the GFD program

Climate change: Trade-offs between people and planet
2020 Rice University Scientia Institute

Data-driven modeling of geophysical turbulence using Fluctuation-Dissipation Theorem and Koopman operator theory
2019: UC Berkeley Fluids Seminar, US Naval Academy Math Colloquium, SIAM Conference on Dynamical Systems
2018: IUTM Workshop on Turbulence (Cornell University), SIAM Conference on Uncertainty Quantification

Quantifying the annular mode eddy feedback using linear response functions
2019: Stanford University Climate Dynamics Colloquium, Columbia University Atmospheric Science Colloquium, Colorado State University Atmospheric Science Colloquium

Hurricane Harvey, jet stream, and climate change
2019: University of Houston Civil Engineering Colloquium
2018: SSPEED Center Conference

Advising at Rice University

Research Scientists & Postdoctoral Research Associates

Dr. Hamid Pahlavan (2022-present, Rice Academy Fellow): Gravity wave forcing and variability of QBO in a changing climate

Dr. Qiang Sun (2021-present): ML & high-fidelity data for subgrid-scale modeling of atmospheric gravity waves

Dr. Rambod Mojgani (2020-present): ML+DA for interpretable structural (climate) model error discovery

Dr. Yifei Guan (2019-present): Physics-guided ML for subgrid-scale modeling of geophysical turbulence

Dr. Maxime Maurice (2020-present): Modeling of magma ocean in terrestrial and exo planets

Dr. Cedric Gillmann (2021-present): Modeling climate-tectonic interaction of old Earth and Venus

Dr. Sandro Lubis (2019-2022). Next: Scientist II at PNNL

Dr. Lei Wang (2017-2018; joint with Prof. Kuang at Harvard University). Next: Assistant professor at Purdue University

Dr. Amin Khodkar (2017-2019). Next: postdoc at UCLA

PhD Students

Karan Jakhar (2021-present): Closed-form equation discovery of subgrid-scale closure in geophysical turbulence

Moein Memar (2022-present): Spectral analysis of neural networks for interpretability & stability

Ashesh Chattopadhyay (2017-2022): Thesis: *Theoretical and applied deep learning for turbulence*. Next: Assistant Professor of Applied Mathematics, UC Santa Cruz

Ebrahim Nabizadeh (2017-2022). Thesis: *Variability and dynamics of atmospheric blocking events under climate change*. Next: ML scientist at Verisk

MS Students

David Lee (2018-2020). Thesis: *Reduced-order modeling of turbulent plane Couette flow using the Green's function method and fluctuation-dissipation theorem*. Next: US Air Force pilot

Researchers/Visitors

Adam Subel (MECH/CAAM undergraduate student, 2019-2021): recipient of NSF Graduate Research Fellowship; now PhD student at Courant Institute (NYU)

Andy Corbato (MECH undergraduate student, 2018-2019)

Joey Lou (MECH undergraduate student, 2018-2019)

Vincent Gonzales (CAAM undergraduate student, Spring 2018-Summer 2018)

Arthi Appathurai (CHEB MS student, Spring 2017-Summer 2018)

Sebastian Jia (MECH undergraduate student, Summer 2017)

Chris Winkler (high school teacher, Summer 2022)

Olivia Ye (high school student, Summer 2022)

Janet Jiang (high school student, Summer 2019)

Prithika Sen (high school student, Summer 2019)

Teaching (since 2016)

Graduate-Level Courses

MECH 575: Introduction to Hydrodynamic Stability (Spring 2017-2020, 2022-2023)

MECH 611/612: Independent Study on Geophysical Fluid Dynamics (Spring & Fall 2018; Spring 2023)

MECH 612: Independent Study on Great Papers of AI for Dynamical Systems (Spring 2023)

Undergraduate-Level Courses

MECH 371: Fluid Mechanics (Fall 2017-2022)

Professional Services (since 2016)

Editorial Board

Associate editor (2021-present): Journal of Advances in Earth Systems Modeling (American Geophysical Union journal). Areas: atmospheric dynamics and data science

Co-editor (2019-present): Weather and Climate Dynamics (new European Geosciences Union journal). Areas: climate dynamics and data science

Editorial Board (2022-present): Environmental Research, Climate (new IOP Publishing journal). Areas: extreme weather and data science

Committees

Chair of the Seminar Series Committee, American Physical Society Topical Group in Physics of Climate, 2022-present

Honors Selection Committee, American Physical Society Topical Group in Physics of Climate, 2022-present

Organizer & Chair

Session *Extratropical Large-Scale Atmospheric Circulation Variability*, AGU Fall Meeting (2017-2022)

New monthly *Virtual Seminar Series on Climate Physics*, American Physical Society Topical Group in Physics of Climate (2022-present)

Mini-symposium *Interpreting and explaining machine learning methods for dynamical systems*, SIAM Mathematics of Data Science Conference (2022)

Mini-symposium *New advances in developing subgrid-scale closures and reducing model errors*, SIAM Mathematics for Planet Earth Conference (2022)

Session *Extratropical Large-Scale Atmospheric Circulation: Dynamics, Variability, and Impacts on Extreme Weather*, AMS Annual Meeting (2022)

Session *Observationally Constrained Digital Twins for the Earth System: Methods and Applications*, AMS Annual Meeting (2022)

Session *Data-driven Modeling of Chaotic Systems and Turbulent Flows*, 16th U.S. National Congress on Computational Mechanics (2021)

Session *Relating the Internal Variability of Climate Systems and their Forced Responses*, AGU Fall Meeting (2018)

Focus Session *Fluid Dynamics of Atmosphere and Ocean Extremes*, APS-DFD Annual Meeting (2018)

Chair

Session at AI Super-Resolution Simulations Workshop, CMU (2022)

Session at KITP Machine Learning and the Physics of Climate workshop (2021)

Session *Nonlinear Dynamics: Model Reduction*, APS-DFD Annual Meeting (2018)

Session *Midlatitude and tropospheric-stratospheric interaction*, Modeling Hierarchies Workshop, Princeton 2016

Session *Transport & Mixing*, AMS-AOFD Meeting, Minneapolis 2015

Session *Geophysical: Stratified Flows*, APS-DFD Annual Meeting, Pittsburgh 2013

Reviewer

Proposals: NSF (ad hoc and panel), NASA (panel), ARO (ad hoc)

Papers: Atmosphere, Atmospheric Chemistry & Physics, Atmospheric Science Letters, Chaos, Climate Dynamics, Earth System Dynamics, Geophysical Research Letters, Journal of Advances in Earth Systems Modeling, Journal of Applied Meteorology & Climatology, Journal of Computational Physics, Journal of Climate, Journal of the Atmospheric Sciences, Journal of Fluid Mechanics, Journal of Geophysical & Astrophysical Fluid Dynamics, Monthly Weather Review, Nature Communications, Nature Physics, NeurIPS, npj Climate and Atmospheric Science, Physics of Fluids, PNAS, Probabilistic Engineering Mechanics, Proceedings of the Royal Society A, Quarterly Journal of the Royal Meteorological Society, Scientific Reports, SIAM Journal of Uncertainty Quantification