Dimitrios Giannakis

Assistant Professor
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Research Interests

Geometric data analysis, climate dynamics, statistical modeling

Appointments

2012– Assistant Professor, *Courant Institute of Mathematical Sciences, New York University*

2009–2012 Postdoctoral Research Scientist, *Courant Institute of Mathematical Sciences, New York University*
Mentor: Andrew J. Majda

2005–2009 Research Assistant, *Department of Physics, University of Chicago*

Education

2003–2009 Ph.D. Physics, *University of Chicago*
Thesis Advisers: Robert Rosner and Paul Fischer

2002–2003 M.Phil. Technology Policy, *University of Cambridge*

1997–2001 BA, MSci Natural Sciences, *University of Cambridge*

Teaching Experience

2012– Courant Institute of Mathematical Sciences, New York University
Graduate Courses: Data Analysis Methods for High-Dimensional Time Series, Fluid Dynamics
Undergraduate Courses: Introduction to Fluid Dynamics

2011–2012 *Courant Institute of Mathematical Sciences, New York University*
Lectured graduate courses on Stochastic Modeling and Uncertainty Quantification, supervised graduate students

2004–2008 *Department of Physics, University of Chicago*
Teaching Assistant, College Tutor

Research Supervision

Ph.D. Students	Romeo Alexander (2014–), Mitchell Bushuk (2013–2015, accepted postdoctoral fellowship at the Geophysical Fluid Dynamics Laboratory, Princeton, NJ)
Masters Students	Xiucai Ding (2013–2014), Zhanyi Dong (2013–2014)
Undergraduate Students	Eli Bingham (Duke University, 2013–2014)
Postdoctoral Scientists	Darin Comeau (2013–), Subhomoy Gosh (2013–2014), Eniko Szekely (2013–), Zhizhen Zhao (2013–)
Ph.D. Committee Member	Nan Chen (expected 2016), Xiao Xiao (expected 2015)
Ph. D. Committee Member (External to NYU)	Mathew Bowers (Purdue University, expected 2016)

Research Grants

2014–2017 Office of Naval Research grant N00014-14-1-0150, "Analysis of Large-Scale Datasets from Dynamical Systems through Discrete Exterior Calculus with Applications to Climate Atmosphere Ocean Science," PI role

2015–2018 Ministry of Earth Sciences, India, grant MM/SERP NYU/ 2014/SSC-01/002, "A Novel Approach for Improving Rain-Gauge Data Assimilation and Extended Range Prediction of Sub-Seasonal Variability over India," co-PI role

Professional Service

Refereeing Journals: Atmospheric Chemistry and Physics, Climate Dynamics, Dynamics of Atmospheres and Oceans, Journal of Climate, Journal of Physical Oceanography, Journal of the Atmospheric Sciences, Nonlinearity, Proceedings of the National Academy of Sciences, SIAM Journal on Applied Dynamical Systems, SIAM/ASA Journal on Uncertainty Quantification, Weather and Forecasting, Monthly Weather Review

Conference Proceedings: NASA Conference on Intelligent Data Understanding (2011, 2012)

Books and Book Chapters: Springer Briefs in Mathematics

Proposals: National Science Foundation

Conferences Special Sessions Co-Organized: Stochastic and Statistical Modeling of Climate, 9th AIMS International Conference on Dynamical Systems and Differential Equations (2012); Improving Climate and Weather Prediction through Data-Driven Statistical Modeling, 10th AIMS International Conference on Dynamical Systems and Differential Equations (2014); Data Driven Methods for Dynamical Systems, 2015 AMMCS-CAIMS Congress; Data-driven methods for Quantifying Uncertainty of Multiscale Dynamical Systems, International Congress on Industrial and Applied Mathematics (2015)

Refereed Publications

1. M. Bushuk, and D. Giannakis (2015), Sea-Ice Reemergence in a Model hierarchy, *Geophys. Res. Lett.*, in review

2. E. Szekely, D. Giannakis, and A. J. Majda (2015), Extraction and Predictability of Coherent Intraseasonal Signals in Infrared Brightness Temperature Data, *Climate Dyn.*, in revision

3. D. Giannakis (2015), Dynamics-Adapted Cone Kernels, *SIAM J. Appl. Dyn. Sys.*, in press

4. T. Berry, D. Giannakis, and J. Harlim, (2015), Nonparametric Forecasting of Low-Dimensional Dynamical Systems, Phys. Rev. E, 91, 032915

5. M. Bushuk, D. Giannakis, and A. J. Majda (2015), Arctic Sea Ice Reemergence: The Role of Large-Scale Oceanic and Atmospheric Variability, *J. Climate*, in press

6. Z. Zhao and D. Giannakis (2014), Analog Forecasting with Dynamics-Adapted Kernels, *Nonlinearity*, in review

7. M. Bushuk, D. Giannakis, and A. J. Majda (2014), Reemergence Mechanisms for North Pacific Sea Ice Revealed through Nonlinear Laplacian Spectral Analysis, *J. Climate*, 27, 6265–6287

8. N. Chen, A. J. Majda, and D. Giannakis (2014), Predicting the Cloud patterns of the Madden-Julian Oscillation through a Low-Order Nonlinear Stochastic Model, *Geophys. Res. Lett.*, 41(15), 5612–56199

9. N. Chen, D. Giannakis, R. Herbei, and A. J. Majda (2014), An MCMC Algorithm for Parameter Estimation in Signals with Hidden Intermittent Instability, *SIAM/ASA J. Uncertainty Quantification*, 2(1), 647–699

10. W.w-. Tung, D. Giannakis, and A. J. Majda (2014), Symmetric and Antisymmetric Madden-Julian Oscillation Signals in Tropical Deep Convective Systems, *J. Atmos. Sci.*, 71, 3302

11. D. Giannakis and A. J. Majda (2013), Nonlinear Laplacian Spectral Analysis: Capturing Intermittent and Low-Frequency Spatiotemporal Patterns in High-Dimensional Data, *Stat. Anal. Data Min.*, 6(3), 180

12. D. Giannakis and A. J. Majda (2012), Limits of Predictability in the North Pacific Sector of a Comprehensive Climate Model, *Geophys. Res. Lett.*, 39, L24602

13. D. Giannakis, A. J. Majda, and I. Horenko (2012), Information Theory, Model Error, and Predictive Skill of Stochastic Models for Complex Nonlinear Systems, *Phys. D*, 241, 1735

14. D. Giannakis and A. J. Majda (2012), Comparing Low-Frequency and Intermittent Variability in Comprehensive Climate Models through Nonlinear Laplacian Spectral Analysis, *Geophys. Res. Lett*, 39, L10710

15. D. Giannakis, P. Schwander, and A. Ourmazd (2012), The Symmetries of Image Formation by Scattering. I. Theoretical Framework, *Optics Express*, 20(12), 12799

16. P. Schwander, C. H. Yoon, A. Ourmazd, and D. Giannakis (2012), The Symmetries of Image Formation by Scattering. II. Applications, *Optics Express*, 20(12), 12827

17. D. Giannakis and A. J. Majda (2012), Quantifying the Predictive Skill in Long-Range Forecasting. Part I: Coarse-Grained Predictions in a Simple Ocean Model, *J. Climate*, 25(6), 1793

18. D. Giannakis and A. J. Majda (2012), Quantifying the Predictive Skill in Long-Range Forecasting. Part II: Model Error in Coarse-Grained Markov Models with Application to Ocean-Circulation Regimes, *J. Climate*, 25(6), 1814

19. D. Giannakis, A. J. Majda (2012), Nonlinear Laplacian Spectral Analysis for Time Series with Intermittency and Low-Frequency Variability, *Proc. Natl. Acad. Sci.*, 109(7), 2222

20. D. Giannakis, R. Rosner, and P. F. Fischer (2009), Large-Wavelength Instabilities in Free-Surface Hartmann Flow at Low Magnetic Prandtl Numbers, *J. Fluid Mech.*, 636, 217

21. D. Giannakis, P. F. Fischer, and R. Rosner (2009), A Spectral Galerkin Method for the Coupled Orr–Sommerfeld and Induction Equations for Free-Surface MHD, *J. Comput. Phys.*, 228(4), 1188

22. D. Giannakis, and W. Hu (2005), Challenges for the Kinetic Unified Dark Matter Model, *Phys. Rev. D*, 72, 063502

23. D. Giannakis, T. Jamasb, and M. G. Pollitt (2005), Benchmarking and Incentive Regulation of Quality of Service: An Application to the UK Electricity Distribution Networks, *Energy Policy*, 33, 2256

Peer-Reviewed Conference Proceedings

1. E. Szekely, D. Giannakis, and A. J. Majda (2014), Extraction and Predictability of Intraseasonal Signals in Infrared Brightness Temperature Data, *Climate Informatics 2014*, Boulder, Colorado, September 25–26, 2014

2. D. Giannakis, W.-w. Tung, and A. J. Majda (2012), Hierarchical Structure of the Madden-Julian Oscillation in Infrared Brightness Temperature Data Revealed through Nonlinear Laplacian Spectral Analysis, *NASA Conference on Intelligent Data Understanding (CIDU) 2012*, Boulder, Colorado, October 24–26, 2012

3. D. Giannakis and A. J. Majda (2011), Time Series Reconstruction via Machine Learning: Revealing Decadal Variability and Intermittency in the North Pacific sector of a Coupled Climate Model, *NASA Conference on Intelligent Data Understanding (CIDU) 2011*, Mountain View, California, October 19–21, 2011

Book Chapters

1. D. Giannakis (2015), Mathematical Methods for Large Geophysical Datasets, *Encyclopedia of Applied and Computational Mathematics*, B. Engquist, Ed., Springer

2. D. Giannakis and A. J. Majda (2014), Data-Driven Methods for Dynamical Systems: Quantifying Predictability and Extracting Spatiotemporal Patterns, *Mathematical and Computational Modeling: With Applications in Engineering and the Natural and Social Sciences*, R. Melnik, Ed., Wiley

Invited Conference and Workshop Talks

1. Kernel Analog Forecasting of Intraseasonal Oscillations, *Workshop on Stochasticity and Organization of Tropical Convection*, Banff International Research Station, Banff, Alberta, April 30, 2015

2. Extracting Spatiotemporal Patterns with Dynamics-Adapted Kernels, *10th AIMS Conference on Dynamical Systems, Differential Equations, and Applications*, Madrid, Spain, July 8, 2014

3. Extracting Spatiotemporal Patterns with Dynamics-Adapted Kernels, *Model-Data Integration in Physical Systems*, Isaac Newton Institute, Cambridge, UK, March 18, 2014

4. Data-Driven Methods for Dynamical Systems: Quantifying Predictability and Extracting Spatiotemporal Patterns, keynote lecture, *Applied Mathematics, Modeling and Computational Science (AMMCS) Conference*, Waterloo, Ontario, August 27, 2013

5. Capturing Intermittent and Low-Frequency Variability in High-Dimensional Data through Nonlinear Laplacian Spectral Analysis, *CMOS/CGU/CWRA Congress*, Saskatoon, Saskatchewan, May 27, 2013

6. Capturing Intermittent and Low-Frequency Variability in High-Dimensional Data through Nonlinear Laplacian Spectral Analysis, *SIAM Conference on Applications of Dynamical Systems*, Snowbird, Utah, May 21, 2013

7. Capturing Intermittent and Low-Frequency Variability in High-Dimensional Data through Nonlinear Laplacian Spectral Analysis, *Stochastic Modeling of the Oceans and Atmosphere*, Institute for Mathematics and its Applications (IMA), Minneapolis, Minnesota, March 12, 2013

8. Capturing Intermittent and Low-Frequency Variability in High-Dimensional Data through Nonlinear Laplacian Spectral Analysis, *Adaptive Data Analysis and Sparsity*, Institute for Pure and Applied Mathematics (IPAM), Los Angeles, California, January 31, 2013

9. Capturing Intermittent and Low-Frequency Variability in High-Dimensional Data through Nonlinear Laplacian Spectral Analysis, *Joint Mathematics Meetings*, San Diego, California, January 10, 2013

10. Hierarchical Structure of the Madden-Julian Oscillation in Infrared Brightness Temperature Data Revealed through Nonlinear Laplacian Spectral Analysis, *NASA Conference on Intelligent Data Understanding (CIDU) 2012*, Boulder, Colorado, October 25, 2012

11. Quantifying Long-Range Predictability & Model Error via Data Clustering & Information Theory, *AIMS Conference on Dynamical Systems*, Orlando, Florida, July 2, 2012

12. Capturing Intermittent and Low-Frequency Variability in High-Dimensional Data through Nonlinear Laplacian Spectral Analysis, *AIMS Conference on Dynamical Systems*, Orlando, Florida, July 1, 2012

13. Diffractive Imaging through Manifold Symmetries of Scattering, *SIAM Conference on Imaging Science*, Philadelphia, May 21, 2012

14. Quantifying Long-Range Predictability and Model Error through Data Clustering and Information Theory, *SIAM Conference on Uncertainty Quantification*, Raleigh, North Carolina, April 5, 2012

15. Comparing Low-Frequency and Intermittent Variability in Comprehensive Climate Models through Nonlinear Laplacian Spectral Analysis, *Workshop on Tropical and Extratropical Interactions in Climate*, Center for Prototype Climate Modeling, New York University Abu Dhabi, March 22, 2012

16. Quantifying the Predictability and Model Error in Regime Forecasts through Data Clustering and Information Theory, *AGU Fall Meeting*, December 8, 2011

17. Nonlinear Laplacian Spectral Analysis for Time Series: Capturing Intermittency and Low-Frequency Variability, *International Workshop on Statistical Inverse Modeling of Complex Nonlinear Systems*, Fudan University, September 8, 2011

18. Quantifying Predictability and Model Error in Long-Range Climate Forecasting through Information Theory, *International Workshop on Statistical Inverse Modeling of Complex Nonlinear Systems*, Fudan University, September 6, 2011

19. Quantifying Predictability and Model Error in Long-Range Climate Forecasting through Information Theory, *Verification, Validation, and Uncertainty Quantification Across Disciplines*, Institute for Computing in Science (ICiS), Park City, Utah, August 9, 2011.

20. Structure and Dynamics from Manifold Symmetries of Image Formation, *Minisymposium on Computational Methods for Three-Dimensional Microscopy Reconstruction*, The City University of New York, November 8, 2010

21. Identifying and Predicting the Extensional and Meandering Phases of the Jet in a Double-Gyre Ocean Model, *Mathematical Theory and Modeling in Atmosphere-Ocean Science*, Oberwolfach Institute, August 12, 2010

22. Identifying and Predicting Regimes in a 1.5-Layer Ocean Model, *Data Hierarchies for Simulating and Understanding Climate*, Institute for Pure and Applied Mathematics (UCLA), June 10, 2010

23. Orientation Recovery by Diffusion Map, Workshop on Single-Particle Diffraction and Imaging, University of Wisconsin, Milwaukee, January 22, 2009

Contributed Talks and Posters

1. Low-Frequency and Intermittent Variability of the North Pacific Revealed through Nonlinear Laplacian Spectral Analysis, poster, *World Climate Research Programme (WCRP) Open Science Conference*, Denver, Colorado, October 27, 2011

2. Quantifying Long-Range Predictability & Model Error via Data Clustering & Information Theory, poster, *World Climate Research Programme (WCRP) Open Science Conference*, Denver, Colorado, October 26, 2011. Received early-career scientist presentation award

3. Time Series Reconstruction via Machine Learning: Revealing Decadal Variability and Intermittency in the North Pacific, poster, *International Workshop on Climate Informatics*, New York Academy of Sciences, August 26, 2011

4. Long-Range Climate Forecasts Using Data Clustering and Information Theory, talk *New York Workshop on Computer, Earth, and Space Sciences*, Goddard Institute for Space Studies, February 25, 2011

5. The Symmetries of Image Formation by Scattering, poster, *Gordon Research Conference on Three-Dimensional Electron Microscopy*, June 20–25, 2010

6. Inferring the Orientation of Molecules by Laplacian Eigenfunctions, talk, *Random Shapes Reunion Conference*, Institute for Pure and Applied Mathematics (UCLA), December 9, 2009

7. Large-wavelength instabilities in free-surface Hartmann flow, poster, *Postdoctoral Research Symposium*, Argonne National Laboratory, September 11–12, 2008

8. Linear stability analysis of incompressible free-surface MHD flows, poster, *Annual APS Division of Plasma Physics Meeting 2006*, Philadelphia, Pennsylvania

9. Linear stability analysis of free-surface MHD flows, poster, *Center for Magnetic Self-Organization General Meeting*, Chicago, Illinois, August 4, 2006

Seminars

1. Department of Mechanical Engineering, Massachusetts Institute of Technology, March 5, 2015

2. Department of Applied Physics and Applied Mathematics, Columbia University, October 13, 2014

3. Department of Mathematics, The Pennsylvania Sate University, October 6, 2014

4. Department of Earth, Atmospheric and Planetary Sciences, Purdue University, November 14, 2013

5. Scientific and Statistical Computing Seminar, University of Chicago, May 30, 2013
6. Pacific Northwest National Laboratory, December 6, 2012
7. School of Marine and Atmospheric Sciences, Stony Brook University, November 14, 2012
8. Department of Applied Physics and Applied Mathematics, Columbia University, October 18, 2012
9. Department of Mathematics, North Carolina State University, March 30, 2012
10. Department of Mathematics, Princeton University, March 28, 2012
11. Department of Mathematics, University of Delaware, April 26, 2011
12. Courant Institute of Mathematical Sciences, New York University, April 13, 2011
13. University of Wisconsin, Milwaukee, February 11, 2011
14. Department of Mathematics, Freie Universit at Berlin, November 4, 2009
15. Department of Mechanical Engineering, University of California, Berkeley, December 1, 2008
16. Princeton Plasma Physics Laboratory, September 22, 2008