

David J. Farnham

Education

- 2018 **Ph.D.**, *Columbia University*, New York, NY
Earth and Environmental Engineering Department
Adviser Upmanu Lall, Columbia Water Center
Thesis *Identifying and modeling spatio-temporal patterns in high dimensional climate and weather datasets with applications to water and energy resource management*
- 2015 **M.S., Earth Resources Engineering**, *Columbia University*, New York, NY
Concentration Water Resources and Climate Risks
Thesis *Predictive Statistical Models Linking Antecedent Meteorological Conditions and Waterway Bacterial Contamination in Urban Waterways*
- 2012 **B.S., Civil Engineering**, *SUNY-Buffalo*, Buffalo, NY
Summa Cum Laude, Honors College member
- 2012 **B.A., Mathematics**, *SUNY-Buffalo*, Buffalo, NY
Summa Cum Laude, Honors College member

Experience

Research

- 2018–Present **Postdoctoral Research Scientist**, *Working with Dr. Ken Caldeira*, Carnegie Science & Department of Global Ecology, Stanford University, Stanford, CA
- 2012–2018 **Graduate Student Researcher**, *Working with Dr. Upmanu Lall*, Columbia Water Center & Department of Earth and Environmental Engineering, Columbia University, New York, NY
- 2012 **Student Researcher**, *Working with Dr. Joe Atkinson*, Department of Civil and Environmental Engineering, SUNY-Buffalo, Buffalo, NY
- 2012 **Student Researcher**, *Ecosystem Restoration through Interdisciplinary Exchange*, NSF IGERT REU, SUNY-Buffalo, Buffalo, NY

Teaching

- 2015 **Teaching Assistant & Guest Lecturer**, *Environmental Data Analysis (Graduate level)*, Department of Earth and Environmental Engineering, Columbia University, New York, NY
- 2015 **Teaching Assistant**, *Better Planet By Design (Undergraduate level)*, Department of Earth and Environmental Engineering, Columbia University, New York, NY
- 2014–2016 **Lead Module Developer**, *HydroViz Web Modules: Teleconnections Module*, <https://hydroviz.org>, (HydroViz is a web-based, student-centered educational system designed to support active learning in the field of hydrology)

Student Advisement

- 2020–Present Yash Amonkar (PhD student at Columbia University)
- 2017–2019 Zeyu Xue, Jianan Cao, Bingquan Wu (master's students at Columbia University)
- 2016–2017 Caroline Schwab (high school student)

Journal Reviewer

- 2017–Present Climate Research, Geophysical Research Letters, Hydrology and Earth System Sciences, International Journal of Geographical Information Science, Science of the Total Environment, Water Research, and Water Resources Research

Diversity, Equity, and Inclusion

- 2020–Present **Coordinator**, *Department of Global Ecology*, Facilitated weekly departmental working group discussions to spur initiatives to make the department a more welcoming and supportive environment, particularly for researchers and staff from underrepresented groups
- 2020 **Training participant**, *Department of Global Ecology*, *Implementing an inclusive search* led by Dr. Stephanie Goodwin (President of Incluxion Works, Inc)

Conferences

- 2019, 2020 **Outstanding Student Paper Award Judge**, American Geophysical Union Fall Meeting
- 2019 **Chair & Convener**, *NH51A/NH53B: Emerging Needs and Approaches for Climate Services: Understanding and Developing Innovative Approaches to User-Oriented Climate Services*, American Geophysical Union Fall Meeting, San Francisco, CA
- 2019 **Chair & Convener**, *H12B/H13J: Advances in Integrated Data Collection, Analyses, and Flood Modeling of Complex Urban Systems*, American Geophysical Union Fall Meeting, San Francisco, CA

Seminar organizing

- 2018–Present **Seminar Committee Member**, *Department of Global Ecology*, Helped plan and run weekly seminars

Publications and Presentations

Peer-reviewed Journal Articles Published, In Press, or Accepted

- [1] Doss-Gollin, J., **Farnham, D. J.**, Lall, U., Modi, V., “How unprecedented was the February 2021 Texas cold snap?” In: (2021). (accepted at *ERL*; preprint: <https://eartharxiv.org/repository/view/2122/>).
- [2] HUI, Y., **Farnham, D. J.**, Atkinson, J., Zhu, Z., Feng, Y., “Circulation in Lake Ontario: A Numerical and Physical Model Analysis (accepted)”. In: *Journal of Hydraulic Engineering* (2021).
- [3] Doss-Gollin, J., **Farnham, D. J.**, Ho, M., Lall, U., “Adaptation over Fatalism: Leveraging High-Impact Climate Disasters to Boost Societal Resilience”. In: *Journal of Water Resources Planning and Management* 146.4 (Apr. 2020), p. 01820001. doi: 10.1061/(ASCE)WR.1943-5452.0001190.
- [4] Ruggles[†], T. H., **Farnham[†], D. J.** Tong, D., Caldeira, K., “Developing reliable hourly electricity demand data through screening and imputation”. In: *Scientific Data* 7.1 (2020), p. 155. doi: 10.1038/s41597-020-0483-x.
- [5] Zeng, P., Sun, X., **Farnham, D. J.**, “Skillful statistical models to predict seasonal wind speed and solar radiation in a Yangtze River estuary case study”. In: *Scientific Reports* 10.1 (2020), p. 8597. doi: 10.1038/s41598-020-65281-w.
- [6] Doss-Gollin, J., **Farnham, D. J.**, Steinschneider, S., Lall, U., “Robust Adaptation to Multiscale Climate Variability”. In: *Earth’s Future* 7.7 (2019), pp. 734–747. doi: 10.1029/2019EF001154.
- [7] **Farnham, D. J.**, Doss-Gollin, J., Lall, U., “Regional Extreme Precipitation Events: Robust Inference From Credibly Simulated GCM Variables”. In: *Water Resources Research* 54.6 (2018), pp. 3809–3824. doi: 10.1002/2017WR021318.
- [8] Hamidi, A., **Farnham, D. J.**, Khanbilvardi, R., “Uncertainty analysis of urban sewer system using spatial simulation of radar rainfall fields: New York City case study”. In: *Stochastic Environmental Research and Risk Assessment* 32.8 (2018), pp. 2293–2308. doi: 10.1007/s00477-018-1563-8.
- [9] Cooper, C. B., Larson, L. R., Holland, K. K., Gibson, R. A., **Farnham, D. J.**, Hsueh, D. Y., Culligan, P. J., McGillis, W. R., “Contrasting the Views and Actions of Data Collectors and Data Consumers in a Volunteer Water Quality Monitoring Project: Implications for Project Design and Management”. In: *Citizen Science: Theory and Practice* 2.1 (2017), pp. 1–14. doi: 10.5334/cstp.82.
- [10] **Farnham, D. J.**, Steinschneider, S., Lall, U., “Zonal Wind Indices to Reconstruct CONUS Winter Precipitation”. In: *Geophysical Research Letters* 44.24 (Nov. 2017), pp. 12, 236–12, 243. doi: 10.1002/2017GL075959.
- [11] **Farnham, D. J.**, Gibson, R. A., Hsueh, D. Y., McGillis, W. R., Culligan, P. J., Zain, N., Buchanan, R., “Citizen science-based water quality monitoring: Constructing a large database to characterize the impacts of combined sewer overflow in New York City”. In: *Science of The Total Environment* (2016). doi: 10.1016/j.scitotenv.2016.11.116.
- [12] **Farnham, D. J.**, Lall, U., “Predictive statistical models linking antecedent meteorological conditions and waterway bacterial contamination in urban waterways”. In: *Water Research* 76 (2015), pp. 143–159. doi: 10.1016/j.watres.2015.02.040.

"†" indicates equal contribution

Articles In Review or Preparation

- [1] Amonkar, Y., **Farnham, D. J.**, Lall, U., "A novel spatio-temporal simulator for large-scale wind and solar power availability". (in prep). 2021.
- [2] Antonini, E. G. A., Ruggles, T. H., **Farnham, D. J.**, Calderia, K., "Meeting Electricity Demand With Distributed Wind and Solar Generation: System Flexibility Drives Optimal Siting". (in review). 2021.
- [3] Brown, P. T., **Farnham, D. J.**, Calderia, K., "Wind and Solar Droughts over western North America". (in review); preprint: <https://www.researchsquare.com/article/rs-433450/v1>. 2021.
- [4] **Farnham, D. J.**, Caldeira, K., "Availability of solar and wind energy during extreme high heat events". (in prep). 2021.
- [5] **Farnham, D. J.**, Duan, L., Caldeira, K., "Could a global interconnected energy grid be a greenhouse gas mitigation game changer?" (in prep). 2021.
- [6] **Farnham, D. J.**, Lall, U., Kwon, H.-H., "Long-term Trends, Decadal Variability, and Teleconnections associated with Sub-weekly Precipitation Extremes from a Multicentury Record". (in prep). 2021.
- [7] **Farnham, D. J.**, Lewis, N., Davis, S., Caldeira, K., "Constraining projections under deep uncertainty: the future of US electricity generation". (in prep). 2021.
- [8] **Farnham, D. J.**, Modi, V., Lall, U., "Interannual to decadal climate variations present risks and opportunities for managing wind/solar power supply". (in prep). 2021.
- [9] Henry, C. L., Caldeira, K., **Farnham, D. J.**, Ruggles, T., Peer, R., DeCarolis, J., Eshraghi, H., Lugovoy, O., Potashnikov, V., Waite, M., Wu, Y., Modi, V., "Model Benchmarking Efforts for Capacity Expansion Models". (in review at *Applied Energy*). 2021.
- [10] Tong, D., **Farnham, D. J.**, Duan, L., Zhang, Q., Lewis, N., Caldeira, K., Davis, S., "Geophysical constraints on the reliability of solar and wind power worldwide". (in review at *Nature Communications*). 2021.
- [11] Yuan, S., **Farnham, D. J.**, Lall, U., Modi, V., "Simultaneous increasing electricity demand for heating and reliance on wind energy: Demand side management using heat pumps during extreme cold events". (in minor revision at *Energy*). 2021.

Conference Presentations, Posters, and Non-peer-reviewed Papers

- [1] Caldeira, K., **Farnham, D. J.**, Davis, S. J., Duan, L., Henry, C., Dowling, J. A., Lewis, N., Peer, R., Rinaldi, K., Ruggles, T., "A Simple Energy Modeling Framework for Transparent Investigation of Fundamental Energy System Properties". In: *AGU Fall Meeting 2019*. AGU. 2019.
- [2] **Farnham, D. J.**, Caldeira, K., "Availability of solar and wind energy during extreme high heat events". In: *AGU Fall Meeting 2019*. AGU. 2019.
- [3] **Farnham, D. J.**, Caldeira, K., Davis, S. J., Lewis, N., Duan, L., Henry, C., Ruggles, T., Peer, R., Dowling, J. A., Rinaldi, K., Tong, D., "The Macro Energy Model: Characterization and utility of an extremely simple energy model". In: *OpenMod workshop*. NREL. 2019.
- [4] **Farnham, D. J.**, Davis, S. J., Lewis, N., Ruggles, T., Caldeira, K., "Constraining projections under deep uncertainty: the future of US electricity generation". In: *AGU Fall Meeting 2019*. AGU. 2019.
- [5] Henry, C., DeCarolis, J., **Farnham, D. J.**, Ruggles, T., Queiroz, A., Eshraghi, H., Peer, R., Caldeira, K., "Generating a framework for inter-model comparisons in electricity dispatch modeling". In: *AGU Fall Meeting 2019*. AGU. 2019.
- [6] Rinaldi, K., Duan, L., **Farnham, D. J.**, Ruggles, T., Caldeira, K., Lewis, N., "Evaluating a near-zero emissions electricity system for California with a simple energy model". In: *AGU Fall Meeting 2019*. AGU. 2019.
- [7] Ruggles, T., Caldeira, K., Duan, L., **Farnham, D. J.**, Henry, C., Peer, R., "Electric Grid Reliability Implications for a Near-Zero Emissions Energy System". In: *AGU Fall Meeting 2019*. AGU. 2019.
- [8] Tong, D., Caldeira, K., **Farnham, D. J.**, Duan, L., Lewis, N., Davis, S. J., "Geophysical constraints on the reliability of solar and wind electricity systems worldwide". In: *AGU Fall Meeting 2019*. AGU. 2019.
- [9] Doss-Gollin, J., **Farnham, D. J.**, Steinschneider, S., Lall, U., "Robust Adaptation to Multi-Scale Climate Variability". In: *American Geophysical Union Fall Meeting*. Washington, DC, Dec. 2018. doi: 10.13140/RG.2.2.28447.20649.

- [10] Faranda, D., Messori, G., Doss-Gollin, J., **Farnham, D. J.**, Lall, U., Yiou, P., "Dynamics and Thermodynamics of weather extremes: a dynamical systems approach". In: *European Geosciences Union General Assembly*. 2018.
- [11] **Farnham, D. J.**, Lall, U., "Climate induced decadal variations in wind/solar energy generation potential and heating/cooling energy demand". In: *AGU Fall Meeting*. Washington, DC, 2018.
- [12] Cao, J., **Farnham, D. J.**, Lall, U., "Spatial-temporal wind field prediction by Artificial Neural Networks". In: vol. abs/1712.05293. 2017. arXiv: 1712.05293.
- [13] Doss-Gollin, J., **Farnham, D. J.**, Lall, U., "Designing and operating infrastructure for nonstationary flood risk management". In: *AGU Fall Meeting*. New Orleans, LA, 2017.
- [14] Faranda, D., Messori, G., Doss-Gollin, J., **Farnham, D. J.**, Lall, U., Yiou, P., "Dynamics and Thermodynamics of weather extremes: a dynamical systems approach". In: *AGU Fall Meeting*. New Orleans, LA, 2017.
- [15] **Farnham, D. J.**, Doss-Gollin, J., Lall, U., "Regional intense precipitation: inference from credibly simulated GCM variables". In: *North East Graduate Student Water Symposium*. Amherst, Mass, 2017.
- [16] **Farnham, D. J.**, Steinschneider, S., Lall, U., "Zonal wind indices to reconstruct United States winter precipitation during El Niño". In: *AGU Fall Meeting*. New Orleans, LA, 2017.
- [17] Gawthrop, E., **Farnham, D. J.**, Fiondella, F., Owusu, A. S., Thomson, M., Ambani, M., Percy, F., Chung, W., McKeown, K., "Media Analysis: Communication of the 2015/16 El Niño in Kenya". In: *97th American Meteorological Society Annual Meeting*. Seattle, WA, 2017.
- [18] Doss-Gollin, J., **Farnham, D. J.**, Lall, U., "Global-Local Interactions Modulate Tropical Moisture Exports to the Ohio River Basin". In: *AGU Fall Meeting*. San Francisco, CA, 2016.
- [19] **Farnham, D. J.**, Doss-Gollin, J., Lall, U., "Seasonal climate signals and synoptic circulation patterns associated with regional daily intense precipitation in the Ohio River Basin". In: *Workshop on Sub-Seasonal to Seasonal Predictability of Extreme Weather and Climate*. Columbia University, 2016.
- [20] **Farnham, D. J.**, Doss-Gollin, J., Lall, U., "Space-time characteristics and statistical predictability of extreme sub-weekly precipitation events in the Ohio River Basin". In: *AGU Fall Meeting*. San Francisco, CA, 2016.
- [21] Habib, E., Tarboton, D., Deshotel, M., **Farnham, D. J.**, "Development of Student-centered Modules to Support Active Learning in Hydrology". In: *ASCE Annual Conference & Exposition*. New Orleans, LA, 2016.
- [22] Larson, L. R., Cooper, C. B., Krafte, K., Gibson, R., **Farnham, D. J.**, Hsueh, D., Culligan, P., Wade McGillis, "Characterizing citizen scientists based on project engagement: Data generators, data users, and "onlooker effects."" In: *Southeastern Recreation Research Conference*. Asheville, NC, 2016.
- [23] **Farnham, D. J.**, Habib, E., Lall, U., "HydroViz: A Web-based Climate Teleconnection Module for Undergraduate and Graduate Water Engineering Students". In: *AGU Fall Meeting*. San Francisco, CA, 2015.
- [24] **Farnham, D. J.**, Lall, U., Kwon, H.-H., Doss-Gollin, J., "Moisture Transport and Extreme Precipitation in Mid-latitudes". In: *AGU Fall Meeting*. San Francisco, CA, 2015.
- [25] Habib, E., Bodin, M., Taboton, D., Merck, M., **Farnham, D. J.**, "Stimulating Active Learning in Hydrology Using Research-Driven, Web-based Learning Modules". In: *ASCE Annual Conference & Exposition*. Seattle, WA, 2015.
- [26] Hsueh, D. Y., **Farnham, D. J.**, Gibson, R. A., McGillis, W. R., Zheng, Y., Buchanan, R., Eddowes, D., Zain, N., Loiselle, S., Butkiewicz, L., "NYC URBAN WATER QUALITY: MONITORING THE FLOW OF CSOS WITH CITIZEN SCIENTISTS". In: *Aquatic Sciences Meeting*. Granada, Spain, 2015.
- [27] Hsueh, D., **Farnham, D. J.**, Gibson, R., McGillis, W. R., Culligan, P. J., Cooper, C., Larson, L., Mailloux, B. J., Buchanan, R., Borus, N., Zain, N., Eddowes, D., Butkiewicz, L., Loiselle, S. A., "Advancing the Potential of Citizen Science for Urban Water Quality Monitoring: Exploring Research Design and Methodology in New York City". In: *AGU Fall Meeting*. San Francisco, CA, 2015.
- [28] **Farnham, D. J.**, Atkinson, J. F., "Flow visualization study: Understanding water circulation in Lake Ontario through physical modeling". In: *The 22nd Annual Great Lakes Research Consortium Student-Faculty Conference*. Oswego, NY, 2012.

Invited Presentations

- [1] *Bronx Sewershed Water Quality and Citizen Science (with W. McGillis and D. Hsueh)*. Interdisciplinary Workshop on Urban Green Infrastructure: Reports on Monitoring, Modeling, Performance & Design Work. Columbia University, New York, NY, USA, 2015.

- [2] *Extreme Rainfall Mechanisms, Prediction, and Simulation at Chonbuk National University in Summer 2015*. NSF EAPSI closing ceremony presentation series at the National Research Foundation of Korea. Seoul, South Korea, 2015.
- [3] *NYC Urban Water Quality: Monitoring the Flow of CSOs with Citizen Scientists (with R. Gibson and D. Hsueh)*. Citizens Advisory Committee, New York-New Jersey Harbor & Estuary Program meeting. New York, NY, USA, 2015.
- [4] *Water Quality Monitoring: 2013 Citizens' Water Quality Testing Program*. New York City Department of Environmental Protection and New York City Department of Health. New York, NY, USA, 2014.
- [5] *Understanding Climate Risks in an Urban Environment (with M. Haraguchi)*. NSF IGERT, Solving Urbanization Challenges by Design summer workshop series. Columbia University, New York, NY, USA, 2013.
- [6] *Urban Water Cycle Responses to Climate*. NSF IGERT, Solving Urbanization Challenges by Design Brown Bag seminar series. Columbia University, New York, NY, USA, 2013.

Invited Panel Participation

- [1] *2016 Planet Forward Sustainable Cities Summit: Rethinking Water: Solutions for a 21st Century Infrastructure*. George Washington University, Washington DC, USA, 2016.
- [2] *Earth Institute Sustainable Development Seminar Series: The Monster El Niño Of 2015-16: What Was Expected? And, What Was Done?* Columbia University, New York, NY, USA, 2016.

Professional Affiliations

Member, American Geophysical Union and American Meteorological Society

Select Honors and Awards

- 2015 **National Science Foundation/National Research Foundation of Korea EAPSI Fellowship**, National Science Foundation
- 2015 **Graduate Research Fellowship Program Honorable Mention**, National Science Foundation
- 2012–Present **Integrated Graduate Education and Research Traineeship**, National Science Foundation
- 2012 **Best Poster Presentation**, 22nd Annual Great Lakes Research Consortium
- 2012 **Garmen Scholarship, Robert P. Apmann Memorial Award, and Undergraduate Research Award**, SUNY-Buffalo

Recent Community Involvement

- 2017–2018 **Volunteer**, *We Run As One Summer Youth Basketball and cultural exchange*, New York, NY
Event set-up, take-down, and score keeping
- 2014–2018 **Volunteer**, *Student Sponsor Partners*, New York, NY
High school student mentor
- 2014, 2016, 2017 **Volunteer**, *International Research Institute for Climate and Society*, New York, NY
Facilitator at Lamont Doherty Earth Observatory open house
- 2013–2014 **Volunteer**, *Citizen's Water Quality Testing Program*, New York, NY
Water quality sampling site coordinator

Select Computer Skills

- Languages **R**, Python, Matlab, C++
- Communication **L^AT_EX**, Markdown, Jupyter
- Modeling **stan**
- Reproducibility **git**

Media Appearances

- December 12, 2018 **Work highlighted and quoted in Ines Kagubare's: "Study tracks climate variation's impact on green power"**, E&E News
<https://www.eenews.net/climatewire/2018/12/12/stories/1060109407>

- December 11, 2018 **Work highlighted and quoted in Sarah Fecht's: "How climate impacts solar and wind power supply"**, Earth Institute's State of the Planet blog *and* Phys.org
<https://blogs.ei.columbia.edu/2018/12/11/climate-solar-wind-power-supply/> *and*
<https://phys.org/news/2018-12-climate-impacts-solar-power.html>
- September 20, 2017 **Quoted in Renee Cho's: "What the U.S. Military is Doing About Climate Change"**, Earth Institute
<https://phys.org/news/2018-12-climate-impacts-solar-power.html>
- April 28, 2016 **Quoted in Mike Hower's: "Sustainable Cities Summit tackles the challenges of urban sustainability"**, Planet Forward
<https://www.planetforward.org/2016/04/28/sustainable-cities-summit-tackles-the-challenges-of-urban-sustainability>
- April 27, 2016 **Quoted in Mike Hower's: "The 5 toughest challenges tomorrow's cities face"**, GreenBiz
<https://www.greenbiz.com/article/5-toughest-challenges-tomorrows-cities-face>

Blog Posts

- March 16, 2021 **How Unprecedented Was the February 2021 Texas Cold Snap?**, Authored with James Doss-Gollin, Upmanu Lall, and Vijay Modi for Earth Institute's State of the Planet blog
<https://blogs.ei.columbia.edu/2021/03/16/unprecedented-texas-cold-snap/>