

# David J. Farnham

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## 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

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## 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

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## Publications and Presentations

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

- [1] 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).
- [2] 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.
- [3] Ruggles<sup>†</sup>, T. H., **Farnham<sup>†</sup>, 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.
- [4] 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.
- [5] 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.
- [6] **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.
- [7] 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.
- [8] 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.
- [9] **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.
- [10] **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.
- [11] **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.

<sup>††</sup> 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] Doss-Gollin, J., **Farnham, D. J.**, Lall, U., Modi, V., "How unprecedented was the February 2021 Texas cold snap?" (in revision at *ERL*; preprint: <https://eartharxiv.org/repository/view/2122/>). 2021.
- [5] **Farnham, D. J.**, Caldeira, K., "Availability of solar and wind energy during extreme high heat events". (in prep). 2021.
- [6] **Farnham, D. J.**, Duan, L., Caldeira, K., "Could a global interconnected energy grid be a greenhouse gas mitigation game changer?" (in prep). 2021.
- [7] **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.
- [8] **Farnham, D. J.**, Lewis, N., Davis, S., Caldeira, K., "Constraining projections under deep uncertainty: the future of US electricity generation". (in prep). 2021.
- [9] **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.
- [10] 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.
- [11] 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.
- [12] 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<sup>A</sup>T<sub>E</sub>X**, 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>

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## 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/>