

Claire Valva

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Education

Courant Institute of Mathematical Sciences, New York University

PhD student in Atmosphere Ocean Science and Mathematics (AOSM)

New York, NY

2020–2025 (expected)

University of Chicago

BS in Geophysical Sciences, Mathematics

Chicago, IL

2016–2020

Publications

- **C. Valva**, Giannakis, D. (2023). Consistent Spectral Approximation of Koopman Operators Using Resolvent Compactification. *arXiv:2309.00732*, *Submitted*.
- Parker, J. P., **C. Valva** (2023) Koopman analysis of the periodic Korteweg–de Vries equation. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 10.1063/5.0137088, *Editor's Choice*
- Lloret, J., **C. Valva**, I. Valiela, J. Rheuban, R. Jakuba, D. Hanacek, K. Chenoweth, E. Elmstrom (2022). Decadal trajectories of land-sea couplings: Nitrogen loads, sources, and interception in SE New England watersheds, discharges to estuaries and effects on water quality. *Estuarine, Coastal and Shelf Science*, 10.1016/j.ecss.2022.108057
- **Valva, C.**, N. Nakamura (2021). What controls the probability distribution of local wave activity in the midlatitudes? *Journal of Geophysical Research: Atmospheres*, 126, 10.1029/2020JD034501.

In Prep

- **C. Valva**, Gerber, E.P. (2023). Understanding interactions between the Quasi-Biennial Oscillation and the annual cycle using Koopman analysis.

Awards

Geophysical Fluid Dynamics Fellow (Woods Hole Oceanographic Institute)	2022
National Science Foundation Graduate Research Fellowship	2020
University of Chicago departmental honors in mathematics, geophysical sciences	2020
University of Chicago Dean's Fund Recipient for research-related travel	2018
Jeff Metcalf Summer Undergraduate Research Fellow (Marine Biological Laboratory)	2017, 2018

Skills

Fluent in Julia, Python, MATLAB, R, and \LaTeX with experience in HTML, Jekyll, Javascript, Markdown, C++, and Fortran.

Research and Workshops

Doctoral Researcher, Center for Atmosphere Ocean Science, Courant Institute 2020 – present

- *Dynamic Spectral Mode Decomposition for Geophysical Fluid Flows*: Improved numerical approximations of Koopman operators for applications to quasi-oscillatory geophysical phenomena (i.e. the Quasi-Biennial Oscillation).
- Advised by Prof. Dimitrios Giannakis and Prof. Ed Gerber.

Geophysical Fluid Dynamics Fellow, Woods Hole Oceanographic Institution 2022

- *Data-Driven Methods for Geophysical Fluid Dynamics*: Studied usage of data-driven methods — including Dynamical Mode Decomposition (DMD) and machine learning methods — for use in analysis of geophysical fluid dynamics. Studied methods to detect invariant 2-tori in turbulent flows.
- Advised by Dr. Jeremy Parker (EPFL) and Prof. Peter Schmid (KAUST).

Workshop on Dynamics and Data in the COVID-19 Pandemic, American Institute of Mathematics 2020

- *A Multiscale Approach to Modeling University Impact on Municipal COVID-19 Dynamics*: Explored the use of multiscale modeling and data assimilation. Improved computing performance and accuracy via sample case of disease dynamics.
- Organized by the Mathematical Climate Research Network.

College Research Fellow, University of Chicago 2018 – 2020

- *Distributions of Midlatitude Local Finite-Amplitude Wave Activity*: Explored the controls on probability distributions of local wave activity through simple models and nonlinear PDEs. Study relation between extreme local wave activity values and weather including geopotential height and temperature.

- Advised by Prof. Noboru Nakamura.

Mathematics REU, University of Chicago

2019

- *Riemannian Geometry and Ergodic Flow on Surfaces of Negative Curvature*: Studied the properties of geodesic flow on spaces with negative curvature which include ergodicity and mixing. Also obtained a background in Riemannian geometry, covariant derivatives, and curvature.

Jeff Metcalf Research Scholar, Ecosystems Center, Marine Biological Laboratory

2017, 2018

- *Regime shifts of nitrogen loads and estuarine response*: Analyzed changed trajectories of nitrogen loads in cape cod estuaries and identified drivers of change over 20 years of data. Explored estuarine water quality and biological response to this regime shift as well as varying levels of nitrogen loading. Work included sampling in several Cape Cod estuaries.
- Advised by Ivan Valiela, distinguished scientist.

Presentations

- **Valva, C.**, J.P. Parker (2023). Finding invariant tori in chaos using dynamical mode decomposition *American Physical Society Annual Meeting of the Division of Fluid Dynamics*
- **Valva, C.**, D. Giannakis (2023). Consistent Spectral Approximation of Koopman Operators Using Resolvent Compactification. *SIAM Conference on Dynamical Systems*
- **Valva, C.**, D. Giannakis (2023). Consistent Spectral Approximation of Koopman Operators Using Resolvent Compactification. *Dartmouth College functional analysis seminar*
- **Valva, C.**, E. P. Gerber (2023). A data-driven analysis of the Quasi-Biennial Oscillation with Koopman modes. *NOAA Physical Sciences Laboratory: Atmosphere-Ocean Processes and Predictability Seminar*
- **Valva, C.**, E. P. Gerber (2022). A data-driven analysis of the Quasi-Biennial Oscillation with Koopman modes. *Institute for Mathematical and Scientific Innovation: Confronting Global Climate Change*
- **Valva, C.**, E. P. Gerber (2022). A data-driven analysis of the Quasi-Biennial Oscillation with Koopman modes. *Stratosphere-Troposphere Processes and their Role in Climate General Assembly*
- **Valva, C.**, D. Giannakis (2022). Data-driven spectral analysis of Koopman operators using resolvent compactification. *SIAM Conference on Mathematics of Data Science*
- **Valva, C.**, J. P. Parker, P. Schmid (2022). Dynamical mode decomposition for detection of invariant 2-tori in turbulent flows *Geophysical Fluid Dynamics Program at Woods Hole Oceanographic Institute*
- **Valva, C.**, C. Roberts, E. Pivo (2020). A multiscale approach to modeling university impact on municipal COVID-19 dynamics. *American Institute of Mathematics Workshop on Dynamics and Data in the COVID-19 Pandemic*
- **Valva, C.**, N. Nakamura (2019). What Controls the Local Wave Activity Distribution in the Midlatitudes? *American Geophysical Union Fall Meeting*
- **Valva, C.** (2019). Geodesic Flow and Ergodicity on Surfaces of Negative Sectional Curvature. *University of Chicago REU on Mathematics*
- **Valva, C.**, C. S. Y. Huang, N. Nakamura (2018). Extreme Events as Atmospheric Rogue Waves. *American Geophysical Union Fall Meeting*
- **Valva, C.**, I. Valiela, J. Lloret (2018). Nitrogen load regime change: changes in atmospheric deposition drives trajectory of nitrogen loads in Buzzards Bay estuaries. *Marine Biological Laboratory Undergraduate Research Symposium*
- **Valva, C.**, I. Valiela, J. Lloret, D. Hanacek, S. Sarathy, R. McHorney (2017). Responses of inorganic nitrogen concentrations and producers in Cape Cod estuarine systems subject to differing rates of nitrogen loading. *Marine Biological Laboratory Undergraduate Research Symposium*

Teaching and Outreach

Courant Diversity Equity and Inclusion (DEI) journal club organizer	2021 – present
Teaching Assistant for Columbia University Summer Immersion Program	2021
Expert in Science Buddies Ask an Expert forums	2018 – 2020
Pen Pal in Letters to a Pre-Scientist Program	2019 – 2020
Resident assistant at the Marine Biological Laboratory	2018
Course assistant (VCA) for undergraduate calculus sequence	2017