# Andrew Edward Brettin

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Website
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## Education

**PhD, Atmosphere-Ocean Science and Mathematics** — **May 2025**
*Courant Institute of Mathematical Sciences, New York University* — New York, NY
Advisor: Laure Zanna

**Bachelor of Science, Mathematics** — **May 2019**
*University of Minnesota, College of Science & Engineering* — Minneapolis, MN
Summa cum laude with high distinction (GPA 3.92)

## Technical Skills

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|---|---|
| **Programming languages** | Python (scipy, dask, xarray, scikit-learn, PyTorch, Keras) • MATLAB • Julia • C++ |
| **Workflows** | Bash • git/GitHub • VS Code • Jupyter • Pytorch Lightning • Weights & Biases |
| **Computational skills** | Numerical methods (optimization, quadrature, interpolation, finite difference, spectral methods) • MCMC • High performance computing • Distributed data parallelism |
| **Statistics and ML** | Linear/logistic regression • PCA • Maximum likelihood estimation • Unsupervised learning • Gaussian processes • Autoencoders • CNNs • Statistical-dynamical techniques (Linear inverse models, dynamic mode decomposition, Kalman filtering) |

## Research Projects

**Constraining estimates of coastal sea level variability using quantile neural networks** | 2024–2025
- Devised a novel yet explicit quantile regression neural network framework for learning probability distributions
- Constrained estimates of tide gauge sea level observations under ERA5-estimated atmospheric conditions

**Learning improved propagators for regional sea surface height dynamics** | 2024
- Developed a machine learning architecture based on Koopman operator theory to learn an improved propagator for regional sea surface height forecasts
- Enhanced prediction skill by ∼5%–10% over conventional statistical-dynamical techniques

**Identifying sources of dynamic sea level predictability with mean-variance networks** | 2023–2024
- Leveraged uncertainty-quantifying neural networks to identify changes in sources of dynamic sea level predictability over daily-to-seasonal forecast leads

## Publications

1. **Brettin, Andrew**, Zanna, L. & Barnes, E. A. Learning Propagators for Sea Surface Height Forecasts Using Koopman Autoencoders. *Geophysical Research Letters* **52.** 10.1029/2024GL112835, e2024GL112835 (2025).
2. **Brettin, Andrew**, Zanna, L. & Barnes, E. A. Uncertainty-permitting machine learning reveals sources of dynamic sea level predictability across daily-to-seasonal timescales. *Submitted to Artificial Intelligence for the Earth Systems.* 10.48550/arXiv.2502.11293 (2025).
3. Falasca, F. *et al.* Exploring the nonstationarity of coastal sea level probability distributions. *Environmental Data Science* **2.** 10.1017/eds.2023.10, e16 (2023).
4. Meyer, K. *et al.* Nitrogen-induced hysteresis in grassland biodiversity: a theoretical test of litter-mediated mechanisms. *The American Naturalist* **201.** 10.1086/724383, E153–E167 (2023).
5. **Brettin, Andrew**, Rossi-Goldthorpe, R., Weishaar, K. & Erovenko, I. V. Ebola could be eradicated through voluntary vaccination. *Royal Society Open Science* **5.** 10.1098/rsos.171591, 171591 (2018).

## Communication Experience

- **Selected presentations**
  - Andrew Brettin, Laure Zanna, and Elizabeth Barnes (2023). *Identifying Drivers of Subseasonal-to-Seasonal Sea Level Predictability Using Uncertainty-Permitting Machine Learning*. Oral session, AGU Fall Meeting.
  - Andrew Brettin and Laure Zanna (2022). Constraining Estimates for South American Sea Level Extremes Using Uncertainty-Permitting Machine Learning. Poster session session, AGU Fall Meeting.
  - Andrew Brettin and Laure Zanna (2022). *Characterizing the Impacts of Continental Shelf Depth on Sea Level Variability Using Clustering*. Poster session, AGU Ocean Sciences Meeting.
- **Teaching and tutoring**
  - Recitation leader, Numerical Methods, *New York University* (Fall 2021)
  - Peer tutor, Honors Calculus I–IV, *University of Minnesota, University Honors Program* (Fall 2016–Spring 2019)

## Workshops

- NASA/JPL Summer School on Satellite Observations and Climate Models
  *Keck Institute for Space Studies, Caltech, Pasadena, CA*
- LEAP Momentum Bootcamp on Climate Data Science
  *Columbia University, New York, NY*
- Workshop on Climate Change and Resilience: Methods of Dynamical Systems and Data Assimilation
  *American Institute of Mathematics, San Jose, CA*

## Service and Outreach

- Vice President, Courant Student Organization, *New York University* (Fall 2021–Summer 2022)
- Volunteer tutor, math grades 5–8, *Common Denominator* (Fall 2021–Spring 2022)
- Project mentor, Undergraduate Research Program in Data Science, *NYU Center for Data Science, in collaboration with NSBP* (Spring 2021)
- Reviewer, *Geophysical Research Letters* (2025–)