

Justin Cooke | Postdoctoral Fellow

University of Rhode Island Graduate School of Oceanography

Narragansett, RI

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Professional Appointments

Postdoctoral Fellow

2024 - Present

Graduate School of Oceanography, University of Rhode Island, Narragansett, RI

Advisors: Kathleen Donohue and D. Randolph Watts

Project: Understanding Gulf Ocean Systems (UGOS). Assessed role of deep (> 1000 m depth) mesoscale eddies in forecast performance in the Gulf of Mexico and compared against pressure inverted echo sounder data, and investigated deep eddy variability using modal and spectral analysis. Leading synthesis paper on deep energy in the Gulf.

Project: Southern Ocean Frontal Exchange (SOFE). Using Argo observations, investigating circumpolar cross-frontal heat exchange from mesoscale eddies in the Antarctic Circumpolar Current.

Research Assistant

2024

PennSED Lab, University of Pennsylvania, Philadelphia, PA

Advisors: Douglas Jerolmack and Paulo Arratia

Project: Explored universal scaling of internal boundary layers.

Education

Ph.D. in Mechanical Engineering, University of Pennsylvania

2019 - 2024

Department of Mechanical Engineering and Applied Mechanics. Philadelphia, PA

Dissertation: "Computational Study on Rough Wall-Bounded Flows and their Effects at Low and Very-High Reynolds Numbers"

Advisor: George Ilhwan Park; Committee: Doug Jerolmack & Paulo Arratia

B.S. in Mechanical Engineering, University of Pittsburgh

2014 - 2018

Department of Mechanical Engineering and Materials Science. Pittsburgh, PA

Magna Cum Laude

Journal Publications

5. **J. P. Cooke***, Donohue, K. A., Rowley, C. D., Thoppil, P. G., and Watts, D. R. (2026). The role of deep mesoscale eddies in ensemble forecast performance. *J. Phys. Ocean.* **56**. <https://doi.org/10.1175/JPO-D-25-0255.1>.
4. **J. P. Cooke***, Park, G. I., Jerolmack, D. J., and Arratia, P. E. (2025). Alternative scaling for

roughness transitions in turbulent flows: The role of the internal boundary layer. *Phys. Rev. Fluids* **10**, 084601. <https://doi.org/10.1103/tmcr-8ss1>.

3. **J. P. Cooke**, Jerolmack, D. J., and Park, G. I. (2025). The evolution of turbulence producing motions in the neutral ABL across a natural roughness transition. *J. Geophys. Res.: Atmos.* **130**, e2024JD041768. <https://doi.org/10.1029/2024JD041768>.
2. **J. P. Cooke**, Jerolmack, D. J., and Park, G. I. (2024). Mesoscale structure of the atmospheric boundary layer across a natural roughness transition. *PNAS* **121**, e2320216121. <https://doi.org/10.1073/pnas.2320216121>.
1. **J. P. Cooke**, Campbell, M. F., Steager, E. B., Bargatin, I., Yim, M. H., and Park, G. I. (2023). Numerical and experimental study on the addition of surface roughness to micro-propellers. *Phys. Fluids* **35**, 113607. <https://doi.org/10.1063/5.0176690>.

* Denotes Corresponding Author.

Manuscripts Under Review

1. **J. P. Cooke***, Donohue, K. A., and Watts, D. R. (2026). Insights into deep mesoscale eddy variability in the Gulf of Mexico. *EGUsphere* **2026**. <https://doi.org/10.5194/egusphere-2026-4505>.

Manuscripts In Preparation

3. K. A. Donohue⁺, Watts, D. R.⁺, **Cooke, J. P.⁺**, et al. (Expected: 2027). Deep variability in the Gulf of Mexico. *Understanding Gulf Ocean Systems Special Issue of Oceanography*.
2. A. Ayouche, Fox-Kemper, B., Freilich, M., Huang, X., Breuer, K., Marston, B., Naylor, D. L., Hell, M., Yu, Y., Matheou, G., Lu, Y., Xiao, S., **Cooke, J. P.**, and Pizzo, N. The coupled frontier of offshore wind energy.
1. S. V. Yates[^], Donohue, K. A., **Cooke, J. P.**, Watts, D. R., and Park, J. H. Increasing Eddy Activity at the Southeast Indian Ridge. (*To be submitted to JGR: Oceans*)

[^] Denotes Mentored Student; ⁺ Denotes Equal Contribution.

Fellowships and Academic Honors

Outstanding Teaching Assistant in MEAM Award Finalist Spring 2021

DoD: Science Mathematics and Research for Transformation (Declined) 2021

National GEM Consortium: GEM Full Fellow 2019

Grants

NASA EPSCoR – Total: \$35k

2026-2027

Energy Fluxes and Velocity Kinematics of the Heterogeneous Polar Tempest

PI: **J Cooke**, Co-PIs: M Freilich (Brown), C Horvat (Brown), and N Pizzo (URI)

NSF ACCESS Discover - Total: 1.5M CPU Hours

2026-2027

Generative Deep Learning for Cloud-Free Submesoscale Ocean Surface Currents at High-Lat.

PI: **J Cooke**, Co-PIs: N Pizzo (URI)

Completed.....

NSF ACCESS Explore - Total: 400k CPU Hours

2024-2025

Influence of a Realistic Roughness Transition on Mesoscale Flow Interactions

PI: J Cooke, Co-PI: GI Park (UPenn)

Teaching

Co-Lecturer

2026

University of Rhode Island Graduate School of Oceanography, Narragansett, RI

- **Introduction to Physical Oceanography** (OCG501), Fall 2026. Instructor: Kathleen Donohue.
 - Developing course unit on surface waves, internal waves, and waves shaped due to Earth's rotation.
 - Giving two graduate level lectures to class of 25 students.

Teaching Assistant

2020–2022

University of Pennsylvania, Philadelphia, PA

- **Heat and Mass Transfer** (MEAM 333), Spring 2022. Instructor: Jennifer Lukes.
 - Led weekly in-person recitations and office hours; deployed active learning strategies to great success.
 - *Anonymous Student Feedback*: "[Justin] is definitely one of the best TAs I have had in MEAM core. He always is really prepared for recitation and can even teach us concepts that we had not covered in lecture yet."
- **Thermodynamics** (MEAM 203), Spring 2021. Instructor: Igor Bargatin.
 - Led remote recitations twice weekly and office hours.
 - Nominated by students for Department's Outstanding Teaching Assistant (Finalist).
- **Fluid Mechanics** (Meam 302), Fall 2020. Instructor: George I. Park.
 - Held weekly remote recitations and twice weekly office hours.

Mentoring and Advising

Co-Mentor, Undergraduate, M.S., and Ph.D.

2024–Present

Graduate School of Oceanography, URI, Narragansett, RI

- Sophie Yates (M.S. 2026, now Ph.D. student, same lab): Met weekly over one year on thesis research, writing, and figure preparation. Student successfully defended and continued to the Ph.D. program.
- Lindsay Grose (Ph.D.): Guided first-author manuscript preparation and response to reviewers; ongoing research support.
- Abbey Gifford (Undergraduate): Co-advising independent study, with weekly meetings.
- Colton Super (Undergraduate): Supporting research efforts and providing coding assistance.

Undergraduate Research Mentor

2024

University of Pennsylvania, Philadelphia, PA

- Ilia Kheirkhah: Developed an LES-based research project; advised on graduate school applications. Now in a Ph.D. program in a related area.

Invited Talks and Seminars

4. "Deep Mesoscale Eddy Variability in the Gulf of Mexico" *Understanding Gulf Ocean Systems Seminar Series*. Virtual, July, 2026.
3. "A 'Deep' Perspective on Forecasting the Loop Current System" *University of Rhode Island Graduate School of Oceanography Spring 2026 Seminar Series*. Narragansett, RI, January, 2026.
2. "A 'Deep' Perspective on Forecasting the Loop Current System" *Woods Hole Oceanographic Institution Physical Oceanography Departmental Seminar*. Woods Hole, MA, January, 2026.
1. "Turbulence is Tough. What Happens When it's Rough?" *University of Rhode Island Ocean Engineering Fall 2025 Sternberger Seminar Series*. Narragansett, RI, October, 2025.

Contributed Talks

11. (Forthcoming) "Revealing Submesoscale Currents in the East Greenland Current System with GOFLOW" *AGU Fall Meeting 2026*. San Francisco, CA, December, 2026.
10. (Forthcoming) "Spirals on the Icy-Sea: Kinematics of Submesoscale Flow Features in the East Greenland Current System" *79th Annual Meeting of the APS Division of Fluid Dynamics*. Orlando, FL, November, 2026.
9. "Deep Mesoscale Eddy Variability in the Gulf of Mexico" *Physical Oceanography Early Career Researcher Symposium*. Narragansett, RI, September, 2026.
8. "How Does an Unconstrained Deep Ocean Impact an Ensemble Forecast? A Call for Deep Observation Assimilation" *AGU Ocean Sciences Meeting 2026*. Glasgow, Scotland, UK, February, 2026.
7. "Ensemble Forecast Performance: An Outlook of the Deep" *Understanding Gulf Ocean Systems Annual Meeting Woods Hole Oceanographic Institution*. Woods Hole, MA, September, 2025.
6. "Roughness Transition Induced Internal Boundary Layers: Insights from Wall-Modeled LES" *Naval Research Lab Ocean Dynamics and Prediction Group Seminar*. Stennis Space Center, MS, March, 2025.
5. "Scaling for Turbulent Flows Encountering Roughness Transitions" *77th Annual Meeting of the APS Division of Fluid Dynamics*. Salt Lake City, UT, November, 2024.
4. "Evolution of the Flow within the Atmospheric Boundary Layer Encountering a Dune Field" *University of Pennsylvania Environmental and Biological Fluid Dynamics Group Seminar*. Philadelphia, PA, February 2024.
3. "Mesoscale Structure of the Atmospheric Boundary Layer Across a Natural Roughness Transition at White Sands National Park" *76th Annual Meeting of the APS Division of Fluid Dynamics*. Washington, D.C., November, 2023.
2. "Computational Study on the Influence of Roughness at Low and Very-High Reynolds Numbers" *University of Pennsylvania MEAM Seminar*. Philadelphia, PA, June, 2023.
1. "Numerical and Experimental Investigation of the Addition of Surface Roughness on Micro-Scale Propeller Performance" *74th Annual Meeting of the APS Division of Fluid Dynamics*. Phoenix, AZ, November, 2021.

Service, Leadership, and Membership

Professional Service:.....

- Reviewer:
 - Physics of Fluids* (2023–Present)
 - Geophysical Research Letters* (2026–Present)
 - Journal of Geophysical Research Oceans* (2026–Present)
- URI GSO Physical Oceanography Seminar Coordinator (2025–2026)
- Early Career Convener, AGU Fall Meeting Session “Understanding Gulf Ocean Systems” (2025).

Leadership:.....

- Society of Hispanic Professional Engineers
 - Graduate Liaison (Penn, 2019–2023)
 - Chapter President (Pitt, 2016–2017, *Small Chapter of the Year Award*)
- B.R.O.T.H.E.R.H.O.O.D. Co-President (Pitt, 2017–2018)

Professional Membership:.....

- American Physical Society (Since 2020)
- American Geophysical Union (Since 2023)

Skills

- **Numerical Simulation:** Wall-modeled LES, Wall-resolved LES, Finite-Volume Methods, Non-hydrostatic Ocean Modeling.
 - *Codes:* GOFLOW (Advanced), CharLES (Advanced), Oceananigans (Basic)
- **Scientific Machine Learning:** Generative Deep Learning for Geophysical Flow Reconstruction, U-Nets, Sci-kit Learn
- **Data Analysis and Observations:** Argo Floats, Satellite Altimetry, Geostationary Satellites, Inverted Echo Sounders (PIES/CPIES), Wind LiDAR, Complex Empirical Orthogonal Function Analysis, Spectral Analysis
- **High-Performance Computing:** Linux/Unix, Slurm, MPI-based Parallel Computing, GPU Computing
- **Programming Languages:** Python (Advanced), MATLAB (Advanced), C++ (Intermediate), Julia (Basic), Fortran (Basic)
- **Development Tools:** Git/GitHub, Visual Studio, Shell Scripting (Bash), LaTeX
- **Languages:** Intermediate Spanish