ETHAN YOUNGIN SHIN

Address: 15 Vassar Street (Building 48), Cambridge MA 02139, USA
Email: youngin@mit.edu
Website: duddlshin.github.io

RESEARCH INTERESTS

Turbulence, Boundary-Layer Meteorology, Air-Sea Interactions, Uncertainty Quantification, Inverse Problems, Environment–Energy System Interactions, Engineering for Global Development

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA, United States *Sep. 2022 – Expected May 2027*
Ph.D. Candidate in Civil and Environmental Engineering
Thesis Advisor: Michael F. Howland

Yonsei University, Seoul, Republic of Korea *Mar. 2016 – Aug. 2022*
B.S. in Mechanical Engineering
Honors: *magna cum laude*

RESEARCH EXPERIENCE

Howland Lab (Prof. Michael Howland), Massachusetts Institute of Technology
Graduate Research Assistant *Sep. 2022 – Present*

- Coupled multifidelity simulations of atmospheric boundary layer flows with forward and inverse uncertainty quantification methods to quantify and reduce uncertainty in turbulence parameterizations across atmospheric conditions
- Investigated the sensitivity and dependence of wall-stress errors (log-layer mismatch) in wall-modeled large-eddy simulations of geophysical flows to numerical setup and surface parameters
- Developed a probabilistic Bayesian method to estimate surface roughness parameters for Monin–Obukhov similarity theory from high-fidelity simulations and field observations, producing estimates with quantified uncertainty

Innovative Design and Integrated Manufacturing Lab (Prof. Sung-Hoon Ahn), Seoul National University
Undergraduate Research Intern *Dec. 2020 – Feb. 2022*

- Conducted field demonstration of a polling-based energy management system with an off-grid solar power plant in Tanzania
- Investigated feasibility of a smart electric mobility operating system for integration with off-grid solar power plants in Tanzania

Multiphysics Energy System Laboratory (Prof. Jongsup Hong), Yonsei University
Undergraduate Research Intern *Jul. 2020 – Aug. 2020*

- Conducted a thermofluidic analysis of a solid oxide fuel cell (SOFC) cooling system using ANSYS Fluent
- Designed and tested the effects of rib turbulators on SOFC interconnect fuel channels

PUBLICATIONS

Working Papers

2. **E. Y. Shin**, B. Kale, and M. F. Howland. "Navigating parameter uncertainty and model-form error in the data-driven development of parameterizations in Earth system models". In preparation.
1. **E. Y. Shin**, B. Kale, and M. F. Howland. "Multi-fidelity modeling and uncertainty quantification of wind–wave interactions in the marine atmospheric boundary layer". In preparation.

Papers in Review

2. **E. Y. Shin** and M. F. Howland. "Probabilistic inference of surface parameters for Monin–Obukhov similarity theory". 2026. arXiv: 2608.21549. In review.
1. **E. Y. Shin**, B. Kale, and M. F. Howland. "Connecting the forward problem to the inverse problem in uncertainty quantification of Earth system models using fast emulators". 2026. arXiv: 2604.19500. In review.

Journal Publications

3. **E. Y. Shin** and M. F. Howland. "Accelerated Bayesian calibration and uncertainty quantification of RANS turbulence model parameters for stratified atmospheric boundary layer flows". *Boundary-Layer Meteorology* 192, 3 (2026). DOI: 10.1007/s10546-025-00945-6.
2. **E. Y. Shin**, X. I. A. Yang, and M. F. Howland. "Addressing grid convergence and log-layer mismatch in wall modeled large eddy simulations of geophysical flows over rough surfaces and canopies". *Boundary-Layer Meteorology* 191, 42 (2025). DOI: 10.1007/s10546-025-00934-9.
1. H. Rhee, H. Im, F. Manongi, **Y. Shin**, H. Song, W. Jung, and S. Ahn. "Smart electric mobility operating system integrated with off-grid solar power plants in Tanzania: Vision and trial run". *Journal of Appropriate Technology* 7.2 (2021), pp. 127–135. DOI: 10.37675/jat.2021.7.2.127.

Conference Proceedings

1. **E. Y. Shin**, M. Chan, J. Wang, T. Zahtila, C. Gorlé, G. Iaccarino, and M. F. Howland. "Multifidelity modeling and uncertainty quantification of heterogeneous roughness". *Proceedings of the Summer Program*. Center for Turbulence Research, Stanford University. 2024.

CONFERENCE PRESENTATIONS AND POSTERS

10. **E. Y. Shin**, B. Kale, and M. F. Howland. "A framework for addressing parameter uncertainty and model-form error in parameterizations using scale-resolving large-eddy simulations." *107th Americal Meteorological Society Annual Meeting*, Jan. 10–14, 2027, Denver, CO, USA.
9. B. Kale, **E. Y. Shin**, and M. F. Howland. "Multi-fidelity modeling of wind-wave interactions using scale-resolving simulations and emulator-accelerated uncertainty quantification." *107th Americal Meteorological Society Annual Meeting*, Jan. 10–14, 2027, Denver, CO, USA.
8. M. F. Howland and **E. Y. Shin**. "A Bayesian framework for uncertainty quantification of surface parameters within Monin–Obukhov similarity theory." *107th Americal Meteorological Society Annual Meeting*, Jan. 10–14, 2027, Denver, CO, USA.
7. **E. Y. Shin**, B. Kale, and M. F. Howland. "Navigating parameter uncertainty and model-form error in the data-driven development of turbulence parameterizations." *79th Annual Meeting of the APS Division of Fluid Dynamics*, Nov. 22–24, 2026, Orlando, FL, USA.
6. **E. Y. Shin**, B. Kale, and M. F. Howland. "Reducing parametric uncertainty in Earth system models with efficient emulators." *MIT Climate & Sustainability Consortium: Poster Session on AI for Sustainability*, Apr. 13, 2026, Cambridge, MA, USA.
5. **E. Y. Shin**, X. I. A. Yang, and M. F. Howland. "Addressing grid convergence and log-layer mismatch in wall modeled large eddy simulations over rough surfaces and canopies." *78th Annual Meeting of the APS Division of Fluid Dynamics*, Nov. 23–25, 2025, Houston, TX, USA.
4. **E. Y. Shin** and M. F. Howland. "Bayesian inversion to quantify parameter uncertainty in RANS turbulence models for stratified atmospheric boundary layer flows." *AMS 25th Symposium on Boundary Layers and Turbulence*, Jun. 17–20, 2025, Turin, Italy.
3. **E. Y. Shin** and M. F. Howland. "Accelerated uncertainty quantification of RANS turbulence models for stratified atmospheric boundary layer flow." *AGU24 Annual Meeting*, Dec. 9–13, 2024, Washington, DC, USA.
2. **E. Y. Shin**, M. Chan, J. Wang, T. Zahtila, C. Gorlé, G. Iaccarino, and M. F. Howland. "Multifidelity modeling and uncertainty quantification of heterogeneous roughness." *77th Annual Meeting of the APS Division of Fluid Dynamics*, Nov. 24–26, 2024, Salt Lake City, UT, USA. (Invited)
1. **E. Y. Shin** and M. F. Howland. "Uncertainty quantification of RANS turbulence model parameters with ensemble Kalman methods and machine learning." *76th Annual Meeting of the APS Division of Fluid Dynamics*, Nov. 19–21, 2023, Washington, DC, USA.

AWARDS AND SCHOLARSHIPS

1st Place Best Student Oral Presentation, American Meteorological Society (25th Symposium on Boundary Layers and Turbulence, Jun. 17–20, 2025)
CEE MathWorks Fellowship, Massachusetts Institute of Technology (Fall 2023, Spring 2024)
Louis Berger Fellowship, Massachusetts Institute of Technology (Spring 2023)
Schoettler Fellowship, Massachusetts Institute of Technology (Fall 2022)
Highest Honors, Yonsei University (Spring 2021)
Honors, Yonsei University (Fall 2016, Spring 2019, Spring 2020, Fall 2020)
Merit-based Scholarship, Yonsei University (2019, 2020, 2021, 2022)
National Scholarship, Korea Student Aid Foundation (2016, 2019, 2020)
Lee Choong Kon Pay Forward Scholarship (Spring 2019)

TEACHING EXPERIENCE

Teaching Assistant
1.861/1.086 Physics and Engineering of Renewable Energy Systems (Prof. Michael F. Howland) *Feb. 2026 – May 2026*

- Delivered one lecture, created four problem sets and a midterm, and held two office hours per week

Teaching Assistant
1.61/1.061 Transport Processes in the Environment (Prof. Heidi Nepf) *Sep. 2025 – Dec. 2025*

- Delivered two lectures, created a problem set, held two office hours per week, and designed a laboratory class on particle advection and diffusion

Guest Lecturer
Leaders in Industry-University Cooperation 3.0 *Jul. 2023 – Present*

- Delivered guest lectures on modeling wind in the atmospheric boundary layer to undergraduate students from Korean universities (Jeonbuk National University, Sookmyung Women's University)

Participant
MIT Teaching & Learning Lab *Feb. 2023 – Dec. 2023*

- Completed the four tracks of the Grad Teaching Development Tracks (equivalent to the Kaufman Teaching Certificate Program), a set of workshops for graduate students interested in improving their teaching skills

Part-time Teacher
ASAP Academy *Jul. 2019 – Aug. 2020*

- Taught high school math, physics, and English grammar to classes of up to 7 students

ACADEMIC SERVICE

Reviewer
Boundary-Layer Meteorology, Wind Energy *Sep. 2025 – Present*

Reviewer
Tackling Climate Change with Machine Learning Workshop, NeurIPS 2025 *Sep. 2025*

Student Member
Committee on Boundary Layers and Turbulence, American Meteorological Society *Feb. 2025 – Present*

VOLUNTEER EXPERIENCE

Volunteer
Loaves and Fishes Meal Program *Dec. 2022 – Sep. 2024*

Volunteer
Yonsei Habitat for Humanity *Mar. 2020 – Jun. 2022*

Student Volunteer
Incheon Support Center for Foreign Workers *Mar. 2016 – Jun. 2016*

LEADERSHIP EXPERIENCE

Panel Director
MIT Energy Conference *Oct. 2023 – Mar. 2024*

President
Charles River Running Crew, MIT KGSA *Jun. 2023 – Jun. 2024*

15th Class President
Yonsei Habitat for Humanity *Mar. 2020 – Jun. 2021*

Student Ambassador
Yonsei–Waseda Exchange Program *Jul. 2016, Feb. 2019*

Police Bus Driver
Auxiliary Police, Republic of Korea (Military Service) *Apr. 2017 – Dec. 2018*