

# ETHAN YOUNGIN SHIN

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## RESEARCH INTERESTS

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Atmospheric Boundary Layer, Turbulence, Uncertainty Quantification, Inverse Problems, Environment-Energy System Interactions, Engineering for Global Development

## EDUCATION

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Massachusetts Institute of Technology, Cambridge, MA, United States

*Sep. 2022 – Present*

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

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Howland Lab (Prof. Michael Howland), Massachusetts Institute of Technology

*Graduate Research Assistant*

*Sep. 2022 - Present*

- Coupling multifidelity simulations of atmospheric boundary layer flows with forward and inverse uncertainty quantification methods, to improve parameterizations of atmospheric turbulence
- Leveraging analytical models and data-driven techniques to improve parameterizations of urban roughness in simulations of atmospheric boundary layer flows

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

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### Journal Publications

3. **Shin, E. Y.**, Kale B., and Howland, M. F. Connecting the forward problem to the inverse problem in uncertainty quantification of Earth system models using fast emulators. *In review*.
3. **Shin, E. Y.** and Howland, M. F. Accelerated Bayesian calibration and uncertainty quantification of RANS turbulence model parameters for stratified atmospheric boundary layer flows. *Boundary-Layer Meteorology*, 192(3).
2. **Shin, E. Y.**, Yang, X. I. A., and Howland, M. F. 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).
1. Rhee, H., Im, H., Manongi, F., **Shin, Y.**, Song, H., Jung, W., Ahn, S. (2021). Smart Electric Mobility Operating System Integrated with Off-Grid Solar Power Plants in Tanzania: Vision and Trial Run. *Journal of Appropriate Technology*, 7(2), 127-135.

### Conference Proceedings

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

## CONFERENCE PRESENTATIONS AND POSTERS

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5. **Shin, E. Y.**, Kale B., and Howland, M. F. 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. **Shin, E. Y.**, Yang, X. I. A., and Howland, M. F. Addressing grid convergence and log-layer mismatch in wall modeled large eddy simulations over rough surfaces and canopies. *77th Annual Meeting of the APS Division of Fluid Dynamics, Nov. 23-25, 2025, Houston, TX, USA.*
4. **Shin, E. Y.** and Howland, M. F. 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, IT.*
3. **Shin, E. Y.** and Howland, M. F. Accelerated uncertainty quantification of RANS turbulence models for stratified atmospheric boundary layer flow. *AGU24 Annual Meeting, Dec. 9-13, 2024, Washington, DC, USA.*
2. **Shin, E. Y.**, Chan, M., Wang, J., Zahtila, T., Gorle, C., Iaccarino, G., and Howland M. F. Multi-fidelity 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. **Shin, E. Y.** and Howland, M. F. 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

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**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

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### Teaching Assistant

*1.861/1.086 Physics and Engineering of Renewable Energy Systems (Prof. Michael F. Howland)* Mar. 2026 - Present

- Created 4 problem sets and a midterm, 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 Kaufman Teaching Certificate Program), a set of workshops intended for early- and mid-program 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

## VOLUNTEER EXPERIENCE

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### 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**

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**Student Member***Committee on Boundary Layers and Turbulence, Americal Meteorological Society**Feb. 2025 - Present***Panel Director***MIT Energy Conference**Oct. 2023 - Mar. 2024***President***Charles River Running Crew, MIT KGSA**June. 2023 - June. 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*