ABIGAIL BODNER

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APPOINTMENTS

Assistant Professor, Department of Earth, Atmospheric, and Planetary Sciences, MIT
Department of Electrical Engineering and Computer Science, MIT — *2024-Present*

Postdoctoral Fellow, Center for Atmosphere Ocean Science, Courant Institute, NYU — *2021-2023*

Research Fellow, Kavli Institute for Theoretical Physics, UCSB — *Fall 2021*

EDUCATION

PhD Earth, Environmental and Planetary Sciences, Brown University — *2021*

ScM Applied Mathematics, Brown University — *2020*

MSc Atmospheric Sciences, Tel Aviv University — *2019*

BSc Tel Aviv University, Double Major: Mathematics & Geophysics — *2014*

HONORS AND AWARDS

X-Window Consortium Career Development Professor — *2024-2027*

Simons Society Junior Fellow — *2021-2024*

Community Earth System Model (CESM) Graduate Student Award — *2022*

Physical Oceanography Dissertation Symposium (PODS) XI — *2021*

Associate of Sigma Xi Scientific Research Honor Society — *2019*

Gulf of Mexico Research Initiative Scholar — *2018*

Departmental Graduate Fellowship, Brown University — *2015*

Rana Samuels Ofran MSc Student Excellence Award, Tel Aviv University — *2014*

PUBLICATIONS

McConkey, R., Balla, J., Bailey, J., Backour, A., Hofgard, E., Jaakola, T., **Bodner, A.**, & Smidt, T. **Turbulence Teaches Equivariance to Neural Networks**. *In preparation for the Journal of Fluid Mechanics - Rapids.*

Si, Y., Johnson, L., & **Bodner, A. Diagnosing Mixed Layer Dynamics from Sea Surface Height Anomalies: A Theoretical Framework**. *In preparation for Geophysical Research Letters.*

Champenois, B., Ali, A., & **Bodner, A. Reconstructing Ocean Mixed Layer Variability from SWOT Using Machine Learning**. *In preparation for Geophysical Research Letters.*

Peng, S. & **Bodner, A. A Theoretical Model for Oceanic Submesoscales Under Next-Order Effects of Strain and Turbulence**. *In preparation for the Journal of Fluid Mechanics.*

Peng, S., Silvestri, S., & **Bodner, A. Submesoscale and Boundary Layer Turbulence Under Mesoscale Forcing in the Upper Ocean**. *Journal of Fluid Mechanics, Under Review.*

Zhang, Z., Dong, J., Yu, X., Qu, L., Wang, S., Cai, W., Qiu, B., Klein, P., Zhang, X., Tang, T., Wenegrat, J., Renault, L., Sasaki, H., Barkan ,R., **Bodner, A.**, Siegelman, L., Fox-Kemper, B., Liu, Z., Xu, L., Zhang, Z., Jing, Z., Yang, H., Jing, Z., Chen, Z., Song, X., Lin, X., Tian, J., & Zhao W. **Oceanic Submesoscale Processes and Their Impacts**. *Nature Reviews Earth & Environment, Under Review.*

Dong, J., **Bodner, A**., Fox-Kemper, B., Dong, C., & Tian, J. **Significant contribution of submesoscales to turbulence in the upper ocean boundary layer of an anticyclonic mesoscale eddy**. *Journal of Physical Oceanography, Under Review.*

Uchida, T., **Bodner, A.**, Reichl, B., Adcroft, A., Fox-Kemper, B. Ilicak, M., & Bentsen, M. (2025) **Surface Mixed-Layer Eddies Affect the Large-Scale Ventilation of the Global Ocean**. *Geophysical Research Letters, In Press.*

Bodner, A., Balwada, D., & Zanna, L. (2025) **A Data-Driven Approach for Parameterizing Ocean Submesoscale Buoyancy Fluxes**. *Journal of Advances in Modeling Earth Systems, doi.org/10.1029/ 2025MS004991.*

Dong, J., Fox-Kemper, B., Wenegrat, J.O., **Bodner, A**., Zhang, H., Yu, X., & Dong, C., Belcher, S. (2024) **Submesoscales are a significant turbulence source in global ocean surface boundary layer**. *Nature Communications, doi.org/10.1038/s41467-024-53959-y*

Bodner, A., Fox-Kemper, B., Johnson, L., Van Roekel, L.P., McWilliams, J.C., Sullivan, P.P., Hall, P.S., & J.Dong (2023). **Modifying the Mixed Layer Eddy Parameterization to Include Frontogenesis Arrest by Boundary Layer Turbulence**. *Journal of Physical Oceanography.* (doi.org/10.1175/JPO-D-21-0297.1)

Bodner, A. & Fox-Kemper, B. (2020). **A Breakdown in Potential Vorticity Estimation Delineates the Submesoscale-to-Turbulence Boundary in Large Eddy Simulations**. *Journal of Advances in Modeling Earth Systems*, e2020MS002049. (doi.org/10.1029/2020MS002049)

Bodner, A., Fox-Kemper, B., Van Roekel, L.P., McWilliams, J.C. & Sullivan, P.P. (2019).
A Perturbation Approach to Understanding the Effects of Turbulence on Frontogenesis. *Journal of Fluid Mechanics*, 883. (doi.org/10.1017/jfm.2019.804)

GRANTS AND COLLABORATIONS

NSF Physical Oceanography, Lead PI *Pending*
Quantifying mixing and restratification in the upper ocean: a unified approach

NSF Collaborations in Artificial Intelligence and Geosciences (CAIG), Co-Investigator *2025-2028*
Understanding Ocean Physics via Multiscale AI Emulators

MIT Research Support Committee *2025*
Estimating Cross-Scale Energy Fluxes in the Global Ocean

NASA SWOT Science Team, Co-Investigator *2024-2028*
Leveraging machine learning, realistic simulations and in-situ observations to infer submesoscale transport

EECS Transformative Research Fund, Co-Investigator *2024-2026*
Multi-Scale Climate Turbulence with Euclidean Neural Networks

NSF Collaborations in Artificial Intelligence and Geosciences (CAIG), Collaborator *2024-2027*
Leveraging AI to Observe and Predict the Drivers of Mixed Layer Heat Inventory Variability

NASA Transform to Open Science Training, Co-Investigator *2023-2025*
An Open, Community Supported, Accessible Summer School for Climate Science

SELECTED PRESENTATIONS

International Liège Colloquium on Ocean Dynamics (**invited**) *2026*
Atmospheric & Oceanic Fluid Dynamics (**oral**) | Gordon Research Conference of Ocean Mixing (**invited**)

Max Planck Institute CELLO (**keynote**) | University of Rhode Island (**invited**) | *2025*
Harvard University (**invited**) | Women in Data Science (**invited**) | Simons Foundation (**invited**) |
Climate Process Team (**oral**) | MIT Center for Computational Science and Engeneering (**invited**)

MIT Climate and Robotics Workshop (**keynote**) | Brown University (**invited**) *2024*
Ocean Sciences Meeting (**oral**) | Complex Systems Workshop (**keynote**)

NOAA Geophysical Fluid Dynamics Laboratory (**invited**) *2023*
Ocean Transport and Eddy Energy meeting (**invited**) | DRAKKAR Ocean Modelling Workshop (**keynote**)

American Geophysical Union Fall Meeting (**invited**) | CESM workshop (**award recipient**) *2022*
Woods Hole Oceanographic Institution (**invited**) | Ocean Sciences Meeting (**oral**)

University of Cambridge (**invited**) | Ocean Model Working Group Winter Meeting (**oral**) *2021*
Kavli Institute for Theoretical Physics (**invited**) | Weizmann Institute of Science (**invited**)

Yale University (**invited**) | Courant Institute of Mathematical Sciences (**invited**) *2019*
Atmospheric and Oceanic Fluid Dynamics Meeting (**best presentation award**)
US CLIVAR Sources and Sinks of Ocean Mesoscale Eddy Energy Workshop (**oral**)

MIT ADVISING

PhD

Raphael Benamran, EAPS PhD *2025- Present*
Cody Cruz, MIT-WHOI Joint Program PhD *2025- Present*
Sarah Snider, CSE-Math PhD *2024- Present*

Postdoctoral Researchers

Dr. Ryley McConkey (joint with Prof. Tess Smidt, EECS) *October 2024- Present*
Dr. Scott Conn *January 2026 - Present*
Dr. Shirui Peng *July 2024- February 2026*
Dr. Yidongfang Si *July 2025 - March 2026*

Second Generals

Kenneth Gee, EAPS PhD *2024/2025*
Cathrine Zhang, MIT-WHOI Joint Program PhD *2025/2026*

Masters

Anshul Agarwal, EECS-SDM dual SM *2024- Present*

UROP

Siiri Roschier, Course 6 *Fall 2025-Present*

Undergraduate Academic

Anoushka Tamhane, Course 1-12 *Fall 2025 - Present*
Katherine Stabb, Course 1-12 *Fall 2025 - Present*
Landon Hering, Course 6 *Fall 2025 - Present*
Yuanxi Li, Course 6 *Fall 2025 - Present*
Vidya Ranjan, Course 6 *Fall 2025 - Present*
Eleanor Yang, Course 6 *Fall 2025 - Present*
Richard Yeboah, Course 6 *2024-2025*
Andres Arroyo, Course 6 *2024-2025*

Visiting

Aalyaan Ali, Brown University, undergraduate student *Summer 2025*
Junyang Gou, ETH Zurich, PhD student *Fall 2025*

Student Awards

Raphael Benamran, MIT Presidential Fellowship *2025*
Cody Cruz, MIT-WHOI Presidential Fellowship *2025*
Cody Cruz, NSF Graduate Research Fellowship *2025*

MIT TEACHING

12.S992 AI for Climate Action, Common Ground for Computing Education *Spring 2026*
12.850 Computational Ocean Modeling, EAPS *Spring 2026*
Modeling the Earth System and Climate, EAPS *Planned for Fall 2026*

MIT SERVICE

Departmental
Climate System Science and Engineering (Course 1–12) Steering Committee *2024- Present*
Center for Computational Science and Engineering Core Member & Graduate Committee *2024- Present*
EAPS PAOC Graduate Curriculum committee *2024- Present*
EAPS PAOC UCAR/NCAR representative *2024- Present*

Student Committees
Elena Perez, MIT-WHOI Joint Program PhD, Thesis *2024- Present*
Lilli Enders, MIT-WHOI Joint Program PhD, Thesis *2024- Present*
Xin Kai Lee, EAPS PhD, Thesis *2025- Present*
Cathrine Zhang, MIT-WHOI Joint Program PhD, Generals *Spring 2026*
Samson Mercier, EAPS PhD, Generals *Spring 2026*
Leah Albrow, EAPS PhD, Generals *Spring 2026*
Kenneth Gee, EAPS PhD, Generals *Fall 2025*
Ze-Wen Koh, EAPS PhD, Generals *Spring 2025*

Admissions Committees
Center for Computational Science and Engineering: Standalone PhD *2025- 2026*

SERVICE TO THE COMMUNITY AND OUTREACH

Climatematch Academy Steering Committee *2024- Present*
Climatematch Academy Executive Director and Co-founder *2021- 2023*

NASA ocean AI working group chair *2025- Present*
Ocean Sciences Meeting Student Reviewer | Session Convener *2022, 2024, 2026*
Inter-scale connections and transfers in mesoscale, submesoscale, and boundary layer turbulence

Journal Reviewer *2017- Present*
Ocean Modeling | Geophysical Research Letters | Journal of Fluid Mechanics |
Meta-reviewer for ICLR tackling climate change with machine learning | Climate Informatics |
Journal of Physical Oceanography | Advances in Atmospheric Sciences |
Geophysical Research Letters | Journal of Turbulence | Journal of Advances in Modeling Earth System
Geoscientific Model Development | IPCC AR6 (expert reviewer) | SROCC (expert reviewer)