Benjamin W. Barr

Postdoctoral Investigator
Department of Physical Oceanography
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Research Interests

Air-sea interaction; air-sea flux processes in high winds (e.g., ocean surface waves, sea spray, upper ocean mixing); tropical cyclone (TC) intensification and connections to air-sea processes; coupled atmosphere-wave-ocean modeling; model and parameterization development; high-wind air-sea interface observations

Education

Ph.D. in Atmospheric Sciences, University of Washington, Seattle 2023
Thesis Title: "Seastate-dependent sea spray heat fluxes and impacts on tropical cyclone structure and intensity using fully coupled atmosphere-wave-ocean model simulations"
Advisor: Dr. Shuyi S. Chen

M.S. in Mechanical Engineering, University of Texas at Austin 2012

B.S. in Mechanical Engineering, University of Texas at Austin 2010

Experience

Postdoctoral Investigator Aug 2023 – Present
Woods Hole Oceanographic Institution, Woods Hole, MA
Developing air-sea interaction model physics using the atmosphere-wave-ocean Scripps Coupled Ocean-Atmosphere Regional (SCOAR) model, including incorporation of seastate-dependent sea spray heat fluxes into the Coupled Ocean-Atmosphere Response Experiment (COARE) algorithm. Testing new model physics in coupled atmosphere-wave-ocean model simulations of TCs and extratropical cyclones.

Graduate Research Assistant Sep 2017 – Sep 2018, Jan 2019 – July 2023
University of Washington, Seattle
Studied the impact of seastate-dependent sea spray heat fluxes on TC structure and intensity by developing a new seastate-based parameterization for air-sea heat fluxes with spray, implementing it in the atmosphere-wave-ocean Unified Wave Interface-Coupled Model (UWIN-CM), and performing numerical experiments on TCs.

Teaching Assistant – ATMS 101: Introduction to Weather Sep 2018 – Dec 2018
University of Washington, Seattle

Associate Jan 2015 – May 2017

Analyst July 2012 – Dec 2014
Stress Engineering Services, Inc., Houston, TX
Performed structural and dynamic analysis for a variety of engineering applications related to offshore deep-water oil and gas drilling, including design and installation analysis for

top-tensioned risers deployed from a floating oil production facility subjected to a range of extreme wind-wave-current loading combinations.

Graduate Research Assistant Jan 2011 – May 2012

University of Texas at Austin

Investigated the thermo-chemo-mechanical degradation of thermal protection materials in atmospheric reentry scenarios and organic materials in wildland fire scenarios by developing numerical models for heat transfer, mass transfer, and chemical processes.

Teaching Assistant – ME 330: Fluid Mechanics Aug 2010 – Dec 2010

University of Texas at Austin

Structural Analyst (Co-op) Aug 2008 – Dec 2008, Jun 2009 – Aug 2009

L-3 Communications IS, Greenville, TX

Performed structural analysis to approve design modifications to military aircraft.

Honors, Awards, and Achievements

Second Place Student Oral Presentation 2023

AMS 23rd Conference on Air-Sea Interaction

First Place Student Oral Presentation 2021

AMS 22nd Conference on Air-Sea Interaction

Future Investigators in NASA Earth and Space Science and Technology Award 2019 – 2022

Licensed as a Professional Engineer (licensed in Texas) 2016 – Present

Service

Journal Peer Reviewer Since 2022

Geophysical Research Letters, Journal of Geophysical Research: Atmospheres, Journal of Physical Oceanography

Co-Chair, Air-Sea Interaction Session 2022

AMS 35th Conference on Hurricanes and Tropical Meteorology

Mentoring Program Coordinator, Univ. of Wash. Atmospheric Sciences 2019 – 2023

Performed mentor-mentee matching, planned social and professional development events, and handled administrative tasks for department undergraduate-graduate mentoring program.

Graduate Mentor, Univ. of Wash. Atmospheric Sciences 2017 – 2022

Served as graduate student mentor to undergraduates in department mentoring program.

Computational Skills

Programming Languages: Python, Fortran, MATLAB, HTML
Commercial Software: Microsoft Office, ABAQUS, FLUENT
Operating Systems: Windows, Linux

Peer-Reviewed Publications

Sauvage, C., H. Seo, B. W. Barr, J. B. Edson, and C. A. Clayson: Misaligned wind-waves behind atmospheric cold fronts. ***In preparation.***

Barr, B. W. and S. S. Chen: Impacts of seastate-dependent sea spray heat fluxes on tropical cyclone structure and intensity in fully coupled atmosphere-wave-ocean model simulations. ***In preparation.***

Barr, B. W., S. S. Chen, and C. W. Fairall, 2023: Sea-state-dependent sea spray and air-sea heat fluxes in tropical cyclones: A new parameterization for fully coupled atmosphere-wave-ocean models. *J. Atmos. Sci.*, **80**, 933 – 960, https://doi.org/10.1175/JAS-D-22-0126.1.

Anzalone, R., B. W. Barr, R. R. Upadhyay, and O. A. Ezekoye, 2017: Use of a quasi-steady ablation model for design sensitivity with uncertainty propagation. *J. Thermal Sci. Eng. Appl.*, **9**, 011004, https://doi.org/10.1115/1.4034595.

Barr, B. W. and O. A. Ezekoye, 2013: Thermo-mechanical modeling of firebrand breakage on a fractal tree. *Proc. Comb. Inst.*, **34**, 2649 – 2656, https://doi.org/10.1016/j.proci.2012.07.066.

Conferences, Seminars, and Workshops (Presenting Author Only)

* = Oral, # = Poster, ° = Invited, † = Accepted for upcoming presentation

†*Barr, B. W., C. Sauvage, H. Seo, C. A. Clayson, and J. B. Edson, 2024: Impacts of surface wave-driven upper ocean mixing processes on sea surface temperature and storm intensity in model forecasts of Typhoon Fanapi (2010) and Hurricane Ian (2022). *AMS 36th Conference on Hurricanes and Tropical Meteorology*, Long Beach, CA, USA.

†#Barr, B. W. and S. S. Chen, 2024: Impacts of seastate-dependent sea spray heat fluxes on tropical cyclone structure and intensity using fully coupled atmosphere-wave-ocean model simulations. *AMS 36th Conference on Hurricanes and Tropical Meteorology*, Long Beach, CA, USA.

†*Barr, B. W., H. Seo, C. A. Clayson, and J. B. Edson, 2024: Using high-wind observations to constrain a seastate-dependent air-sea heat flux parameterization with spray for use in coupled atmosphere-wave-ocean models. *ECMWF 5th Workshop on Waves and Wave-Coupled Processes*, Reading, UK.

†*Barr, B. W., H. Seo, C. A. Clayson, and J. B. Edson, 2024: Use of in situ air-sea-wave and direct covariance flux observations to constrain a model for seastate-dependent sea spray-mediated air-sea heat fluxes in high winds. *IEEE/OES 13th Currents, Waves, and Turbulence Measurement Workshop*, Wanchese, NC, USA.

†*Barr, B. W., 2024: Seastate-dependent sea spray heat fluxes and impacts on tropical cyclone structure and intensity using fully coupled atmosphere-wave-ocean model simulations. *University of Rhode Island Graduate School of Oceanography Physical Oceanography Seminar*, 1 March 2024, Narragansett, RI, USA.

†*Barr, B. W. and S. S. Chen, 2024: Impacts of seastate-dependent sea spray heat fluxes on tropical cyclone structure and intensity using fully coupled atmosphere-wave-ocean model simulations. *AGU Ocean Sciences Meeting 2024*, New Orleans, LA, USA.

°*Barr, B. W., 2023: Seastate-dependent sea spray heat fluxes and impacts on tropical cyclone structure and intensity using fully coupled atmosphere-wave-ocean model simulations.

NOAA EMC Coupled Systems and Dynamics Seminar, 28 November 2023, College Park, MD, USA.

*Barr, B. W., 2023: Seastate-dependent sea spray heat fluxes and impacts on tropical cyclone structure and intensity using fully coupled atmosphere-wave-ocean model simulations. *WHOI Physical Oceanography Dept. Seminar*, 19 September 2023, Woods Hole, MA, USA.

*Barr, B. W. and S. S. Chen, 2023: Multiscale air-sea interactions in hurricanes: From seastate-dependent sea spray to surface and boundary layers in coupled atmosphere-wave-ocean model simulations. *AMS 23rd Conference on Air-Sea Interaction*, Denver, CO, USA.

*Barr, B. W. and S. S. Chen, 2022: Interactions between seastate-dependent air-sea heat fluxes and hurricane boundary layers using a fully-coupled atmosphere-wave-ocean model. *AGU Ocean Sciences Meeting 2022*, Virtual.

*Barr, B. W. and S. S. Chen, 2021: Rapid intensification of Hurricane Michael (2018) and its sensitivity to upper ocean temperature. *AMS 34th Conference on Hurricanes and Tropical Meteorology*, Virtual.

*Barr, B. W. and S. S. Chen, 2021: Interactive processes among sea spray, enthalpy flux, and surface layer temperature and humidity in hurricanes. *AMS 22nd Conference on Air-Sea Interaction*, Virtual.

*Barr, B. W. and S. S. Chen, 2020: Effects of sea spray on air-sea fluxes and the wave boundary layer in high winds. *AGU Ocean Sciences Meeting 2020*, San Diego, CA, USA.

*Barr, B. W. and S. S. Chen, 2019: Understanding spray-mediated air-sea fluxes and boundary layer processes in tropical cyclones. *American Geophysical Union Fall Meeting 2019*, San Francisco, CA, USA.

#Barr, B. W. and S. S. Chen, 2018: Impacts of sea spray on air-sea fluxes in tropical cyclones: Results from coupled atmosphere-wave-ocean modeling of Hurricane Harvey (2017). *American Geophysical Union Fall Meeting 2018*, Washington, D.C., USA.

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