Ethan Murray

ethanjmur@gmail.com | Ethan.Murray@colorado.edu | LinkedIn Profile

Education

University of Colorado, Boulder, CO
PhD, Department of Atmospheric and Oceanic Sciences — December 2023 – July 2025 (Expected)
MS, Department of Atmospheric and Oceanic Sciences — August 2021 – December 2023

- GPA: 4.00/4.00
- Advisors: Dr. Kristopher Karnauskas, kristopher.karnauskas@colorado.edu and Dr. Zhien Wang, zhien.wang@stonybrook.edu

Vassar College, Poughkeepsie, NY 12604
BA, Physics Major, Computer Science Minor — August 2017 - June 2021

- GPA: 3.87/4.00
- Advisor: Dr. Brian Daly, brdaly@vassar.edu

Technical and Interpersonal Skills

- Python, Matlab, Github, and Linux
- ArcGIS Pro
- Data analysis
- Weather models and observations
- Lidar and Optics Development
- Data visualization
- Effective communication
- Collaboration
- Atmospheric Boundary Layer and Microphysics Schemes

Research Experience

Understanding Tropical Cyclone Cloud and Thermodynamic Structure — August 2021 – July 2025
University of Colorado, Boulder, CO
Laboratory for Atmospheric and Space Physics (LASP) and the Department of Atmospheric and Oceanic Sciences (ATOC)
Advisors: Dr. Kris Karnauskas and Dr. Zhien Wang

- Improved our understanding of TC boundary layer thermodynamics, aerosols and clouds through multiple research projects, publications and conference presentations.
- Synergized novel compact Raman lidar (CRL) measurements of tropical cyclones (TCs) with existing radar, in situ, and dropsonde observations.
- Analyzed low level TC cloud heights in the eye and connected them to TC thermodynamic and dynamic conditions. Resulted in a paper published in *GRL*.
- Expanded this analysis to the TC rainbands by using CRL data to characterize fine scale cloud, rainfall, and aerosol structures. This project will result in a forthcoming journal article.
- Compared temperature and moisture observations of the atmospheric boundary layer to the Navy's operational COAMPS-TC model to diagnose the main drivers of forecast errors for TC Sam (2021). This work was recently submitted to *MWR.*
- Demonstrated proficiency in statistical analysis, software management, collaboration, and independence throughout these projects.

Simulation of Ocean Wave Breaking Processes June – August 2021
Scripps Institution of Oceanography, La Jolla, CA
Air-Sea Interaction Laboratory
Advisor: Dr. Nick Pizzo

- Created Matlab scripts to run and interpret the results of a fully nonlinear ocean wave breaking simulation written in Fortran.
- Ran the wave breaking model from a Linux terminal while working fully remotely.
- Established a connection between a wave packet's bandwidth and its tendency to overturn and break, leading to the publication of a second author research paper.
- Effectively collaborated with my research group during weekly meetings and demonstrated my ability to independently lead a research project.

Experimental Characterization of 2D and 3D Materials June 2019 – June 2021
Vassar College, Poughkeepsie, NY
Ultrafast Optics Laboratory
Advisor: Dr. Brian Daly

- Participated in the URSI Summer Research Program at Vassar and built upon this experience throughout my Junior and Senior years.
- Used ultrafast laser pulses to study how acoustic waves propagate through 2D and 3D crystals.
- Installed a motorized stage and created a LabView program to control it. Built multiple lens systems to magnify and view small crystal samples. Optimized the efficiency and readability of our data collection and analysis software.
- Conducted foundational research on the velocity of acoustic waves in $MoSe_2$, leading to three research presentations and co-authorship on one journal article.

Professional Experience

NREIP Summer Intern June - August 2024
Naval Research Laboratory, Monterey, CA
Marine Meteorology Division
Advisor: Dr. Jon Moskaitis

- Collaborated with NRL scientists as a participant in the 10 week Naval Research Enterprise Internship Program (NREIP).
- Compared low-level TC wind and thermodynamic observations (dropsondes, CRL, radar) with the Navy's COAMPS-TC hurricane forecasting model.
- Focused on TC Sam (2021) to build a model validation framework. Discovered that verifying TC structure, not just track and intensity, through detailed observations provides a valuable avenue for model improvement.
- Presented project results to NRL scientists at the conclusion of the summer internship and continued collaboration with Dr. Moskaitis to turn this work into a research paper.

Field Campaign Research Scientist, Bridgetown, Barbados August – September 2023

- Participated in the 2023 MAGPIE field campaign. Observed the marine atmospheric boundary layer and aerosol gradients in a tropical environment.
- Launched regularly scheduled radiosonde balloons, operated the CRL in ground-based scanning and stationary modes, and took ocean measurements on a small research ship.
- Worked with Caribbean Institute for Meteorology and Hydrology and the Barbados Meteorological Services scientists to facilitate international collaboration, benefiting all researchers.

Field Campaign Airborne Lidar Operator, Topeka, KS May – June 2022

- Operated the CRL during the 2022 TORUS field campaign, which investigated the environmental and structural properties of supercell thunderstorms. Assisted with the calibration of the CRL.
- Worked as a crew member on NOAA's P-3 aircraft for 12 research flights, logging 70 flight hours.
- Gained operational experience as a flight scientist by communicating effectively and directing P-3 flight legs while sampling the supercell environment.

Physics Departmental Tutor, Poughkeepsie, NY September 2020 - June 2021

- Communicated effectively in online and in-person settings to accommodate students on and off campus during the COVID 19 pandemic.
- Explained physics concepts, supported students in understanding assignments, and led study groups for introductory and intermediate level physics classes.

Intermediate Physics Lab Assistant, Poughkeepsie, NY February – April 2020

- Helped instructors with the setup and maintenance of current and new experiments.
- Gained additional experience working with lasers, piezoelectric crystals, and optical fibers.
- Introduced students to new experiments and answered questions throughout lab periods.

Publications

Ethan Murray, Zhien Wang, Kristopher Karnauskas, and Jun Zhang, "Fine-Scale Cloud and Rainfall Structures Revealed by the Compact Raman Lidar in the Low Level Tropical Cyclone Rainbands," *In Preparation* (2025).

Ethan Murray, Jonathan Moskaitis, James Doyle, Kristopher Karnauskas, Zhien Wang, and Jun Zhang, "An Observation-Model Intercomparison Framework for Diagnosing Tropical Cyclone Thermodynamic Change: Application to Hurricane Sam (2021)," submitted to *Monthly Weather Review* (2025).

Ethan Murray, Jason Dunion, Kristopher Karnauskas, Zhien Wang, and Jun Zhang, "Cloud Height Distributions and the Role of Vertical Mixing in the Tropical Cyclone Eye Derived From Compact Raman Lidar Observations," G*eophysical Research Letters* (2024), https://doi.org/10.1029/2024GL108515.

Nick Pizzo, **Ethan Murray**, David Llewellyn Smith, Luc Lenain, "The Role of Bandwidth in Setting the Breaking Slope Threshold of Deep-Water Focusing Wave Packets," *Physics of Fluids* (2021), https://doi.org/10.1063/5.0072166.

Ellis Thompson, Emma Manzella, **Ethan Murray**, Maya Pelletier, Jacob Stuligross, Brian Daly, "Picosecond Laser Ultrasonic Measurements of Interlayer Elastic Properties of 2H-$MoSe_2$ and 2H-WSe_2," *Materials Today Chemistry* 18, 100369 (2020), https://doi.org/10.1016/j.mtchem.2020.100369.

Conference Presentations

Tropical Cyclone Cloud and Thermodynamic Structures:

Murray et al. 2024, "Validation of COAMPS-TC Boundary Layer Thermodynamics using Novel Aircraft Observations," oral presentation, Naval Research Laboratory Seminar Series, Monterey, CA.

Murray et al. 2024, "Investigating Convective Scale Variability in Tropical Cyclone Rainband Clouds and Thermodynamics using Compact Raman Lidar Measurements," oral presentation, 36th Conference on Hurricanes and Tropical Meteorology, Long Beach, CA.

Murray et al. 2023, "Tropical Cyclone Dynamics Inferred from Aircraft Eye and Eyewall Cloud Observations," oral presentation, American Geophysical Union Annual Meeting, San Francisco, CA.

Murray et al. 2023, "Convective Properties of Inner Core Tropical Cyclone Clouds Observed by Airborne Compact Raman Lidar," poster presentation, American Meteorological Society Annual Meeting, Denver, CO.

Murray et al. 2022, "Convective Properties of Inner Core Tropical Cyclone Clouds Observed by Airborne Compact Raman Lidar," poster presentation, ESSS Conference, Boulder, CO.

Murray et al. 2022, "Convective Properties of Tropical Cyclone Eye and Eyewall Clouds Observed by Airborne Compact Raman Lidar," poster presentation, YSSAR Conference, Fort Collins, CO.

Wang, Zhien and Murray, Ethan 2023, "Observing Atmospheric Boundary Layer Property and Processes Associated Rapid Intensification in TCs," oral presentation, Naval Research Laboratory's Annual TCRI Conference, Monterey, CA.

Ocean Wave Modeling:

Murray et al. 2021, "The Role of Bandwidth in Setting the Breaking Slope Threshold of Deep-Water Focusing Wave Packets," poster presentation, ESSS Conference, Boulder, CO.

Ultrafast Physics:

Murray et al 2021, "Ultrafast optical measurements of elastic properties of 2H-MoSe2," poster presentation, APS March Meeting, virtual.

Murray, Ethan 2019, "Ultrafast Laser Science at the Nanoscale: Pump-Probe Spectroscopy of $MoSe_2$," poster presentation, Vassar College URSI Symposium, Poughkeepsie, NY.

Murray et al. 2019, "Ultrafast Laser Science," oral presentation, keynote speaker at URSI Symposium, Poughkeepsie, NY.

Leadership Activities

Elementary School Outreach Leader, Boulder, CO September 2024 – Present

- Co-taught six science lessons to elementary school classes during Fall 2024 and Spring 2025. Varied teaching methods, lesson plans, and in class demos depending on the grade of the students.
- Led a group of 25 4^{th} grade students for Snow School, an outdoor field program in Nederland, Colorado. Students learned about snow science, the hydrological cycle, and the importance of the snowpack to Western states. Prior to teaching, I participated in a student training session, where I

learned course material and how to engage with students. This program was organized by Wild Bear Nature Center and the Winter Wildlands Alliance.

Undergraduate Application Mentor, Boulder, CO September 2024 – Present

- Mentored three undergraduate students interested in applying to the ATOC department at CU Boulder.
- Provided advice for applying to graduate school, future career plans, and drafting application essays and CVs.

ATOC Social Committee Member, Boulder, CO February 2023 – Present

- Organized social events for the ATOC department, including a career fair, ping pong tournament, and attending a basketball game.
- Created connections between undergraduates, graduate students, postdocs, and faculty, groups who don't often interact.

Varsity Men's Crew, Poughkeepsie, NY September 2018 – June 2021

- Member of the Varsity 8 and Varsity 4 boats from Sophomore through Senior year.
- Practiced 6 days a week, starting at 6 am, on the Hudson River. Demonstrated time management skills and dedication to teammates.
- Rowed in regattas including the Head of the Fish, New York State Championships, and Dad Vails.

Awards

- **Naval Research Enterprise Internship Program**, Office of Naval Research (2024)
- **Naval Horizons Essay Competition**, Office of Naval Research (2023)
- **Lucy Kellogg English Prize**, Physics Department, Vassar College (2021)
- **Sigma Xi Scientific Research Society**, Inducted Member (2021)
- **Ethel Hickox Pollard Memorial Physics Award,** Physics Department, Vassar College (2020)
- **Departmental Intern,** Physics Department, Vassar College (2020)
- **Foresters Competitive Scholarship,** Foresters Life Insurance (2017)