

Research Interests

Large-scale atmospheric circulation, climate dynamics, stratosphere-troposphere connections

Education

- 2022 **Ph.D. Johns Hopkins University | Earth and Planetary Sciences**
Baltimore, MD Dissertation: Atmospheric Interactions in a Changing Climate
- 2017 **M.Sc. McGill University | Atmospheric and Oceanic Sciences**
Montreal, QC Thesis: Investigating the Impact of Direct Effects of Radiative Forcing on Ocean Heat Uptake
- 2014 **B.Sc. Virginia Tech | Engineering Science and Mechanics**
Blacksburg, VA Capstone: Computational Analysis of Undulatory Batoid Motion for Underwater Robotic Propulsion

Professional Experience

- 2025 – present **AAAS Science and Technology Policy Fellow | Department of State**
Washington, DC Bureau of Near East Affairs, Office of Regional and Multilateral Affairs
- *Establishing* the bureau's *data analysis capability* to support *strategy development* on economic, technological, and scientific affairs.
 - Serving as an action officer and *subject matter expert* on science and technology topics by *identifying emerging issues*, providing *expert analysis*, and *advising* department officials.
 - *Representing* the State Department and *building relationships* within the U.S. government and with foreign governments, multilateral institutions, and other external organizations.
- 2022 – 2025 **NASA Postdoctoral Program Fellow | Goddard Institute for Space Studies**
New York, NY Advisor: Clara Orbe
- *Designing and implementing idealized simulations* with the NASA GISS ModelE 2.2 global climate model to *isolate* atmospheric circulation features' response to climate forcings and *elucidate connections* between the troposphere and stratosphere.
 - *Collaborating* with a team of 4 scientists to *identify* atmospheric circulation fingerprints of an Atlantic Meridional Overturning Circulation collapse.
 - *Liaising* between our Atmospheric Dynamics group and external academic collaborators by *providing and transferring available output* from simulations conducted with the NASA GISS ModelE 2.2 global climate model.
- 2017 – 2022 **Graduate Research Assistant | Johns Hopkins University**
Baltimore, MD Advisor: Darryn Waugh
- Performed a *suite of idealized atmospheric simulations* and analyzed output from 23 of IPCC's CMIP5 global climate models and 3 S-RIP meteorological reanalysis products to *investigate* the relationship between the Hadley Cell and subtropical jet.
 - Participated in collaboration of all research groups across atmospheric and oceanic science to *share new research developments* and *provide verbal feedback* to other students' progress.
 - *Led coordination* of departmental student seminars by formulating the schedule and *collecting and distributing peer evaluation* to each presenter.

2015 – 2017 **Graduate Research Assistant | McGill University**
Montreal, QC Advisor: Timothy Merlis

- Examined the *impact of direct effects* of CO₂ radiative forcing on the *efficiency of ocean heat uptake* by perturbing the GFDL Modular Ocean Model 5 with output fields from IPCC's CMIP5 global climate models.

Refereed Journal Publications

Menzel, Molly E., Clara Orbe, and Lorenzo Polvani, in prep: Distinguishing the Direct Radiative, Surface Warming, and Ozone Mediated Contributions to BDC acceleration under Abrupt CO₂ Forcing. *Journal of Climate*, in preparation.

Menzel, Molly E., and Clara Orbe, in revision: Winter Patterns of the Hadley Circulation's Response to Increase CO₂ are Distinct between the Upper and Lower Troposphere. *Journal of Climate*, in revision.

Menzel, Molly E., Darryn W. Waugh, Zheng Wu, and Thomas Reichler, 2024: Replicating the Hadley Cell edge and Subtropical Jet latitude disconnect in idealized atmospheric models. *Weather and Climate Dynamics*, **5(1)**, 251-261. <https://doi.org/10.5194/egusphere-2023-1645>

Menzel, Molly E., Darryn W. Waugh, and Clara Orbe, 2023: Connections between upper tropospheric and lower stratospheric circulation responses to increased CO₂. *Journal of Climate*, **36 (12)**, 4101-4112. <https://doi.org/10.1175/JCLI-D-22-0851.1>

Menzel, Molly E., Darryn W. Waugh, and Kevin M. Grise, 2019: Disconnect between Hadley Cell and Subtropical Jet variability and response to increased CO₂. *Geophysical Research Letters*, **46 (12)**, 7045-7053. <https://doi.org/10.1029/2019GL083345>

Menzel, Molly E. and Timothy M. Merlis, 2019: Connecting direct effects of CO₂ radiative forcing to ocean heat uptake and circulation. *Journal of Advances in Modeling Earth Systems*, **11 (7)**, 2163-2176. <https://doi.org/10.1029/2018MS001544>

Professional Service

2023 – present **AGU Outstanding Student Presentation Award Committee, Atmospheric Science**

One of four coordinators to manage the recruitment of judges evaluating student presentations, our section is the largest with over 300 students presentations requiring over 900 judges.

2020 – present **AMS Atmospheric and Oceanic Fluid Dynamics Committee**

Contribute to the planning and implementation of the biannual conference.

2018 – 2022 **JHU Earth and Planetary Science Student Colloquium Coordinator**

Coordinated graduate student seminars, created the annual schedule accommodating 30-40 mandatory presentations, announced abstracts for upcoming talks weekly.

2021 **Unlearning Racism in Geosciences (URGE) Pod Member**

Participated in ongoing departmental discussions reflecting on the fingerprints of historical racism still evident in science, collaborated to develop and advocate for equitable admission policies.

Member of American Meteorological Society (AMS), American Geophysical Union (AGU), American Association for the Advancement of Science (AAAS)

Journal Reviewer for *Journal of Climate*, *Geophysical Research Letters*, *npj Climate and Atmospheric Science*, *Journal of Geophysical Research—Atmospheres*

Proposal Volunteer for *NASA Science Mission Directorate*, *NASA Research Initiative Award*

Fellowship Grants

- 2024 – 2026 AAAS Science and Technology Policy Fellowship | \$201,706
- 2024 (declined) Georgetown University’s Earth Commons Postdoctoral Fellowship | \$140,000
“A Physical and Societal Impact View of Extreme Temperature Events”
- 2022 – 2024 NASA Postdoctoral Program Fellowship | \$186,400
“Tropical Stratospheric-Tropospheric Interaction in a Changing Climate”
Developed highly competitive proposal for postdoctoral research to investigate interactions between upper tropospheric and lower stratospheric circulation which would improve predictive capability for future climate states pertaining to stratospheric ozone, surface air quality, climate sensitivity, and human health.
- 2021 JHU Krieger School of Arts and Sciences’ Dean’s Prize Fellowship | \$11,500
“Communicating Climate Science: Freshman Seminar”
Restructured “Communicating Climate Science” as a freshman seminar after success of its inaugural semester, opting for a wider array of media.
- 2020 JHU Krieger School of Arts and Sciences’ Dean’s Teaching Fellowship | \$11,500
“Communicating Climate Science”
Designed and implemented a new course, 6 undergraduate students were taught to recognize the broader significance of the technical content, incorporate narrative structure in sharing complex topics, and consider how they may relate it to others with differing views.
- 2019 Travel Grant to SPARC’s DynVar & SNAP Workshop | \$2,000
“Disconnect Between Hadley Cell and Subtropical Jet Variability and Response to CO₂”

Certificates and Awards

- 2019 – present Tropical Width Impacts on the Stratosphere, Young Scientist
International Space Studies Institute (ISSI)
Chosen as one of two young scientists to collaborate with an international team of researchers
- 2023 Science Policy and Advocacy Certificate Program
Journal of Science Policy and Governance, Union of Concerned Scientists, et al.
Enrolled in an 11-week online course that taught relevant science policy skills including advocacy strategies such as elevator pitches and written memos.
- 2019 Johns Hopkins University Teaching Academy
Center for Teaching Excellence and Innovation
Received training for teaching at the undergraduate and graduate levels by attending 10 workshops, participating in a 3-day intensive Teaching Institute, and demonstrating at least 6 hours of real class instruction.
- 2019 Outstanding Student Oral Presentation Award
22nd Atmospheric and Oceanic Fluid Dynamics Conference
Recognized for excellence in delivering a 15-minute oral talk at a reputable conference.
- 2014 Dan H. Pletta Award, Outstanding Senior Research Project
Virginia Tech Department of Engineering Science and Mechanics
Conducted undergraduate research with a team of 5 for a senior capstone project and received the annual departmental award for research merit.

Teaching, Outreach, Mentorship

- 2024 **Undergraduate Intern Advisor | NASA GISS**
Patricia Hutton, "Replicating Regional Atmospheric Circulation Analysis with CMIP6"
(now a Graduate Student at University of Alaska, Fairbanks)
- STEM Champion | Children's Science Center in Northern Virginia**
Interviewed by Westfield High School student KD Powell
- 2020 – 2021 **Instructor | Johns Hopkins University**
AS.270.130: Freshman Seminar, Communicating Climate Science
AS.270.348: Communicating Climate Science
- 2019 **Guest Lecturer and Teaching Assistant | Johns Hopkins University**
AS.270.378/641: Present and Future Climates
- 2017 **Climate Outreach | Faith Presbyterian Church**
- 2016 – 2017 **Teaching Assistant | McGill University**
ATOC 181: Introduction to Atmospheric Science
ATOC 215: Oceans, Weather and Climate
- 2014 **Physics Outreach | Virginia Tech Physics Department**
Elementary, middle, and high school classrooms

Presentations

Invited Talks

- 2024 **AGU's Fall Meeting | Washington, DC**
"Isolating the Interactive Ozone, Direct Radiative, and Surface Warming Impacts on the Whole Atmospheric Circulation Response to Increased CO₂"
- University of St. Andrews | St. Andrews, Scotland**
"Characterizing the Whole Atmospheric Circulation's Nuanced Response to Increased CO₂"
- University of Exeter | Exeter, England**
"Characterizing the Whole Atmospheric Circulation's Nuanced Response to Increased CO₂"
- University of Oxford | Oxford, England**
"Characterizing the Whole Atmospheric Circulation's Nuanced Response to Increased CO₂"
- Temple University | Philadelphia, PA**
"Decomposing the Whole Atmospheric Circulation Response to Increased CO₂: Interactive Ozone, Direct Radiative, and Surface Warming Impacts"
- Geophysical Fluid Dynamics Laboratory | Princeton, NJ**
"Disentangling the Upper Tropospheric and Lower Stratospheric Circulation Responses to Increased CO₂"
- University of Reading | Reading, United Kingdom**
"Disentangling the Upper Tropospheric and Lower Stratospheric Circulation Responses to Increased CO₂: Considering Interactive Ozone Impacts, (Non)Linearity, Regionality, and Vertical Structure"
- University of Cambridge | Cambridge, United Kingdom**

"Disentangling the Upper Tropospheric and Lower Stratospheric Circulation Responses to Increased CO₂: Considering Interactive Ozone Impacts, (Non)Linearity, Regionality, and Vertical Structure"

2023 NASA Sciences and Exploration Directorate Director's Seminar | Virtual
"Atmospheric Circulation's Response to CO₂: A Seasonal, Hemispheric, and Scaling Perspective"

Lamont-Doherty Earth Observatory | Palisades, NY

"Examining Connections between Upper Tropospheric and Lower Stratospheric Circulation Responses to Increased CO₂"

2022 NASA Goddard Institute for Space Studies | New York, NY
"Connections between Upper Tropospheric and Lower Stratospheric Circulation Responses to Increased CO₂"

United States Naval Academy | Annapolis, MD

"Reconciling the Subtropical Jet and Hadley Cell Relationship using a Model Hierarchy"

2021 University of Exeter | Virtual
"Revisiting the Coupled Behavior of the Subtropical Jet and Hadley Cell"

McGill University | Virtual

"Hadley Cell and Subtropical Jet Disconnect in Idealized Models"

Conference and Workshop Talks

2024 AMS's 24th Atmospheric and Oceanic Fluid Dynamics Conference | Burlington, VT
"Assessing the (Non)Linearity, Regionality, and Vertical Structure of the Hadley Circulation's Response to CO₂"

AMS's 22nd Conference on Middle Atmosphere | Burlington, VT

"Disentangling the Impact of Interactive Ozone and Surface Warming to the Lower Stratospheric Circulation Response to Increased CO₂"

AMS's 37th Climate Variability and Change Conference | Baltimore, MD

"Vertical and Regional Patterns of Tropical Circulation Response to CO₂"

2023 ISSI's Tropical Width Impacts on the Stratosphere | Bern, Switzerland
"Isolating Tropical Circulation Responses of the Upper Troposphere and Lower Stratosphere with Various Forcings"

AMS's 36th Climate Variability and Change Conference | Denver, CO

"Connections between Upper Tropospheric and Lower Stratospheric Circulation Responses to Increased CO₂"

2022 ISSI's Tropical Width Impacts on the Stratosphere | Bern, Switzerland
"Connections between Tropospheric and Stratospheric Metrics"

AMS's 23rd Atmospheric and Oceanic Fluid Dynamics Conference | Breckenridge, CO

"Hadley Cell and Subtropical Jet Behavior in Idealized Atmospheric Models"

2019 Joint DynVarMIP/CMIP6 and SPARC's DynVar & SNAP Workshop | Madrid, Spain

"Disconnect Between Hadley Cell and Subtropical Jet Variability and Response to Increased CO₂"

AMS's 22nd Atmospheric and Oceanic Fluid Dynamics Conference | Portland, ME

"Disconnect Between Hadley Cell and Subtropical Jet Variability and Response"

Conference Posters

- 2022 SPARC's 7th General Assembly | Reading, United Kingdom
"Connections between UTLS Circulation Responses to Abrupt CO2"
- 2020 AGU's Fall Meeting | Virtual
"Decoupling the Subtropical Jet from the Hadley Cell in Idealized Atmospheric Models"
- 2018 AGU's Fall Meeting | Washington, DC
"Relationships between the Hadley Cell and Subtropical Jet"
- 2017 AMS's 21st Atmospheric and Oceanic Fluid Dynamics Conference | Portland, OR
"Direct Effects of Radiative Forcing on Ocean Heat Uptake"

Acronyms

AAAS | American Association for the Advancement of Science

NASA | National Aeronautics and Space Administration

JHU | Johns Hopkins University

ISSI | International Space Science Institute

AMS | American Meteorological Society

AGU | American Geophysical Union

SPARC | Stratosphere-Troposphere Processes And their Role in Climate

S-RIP | SPARC Reanalysis Intercomparison Project

IPCC | Intergovernmental Panel on Climate Change

CMIP5 | Climate Model Intercomparison Project, Phase 5