Molly Menzel

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Research Interests

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

Education

2022 — Baltimore, MD
Ph.D. Johns Hopkins University | Earth and Planetary Sciences
Dissertation: "Atmospheric Interactions in a Changing Climate"

2017 — Montreal, QC
M.Sc. McGill University | Atmospheric and Oceanic Sciences
Thesis: "Investigating the Impact of Direct Effects of Radiative Forcing on Ocean Heat Uptake"

2014 — Blacksburg, VA
B.Sc. Virginia Tech | Engineering Science and Mechanics
Capstone Project: "Computational Analysis of Undulatory Batoid Motion for Underwater Robotic Propulsion"

Professional Experience

2025 — Washington, DC
Science and Technology Policy Fellow | AAAS
Science Advisor, U.S. Government

2022 – present — New York, NY
Postdoctoral Fellow | NASA Goddard Institute for Space Studies
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 — Baltimore, MD
Graduate Research Assistant | Johns Hopkins University
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 weekly meetings encompassing all research groups across atmospheric and oceanic science to *share new research developments* and *provide verbal encouragement and feedback* to other student's progress.
- *Led coordination* of departmental student seminars by formulating the schedule and *collecting and distributing peer evaluation* to each presenter.

2015 – 2017 — Montreal, QC
Graduate Research Assistant | McGill University
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, 2024: Competing Influences of the Direct Radiative, Surface Warming, and Ozone Responses to Increased CO2 on the Brewer-Dobson Circulation. *in prep*.

Menzel, Molly E., and Clara Orbe, 2024: Winter Patterns of the Hadley Circulation's Response to Increase CO2 are Distinct between the Upper and Lower Troposphere. *Journal of Climate*, submitted.

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 CO_2. *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 CO_2. *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 of the entire conference with over 300 students presentations across roughly 150 sessions and requiring over 900 judges.

2020 – present AMS Atmospheric and Oceanic Fluid Dynamics Committee
Contribute to the planning and implementation of the biannual conference, started as a student member and was promoted upon graduation.

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 discussions with others in my department reflecting on the fingerprints of historical racism still evident in our scientific field, collaborated with other members to develop and advocate for equitable admission policies.

Member of American Meteorological Society (AMS), American Geophysical Union (AGU), National Association of Geoscience Teachers (NAGT)

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

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 (i.e., podcasts, videos, documentaries, book chapters).

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 CO_2"
Offered support to attend a scientific workshop due to the relevance of my research.

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

Upcoming — 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"

2024 — 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