Aaron Match

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PROFILE

I am an atmospheric scientist who uses theory, simple models, and complex models to advance understanding of stratospheric dynamics, photochemistry, and transport in the basic state and in response to perturbations such as rising CO_2 and ozone-depleting substances.

JOBS

Cornell University, Ithaca, NY
- Department of Earth and Atmospheric Sciences
- Supervisor: Prof. Peter Hitchcock

▪ Postdoctoral Associate, co-wrote NSF grant: "From surface warming to stratospheric change" 2024-

New York University, New York, NY
- Center for Atmosphere Ocean Science (CAOS), Courant Institute of Mathematical Sciences
- Supervisor: Prof. Edwin P. Gerber

▪ Postdoctoral Associate 2024
▪ NSF Postdoctoral Research Fellow in Atmospheric and Geospace Sciences 2021-2023

EDUCATION

Princeton University, Princeton, NJ
▪ Ph.D. Atmospheric and Oceanic Sciences (AOS) 2015 – 2021
- Thesis: *The Unified Internal Dynamics and Global Interactions of the Quasi-Biennial Oscillation*
- Advisor: Prof. Stephan Fueglistaler

Cornell University, Ithaca, NY
▪ B.S. Atmospheric Science, minor Mathematics, summa cum laude, Research Honors 2011 – 2015
- Thesis: *Diagnosing the structure of finite amplitude wave activity in the polar stratosphere*
- Advisor: Prof. Gang Chen

PUBLICATIONS

A. Match, E.P., Gerber, S. Fueglistaler: **Protection without poison: Why does tropical ozone maximize in the stratosphere?**. *Atmos. Chem. Phys.*, accepted, 2024.

A. Match, E.P., Gerber, S. Fueglistaler: **Beyond self-healing: Stabilizing and destabilizing photochemical adjustment of the ozone layer**. *Atmos. Chem. Phys.*, 24, 10305–10322, 2024.

A. Match, E.P., Gerber, 2022: **Tropospheric expansion under global warming reduces tropical lower stratospheric ozone**. *Geophysical Research Letters*, 49, 19, 1-12.

A. Match, S. Fueglistaler, 2021: **Large internal variability precludes global warming signal detection in observed lower stratospheric QBO amplitude**. *Journal of Climate*, 34, 24, 9823–9836.

A. Match, S. Fueglistaler, 2021: **Anomalous dynamics of QBO disruptions explained by 1D theory with external triggering.** *Journal of the Atmospheric Sciences*, 78, 2, 373-383.

A. Match, S. Fueglistaler, 2020: **Mean flow damping forms the buffer zone of the Quasi-Biennial Oscillation: 1D theory**. *Journal of the Atmospheric Sciences*, 77, 1955-67.

A. Match, S. Fueglistaler, 2019: **The buffer zone of the Quasi-Biennial Oscillation**. *Journal of the Atmospheric Sciences*, 76, 11, 3553-3567.

A. Butler, D. Seidel, S.C. Hardiman, N. Butchart, T. Birner, A. Match, 2015: **Defining sudden stratospheric warmings**. *Bulletin of the American Meteorological Society*, 96, 11, 1913–1928.

PUBLICATIONS (IN PROGRESS)

A. Match, E.P., Gerber: **The double dip: How tropospheric expansion counteracts increases in extratropical stratospheric ozone under global warming**. Under review.

A. Match, B. Schaffer (co-first authors), S. Fueglistaler: **On the complementarity of extreme event costs attributed to changes in frequency versus intensity**. In prep.

AWARDS & SCHOLARSHIPS

AGU 2023 Editor's Citation for Excellence in Reviewing (JGRA) 2024
NSF Postdoctoral Research Fellow in Atmospheric and Geospace Sciences 2021-2023
Recognized for Service and Outreach by Princeton Department of Geosciences 2021
Princeton Energy and Climate Scholar 2017 – 2019
NSF Graduate Research Fellowship (GRFP) 2016 – 2019
Centennial Fellowship in the Natural Sciences, Princeton University 2015 – 2019
Merrill Presidential Scholar, Cornell University (Top 1% of Cornell graduating seniors) 2015
Academic Excellence in Atmospheric Sciences Award, Cornell University (Top GPA in major) 2015
SUNY Chancellor's Award for Student Excellence 2015
Barry M. Goldwater Scholarship 2014 – 2015
NOAA Ernest F. Hollings Scholarship 2013 – 2015
Orville Family Endowed Scholarship, American Meteorological Society 2014
Freshman Undergraduate Scholarship, American Meteorological Society 2011

TEACHING

Assistant-in-Instruction, GEO 361: Earth's Atmosphere. Prof. Stephan Fueglistaler Fall 2019
Assistant, FRS 151: Time Capsules for Climate Change. Prof. Rob Socolow Fall 2018

RESEARCH INTERNSHIPS

NOAA Hollings: Geophysical Fluid Dynamics Laboratory, Princeton, NJ 2014
- Project: "Sensitivities of stratospheric aerosol dispersal to variations in location and timing"
- Advisors: Jasmin John and Dr. Larry Horowitz

NSF REU: Center for Multiscale Modeling of Atmospheric Processes, Fort Collins, CO 2013
- Project: "Dynamically motivating a definition for sudden stratospheric warmings"
- Advisor: Prof. Thomas Birner

OUTREACH

Founding member, Climate Up Close. Climate scientists who tour the US presenting a non-prescriptive synthesis of the science of climate change. 2019-Pres.
- New Hampshire Lakes Region (2024), Chicago (2023), Central New Jersey (2022), Florida Panhandle (2022), Philadelphia (2020), Central PA (2019)
- Media interviews: NHPR, Concord Monitor

Co-presenter, "Setting climate activism in a broader context of environmental and social action"
- Chisuk Emuna Congregation, Harrisburg, PA 2022

Co-presenter, Princeton Day School Energy and Climate Scholars, 3 presentations 2018-2019
Co-organizer, AOS workshop on Tropical Dynamics, Princeton University 2017
Co-organizer, AOS workshop on Climate Engineering, Princeton University 2016

PROFESSIONAL ACTIVITIES

- Member, ISSI Team on INFO-QBO: Investigating the Feedback from Ozone in the Quasi-Biennial Oscillation 2025-
- Community Lead, Quasi-biennial oscillation and Ozone Chemistry interactions in the Atmosphere (QUOCA) Working Group on Analytical Models and Linearized Ozone Parameterizations 2025-
- Co-organizer of Atmospheric and Climate seminars, Cornell EAS 2024-
- Co-organizer of department seminars, NYU Center for Atmosphere Ocean Science 2022-2024
- Student member, AMS Middle Atmosphere Committee 2021
- Student member, AMS Atmospheric and Oceanic Fluid Dynamics Committee 2017-2019
- Reviewer: GRL, ACP, QJRMS, JClim, JAS, JGRA, npj-AS, Nature Climate Change, JAMES

SELECTED PRESENTATIONS

- **A conceptual model of the tropical [O_3] profile***
  - Invited talk. QBOi-SNAP-QUOCA joint workshop. Cambridge, UK Mar 2025
- **Protection without poison: Why tropical ozone maximizes in the interior of the atmosphere**
  - Invited talk. AGU Fall Meeting 2024. Washington, DC Dec 2024
- **The buffer zone of the QBO: Theory of formation and future projections**
  - Invited talk. 21^{st} AMS Conf. on the Middle Atmosphere, Houston, TX (remote) Jan 2022

- **Diagnosing the structure of finite amplitude wave activity in the polar stratosphere***
  - Poster. 20^{th} Conf. on Atmos. and Oceanic Fluid Dyn., Minneapolis, MN, USA Jun 2015
- **Sensitivities of stratospheric aerosol dispersal to variations in location and timing***
  - Talk. AMS 18^{th} Conf. on the Middle Atmosphere, Phoenix, AZ, USA, Feb 2014

***Denotes best student/early career presentation award

PRESENTATIONS

- **Protection without poison: Why tropical [O_3] maximizes around 26 km**
  - University of St. Andrews COASt Seminar, St. Andrews, Scotland Mar 2025
- **The double dip: How tropospheric expansion counteracts increases in extratropical stratospheric O_3 under global warming**
  - Talk. AGU Fall Meeting 2024. Washington, DC Dec 2024
- **On the complementarity of extreme event costs attributed to changes in frequency vs. intensity**
  - Poster. AGU Fall Meeting 2024. Washington, DC Dec 2024
- **Protection without poison: Why tropical ozone maximizes in the interior of the atmosphere**
  - Seminar. NYU CAOS Colloquium, New York, NY Sep 2024
  - Seminar. UW Atmospheric and Climate Science Seminar, Seattle, WA Sep 2024
  - Talk. AOFD/MA meeting, Burlington, VT Jun 2024
  - Seminar. SEAS Colloquium, Lamont-Doherty Earth Observatory, Palisades, NY Apr 2024
- **Beyond self-healing: Stabilizing and destabilizing photochemical adjustment of the ozone layer**
  - Talk. Quadrennial Ozone Symposium, Boulder, CO Jul 2024
- **Explaining ozone layer structure and self-healing**
  - Seminar. NASA GISS, NY, NY Feb 2024
- **Beyond self-healing: photochemical adjustments of the ozone layer**
  - Seminar. AOS Dynamics Seminar, Princeton University, NJ Jan 2024
- **Extreme Event Attribution: A critical review**
  - 2.5-hour workshop. Co-led with Ben Schaffer. Princeton University, NJ Jan 2024
- **Understanding the stratospheric ozone response to global warming**
  - Poster. AOFD/MA meeting, Burlington, VT Jun 2024
  - Talk. 2023 EGU General Assembly, Vienna, AT Apr 2023
- **Simple models of stratospheric ozone photochemistry**
  - Seminar. University of Reading, Reading, UK Apr 2023
  - Seminar. Cambridge University, Cambridge, UK Apr 2023
  - Seminar. Max Planck Institute for Meteorology, Hamburg, DE Apr 2023
  - Seminar. Free University of Berlin, Berlin, DE Apr 2023
  - Seminar. Institute of Atmospheric Physics & University of Munich, Munich, DE Apr 2023
  - Seminar. Harvard University ClimaTea, Cambridge, MA Feb 2023
- **The buffer zone of the QBO: Theory of formation and response to global warming**
  - Talk. QBO Workshop, Oxford, UK Mar 2023
- **Revisiting the ozone response to global warming**
  - Talk. AGU Fall Meeting, Strat. and Trop. Composition Changes, Chicago, IL Dec 2022
- **Understanding the stratospheric ozone response to global warming**
  - Seminar. SEAS Colloquium in Climate Science, Columbia University, NY, NY Nov 2022
  - Seminar. Dept. of Earth and Atmospheric Sciences, Cornell University, Ithaca, NY Nov 2022
  - Poster. SPARC General Assembly, Boulder, CO Nov 2022
- **Why does ozone have an interior maximum? How does ozone respond to global warming?**
  - Talk. From Spectroscopy to Climate, Princeton Center for Theoretical Science, NJ Aug 2022
- **The decade the QBO faltered: Do disruptions pose a crisis to QBO science?**
  - Talk. 23^{rd} Conf. on Atmos. & Oceanic Fluid Dynamics (AOFD), Breckenridge, CO Jun 2022

PRESENTATIONS CONT.

- **Stratospheric dynamics for tropical tropopause layer (TTL) scientists**
  - Seminar. NSF PIRE-CIRRUS student/postdoc seminar — Dec 2020.
- **QBO inference in reanalyses & idealized models: The buffer zone & disruptions**
  - Seminar. NCAR WACCM dev team meeting (remote) — Nov 2020
  - Seminar. Stanford University CLAOD seminar (remote) — Nov 2020
  - Seminar. NASA GMAO informal QBO team (remote) — Oct 2020
  - Seminar. Lutsko group meeting at Scripps Institute of Oceanography (remote) — Oct 2020
- **The buffer zone of the Quasi-Biennial Oscillation: formation and variability**
  - Poster. American Meteorological Society Annual Meeting, Boston, MA — Jan 2020
  - Poster. Atmospheric Circulation in a Changing Climate Workshop, Madrid, ES — Oct 2019
- **The case for a resilient Quasi-Biennial Oscillation**
  - Poster. 22^{nd} Atmospheric and Oceanic Fluid Dynamics Conference, Portland, ME — Jun 2019
  - Talk. IUGG General Assembly, Montreal, QC, CA — Jun 2019
  - Talk. Graduate Climate Conference, Woods Hole, MA — Nov 2019
- **What can observed temperatures tell us about stratospheric dynamics over the past 40 years?**
  - Talk. 19^{th} Conference on the Middle Atmosphere, Portland, OR — Jun 2017
- **Stratospheric dynamics following the eruption of Mt. Pinatubo**
  - Talk. 2^{nd} Stratospheric Sulfur and Its Role in Climate Workshop, Potsdam, DE — Apr 2016
  - Poster. EGU General Assembly, Vienna, AT — Apr 2016
- **Dynamically motivating a definition for sudden stratospheric warmings**
  - Poster. AMS 26^{th} Conference on Climate Variability and Change, Atlanta, GA — Feb 2014