Sylvia C. Sullivan

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EDUCATION

Ph.D. | May 2017 | Georgia Institute of Technology
Major: Chemical Engineering, Minor: Earth and Atmospheric Science
Thesis: *Multi-scale modeling of in-cloud ice crystal formation*
Advisor: Athanasios Nenes

B.S. | June 2012 | California Institute of Technology
Major: Chemical Engineering, Minor: Environmental Science

Study Abroad | Fall 2011 | École Polytechnique
Program: Environmental Fluid Mechanics

ACADEMIC EMPLOYMENT

Assistant Professor | Department of Chemical and Environmental Engineering
Courtesy Appointment | Department of Hydrology and Atmospheric Sciences
University of Arizona | January 2022 - present
- elucidating scale interaction in atmospheric phenomena with simulation and experimentation

Young Investigator Fellow | Institute for Meteorology and Climate Research
Karlsruhe Institute of Technology | November 2019 – November 2021
- radiative effects of tropical ice clouds in the ICON convection-resolving model

Postdoctoral Researcher | Earth and Environmental Engineering Department
Columbia University | September 2017 – September 2019
- satellite climatologies of tropical organized convection and collocated meteorology
- precipitation changes from tropical organized convection with El Niño phase

Doctoral Student | School of Chemical and Biomolecular Engineering
Georgia Institute of Technology | August 2012 – May 2017
- adjoint sensitivity analyses of ice nucleation parameterizations in global climate models
- parcel model development for simulation of secondary ice production processes

Visiting Researcher | Institute for Meteorology and Climate Research
Karlsruhe Institute of Technology | January - July 2016
- secondary ice production parameterizations within the COSMO mesoscale weather model

Visiting Researcher | Climate and Radiation Laboratory
Goddard Space Flight Center | February 2015
- adjoint sensitivity and attribution analyses within the GEOS-5 global climate model

Undergraduate Research Fellow | Air Quality Monitoring Laboratory
Gwangju Institute of Technology | June – August 2011
- NO_2 mixing ratio measurements using Differential Optical Absorption spectroscopy

AWARDS & FUNDING

2024 Science PI, NASA Instrument Incubator Program: *CHanneled Infrared Polarimeter* ($4.5M budget)

2024 PI, NASA Future Investigators in Space Science & Technology: *Investigating MCS Precipitation Biases* ($150k budget)

2024 PI, Salt River Project: *Impact of aerosol vertical distribution on solar panel output during extreme events* ($78.5k budget)

2023 PI, NCAR Collaborative Opportunity for Research Engagement: *Interactive Graphics and Virtual Reality to Communicate Research on Clouds & Precipitation* ($100k budget)

2022 PI, UA Research Innovation, and Impact International Research Grant: *A Transatlantic Collaboration to Link Parameterized Ice Crystal Optical Properties and Simulated Atmospheric Flow* ($12k budget)

2020-2021 KIT Young Investigator Group Preparation Fellowship (100k € budget)

2016 Chemical Engineering Department Ziegler Award for Best Paper

2013-2016 FI, NASA Earth and Space Science Fellowship: Mixed-Phase Cloud Parameterization in Global Climate Models ($150k budget)

2012 Georgia Tech Chemical Engineering Excellence Fellowship

TEACHING

2024-present Instructor for CHEE 402: Chemical Engineering Modeling

2024 Faculty Learning Community on AI-Savvy Education

2023-2024 Faculty Development Communities for Promotion Mentoring Program

2023 Faculty Learning Community on Improving Mental Health in the College Classroom

2022-present Instructor for ATMO/CHEE/ENVS 469B/569B: Aerosol Physics

2022 Kanto Student Engagement Educators Workshop and Mini-FLC

2021 International High-Performance Computing Summer School, mentor

2017 Coursework: Fundamentals of Teaching and Learning in Higher Education, Teaching Practicum, Course Design for Higher Education in fulfillment of the **Tech to Teaching Certification**

2016 Co-Instructor for Georgia Tech ChBE4300: Chemical Kinetics & Reactor Design

2014 Teaching Assistant for Georgia Tech ChBE3210: Transport Processes II

2013 Teaching Assistant for Georgia Tech ChBE4300: Chemical Kinetics & Reactor Design

2012 Teaching Assistant for Caltech ChE 10: Introduction to Chemical Engineering

MENTORING

Doctoral Mentees: Thabo Makgoale (UA ATMO, Fall 2022-present), Edgardo Sepúlveda Araya (UA ENVE, Fall 2022-present), Juliana Mejía Sepúlveda (UA ENVE, Fall 2023-present)

Undergraduate Mentees: Paul Vautravers (University of Manchester Physics, Summer 2022), Tanmay Agrawal (UA CS, Summer-Fall 2023), Linda Engelman (UA ENVE, Fall 2022-Spring 2024), Akshat Singh (UA CS, Fall 2024-present), Hannah Golden (UA CHEME, Spring 2025)

SERVICE & LEADERSHIP

2025 AMS Convener, Climate Impacts of Tropical Cirrus Clouds

2023-present Editorial board, *Nature Communications Earth & Environment*
2023-present UA Summer Engineering Academy (SEA): Environmental Engineering
2022-present Chemical Engineering Graduate Studies Committee
2016-present Reviewer for Geophysical Research Letters, Atmospheric Chemistry and Physics, Geoscientific Model Development, Nature Communications, Nature Geoscience, npj Climate and Atmospheric Science, DOE Atmospheric Science Research, and the NSF Physical Meteorology division.
2014-present American Geophysical Union, European Geophysical Union, and American Meteorological Society member
2019-2023 Lead editor, *Cloud and their Climatic Impacts: Radiation, Circulation, and Precipitation*, AGU Wiley Geophysical Monograph
2022-2023 Research Computing Governance Committee
2022 AGU Co-convener, Cirrus in the tropical upper troposphere and lower stratosphere
2020-2021 EGU Co-convener, Atmospheric Ice clouds observations and modelling
2020-2021 European Conference on Non-Linear Optical Spectroscopy (ECONOS), Co-chair
2014-2015 Chemical and Biomolecular Engineering Graduate Research Symposium, Chair
2014-2015 Women in Engineering Outreach Ambassador
2011 Student Faculty Committee for Chemical Engineering, student representative
2010 Committee on Exchange Programs and Study Abroad, student representative

PUBLICATIONS

Underline indicates an advisee.

1. ***S. C. Sullivan****, D. Bayly, N. Cherukuru, A. Arellano, J. Levine, E. Sepúlveda Araya, and K. Wood. Advanced Visualization Techniques for Clouds & Climate (2025) [in preparation for the Bull. Amer. Meterol. Soc.]*

2. **S. C. Sullivan**, P. Vautravers, T. Beucler, *T. E. Makgoale, and J. Yin. From environmental moisture to surface precipitation in simulations and observations of mesoscale convective systems (2024) [under review at J. Atmos. Sci.].

3. T. E. Makgoale and **S. C. Sullivan**. Characterization and comparison of simulated precipitation efficiency from global storm-resolving models over the Asian monsoon region (2024) [under review at J. Geophys. Res.].

4. E. Sepúlveda Araya, **S. C. Sullivan**, and A. Voigt. Sensitivity of ice-cloud radiative heating to optical, macro- and microphysical properties (2024) [under review at Atmos. Chem. Phys.].

5. B. Gasparini, **S. C. Sullivan**, A. Sokol, B. Kärcher, E. Jensen, and D. Hartmann. Opinion: Tropical cirrus—From micro-scale processes to climate-scale impacts. *Atmo. Chem. Phys.* 23 (24): 15413-15444.

6. L. Gu, J. Yin, P. Gentine, S. Guo, H.-M. Wang, L. J. Slater, **S. C. Sullivan**, J. Zscheischler, J. Zhou, and J. Chen. Large anomalies in future extreme precipitation sensitivity driven by atmospheric dynamics (2023). *Nat. Comm.* 14 (3197).

7. **S. C. Sullivan**, B. Keshtgar, N. Albern, E. Bala, C. Braun, A. Choudhary, J. Hörner, H. Lentink, G. Papavasileiou, and A. Voigt. How Does Cloud-Radiative Heating over the North Atlantic

Change with Grid Spacing, Convective Parameterization, and Microphysics Scheme in ICON version 2.1.00? (2023). *Geosci. Model Develop.* 16 (12) pp. 3535-3551.

8. S. Chakraborty, **S. C. Sullivan**, and Z. Feng. An overview of mesoscale convective systems: Global climatology, satellite observations, and modeling strategies (2023) *Geophys. Monog. Series*. Chapter 9: Clouds & Their Climatic Impacts, pp. 195-221.
9. **S. C. Sullivan** and C. Hoose. Science of cloud and climate science: An analysis of the literature over the past 50 years (2023). *Geophys. Monog. Series*. Chapter 1: Clouds & Their Climatic Impacts, pp. 1-12.
10. **S. C. Sullivan**, A. Voigt, A. Miltenberger, C. Rolf, and M. Krämer. A Lagrangian perspective of ice microphysical impact on cloud-radiative heating (2022). *J. Adv. Model. Earth Sys.* 14 e2022MS003226.
11. **S. C. Sullivan** and A. Voigt. Ice microphysical processes exert a strong control on the simulated radiative energy budget in the tropics (2021). *Comms. Earth & Env.* 2 (137).
12. J. Yin, S. Guo, P. Gentine, **S. C. Sullivan**, L. Gu, S. He, J. Chen, and P. Liu. Does the hook structure constrain future flood intensification under anthropogenic climate warming? (2021). *Water Res. Rev.* 57 (2). [WRR 2021 Editors' Choice Award]
13. S. Bacer, **S. C. Sullivan**, O. Sourdeval, H. Tost, J. Lelieveld, and A. Pozzer. Ice microphysical process rates of large-scale clouds in EMAC (2021). *Atm. Chem. Phys.* 21: 1485-1505.
14. K. Schiro, **S. C. Sullivan**, Y.-H. Kuo, H. Su, P. Gentine, G. S. Elsaesser, J. H. Jiang, and J. David Neelin. Environmental controls on tropical mesoscale convective system precipitation intensity (2020). *J. Atm. Sci.* 77 (12): 4233-4249.
15. **S. C. Sullivan**, K. Schiro, J. Yin, and P. Gentine. Changes in precipitation extremes from organized convection with El Niño warming (2020). *Geophys. Res. Lett.* 47: e2020GL087663.
16. G. Sotiropoulou, **S. C. Sullivan**, J. Savre, G. Lloyd, T. Lachlan-Cope, A. Ekman, and A. Nenes. The impact of secondary ice production on Arctic stratocumulus (2020). *Atmos. Chem. Phys.* 20: 1301-1316.
17. L. Gu, J. Yin, J. Chen, S. Guo, **S. C. Sullivan**, H.-M. Wang, and C.-Y. Xu. Projected increases in magnitudes and socioeconomic exposures of global droughts in 1.5° and 2°C warmer climates (2019). *Hydrol. Earth Syst. Sci.* 24: 451-472.
18. **S. C. Sullivan**, K. Schiro, C. Stubenrauch, and P. Gentine. The response of convective organization throughout the tropics to El Niño warming (2019). *J. Geophys. Res.* 124: 8481-8500.
19. **S. C. Sullivan**, C. Barthlott, J. Crosier, A. Nenes, and C. Hoose. The effect of secondary ice parameterizations on a simulated frontal rain band (2018). *Atmo. Chem. Phys.* 18: 16461-16480.
20. J. Yin, P. Gentine, S. Zhou, **S. C. Sullivan**, R. Wang, Y. Zhang, and S. Guo. Large increase in storm runoff extremes under anthropogenic changes (2018). *Nat. Comm.* 9: 4389.

21. S. Bacer, **S. C. Sullivan**, V. A. Karydis, D. Barahona, A. Nenes, H. Tost, A. P. Tsimpidi, J. Lelieveld, and A. Pozzer. Implementation of a comprehensive ice crystal formation parameterization into the EMAC model (2018). *Geosci. Model Develop.* 11: 4021-4041.
22. **S. C. Sullivan**, C. Hoose, A. Kiselev, T. Leisner, and A. Nenes. Initiation of secondary ice production in clouds (2018). *Atmos. Chem. Phys.* 18: 1593-1610.
23. **S. C. Sullivan**, C. Hoose, and A. Nenes. Investigating the relative contributions of secondary ice formation processes to ice crystal number concentrations (2017). *J. Geophys. Res.* 122 (17): 9391-9412.
24. Field, P. et al. Chapter 7. Secondary Ice Production – current state of the science and recommendations for the future (2016). *Met. Monog.* 58: 7.1-7.20.
25. **S. C. Sullivan**, D. Lee, L. Oreopoulos, and A. Nenes. The role of updraft velocity in temporal variability of cloud hydrometeor number (2016). *Proc. Nat. Acad. Sci.* 113 (21): 5791-5796.
26. **S. C. Sullivan**, R. Morales, D. Barahona, and A. Nenes. Understanding cirrus ice crystal number variability for different heterogeneous nucleation spectra (2016). *Atmos. Chem. Phys.* 16: 2611-2629.
27. B. Sheyko, **S. C. Sullivan**, R. Morales, S. L. Capps, D. Barahona, X. Shi, X. Liu, and A. Nenes. Quantifying sensitivities of ice crystal number and sources of ice crystal number variability in CAM 5.1 using the adjoint of a physically-based cirrus formation parameterization (2015). *Journal of Geophysical Research* 120 (7): 2169-8996.

INVITED PRESENTATIONS

1. Addressing outstanding uncertainties associated with high clouds, *Micro2Macro Workshop*, University of Wyoming, October 2024.
2. Four short stories of interactions across scales in cloud systems, *NASA Goddard Space Flight Center Seminar Series*, October 2024.
3. Convective plumes and ice crystals: The large-scale impacts of local atmospheric phenomena, *UArizona Department of Physics Seminar Series*, September 2024.
4. What Goes on Inside the Clouds? *Desert Laboratory on Tumamoc Hill Public Speaker Series*, February 2024.
5. How ice heats the upper atmosphere, *Lund University Seminar Series*, December 2023.
6. Three frameworks for understanding ice microphysical impact on cloud-radiative heating, *Geophysical Fluid Dynamics Laboratory Seminar Series*, April 2023.
7. Two perspectives on model dependencies of upper tropospheric cloud-radiative heating, *International Commission on Clouds & Precipitation*, November 2022.
8. Ice microphysics and tropical atmospheric radiative heating, *Forschungszentrum Jülich Seminar Series*, July 2022.
9. Ice microphysics and tropical atmospheric radiative heating, *The Swiss Federal Institute of Technology INP Colloquium [virtual]*, May 2021.

10. Ice crystals and convective plumes: The large-scale impacts of local atmospheric phenomena, *The University of Arizona Chemical & Environmental Engineering Seminar Series*, March 2021.
11. From environmental moisture to precipitation intensity in tropical convective systems, *Laboratoire de Météorologie Dynamique*, February 2020.
12. The role of large-scale circulation and ice microphysics on Mediterranean precipitation extremes, *Centre National d'Études Spatiales*, May 2019.
13. The relationship of atmospheric ice content and vertical velocities, *Brookhaven National Laboratory*, December 2018.
14. Multi-scale modeling of in-cloud ice crystal formation, *Geophysical Fluid Dynamics Laboratory*, October 2016.
15. The role of updraft velocity in temporal variability of cloud hydrometeor number, *Georgia Tech School of Chemical Engineering Seminar Series*, October 2016.

SKILLS

Computer: Python, MATLAB, Fortran, LaTeX, bash, git
Language: French (advanced), German (intermediate), Spanish (elementary)