

Clare Singer

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Pasadena, CA 91125

Education

- **California Institute of Technology** Pasadena, CA
Department of Environmental Science and Engineering October 2018 - Present
 - M.S. June 2020; Ph.D. expected June 2023
 - Advisor: Dr. Tapio Schneider
- **University of Chicago** Chicago, IL
BA Physics, BS Mathematics September 2014 - June 2018
 - Research Advisor: Dr. Liz Moyer

Research Experience

- **Caltech, Department of Environmental Science & Engineering** Pasadena, CA
Graduate Researcher October 2018 - Present
 - I study cloud feedbacks: how clouds respond to climate change. I use high-resolution simulations, pencil-and-paper theory, and satellite observations to study cloud dynamics and constrain cloud changes in a bottom-up approach, while also looking at how clouds shape Earth's climate from a top-down perspective.
- **University of Chicago, Department of the Geophysical Sciences** Chicago, IL
Undergraduate Researcher January 2017 - January 2022
 - Helped test, calibrate, and operate the Chicago Water Isotope Spectrometer (ChiWIS) that flew in the StratoClim campaign in July/August 2017 over the Asian monsoon. Processed and analyzed data from the StratoClim campaign. Led to a publication with an intercomparison of water vapor measurements taken during StratoClim.

Publications

1. **C.E. Singer**, I. Lopez-Gomez, X. Zhang, and T. Schneider, "Top-of-atmosphere albedo bias from neglecting three-dimensional cloud radiative effects." *Journal of Atmospheric Science*, 78(12), 4053-4069, 2021.
2. P. Bartman, O. Bulenok, K. Górski, A. Jaruga, G. Lazarski, M.A. Olesik, B. Piasecki, **C.E. Singer**, A. Talar, and S. Arabas, "PySDM v1: particle-based cloud modeling package for warm-rain microphysics and aqueous chemistry." *Journal of Open Source Software*, 7(72), 3219, 2022.
3. Y. Ming, N. G. Loeb, P. Lin, Z. Shen, V. Naik, **C.E. Singer**, R.X. Ward, F. Paulot, Z. Zhang, N. Bellouin, L.W. Horowitz, P.A. Ginoux, and V. Ramaswamy, "Assessing the influence of COVID-19 on the shortwave radiative fluxes over the East Asian Marginal Seas." *Geophysical Research Letters*, e2020GL091699, 2020.
4. **C.E. Singer**, B.W. Clouser, S.M. Khaykin, M. Krämer, F. Cairo, T. Peter, A. Lykov, C. Rolf, N. Spelten, A. Afchine, S. Brunamonti, and E.J. Moyer, "Intercomparison of UTLS water vapor measurements over the Asian Summer Monsoon." *Atmospheric Measurement Techniques*, 15, 4767-4783, 2022.
5. S.M. Khaykin, E.J. Moyer, M. Krämer, B. Clouser, S. Bucci, B. Legras, A. Lykov, A. Afchine, F. Cairo, I. Formanyuk, V. Mitev, R. Matthey, C. Rolf, **C.E. Singer**, N. Spelten, V. Volkov, V. Yushkov, and F. Strohm, "Persistence of moist plumes from overshooting convection in the Asian monsoon anticyclone." *Atmospheric Chemistry and Physics*, 22, 3169-3189, 2022.
6. R. Bernstein, **C.E. Singer**, S.P. Singh, C. Mao, and C.J. Arnusch, "UV initiated surface grafting on polyethersulfone ultrafiltration membranes via ink-jet printing assisted modification." *Journal of Membrane Science*, 548, 2018.
7. K.A. Murphy, N. Reiser, D. Chosky, **C.E. Singer**, and H.M. Jaeger, "Freestanding loadbearing structures with Z-shaped particles." *Granular Matter*, 18 (26), 2016.

In review or in preparation:

- a) K.A. Schiro, H. Sui, F. Ahmed, N. Dai, **C.E. Singer**, P. Gentine, G.S. Elsaesser, J.H. Jiang, and J.D. Neelin, “Model spread in tropical low cloud feedback tied to overturning circulation response to warming.” *Nature Communications*, In review.
- b) E.K. de Jong, **C.E. Singer**, S. Azimi, P. Bartman, K. Derlatka, I. Dula, A. Jaruga, J.B. Mackay, R.X. Ward, and S. Arabas. “PySDM v2: collisional breakup, immersion freezing, dry aerosol initialization, and adaptive time-stepping.” *Journal of Open Source Software*, In review.
- c) **C.E. Singer** and T. Schneider, “Stratocumulus-to-cumulus transition explained by bulk boundary layer theory.” *Journal of Climate*, In Prep.
- d) **C.E. Singer** and T. Schneider, “CO₂-driven stratocumulus cloud breakup in a bulk boundary layer model.” *Journal of Climate*, In Prep.
- e) B.W. Clouser, L.C. Sarkozy, **C.E. Singer**, C. KleinStern, D. Gaeta, S.M. Khaykin, and E.J. Moyer, “The Airborne Chicago Water Isotope Spectrometer: An Integrated Cavity Output Spectrometer for Measurements of the HDO/H₂O Isotopic Ratio in the Asian Summer Monsoon.” *Atmospheric Measurement Techniques*, In Prep.
- f) B.W. Clouser, **C.E. Singer**, S.M. Khaykin, and E.J. Moyer, “Isotopic composition of water vapor in the Asian Summer Monsoon.” *Atmospheric Chemistry and Physics*, In Prep.

Conference Presentations

- 1. “Stratocumulus cloud feedbacks in a simple physical model.” **Oral**. CalGFD; Pasadena, CA; August 2022.
- 2. “Extended mixed-layer theory for the stratocumulus-cumulus transition in climatology and under extreme CO₂ forcing.” **Oral**. CFMIP; Seattle, WA; July 2022.
- 3. “Successes, Challenges, and Lessons Learned by the Caltech URGE Pod.” **Poster**. AGU 2021 Fall Meeting; New Orleans, LA; December 2021.
- 4. “Analytical Theory for Stratocumulus Cloud Feedbacks.” **Oral**. AGU 2021 Fall Meeting; New Orleans, LA; December 2021.
- 5. “Quantifying Cloud Sensitivity to Aerosol Hygroscopicity using a Lagrangian Cloud Model.” **Virtual oral**. ICCP; August 2021.
- 6. “Top-of-atmosphere albedo bias from neglecting three-dimensional radiative transfer through clouds.” **Virtual poster**. AGU 2020 Fall Meeting; December 2020.
- 7. “Investigating Stratocumulus Cloud Sensitivity to Aerosol Hygroscopicity using a Lagrangian Particle-based Microphysics Model.” **Poster**. AGU 2019 Fall Meeting; San Francisco, CA; December 2019.
- 8. “A Conceptual Model of the Climate Change Response in Stratocumulus-Topped Boundary Layers.” **Poster**. AMS Conference on Atmospheric and Oceanic Fluid Dynamics; Portland, ME; June 2019.
- 9. “ChiWIS: The Chicago Water Isotope Spectrometer.” **Poster** Goldschmidt; Boston, MA; Aug 2018.
- 10. “Comparison of water vapor from observations and models in the Asian Monsoon UTLS region.” **Poster**. AGU 2017 Fall Meeting; New Orleans, LA; Dec 2017.

Professional Service

- **Journal reviewer** for *Nature*, *Geophysical Research Letters*, *Journal of Geophysical Research: Atmospheres*, *Journal of the Atmospheric Sciences*
- **Organizer** of ESE Department Seminar (2019-2022)

Selected Awards, Fellowships, and Honors

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| CalGFD Student Presentation Award | 2022 |
| CFMIP Outstanding Early Career Presentation Award | 2022 |
| Caltech ESE Department Service Award | 2021 |
| Richard H. Jahns Teaching Award (Caltech GPS Division TA Award) | 2021 |
| NSF Graduate Research Fellowship | 2018-2021 |
| Barry M. Goldwater Scholarship | 2017 |
| Astronaut Scholarship | 2017 |
| John Haeseler Lewis Prize (UChicago top graduating physics major) | 2018 |
| David W. Grainger Fellowship (UChicago top rising senior in physics) | 2017 |

Teaching and Mentoring

- **Teaching Assistant** Caltech
ESE 101 (Fall 2019), ESE 130 (Winter 2021), ESE 134 (Spring 2022) 2019-2022
 - ESE 101 (Earth's Atmosphere): I developed weekly quizzes, hosted office hours, and graded homework assignments.
 - ESE 130 (Atmosphere and Ocean Dynamics, an introductory GFD course): I hosted office hours, graded homework assignments, and created short videos for asynchronous learning.
 - ESE 134 (Cloud and Boundary Layer Dynamics): I wrote and graded homework assignments, hosted weekly office hours, prepared two 90-minute lectures on stratocumulus-topped boundary layers and cloud microphysics, and graded student final presentations and written reports.
- **SURF mentor** Caltech
Summer Undergraduate Research Fellow program Summer 2022
 - I mentored a Caltech undergrad student in her first research experience through the SURF program.
 - **Scientific goals:** characterize subtropical humidity in present climate, how it changes under future emissions scenarios, and quantify the spread across the CMIP6 model ensemble.
 - **Technical goals:** develop coding skills, learn how to work with large amounts of data on remote machines, gain familiarity with climate science concepts.

DEI and Outreach Activities

- **Caltech GPS URGE Pod** Caltech
Member (2020-2022) and Leader (2022) 2020 - Present
 - Participant and leader of the Caltech GPS's Unlearning Racism in the Geoscience Pod. This group participated in the national curriculum for URGE in Jan-June 2020 reading primary literature on structural racism in the geosciences and developing action plans for our own department. From June 2020 until present our Pod has been enacting these plans – working with our division's DEI committee, Academic Committee, Fieldwork Committee, and the Chair.
- **Women in GPS student group** Caltech
President (2021-2022); Vice President (2019-2021) 2018 - Present
 - Manages and oversees club activities – including journal club discussions, workshops, and social events – communicates with faculty, and recruiting new members.
- **Title IX Student Leadership Team** Caltech
Giving Voice script writer (2019-2020); Title IX Council member (2019-2022) 2019 - Present
 - My work on the Student Advisory Council and with Giving Voice creates awareness around Title IX issues and provides resources for students, staff, and faculty.
- **SAT Math Tutor** Pasadena, CA
Caltech Y Rise Program 2020 - 2021
 - Tutored local high school students on SAT Math skills remotely over Zoom (due to COVID-19 pandemic shutdowns).