Shay Gilpin

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Education

Doctorate in Philosophy **Aug 2023**
University of Colorado Boulder, Applied Mathematics.
Advisor: Dr. Tomoko Matsuo
Thesis: *A new perspective on covariance propagation for data assimilation applications.*

Masters of Science **May 2022**
University of Colorado Boulder, Applied Mathematics.

Bachelor of Arts **Jun 2017**
University of California Santa Cruz, Mathematic major, minor in Chemistry.
Summa cum laude with highest honors in the major.

Research Experience

Postdoctoral Research Associate I **Aug 2023 – Present**
Department of Mathematics, University of Arizona. Funded by the National Science Foundation (NSF) Data Driven Discovery Research Training Grant (RTG).

National Science Foundation Graduate Research Fellow **Aug 2019 – Aug 2023**
University of Colorado Boulder. Graduate research funded by the NSF Graduate Research Fellowship.
Advisor: Dr. Tomoko Matsuo.

Visiting Scientist **Oct 2017 – Mar 2019**
UCAR COSMIC Program. Research scientist at the University Corporation for Atmospheric Research (UCAR) Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC) Program. Advisor: Dr. Richard Anthes.

NSF SOARS Protegé **Jun – Oct 2017; Jun – Sep 2016**
UCAR. NSF Significant Opportunities in Atmospheric Research and Science (SOARS) research intern at the UCAR COSMIC Program.

Fellowships, Grants, and Honors

Donald L. Turcotte Award **Sep 2024**
Recognization for outstanding dissertation research in nonlinear geophysics awarded by the American Geophysical Union.

American Mathematical Society (AMS)-Simons Travel Grant **Jul 2024**
Two year travel grant awarded to postdoctoral researchers by the Simons Foundation.

National Science Foundation Graduate Research Fellowship **Apr 2019**
Five year graduate research fellowship funded through the NSF that supports outstanding graduate students in the science, technology, engineering, and mathematics disciplines.

Publications

Gilpin, S., Matsuo, T., and Cohn, S.E., 2025: *Inaccuracy of the variance evolution associated with discrete covariance propagation*, *Q. J. Roy. Meteor. Soc.*, 1 – 26, https://doi.org/10.1002/qj.5016.

Gilpin, S., Matsuo, T., and Cohn, S.E., 2023: *A generalized, compactly-supported correlation function for data assimilation applications, Q. J. Roy. Meteor. Soc.*, 149, 1953 – 1989, https://doi.org/10.1002/qj.4490.

Gilpin, S., Matsuo, T., and Cohn, S.E., 2022: *Continuum covariance propagation for understanding variance loss in advective systems, SIAM/ASA J. Uncertainty Quantification*, 10, 886 – 914, https://doi.org/10.1137/21M1442449.

Gilpin, S., Anthes, R., and Sokolovskiy, S., 2019: *Sensitivity of forward-modeled bending angles to vertical interpolation of refractivity for radio occultation data assimilation, Mon. Weather Rev.*, 147, 269 – 289, https://doi.org/10.1175/MWR-D-18-0223.1.

Gilpin, S., Rieckh, T., and Anthes, R., 2018: *Reducing representativeness errors during radio occultation – radiosonde comparisons, Atmos. Meas. Tech.*, 11, 2567 – 2582, https://doi.org/10.5194/amt-11-2567-2018.

Submitted Publications

Gilpin, S., 2025: *Inaccuracy of ensemble-based covariance propagation, beyond sampling error,* submitted to *Tellus A: Dynamic Meteorology and Oceanography*, Aug 2025. https://doi.org/10.48550/arXiv.2508.16567.

Gilpin, S., Morzfeld, M., Lin, K., 2025: *Numerical study of high-dimensional covariance estimation and localization for data assimilation,* submitted to *Mon. Weather Rev.*, Aug 2025. https://doi.org/10.48550/arXiv.2508.18299.

Invited Talks and Seminars

Gilpin, S.: *Inaccurate variance evolution implied by discrete covariance propagation*, 1W-MINDS Virtual Seminar Series, Sep 25, 2025.

Gilpin, S.: *A new perspective on covariance propagation for data assimilation applications*, Turcotte Awardee Lecture, American Geophysical Union Annual Meeting, Washington D.C., Dec, 2024.

Gilpin, S., Matsuo, T., and Cohn, S.E.: *Inaccuracy of the variance evolution associated with discrete covariance propagation*, Advances in Data Assimilation, Data Fusion, Machine Learning, Predictability and Uncertainty Quantification in the Geosciences, American Geophysical Union Annual Meeting, Washington D.C., Dec, 2024.

Gilpin, S.: *A new parametric correlation function for geophysical data assimilation applications*, IGPP Seminar, Scripps Institution of Oceanography, UCSD, San Diego, CA, Apr, 2024.

Gilpin, S., Matsuo, T., and Cohn, S.E., 2023: *Covariance propagation in data assimilation: a continuum analysis for advective systems*. Mathematical Approaches of Atmospheric Chemical Constituent Data Assimilation and Inverse Modeling Workshop, Banff, Alberta, CAN, Mar, 2023.

Gilpin, S.: *Bringing science to the next generation: the impacts of Richard Anthes on a young scientist's carrer*. Invited Oral Presentation, American Meteorological Society Annual Meeting, Phoenix, AZ, Jan, 2019.

Conference Activity

Gilpin, S., Morzfeld, M., and Lin, K.,: *Simple and sophisticated localization for ensemble-based data assimilation*. Oral Presentation. SIAM Conference on Mathematical & Computational Issues in the Geosciences, Baton Rouge, LA, Oct, 2025.

Gilpin, S., Morzfeld, M., and Lin, K.,: *Covariance estimation for high-dimensional data assimilation applications*. Oral Presentation. SIAM Conference on Applications of Dynamical Systems, Denver, CO, May, 2025.

Gilpin, S., Matsuo, T., and Cohn, S.E.: *Inaccuracy of the variance evolution associated with discrete covariance propagation*, Poster Presentation, Dynamics Days, Denver, CO, Jan, 2025.

Gilpin, S., Morzfeld, M., and Lin, K.,: *Covariance estimation for high-dimensional geophysical applications*. Oral Presentation. SIAM Mathematics of Planet Earth, Portland, OR, June, 2024.

Gilpin, S., Matsuo, T., and Cohn, S.E.: *The inaccurate variance evolution associated with discrete covariance propagation*, Oral Presentation, 12th Workshop on Meteorological Sensitivity Analysis and Data Assimilation, Lake George, NY, May, 2024.

Gilpin, S., Morzfeld, M., and Lin, K.: *Covariance estimation for high-dimensional geophysical applications*. Oral Presentation. CaCAO Days, Scripps Institution of Oceanography, UCSD, San Diego, CA, Apr, 2024.

Gilpin, S., Matsuo, T., and Cohn, S.E.: *An alternative approach to standard methods of covariance propagation*. Oral Presentation, SIAM Conference on Uncertainty Quantification, Trieste, Italy, Feb/Mar, 2024.

Gilpin, S., Matsuo, T., and Cohn, S. E.: *A generalized, compactly-supported correlation function for data assimilation applications*. Oral Presentation, American Meteorological Society Annual Meeting, Denver, CO, January, 2023.

Gilpin, S., Matsuo, T., and Cohn, S. E.: *Continuum covariance propagation for understanding variance loss in advective systems*. Poster Presentation, WCRP-WWRP Joint Symposium on Data Assimilation and Reanalysis (virtual), Sept, 2021.

Gilpin, S., Matsuo, T., and Cohn, S. E.: *Continuum covariance propagation for understanding variance loss in advective systems*. Contributed Presentation, Society for Industrial and Applied Mathematics (SIAM) Conference on Mathematical & Computational Issues in the Geosciences (virtual), June, 2021.

Gilpin, S., Matsuo, T., and Cohn, S. E.: *Continuum covariance propagation for understanding variance loss in advective systems*. Oral Presentation, International Symposium on Data Assimilation (virtual), Mar, 2021.

Gilpin, S., Rieckh, T., and Anthes, R.: *Reducing representativeness errors during radio occultation – radiosonde comparisons*. Oral Presentation, American Meteorological Society Annual Meeting, Phoenix, AZ, Jan 2019.

Gilpin, S., Anthes, R., Sokolovskiy, S., and Rieckh, T.: *Calculation of radio occultation bending angles from models: sensitivity to vertical interpolation methods.* Oral presentation, American Meteorological Society Annual Meeting, Austin, TX, Jan 2018.

Gilpin, S., Anthes, R., Sokolovskiy, S., and Rieckh, T.: *Calculation of radio occultation bending angles from models: sensitivity to vertical interpolation methods.* Poster presentation, COSMIC/IROWG Workshop, Estes Park, CO, Sept 2017.

Gilpin, S., Rieckh, T., Anthes, R., and Lu, G.: *An elliptical approach to radio occultation and radiosonde comparisons.* Poster presentation, American Meteorological Society Annual Meeting, Seattle, WA, Jan 2017.

Software Development

A Generalied Gaspari-Cohn Correlation Function **2023**
https://doi.org/10.5281/zenodo.7859258
Python and Fortran software to construct the correlation function in Gilpin et al., (2023).

Teaching Experience

Instructor

Analysis of Ordinary Differential Equations (Math 355), University of Arizona. **Fall, Spring 2025**

Introduction to Linear Algebra (Math 313), University of Arizona. **Fall 2024**

Undergraduate Teaching Assistant (UTA) Seminar (Math 491), University of Arizona. **Fall 2024**

Wildcat Proof Workshop (Math 396L), University of Arizona. **Spring 2024**

Vector Calculus Supplement (Math 196V), University of Arizona. **Spring 2024**

First Semester Calculus (Math 122B), University of Arizona. **Fall 2023**

Teaching Assistant

Teaching Excellence, University of Colorado Boulder. **Fall 2020**
Teaching assistant for the graduate course on teaching pedagogy.

Calculus 1 and 2 for Engineers (APPM 1350, 1360), University of Colorado Boulder. **Fall 2020, Spring 2019, Fall 2018**

Academic Service, Mentoring, and Scientific Outreach

RTG Seminar Co-Organizer **Aug 2023 – Present**
University of Arizona. Co-organizer of the department RTG Seminar, focusing on technical topics in data driven discovery and applied mathematics, and professional development for graduate students.

Undergraduate Committee Postdoc Representative **Aug 2025 – Present**
University of Arizona. Non-voting member of the Undergraduate Committee, which is responsible for setting the undergraduate curriculum.

Undergraduate Teaching Assistant Mentor **Aug 2025 – Present**
University of Arizona. Mentor for undergraduate teaching assistant for Math 355 course.

Undergraduate Research Mentor **Jun – Aug 2025, 2024**
University of Arizona. Research mentor for a undergraduate student in the NSF Data Driven Discovery RTG Summer REU Program.

Undergraduate Teaching Assistant (UTA) Program Co-Coordinator **Nov 2023 – Dec 2024**
University of Arizona. One of two coordinators of the UTA program, which provides undergraduate math majors teaching experience in upper division math courses.

RTG Showcase Co-Organizer **Jan – Apr 2024**
University of Arizona. Co-organizer for a two-day workshop on Data Driven Discovery hosted by the University of Arizona on Apr 13 – 14th, 2024.

Applied Mathematics Graduate Student Mentor **Jul 2019 – Jul 2023**
University of Colorado Boulder. Mentorship program for first year graduate students in the Applied Mathematics Department.

AWM/SIAM Study Session Coordinator **Jan 2020 – May 2022**
University of Colorado Boulder. One of two coordinators for the Association for Women and Math (AWM)/Society for Industrial and Applied Mathematics (SIAM) study sessions for Calculus 1/2/3 and Differential Equation courses.

Center for Teaching and Learning Lead **May 2020 – May 2021**
University of Colorado Boulder. One of two lead teaching assistants for the Applied Mathematics Department, serving as a resource for department teaching assistants and liaison between department and the Center for Teaching and Learning.

Gilpin, S.: *Mathematics of the atmosphere and how we predict the weather*. Oral Presentation, CU Boulder STEMinar Series, Apr 6, 2021.

Graduate School Peer Mentor **Aug – Dec 2019**
Mentor for a first year PhD physics student, providing support and mentorship through the first semester of graduate school.

NSF SOARS Mentor **May – Aug 2019**
UCAR. Mentor for a NSF SOARS Protegé through the UCAR. Included mentoring in research skills, presenting scientific research, and the graduate school application process.

Professional Development and Workshops

Transforming Your Research into Teaching (TYRIT) Workshop **Jun – Jul 2022**
University of Colorado Boulder. The TYRIT workshop series teaches graduate students how to build a course from the ground up using their PhD research as the inspiration for their course.

Gilpin, S. and V. Stout: *Establishing Your Ideal Classroom Climate on Day 1.* Center for Teaching and Learning Fall Intensive, August 20, 2020.

Joint Effort for Data Assimilation Integration (JEDI) Academy **Jun 2019**
UCAR. The JEDI Academy Workshop provides an overview and training in the Joint Center for Satellite Data Assimilation's JEDI system.

Honors, Awards, and Certificates

Certificate in College Teaching **Aug 2022**
Certificate awarded through the Center for Teaching and Learning (CTL) at the University of Colorado Boulder, for graduate students to develop a firm foundation in college teaching.

Society for Industrial and Applied Mathematics Travel Award **May 2021**
Travel award for attendance at the Society for Industrial and Applied Mathematics Conference on Mathematical & Computational Issues in the Geosciences, June 21 – 24, 2021.

American Meteorological Society Conference Best Student Presentation **Feb 2019**
Best student presentation at the 23rd Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS) Conference at the American Meteorological Society Annual Meeting, Phoenix, AZ, 2019.