

Shay Gilpin

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EDUCATION

<i>Doctorate in Philosophy</i>	Aug 2023
University of Colorado Boulder, Applied Mathematics.	
Advisor: Dr. Tomoko Matsuo	
Thesis: <i>A new perspective on covariance propagation for data assimilation applications.</i>	
<i>Masters of Science</i>	May 2022
University of Colorado Boulder, Applied Mathematics.	
<i>Bachelor of Arts</i>	Jun 2017
University of California Santa Cruz, Mathematic major, minor in Chemistry.	
Summa cum laude with highest honors in the major.	

RESEARCH EXPERIENCE

<i>Postdoctoral Research Associate I</i>	Aug 2023 – Present
Department of Mathematics, University of Arizona. Funded by the National Science Foundation (NSF) Data Driven Discovery Research Training Grant (RTG).	
<i>National Science Foundation Graduate Research Fellow</i>	Aug 2019 – Aug 2023
University of Colorado Boulder. Graduate research funded by the NSF Graduate Research Fellowship.	
Advisor: Dr. Tomoko Matsuo.	
<i>Visiting Scientist</i>	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.	
<i>NSF SOARS Protégé</i>	Jun – Oct 2017; Jun – Sep 2016
UCAR. NSF Significant Opportunities in Atmospheric Research and Science (SOARS) research intern at the UCAR COSMIC Program.	

HONORS AND FELLOWSHIPS

<i>Donald L. Turcotte Award</i>	Sep 2024
Recognition for outstanding dissertation research in nonlinear geophysics awarded by the American Geophysical Union.	
<i>National Science Foundation Graduate Research Fellowship</i>	Apr 2019
Five year graduate research fellowship funded through the NSF that supports outstanding graduate students in the science, technology, engineering, and mathematics disciplines.	
<i>American Meteorological Society Conference Best Student Presentation</i>	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.	

GRANTS

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- American Mathematical Society (AMS)-Simons Travel Grant* **Jul 2024**
Two year travel grant awarded to postdoctoral researchers by the Simons Foundation.
- 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, Jun 2021.

PUBLICATIONS

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- 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.** and Herty, M., 2025: *A modified particle filter that reduces weight collapse*, submitted to *Physical Review E*, Oct 2025. <https://doi.org/10.48550/arXiv.2510.23740>.
- 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

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- 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 career*. 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, 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 Generalised 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**
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

Certificate in College Teaching **Aug 2022**
Awarded by the Center for Teaching and Learning (CTL) at the University of Colorado Boulder.

Transforming Your Research into Teaching (TYRIT) Workshop **Jun – Jul 2022**
University of Colorado Boulder. Workshop series to train graduate students in designing university courses based on their research.

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.