

Nicholas M. Geyer

CONTACT INFORMATION	234 ATS West Department of Atmospheric Science Colorado State University Fort Collins, CO 80521 USA	<i>Phone:</i> (970) 631-7393 <i>E-mail:</i> geyer@atmos.colostate.edu <i>Website:</i> nmg5038.github.io <i>Linked-In:</i> https://www.linkedin.com/in/nicholasgeyer
RESEARCH INTERESTS	Land-surface, chemical, and atmospheric modeling, statistical inversion modeling, bayesian statistics, spatial statistics, modeling optimization methods, ecosystem remote sensing methods	
EDUCATION	Colorado State University , Fort Collins, Colorado USA Ph.D., Atmospheric Science, September 2018-Present <ul style="list-style-type: none">• Thesis Topic: “Carbon Dioxide Distribution Implications using Explicit Convective Transport in A Climate Model”• Advisor: Scott Denning Colorado State University , Fort Collins, Colorado USA M.Sc., Atmospheric Science, August 2011-May 2015 <ul style="list-style-type: none">• Thesis Topic: “Time-Filtered Inverse Modeling of Land-Atmosphere Carbon Exchange”• Advisor: Scott Denning The Pennsylvania State University , State College, Pennsylvania USA B.Sc., Meteorology with Option in Atmospheric Science, December 2010	
HONORS AND AWARDS	Chi Epsilon Pi, International Meteorological Honors Society, 2008. NSF Research Experiences for Undergraduates, Arctic Region Supercomputing Center, 2009.	
RESEARCH EXPERIENCE	Aeris LLC , Louisville, Colorado USA <i>Research Scientist II</i> December 2020 - June 2021 Worked on various projects related to Department of Defense and other government entity meteorological needs. Responsible for input preparation, model execution and output analysis of multiple weather and dispersion model output for client needs. <ul style="list-style-type: none">• Analyzed multiple sources of output from several dispersion models to create multiple fidelity products for clients regarding interests with both weather and climate concerns.• Implemented GPU-based methods to increase efficiency of large eddy simulations in both resolution and size.• Validated new dispersion and GPU-LES models for usage within an application interface for an operational product used by the U.S. Department of Defense Colorado State University , Fort Collins, Colorado USA <i>Research Associate II, Project: Atmospheric Carbon Transport-America</i> January 2018 - November 2020 Worked with my advisor, Dr. Scott Denning, to introduce explicit vertical atmospheric carbon dioxide transport within a fully coupled General Circulation Model. Responsible for resource solicitation, algorithm implementation, code testing, data analysis, and scientific communication of the results. <ul style="list-style-type: none">• Solicited and awarded all requested supercomputer resources on NASA’s Pleiades cloud supercomputer.• Implemented vertical passive tracer transport within both the Community Earth System Model 2 and its super-parameterized convection variant.	

- Compared resultant carbon dioxide fields against both versions of the model and aggregated statistics from flight campaign observations, high resolution transport models, and coarse resolution cloud resolving models.
- Found a significant difference in the transport and seasonality of carbon dioxide at local, regional, and global scales by using explicit convection and resolving atmospheric frontal features.

Research Associate II, Project: Orbiting Carbon Observatory-2 **May 2016 - December 2017**

Created a new Bayesian optimization regularization framework designed to temporally characterize long-lived and persistent ecosystem carbon dioxide flux biases by using biospheric net ecosystem exchange and solar-induced fluorescence (SIF) fluxes. Responsible for algorithm development, implementation and results communication. Advised by Dr. Scott Denning

- Worked and cleaned with satellite data from Global Ozone Monitoring Experiment 2 (GOME-2) and Orbiting Carbon Observatory 2 from 2014 through 2018 aggregated over 30 FLUXNET sites.
- Designed and implemented a Bayesian Hierarchical Regression Model to determine functional relations between SIF and photosynthesis for atmospheric inversion implementation.
- Found that seasonal cycle of photosynthesis and respiration were well-resolved and robust

Graduate Research Assistant

August 2011 - December 2015

Worked with my advisor, Dr. Scott Denning, to create a Bayesian optimization algorithm used to temporally characterize long-lived and persistent ecosystem carbon dioxide flux biases. Responsible for algorithm development, implementation and results significance. Obtained proficiency with observing and modeling ecosystem quantities and uncertainties from eddy-covariance measured ecosystem fluxes: net ecosystem exchange, gross primary production, respiration; as well as satellite measured quantities: column-integrated carbon dioxide mole fraction (χ_{CO_2}) and solar-induced fluorescence (SIF). Furthermore, this position also required mandatory and optional course work to use satisfy an M.Sc in Atmospheric Science from the university.

- Created an Bayesian optimization algorithm based on state estimation theory and signal harmonics to isolate long-lived biases in land-surface model output.
- Tested framework with land-surface output from the Simple Biosphere Model 4 against net ecosystem exchange and photosynthesis fluxes from 36 FLUXNET eddy-covariance towers.
- Found that resultant estimates were statistically better seasonally and more robust than comparable discrete algorithms.

Center for Multiscale Modeling of Atmospheric Processes, Fort Collins, Colorado USA

Research Intern

June 2010 - August 2010

Undergraduate summer research project focused toward the 3-D visualization of output from the Colorado State University's Vector Vorticity Model focused toward modeling of the Tropical Warm Pool-International Cloud Experiment. Advised by Dr. David Randall and Dr. Celal Konor.

- Used visualization results to develop new skills in model theory, development and statistical data analysis
- Discovered several theoretical biases and bugs which lead to fixes and overhauls in the model design once the internship was complete.

University of Alaska, Fairbanks, Alaska USA

Research Intern

June 2009 - August 2009

Worked with my summer research advisor, Dr. Martha Shulski, to create FORTRAN-based Quality Assured/Quality Control protocol for usage with state-wide weather observations of Alaska. This was a big data problem that required the usage of a supercomputer and the Weather Research and Forecasting Model (WRF) to validate many weather observations. Used the resultant observations to create basic meteorological climatologies for Alaska's North Slope

region.

- Learned the effective usage of FORTRAN for multi-processor (MPI) modeling and basic data analysis.
- Developed communication skills for non-meteorologists

PAPERS IN
PREPARATION

Geyer, N. M., A. S. Denning, and K. D. Haynes. Time-Filtered Inverse Modeling of Land-Atmosphere Carbon Exchange.

Geyer, N. M., A. S. Denning, I. T. Baker, K. D. Haynes, and A. S. Schuh. Robust Estimation of Long-lived Carbon Dioxide Flux Biases via SIF and NEE.

CO-AUTHORED
PAPERS

Gallup, S. M., Baker, I. T., Gallup, J. L., Restrepo-Coupe, N., Haynes, K. D., Geyer, N. M., Denning, A. S. (2021). Accurate simulation of both sensitivity and variability for Amazonian photosynthesis: Is it too much to ask? *Journal of Advances in Modeling Earth Systems*, 13, e2021MS002555. <https://doi.org/10.1029/2021MS002555>

CONFERENCE
PRESENTATIONS

Geyer, N. M., A. Schuh, M. Branson, and A. S. Denning. 2020. Resolving Scales on Atmospheric Tracer Transport. Spring 2020 Atmospheric Carbon Transport: America Science Team Meeting, Online, April 27–27, 2020.

Geyer, N. M., A. S. Denning, M. Branson, A. Schuh, and A. Jacobson. 2019. Multi-scale Dependence of Atmospheric Carbon Dioxide Transport within a GCM. A53I-04, 52nd American Geophysical Union Fall Meeting, San Francisco, California December 9–13, 2019. (eLightning)

Geyer, N. M., A. S. Denning, and M. Branson. 2018. Scale Dependence of Atmospheric Carbon Transport. A43N-3321, 51st American Geophysical Union Fall Meeting, Washington, D.C. December 10–14, 2018. (Poster)

Geyer, N. M., A. S. Denning, I. T. Baker, K. D. Haynes, and A. S. Schuh. 2017. Robust Estimation of Long-lived Carbon Dioxide Flux Biases via SIF and NEE. Fall 2017 OCO-2 Science Team Meeting, Boulder, Colorado. October 25–27, 2017.

Geyer, N. M., A. S. Denning, I. T. Baker, K. D. Haynes, and A. S. Schuh. 2017. Robust Estimation of Long-lived Carbon Dioxide Flux Biases via SIF and NEE. 127, 10th International Carbon Dioxide Conference, Interlaken, Switzerland. August 20–27, 2017. (Poster)

Geyer, N. M., A. S. Denning, I. T. Baker, K. D. Haynes, and A. S. Schuh. 48. Long-lived and Robust Land-Atmosphere Flux Bias Estimation via SIF and NEE. B21B-0443, 2017 Joint NACP & AmeriFlux PI Meeting, Bethesda, Maryland. March 27–30, 2017. (Poster)

Geyer, N. M., A. S. Denning, I. T. Baker, and K. D. Haynes. 2016. Long-lived and Robust Land-Atmosphere Flux Bias Estimation via SIF and NEE. B21B-0443, 49th American Geophysical Union Fall Meeting, San Francisco, California. December 12–16, 2016. (Poster)

Geyer, N. M., A. S. Denning, and K. D. Haynes. 2015. Time-Filtered Inverse Modeling of Land-Atmosphere Carbon Exchange. B21I-08. 48th American Geophysical Union Fall Meeting. San Francisco, California. December 14–18, 2015.

Geyer, N. M. and A. S. Denning. 2015. Time-Filtered Inverse Modeling of Land-Atmosphere Carbon Exchange. 18th CMMAP Team Meeting, La Jolla, California, January 13–15, 2015.

Geyer, N. M., T. A. Cram, C. Konor. Simulation of the TWP-ICE case with the Vector Vorticity Model. 2011. 91st Annual American Meteorological Society Conference, Seattle, Washington, January 22–27, 2011. (Poster)

Geyer, N. M., T. A. Cram, C. Konor. Simulation of the TWP-ICE case with the Vector Vorticity Model. 2010. 9th CMMAP Team Meeting, Fort Collins, Colorado, August 3–5, 2010. (Poster)

Geyer, N. M., M. Shulski. Quality Assured/Quality Control Meteorological Data Processing and Analysis. 2009. 2009 Arctic Region Supercomputing Center REU Conference, Fairbanks, Alaska, August 1, 2009.

TEACHING AND OTHER EXPERIENCE **Colorado State University**, Fort Collins, Colorado USA

Graduate Teaching Assistant

January 2013 - May 2013

Shared administrative responsibilities with faculty instructor for about 20 students. Helped in administering examinations. Fielded theory inquiries of all students. Graded homeworks and projects troubleshooting several coding languages with students.

- ATS-606 Introduction to Climate, Spring 2013.

The Pennsylvania State University, Fort Collins, Colorado USA

Mathematics Tutor

December 2009 - December 2010

Voluntary work through Chi Epsilon Pi at The Pennsylvania State University. Duties included meeting with students at various, but consistent times throughout the semester to answer mathematical inquiries and help develop fundamental mathematical skills and techniques for any of the Geoscience programs offered through the college of Earth and Mineral Sciences.

- Math140 Calculus with Analytic Geometry I
- Math141 Calculus with Analytic Geometry II
- Math220 Matrices
- Math230 Calculus and Vector Analysis
- Math251 Ordinary and Partial Differential Equations

Mathematics Grader

December 2009 - December 2010

Responsible for critique and grading of homework assignments for undergraduates taking basic calculus mathematics courses through the Department of Mathematics at The Pennsylvania State University. Met with employing professors to discuss classwork and how to evaluate student work.

- Math140 Calculus with Analytic Geometry I
- Math220 Matrices
- Math251 Ordinary and Partial Differential Equations

COMPUTATIONAL SKILLS

- Climate Model Familiarity: Community Earth System Model 2 and super-parameterized convection variant.
- Chemical Transport Models: GEOS-Chem (v9-02), PCTM, and TM5
- Numerical Weather Prediction Models: Weather Research and Forecasting Model (WRF)
- Familiar with GPU-accelerated modeling and coding
- Optimization Algorithms: 3D-Var, 4D-Var, Kalman, Ensemble Kalman Filter, and Particle Filter
- Computational Statistical Packages: R, FORTRAN statistical libraries, and CDO
- Languages: FORTRAN (through 2000), IDL, MATLAB, PYTHON, NCL, PERL, Unix shell scripts (bsh, bash and csh), C++
- Operating Systems: Unix/Linux, Mac OS X, Windows
- Applications: L^AT_EX, Microsoft Office, Google Drive

DATA SET FAMILIARITY

- Meteorological Data Set Familiarity: GMAO, NCEP, and ECMWF related reanalysis products
- Global Satellite Carbon Data Sets (OCO and GOME-2): Column-integrated carbon dioxide mole fraction and solar-induced fluorescence

- Land-based Carbon Dioxide Data: FLUXNET eddy-covariance, NOAA/CMDL Cooperative Flask Sampling Network, ODIAC fossil fuel, FFDAS fossil fuel, GFED fire, Takahashi ocean emissions
- Large Scale Climate Related Datasets: CMIP6 input/output