William S. Daniels

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Education

Colorado School of Mines 2021 (expected)
M.S. Statistics, GPA: 4.0

Colorado School of Mines 2019
B.S. Engineering Physics, GPA: 3.99, *summa cum laude*
Minor: Computational and Applied Mathematics

Research Projects

Monitoring Methane Emissions from Oil and Gas Operations **Apr 2020 - Present**
Colorado School of Mines, Department of Applied Mathematics and Statistics
Colorado School of Mines, Payne Institute for Public Policy
Advisors: Dorit Hammerling, Morgan Bazilian

- Working on a variety of projects broadly seeking to more completely and accurately monitor methane emissions from the oil and gas industry.
- Used techniques from time series analysis to detrend continuous monitoring data and am currently using them to help pinpoint potential emissions sources.
- Created an empirical Bayesian hierarchical model to estimate daily methane fields on a very fine grid with uncertainty using coarsely "pixelated" satellite observations.
- Performed an exploratory analysis of satellite methane data in the DJ Basin, Colorado.
- Results from this work have been summarized in a number of non-refereed papers.

Modeling Atmospheric Carbon Monoxide **Aug 2019 - Present**
Colorado School of Mines, Department of Applied Mathematics and Statistics
National Center for Atmospheric Research, Atmospheric Chemistry Observations & Modeling
Advisors: Dorit Hammerling, Rebecca Buchholz

- Used lagged multiple linear regression to model atmospheric carbon monoxide from climate indices.
- Implemented a regularization method that preserves hierarchical model structure between main effects and interaction effects.
- Created an algorithm to optimize regularization method over a number of free parameters.
- Used cross-validation to quantify stability of selected model terms, aiding model interpretability.
- A manuscript summarizing this work is currently in prep.

Verifying Elve Simulation using Data Set of Observed Elves **Aug 2018 - May 2019**
Colorado School of Mines, Department of Physics
Advisor: Lawrence Wiencke

- Used elves, a class of transient luminous events that occur in the ionosphere, to study lighting.
- Analyzed a large elve dataset using ROOT, a data analysis framework written in C++.
- Determined the sensitivity of an elve simulation by mapping the input and output parameter spaces.
- Used this sensitivity study to simulate observed elves and analyze differences between simulation and data, ultimately finding that simulation matches elve shape but not amplitude.
- Presented my work at the American Physical Society (APS) April conference.

Implementing Astrometry Based Laser System **Jan 2018 - Dec 2018**
Colorado School of Mines, Department of Physics
Advisor: Lawrence Wiencke

- Implemented a laser system that gives the pointing direction of a laser from a photo of the stars.
- Used an astrometric software to determine equatorial coordinates of a picture of the stars.
- Created a coordinate conversion algorithm in MATLAB to convert from equatorial coordinates to horizontal coordinates centered on the laser system.
- Determined the relationship between azimuth angle and steps of the laser system stepper motor.

Planning Laser Field Campaigns for EUSO Overflight **Oct 2016 - Jun 2017**
Colorado School of Mines, Department of Physics
Advisor: Lawrence Wiencke

- Planned laser field campaigns to test the Extreme Universe Space Observatory (EUSO), which was going to be sent to the ISS.
- Calculated the ground velocity of the ISS and used JSatTrack to plot ground tracks.
- Developed an orbital model for the ISS using Mathematica and JSatTrack that predicts the time and location of passes and takes into account the lunar cycle.

Characterizing Biorefinery Lignin **Jun 2016 - Aug 2016**
Washington State University, Voiland School of Bioengineering and Chemical Engineering
Advisor: Ruoshui Ma

- Summer Research Experience for Undergraduates (REU) at Washington State University.
- Studied the chemical conversion of lignins into aviation biofuel.
- Used thermal gravimetric analysis and Fourier-transform infrared spectroscopy to find differences in characteristics between lignin samples.
- Presented at poster symposium: "Characterization of Molecular Structure and Interlinkage Network for Seven Representative Biorefinery Lignin"

Industry Experience

Systems Engineering Intern **May 2019 - Aug 2019**
Northrop Grumman, Colorado Springs

- Worked with the Infrared Hardbody Signatures Team within the Threat Modeling Center (TMC).
- Investigated ways of increasing efficiency of the TMC's production process.
- Created a Python tool to interpolate temperature data, eliminating need for manual calculations and increasing simulation fidelity.
- Performed a sensitivity study on my temperature tool, finding that the error is negligible.
- Wrote Python scripts to automate documentation process, eliminating need to manually produce tables and re-type documents.

Systems Engineering Intern **May 2018 - Aug 2018**
Northrop Grumman, Colorado Springs

- Worked with the Infrared Hardbody Signatures Team within the Threat Modeling Center (TMC).
- Investigated ways of decreasing simulation run time within the TMC's production process.
- Completed investigations into reflectance and false lines of sight, reducing run time by up to 80%.
- Wrote MATLAB scripts for parsing, plotting, and analysis of infrared signature data.
- Collaborated with other interns to implement a MATLAB and Unix based script that predicts the sunlit status of target objects.

Publications

Submitted or In-Prep

1. **William Daniels**, Dorit Hammerling, Rebecca Buchholz, Helen Worden. A framework for examining the connection between atmospheric carbon monoxide and climate indices at multiple levels of complexity [working title]. *In Prep*, (2021).
2. Meera Duggal, **William Daniels**, Rebecca Buchholz, Dorit Hammerling. Optimizing genetic algorithm parameters for atmospheric carbon monoxide modeling. *NCAR Technical Notes, In Prep*, (2021).
3. **William Daniels**, Doug Nychka, Dorit Hammerling. A hierarchical Bayesian model for estimating methane fields from TROPOMI observations. *Payne Institute for Public Policy Commentary Series, In Prep*, (2021).
4. **William Daniels**, James Crompton, Dorit Hammerling, Morgan Bazilian. Initial findings from continuous monitoring of oil and gas operations. *Payne Institute for Public Policy Commentary Series, In Prep*, (2021).

Non-Refereed or Working Papers

1. **William Daniels**, Dorit Hammerling, Morgan Bazilian. Aggregation and analysis of methane data in the DJ basin, Colorado. *Payne Institute for Public Policy Commentary Series*, (2020).
2. **William Daniels**, Dorit Hammerling, Rebecca Buchholz. regClimateChem: An R package for data driven variable selection applied to atmospheric carbon monoxide. *NCAR Technical Notes*, No. NCAR/TN-562+STR, (2020).

Presentations

Talks

1. Meera Duggal, **William Daniels**, Dorit Hammerling. Optimizing genetic algorithm parameters for atmospheric carbon monoxide modeling. *Electronic Undergraduate Statistics Research Conference (eUSR)*, (2020).
2. **William Daniels**, Rebecca Buchholz, Dorit Hammerling. Using the climate to model atmospheric carbon monoxide. *Mines Graduate Research and Discovery Symposium (GRADS)*, 8th Annual, (2020).
   · **Received best talk award in Environmental Science session.**
3. **William Daniels**, Kevin-Druis Merenda, Lawrence Wiencke. What can elves tell us about very strong lightning? *APS April Meeting*, Volume 64, Number 3, (2019).
   · **Received outstanding presentation award.**

Posters

1. Dorit Hammerling, Lewis Blake, **William Daniels**, Aidan Dykstal, Sean Crowell. Student-led investigation of TROPOMI data for the US. *EGU General Assembly*, (2020).
2. Meera Duggal, **William Daniels**, Dorit Hammerling. Genetic algorithm optimization study for atmospheric carbon monoxide models. *Mines Undergraduate Research Symposium*, (2020).
3. **William Daniels**, Rebecca Buchholz, Dorit Hammerling. Improving atmospheric carbon monoxide models. *Mines Applied Math and Statistics (AMS) Open House*, (2019).
4. **William Daniels**, Kevin-Druis Merenda, Lawrence Wiencke. What can elves tell us about very strong lightning? *Mines Physics Undergraduate Research Symposium*, (2019).
   · **1st place in poster competition**.

Teaching Experience

TEAM-UP Teaching Program Fall 2017

Introduction to Field Based Experience

- Worked as a teaching assistant in a high school chemistry class.
- Gave short lectures, assisted during labs, and participated in lesson planning.
- Took an accompanying education course, where we discussed education psychology, modern STEM education, and our teaching experience.

TA Positions

- Arvada West High School, Honors Chemistry — Fall 2017
- Colorado School of Mines, PHGN 300: Modern Physics — Fall 2017
- Colorado School of Mines, MATH 482: Statistics Practicum — Spring 2020
- Colorado School of Mines, MATH 482: Statistics Practicum — Spring 2021

Academic Achievements and Affiliations

Fellowships	Harvey Undergraduate Scholarship	2015 - 2019
	Mines Undergraduate Research Fellowship	2017 - 2018
	Harvey Graduate Fellowship	2019 - 2021
Awards	General Chemistry Student of the Year	2016
	1st Place Poster, Mines Physics Research Symposium	2019
	Outstanding Presentation Award, APS April Meeting	2019
	Mines Physics Department Distinguished Graduate	2019
	Best Talk in Environmental Science Session, Mines GRADS	2020
Affiliations	Tau Beta Pi Engineering Honor Society	2018 - 2019
	American Physical Society (APS)	2018 - 2019
	Society for Industrial and Applied Mathematics (SIAM)	2019 - present

Computing Experience

Programming Languages	R, Python, MATLAB, LaTeX, Mathematica
Operating Systems	Linux, Windows

Relevant Coursework

Applied Math	MATH 332: Linear Algebra
	MATH 455: Partial Differential Equations
	MATH 510: Ordinary Differential Equations and Dynamical Systems
Statistics	MATH 530: Statistical Methods I
	MATH 531: Statistical Methods II
	MATH 534: Mathematical Statistics I
	MATH 535: Mathematical Statistics II
	MATH 532: Spatial Statistics
	MATH 599: Advanced Applied Regression

Computing	CSCI 261: Programming Concepts
	MATH 307: Introduction to Scientific Computing
	MATH 551: Computational Linear Algebra
	CSCI 580: Advanced High Performance Computing (audited)