

# William S. Daniels

wdaniels@mines.edu

<https://wsdaniels.github.io/>

## Education

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<b>Colorado School of Mines</b> PhD Statistics, GPA: 4.0	(in progress)
<b>Colorado School of Mines</b> M.S. Statistics, GPA: 4.0	2021
<b>Colorado School of Mines</b> B.S. Engineering Physics, GPA: 3.99 ( <i>summa cum laude</i> ) Minor: Computational and Applied Mathematics	2019

## Research Projects

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### **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: Dr. Dorit Hammerling, Dr. Morgan Bazilian*

- Working on a variety of projects broadly seeking to more completely and accurately monitor methane emissions from the oil and gas industry.
- Developed a framework for emission detection and localization using continuous monitoring data.
- 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 and conference talks.

### **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: Dr. Dorit Hammerling, Dr. 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 a framework to highlight the optimally performing models over a range of complexities.
- 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: Dr. 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: Dr. 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: Dr. 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: Dr. 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**

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### **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

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### Submitted or In-Prep

1. Jiayang (Lyra) Wang, **William S. Daniels**, Dorit M. Hammerling, Matthew Harrison, Kaylyn Burmaster, Fiji C. George, Arvind P. Ravikumar. Multi-scale methane measurements at oil and gas facilities reveal necessary framework for improved emissions accounting. *ChemRxiv*, doi:10.26434/chemrxiv-2022-9zh2v, (2022).

### Refereed Papers

1. **William S. Daniels**, Rebecca R. Buchholz, Helen M. Worden, Fatimah Ahamad, Dorit M. Hammerling. Interpretable models capture the complex relationship between climate indices and fire season intensity in Maritime Southeast Asia. *Journal of Geophysical Research: Atmospheres*, 127, e2022JD036774, 10.1029/2022JD036774, (2022).

### Non-Refereed Papers

1. Dorit Hammerling, **William Daniels**, Morgan Bazilian, Brooke Bowser. Improving satellite monitoring of methane emissions. *Payne Institute for Public Policy Commentary Series*, (2021).
2. **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*, (2021).
3. Meera Duggal, **William Daniels**, Rebecca Buchholz, Dorit Hammerling. Optimizing genetic algorithm parameters for atmospheric carbon monoxide modeling. *NCAR Technical Notes* (No. NCAR/TN-566+STR), doi:10.5065/h45f-c987, (2021).
4. **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).
5. **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), doi:10.5065/e8xj-3k89, (2020).

### Theses

1. **William Daniels**. Statistical methods for the interpretation, prediction, and localization of remotely sensed atmospheric pollutants. *ProQuest Dissertations & Theses Global* (No. 28497887), Master's Thesis, (2021).

### Data Sets

1. Rebecca Buchholz, Helen Worden, Fatimah Ahamad, **William Daniels**, Dorit Hammerling. Weekly carbon monoxide anomalies over Maritime Southeast Asia and weekly climate indices. *UCAR/NCAR - DASH Repository*, doi:10.5065/s6rv-rc57, (2021).

## Presentations

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### Invited Talks

1. **William Daniels**, Meng Jia, Amber Rexwinkle, Dorit Hammerling. Leveraging multiple continuous monitoring sensors for emission identification and localization on oil and gas facilities. *Mines Applied Mathematics and Statistics (AMS) Graduate Student Colloquium*, (2022).
2. **William Daniels**. Building intuition around common statistical learning techniques. *University of Colorado Boulder - Quantitative Exploration and Discussion (QED) Supergroup*, (2022).

3. **William Daniels**, Dorit Hammerling, Rebecca Buchholz, Helen Worden, Fatimah Ahamad. Using climate mode indices to forecast carbon monoxide variability in fire-prone Southern Hemisphere regions. *International Global Atmospheric Chemistry (IGAC) Scientific Conference - MANGO Session*, (2021).
4. Dorit Hammerling, **William Daniels**, Meng Jia, Morgan Bazilian. Methane emission monitoring at multiple spatiotemporal resolutions. *Spatial and Temporal Statistics Symposium (STSS)*, (2021).

## Contributed Talks

1. **William Daniels**, Rebecca Buchholz, Helen Worden, Fatimah Ahamad, Dorit Hammerling. Interpretable model captures complex relationship between climate variability and fire season intensity in Maritime Southeast Asia. *International Association of Wildland Fire - Fire and Climate Conference*, (2022).
2. **William Daniels**, Meng Jia, Dorit Hammerling, Shyla Kupis, Nasr Alkadi, Anna Scott. Leveraging multiple continuous monitoring sensors for emissions alerting on oil and gas facilities. *AGU Fall Meeting*, (2021).
3. **William Daniels**, Rebecca Buchholz, Helen Worden, Fatimah Ahamad, Dorit Hammerling. Predicting fire season intensity in Maritime Southeast Asia with interpretable models. *American Statistical Association CO/WY Fall Meeting*, (2021).
4. **William Daniels**, Fatimah Ahamad, Rebecca Buchholz, Dorit Hammerling, Helen Worden. Using atmospheric carbon monoxide models to predict fire season intensity. *Spatial and Temporal Statistics Symposium (STSS)*, (2021).
5. Meera Duggal, **William Daniels**, Dorit Hammerling. Optimizing genetic algorithm parameters for atmospheric carbon monoxide modeling. *Electronic Undergraduate Statistics Research Conference (eUSR)*, (2020).
6. **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.**
7. **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. Zi Li, **William Daniels**, Dorit Hammerling. Seasonal and hourly variability of particulate matter 2.5 in Denver. *Mines Undergraduate Research Symposium*, (2022).
2. Meng Jia, **William Daniels**, Amber Rexwinkle, Dorit Hammerling. Data-driven detection of methane leaks from oil and gas. *Mines Applied Mathematics and Statistics (AMS) Open House*, (2022).
3. **William Daniels**, Dorit Hammerling, Rebecca Buchholz, Helen Worden, Fatimah Ahamad. Using climate mode indices to forecast carbon monoxide variability in fire-prone Southern Hemisphere regions. *International Global Atmospheric Chemistry (IGAC) Scientific Conference - Southern Hemispheres Session*, (2021).  
· **Poster was Highly Commended in Southern Hemisphere Working Group.**
4. Dorit Hammerling, Lewis Blake, **William Daniels**, Aidan Dykstal, Sean Crowell. Student-led investigation of TROPOMI data for the US. *EGU General Assembly*, (2020).
5. Meera Duggal, **William Daniels**, Dorit Hammerling. Genetic algorithm optimization study for atmospheric carbon monoxide models. *Mines Undergraduate Research Symposium*, (2020).
6. **William Daniels**, Rebecca Buchholz, Dorit Hammerling. Improving atmospheric carbon monoxide models. *Mines Applied Mathematics and Statistics (AMS) Open House*, (2019).
7. **William Daniels**, Kevin-Druis Merenda, Lawrence Wiencke. What can elves tell us about very strong lightning? *Mines Physics Undergraduate Research Symposium*, (2019).  
· **1<sup>st</sup> place in poster competition.**

8. **William Daniels**, Ruoshui Ma, Xiao Zhang. Characterization of Molecular Structure and Interlinkage Network for Seven Representative Biorefinery Lignin. *NARA SURE Research Symposium*, (2016).

## Teaching Experience

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### 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

- Colorado School of Mines, MATH 482: Statistics Practicum Spring 2022
- Colorado School of Mines, MATH 482: Statistics Practicum Spring 2021
- Colorado School of Mines, MATH 482: Statistics Practicum Spring 2020
- Colorado School of Mines, PHGN 300: Modern Physics Fall 2017
- Arvada West High School, Honors Chemistry Fall 2017

## Funding, Honors, Awards

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<b>Fellowships</b>	Harvey Graduate Fellowship	2019 - 2021
	Mines Undergraduate Research Fellowship	2017 - 2018
	Harvey Undergraduate Scholarship	2015 - 2019
<b>Awards</b>	Highly Commended poster, IGAC Science Conference	2021
	Best Talk in Environmental Science Session, Mines GRADS	2020
	Mines Physics Department Distinguished Graduate	2019
	Outstanding Presentation Award, APS April Meeting	2019
	1 <sup>st</sup> Place Poster, Mines Physics Research Symposium	2019
	General Chemistry Student of the Year	2016

## Professional Service

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<b>Reviewer</b>	Remote Sensing of Environment	
<b>Affiliations</b>	Society for Industrial and Applied Mathematics (SIAM)	2019 - present
	American Physical Society (APS)	2018 - 2019
	Tau Beta Pi Engineering Honor Society	2018 - 2019
<b>Other</b>	Undergraduate research symposium judge	Spring 2022