

# William S. Daniels

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<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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<b>Monitoring Methane Emissions from Oil and Gas Operations</b> <i>Colorado School of Mines, Department of Applied Mathematics and Statistics</i> <i>Colorado School of Mines, Payne Institute for Public Policy</i> <i>Advisors: Dr. Dorit Hammerling, Dr. Morgan Bazilian</i> <ul style="list-style-type: none"><li>· Working on a variety of projects broadly seeking to more completely and accurately monitor methane emissions from the oil and gas industry.</li><li>· Developed a framework for emission event detection, localization, and quantification using high frequency data from continuous monitoring systems.</li><li>· Created a hierarchical model to estimate daily methane fields on a very fine grid with uncertainty using coarsely “pixelated” satellite observations.</li><li>· Results from this work have been summarized in a journal article, multiple pre-prints, and conference talks.</li></ul>	<b>Apr 2020 - Present</b>
<b>Modeling Atmospheric Carbon Monoxide</b> <i>Colorado School of Mines, Department of Applied Mathematics and Statistics</i> <i>National Center for Atmospheric Research, Atmospheric Chemistry Observations &amp; Modeling</i> <i>Advisors: Dr. Dorit Hammerling, Dr. Rebecca Buchholz</i> <ul style="list-style-type: none"><li>· Used lagged multiple linear regression to model atmospheric carbon monoxide from climate indices.</li><li>· Implemented a regularization method that preserves hierarchical model structure between main effects and interaction effects.</li><li>· Created a framework to highlight the optimally performing models over a range of complexities.</li><li>· Used cross-validation to quantify stability of selected model terms, aiding model interpretability.</li><li>· Results from this work were published in JGR: Atmospheres.</li></ul>	<b>Aug 2019 - Aug 2022</b>
<b>Verifying Elve Simulation using Data Set of Observed Elves</b> <i>Colorado School of Mines, Department of Physics</i> <i>Advisor: Dr. Lawrence Wiencke</i> <ul style="list-style-type: none"><li>· Used elves, a class of transient luminous events that occur in the ionosphere, to study lighting.</li><li>· Analyzed a large elve dataset using ROOT, a data analysis framework written in C++.</li><li>· Determined the sensitivity of an elve simulation by mapping the input and output parameter spaces.</li><li>· 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.</li><li>· Results from this work were presented at the American Physical Society (APS) April conference.</li></ul>	<b>Aug 2018 - May 2019</b>

## 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.
- 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 Papers

1. Meng Jia, **William S. Daniels**, Dorit M. Hammerling. "Comparison of the Gaussian plume and puff atmospheric dispersion models on oil and gas facilities." *Submitted*, doi:10.26434/chemrxiv-2023-hc95q, (2023).
2. **William S. Daniels**, Meng Jia, Dorit M. Hammerling. "Methane emission detection, localization, and quantification using continuous point-sensors on oil and gas facilities." *Submitted*, doi:10.26434/chemrxiv-2022-xxkk8, (2022).

### Refereed Papers

1. **William S. Daniels**, Jiayang (Lyra) Wang, Arvind Ravikumar, Matthew Harrison, Selina Roman-White, Fiji George, Dorit M. Hammerling. "Towards multiscale measurement-informed methane inventories: reconciling bottom-up site-level inventories with top-down measurements using continuous monitoring systems." *Environmental Science & Technology*, 57(32), 11823-11833, doi:10.1021/acs.est.3c01121, (2023).
2. 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." *Environmental Science & Technology*, 56(20), 14743-14752, doi:10.1021/acs.est.2c06211, (2022).
3. **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, doi:10.1029/2022JD036774, (2022).

### Non-Refereed Papers and Articles

1. Dorit M. Hammerling, **William S. Daniels**, Morgan D. Bazilian, Brooke Bowser. "Improving satellite monitoring of methane emissions: data science is fundamental to better emissions tracking." *Payne Institute for Public Policy - Commentary Series*, doi:10.25676/11124/14106, (2021).

2. **William S. Daniels**, James Crompton, Dorit M. Hammerling, Morgan D. Bazilian. “Initial findings from continuous monitoring of oil and gas operations.” *Payne Institute for Public Policy - Commentary Series*, doi:10.25676/11124/14111, (2021).
3. Meera Duggal, **William S. Daniels**, Rebecca R. Buchholz, Dorit M. 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 S. Daniels**, Dorit M. Hammerling, Rebecca R. 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 S. 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 R. Buchholz, Helen M. Worden, Fatimah Ahamad, **William S. Daniels**, Dorit M. Hammerling. “Weekly carbon monoxide anomalies over Maritime Southeast Asia and weekly climate indices.” *NCAR Geoscience Data Exchange*, doi:10.5065/s6rv-rc57, (2021).

## Presentations

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### Invited Talks

1. Dorit M. Hammerling, **William S. Daniels**, Meng Jia. “Estimating methane emissions on oil and gas facilities using continuous monitoring data.” *AGU Fall Meeting*, (2022).
2. 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.” *Stanford - Methane Emissions Technology Alliance (META)*, (2022).
3. **William S. Daniels**, Meng Jia, Amber Rexwinkle, Dorit M. Hammerling. “Leveraging multiple continuous monitoring sensors for emission identification and localization on oil and gas facilities.” *Colorado School of Mines - Applied Mathematics and Statistics (AMS) Graduate Student Colloquium*, (2022).
4. **William S. Daniels**. “Building intuition around common statistical learning techniques.” *University of Colorado Boulder - Quantitative Exploration and Discussion (QED) Supergroup*, (2022).
5. **William S. Daniels**, Dorit M. Hammerling, Rebecca R. Buchholz, Helen M. 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).
6. Dorit M. Hammerling, **William S. Daniels**, Meng Jia, Morgan D. Bazilian. “Methane emission monitoring at multiple spatiotemporal resolutions.” *Spatial and Temporal Statistics Symposium (STSS)*, (2021).

### Contributed Talks

1. **William S. Daniels**, Rebecca R. Buchholz, Helen M. Worden, Fatimah Ahamad, Dorit M. 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 S. Daniels**, Meng Jia, Dorit M. 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 S. Daniels**, Rebecca R. Buchholz, Helen M. Worden, Fatimah Ahamad, Dorit M. Hammerling. “Predicting fire season intensity in Maritime Southeast Asia with interpretable models.” *American Statistical Association CO/WY Fall Meeting*, (2021).
4. **William S. Daniels**, Fatimah Ahamad, Rebecca R. Buchholz, Dorit M. Hammerling, Helen M. Worden. “Using atmospheric carbon monoxide models to predict fire season intensity.” *Spatial and Temporal Statistics Symposium (STSS)*, (2021).
5. Meera Duggal, **William S. Daniels**, Dorit M. Hammerling. “Optimizing genetic algorithm parameters for atmospheric carbon monoxide modeling.” *Electronic Undergraduate Statistics Research Conference (eUSR)*, (2020).
6. **William S. Daniels**, Rebecca R. Buchholz, Dorit M. Hammerling. “Using the climate to model atmospheric carbon monoxide.” *Mines Graduate Research and Discovery Symposium (GRADS)*, 8th Annual, (2020).
  - **Received best presentation award in Environmental Science session.**
7. **William S. 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. **William S. Daniels**, Meng Jia, Dorit M. Hammerling. “Using continuous methane measurements for inventory development on oil and gas sites: three case studies.” *International Indian Statistical Association (IISA) Conference*, (2023).
  - **Finalist in student poster competition.**
2. Meng Jia, **William S. Daniels**, Dorit M. Hammerling. “Methane emission detection, localization, and quantification using continuous point-sensors on oil and gas facilities.” *International Indian Statistical Association (IISA) Conference*, (2023).
  - **Winner of student poster competition.**
3. **William S. Daniels**, Meng Jia, Dorit M. Hammerling. “Using continuous monitoring systems for data-driven methane emissions inventories for oil and gas facilities.” *Mines Applied Mathematics and Statistics (AMS) Open House*, (2023).
4. Meng Jia, **William S. Daniels**, Dorit M. Hammerling. “Methane emission detection, localization, and quantification using continuous point-sensors on oil and gas facilities.” *Mines Applied Mathematics and Statistics (AMS) Open House*, (2023).
5. Zi Li, **William S. Daniels**, Dorit M. Hammerling. “Seasonal and hourly variability of particulate matter 2.5 in Denver.” *Mines Undergraduate Research Symposium*, (2022).
6. Meng Jia, **William S. Daniels**, Amber Rexwinkle, Dorit M. Hammerling. “Data-driven detection of methane leaks from oil and gas.” *Mines Applied Mathematics and Statistics (AMS) Open House*, (2022).
7. **William S. Daniels**, Dorit M. Hammerling, Rebecca R. Buchholz, Helen M. 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).
  - **Highly commended by Southern Hemisphere Working Group.**
8. Dorit M. Hammerling, Lewis Blake, **William S. Daniels**, Aidan Dykstal, Sean Crowell. “Student-led investigation of TROPOMI data for the US.” *EGU General Assembly*, (2020).
9. Meera Duggal, **William S. Daniels**, Dorit M. Hammerling. “Genetic algorithm optimization study for atmospheric carbon monoxide models.” *Mines Undergraduate Research Symposium*, (2020).

10. **William S. Daniels**, Rebecca R. Buchholz, Dorit M. Hammerling. “Improving atmospheric carbon monoxide models.” *Mines Applied Mathematics and Statistics (AMS) Open House*, (2019).
11. **William S. Daniels**, Kevin-Druis Merenda, Lawrence Wiencke. “What can elves tell us about very strong lightning?” *Mines Physics Undergraduate Research Symposium*, (2019).  
· **Winner of student poster competition.**
12. **William S. 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	
	Journal of Undergraduate Reports in Physics	
<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>	International Indian Statistical Association (IISA) conference volunteer	2023
	Mines undergraduate research symposium judge	2022