Penny M. Rowe, Ph.D.

Tacoma, WA
https://prowe12.github.io/
www.linkedin.com/in/penny-rowe/
https://github.com/prowe12

Technical Skills
Python, Pandas, NumPy, SciPy, Django, FastAPI
C, Fortran, Java, R, MATLAB, HTML, CSS, JavaScript, React, Svelte, Sveltekit, AWS
SQL, SQLite, mySQL, Postgres, NetCDF
Git, GitHub, Agile, Sprints
Statistical Analysis
Surface and Satellite-based Remote Sensing (infrared spectrometry, broadband, cloud lidar)

Education
Ph.D., Physical Chemistry, University of Washington
B.S., Chemistry, with Honors (Minor in Mathematics), University of Puget Sound

Professional Experience

Research Scientist: NorthWest Research Associates, Inc 2016 – present

- Quality-controlled radiation, cloud, temperature, and water vapor measurements over the Southern Ocean and compared to model results. Identified and provided a correction for a bias in downwelling shortwave and longwave radiation in ERA5 attributed to under predicting cloud optical thickness.
- Developed the CLoud and Atmospheric Radiation Retrieval Algorithm, which uses Levenberg-Marquardt inverse retrieval in a Bayesian framework, to retrieve cloud properties through ingesting remotely-sensed infrared radiation, radiosonde, and greenhouse gas measurements. Used at South Pole and McMurdo Stations in Antarctica, the North Slope of Alaska, and Eureka, Canada.
- Interpolated and compiled temperature-dependent refractive indices of water based on statistical analysis of numerous laboratory datasets. Created and disseminated dataset of optical constants for supercooled liquid water from 240 to 273 K and 0.7 to 10,000 μm, using Mie theory.
- Developed and tested an educational module applying statistics (linear regression, correlation) to analysis of temperature and CO_2 records from ice cores. Taught to ~80 students per year.
- Co-developed 9 computational modules that teach multidisciplinary topics using Excel, Jupyter Notebook, or R. Several ranked exemplary; taught to hundreds of students in ongoing courses.
- Analyzed student surveys testing efficacy of educational modules (Fisher's test, Cohen's D, p-value, normalized gain, Likert scale), demonstrating statistically significant measures of learning gains.
- Developed a web application to run a simplified climate model (CAMBIO) that allows users to explore effects of changes in variables such as CO_2 emissions and surface albedo on climate. Created using Poetry, Django, SQLite, Python, and CSS. Dockerized and hosted on fly.io using gunicorn for the server and WhiteNoise for serving static files. Maintained and shared on gitHub. Used in courses at a university and community college.
- Led virtual summer NSF Research Experience for Undergraduates site, with 14 students.

Software Engineer Intern/Contractor: 2nd Chair LLC **11/2023 – 02/2024; 07/2024 - present**

- Directed successful submission of project pitch to NSF Seed Fund (SBIR/STTR), resulting in invitation to submit a full proposal.
- Assisted in CI website development (https://www.2ndchair.ai/) using Sveltekit on Vercel, Typescript, Tailwind, AWS ECS & S3, including search engine optimization and website analytics.
- Developed module in Python to upload and parse PDFs in support of machine learning algorithm.
- Coordinated effort to achieve SOC2 attestation.

Research Affiliate: University of Santiago, Physics Dept. 2014 – 2020

- Conducted and led field work at research platform at Chilean Antarctic station.
- Collected, cleaned and analyzed multi-year, continuous atmospheric measurement time series.
- Measured concentrations of soot pollution in snow in Chilean Andes and assessed impact.

Research Affiliate: University of Idaho, Dept. of Geography 2012 – 2014

- Retrieved atmospheric temperature and greenhouse gas concentrations from remote-sensing time series of downwelling infrared radiation, radio soundings, and surface meteorology data.
- Used constrained linear inversion to probe details of water vapor signal in infrared spectra.
- Identified cloud types using principal component analysis.

Contributed Datasets, Computer code, and Educational Materials

- Educational modules (Polar ENgagement through GUided INquiry or PENGUIN modules): https://serc.carleton.edu/penguin.
- Module for modeling the spread of COVID-19: https://www.kaggle.com/pennyrowe/modeling-spread-covid-19.
- Micro-Pulse Lidar Network (MPLNET) data from King George Island: https://mplnet.gsfc.nasa.gov/data?all&s=King_George_Island.
- South Pole Atmospheric Radiation and Cloud Lidar Experiment (SPARCLE) measurement: https://doi.pangaea.de/10.1594/PANGAEA.939770.
- Code to compute cloudy-sky downwelling infrared radiances: https://bitbucket.org/clarragroup/rundisort_py
- Temperature-dependent refractive indices and single-scattering properties of liquid water: https://people.nwra.com/rowe/single_scatter.shtml.
- Infrared radiance spectra for the Arctic atmosphere: https://arcticdata.io/catalog/view/urn:uuid:130bc82b-5a71-487a-9dff-74d8a8ef62b5.

Selected Publications (see full list here: https://prowe12.github.io/index.html#publications)

Rowe, P.M., et al. (2024). Student knowledge gains in polar literacy and statistics after completing guided inquiry modules in an undergraduate statistics course. *J. Geosci. Ed.*, pp.1-14.

Rowe, P.M., et al. (2024). Comparison of Cloud and Radiation Measurements to Models over the Southern Ocean at Escudero Station, King George Island. Submitted to *J. Geophys. Res. Atmos.*

Rowe, P.M., et al. (2021). Evaluation of Temperature-Dependent Complex Refractive Indices of Supercooled Liquid Water Using Downwelling Radiance and In-Situ Cloud Measurements at South Pole, *J. Geophys. Res. Atmos.*, 127, https://doi.org/10.1029/2021JD035182.

Rowe, P. M., et al. (2019), Toward autonomous surface-based infrared remote sensing of polar clouds: retrievals of cloud optical and microphysical properties. *Atmos. Meas. Tech.*, 12(9), 5071-5086, https://amt.copernicus.org/articles/12/5071/2019/.

Rowe, P. M., et al. (2019), Black carbon and other light-absorbing impurities in snow in the Chilean Andes. *Sci. Rep.*, 9(1), 4008, https://www.nature.com/articles/s41598-019-39312-0.

Selected Grants Led

Collaborative Research: Cloud Radiative Impact on the Surface Energy Budget of the Antarctic Peninsula. As PI for this collaborative grant from the National Science Foundation (NSF), I am working with a large, multinational and multidisciplinary team to understand the impacts of extreme weather events in Antarctica. My role includes development of software in Python for analysis of geoscience data. (NSF; 2021-2024)

Collaborative Research: Polar (NSF 19-601): RUI: Computational Polar ENgagement through GUided INquiry (Computational PENGUIN). As PI for this grant, I worked with two co-PIs to develop and test the efficacy of educational modules through student surveys. (NSF; 2020-2024).

Polar (DCL-16-119): Collaborative Research: Computational Guided Inquiry for Incorporating Polar Research into Undergraduate Curricula. As PI for this grant, I worked with two co-PIs to produce educational materials using computational tools such as Python Jupyter Notebooks. (NSF; 2017-2021).

The Infrared Radiative Impact of Antarctic Clouds. As PI for this grant, I produced software to ingest large amounts of geoscience data and use a Levenberg-Marquardt inverse retrieval in a Bayesian framework to retrieve cloud properties. (NSF; 2016-2020).

Characterization of Low Clouds over the Antarctic Peninsula (AP). As PI for this grant, I examined the role of clouds and radiation over the AP, led Antarctic field work, and participated in a major international campaign (Year of Polar Prediction Southern Hemisphere or YOPP-SH). (Chile; CONICYT/FONDECYT; 2016-2019).

Development of the Autonomous Arctic Infrared Observer (AAIRO). As PI for this grant, I developed software to simulate the potential for a novel research instrument (NSF; 2011-2015).