

Curriculum Vitae

Penny M. Rowe

Research Scientist
Northwest Research Associates
Redmond, WA 98052

Affiliate Scientist
Departamento de Física
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Education Ph.D., Physical Chemistry, University of Washington (2004)
B.S., Chemistry, with honors (minor in mathematics),
University of Puget Sound (1997)

Research History

Research Scientist: NorthWest Research Associates (2016 - present)
Research Affiliate: University of Santiago, Physics Department, (2014 – present).
Research Affiliate: University of Idaho, Department of Geography (2014-2015).
Postdoctoral Research: University of Idaho, Department of Geography (2004 - 2014).
Graduate Research Assistant: University of Washington, Department of Chemistry
(1999-2004).
Participated in Surface Heat Budget of the Arctic (SHEBA) program (Summer 1998).

Refereed Publications

Lubin, D., Zhang, D., Silber, I., Scott, R. C., Kalogeras, P., Battaglia, A., et al. (2020).
AWARE: The Atmospheric Radiation Measurement (ARM) West Antarctic Radiation
Experiment. Bulletin of the American Meteorological Society, BAMS–D–18–0278.1.
<http://doi.org/10.1175/BAMS-D-18-0278.1>

Rowe P.M., Fortmann, L., Guasco, T.L., Wright, A., Ryken, A., Sevier, E., Stokes, G.,
Mifflin, A., Wade, R., Cheng, H., Pfalzgraff, W., Beaudoin, J., Rajbhandari, I., Fox-
Dobbs, K., and Neshyba, S. (2020). Integrating polar research into undergraduate
curricula using computational guided inquiry. *J. Geosci. Educ.* (accepted pending minor
revisions).

Fortmann, L., Beaudoin, J., Rajbhandari, I., Wright, A., Neshyba, S., and Rowe, P.
(2020). Teaching Modules for Estimating Climate Change Impacts in Economics Courses
using Computational Guided Inquiry. *J. Econ. Educ.* DOI:

[10.1080/00220485.2020.1731383](https://doi.org/10.1080/00220485.2020.1731383).

Rowe, P. M., Cox, C., Neshyba, S., & Walden, V. P. (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. <http://doi.org/10.5194/amt-12-5071-2019>

Alfonso, J. A., Cordero, R., Rowe, P. M., Neshyba, S., Casassa, G., Carrasco, J., et al., 2019: Elemental and Mineralogical Composition of the Western Andean Snow (18°S–41°S). *Scientific Reports*, 9(1), 1–13. <http://doi.org/10.1038/s41598-019-44516-5>.

Rowe, P. M., Cordero, R., Warren, S. G., Stewart, E., Doherty, S. J., Pankow, A., et al., 2019: Black carbon and other light-absorbing impurities in snow in the Chilean Andes. *Scientific Reports*, 9(1), 4008. <http://doi.org/10.1038/s41598-019-39312-0>.

Rowe, P. M., Cheng, H., Fortmann, L., Wright, A., & Neshyba, S., 2018: Teaching image processing in an upper level CS undergraduate class using computational guided inquiry and polar data. *Journal of Computing Sciences in Colleges*, 34(1), 171–179. <http://doi.org/10.5555/3280489.3280517>

Butterfield, N., Rowe, P. M., Stewart, E., Roesel, D., & Neshyba, S., 2017: Quantitative three-dimensional ice roughness from scanning electron microscopy. *Journal of Geophysical Research: Atmospheres*, 122(5), 3023–3041.

Weaver, D., Strong, K., Schneider, M., Rowe, P. M., Sioris, C., Walker, K. A., et al., 2017: Intercomparison of atmospheric water vapour measurements at a Canadian High Arctic site. *Atmospheric Measurement Techniques*, 10, 2851–2880.

Rowe, P. M., Cox, C., & Walden, V. P., 2016: Toward autonomous surface-based infrared remote sensing of polar clouds: Cloud height retrievals. *Atmospheric Measurement Techniques*, 9, 3641–3659. <http://doi.org/10.5194/amt-9-3641-2016>.

Cox, C., Rowe, P. M., Neshyba, S., & Walden, V. P., 2016: A synthetic data set of high-spectral resolution infrared spectra for the Arctic atmosphere. *Earth System Science Data Discussions*, 1–29. <http://doi.org/10.5194/essd-2015-40>.

Cordero, R. R., Damiani, A., Seckmeyer, G., Jorquera, J., Caballero, M., Rowe, P. M., et al., 2016: The Solar Spectrum in the Atacama Desert. *Scientific Reports*, 6. <http://doi.org/10.1038/srep22457>.

Gladich, I., A. Oswald, N. Bowens, S. Naatz, P. Rowe, M. Roeselova and S. Neshyba, 2015: Mechanism of Anisotropic Surface Self-Diffusivity at the Prismatic Ice-Vapor Interface, *Physical Chemistry Chemical Physics*, 2015, 17, 22947 – 22958, DOI: 10.1039/C5CP01330E.

Cox, C., Walden, V. P., Rowe, P. M., & Shupe, M., 2015: Humidity trends imply increased sensitivity to clouds in a warming Arctic. *Nature Communications*, 6, 10117.

Lubin, D., B.H. Kahn, M.A. Lazzara, P.M. Rowe, and V.P. Walden, 2015: Variability in AIRS-retrieved cloud amount and thermodynamic phase over west versus east Antarctica influenced by the SAM, *Geophys. Res. Lett.*, 42, doi:10.1002/2014GL062285.

Cox, C., V. Walden, G.P. Compo, P.M. Rowe, M. Shupe, and K. Steffen, 2014: Downwelling longwave flux over Summit, Greenland, 2010–2012: Analysis of surface-based observations and evaluation of ERA-Interim using wavelets, *J. Geophys. Res. Atmos.*, 119(21), 12317–12337, doi:10.1002/2014JD021975.

Cox, C.J., D.D. Turner, P.M. Rowe, M.D. Shupe, and V.P. Walden, 2014: Cloud microphysical properties retrieved from downwelling infrared radiance measurements made at Eureka, Nunavut, Canada (2006-2009), *J. Appl. Meteor. Climatol.*, doi: 10.1175/JAMC-D-13-0113.1.

Rowe, P.M., S. Neshyba, and V.P. Walden, 2013: Radiative consequences of low-temperature infrared refractive indices for supercooled water clouds, *Atmos. Chem. Phys.*, 13, 11925-11933, doi: 10.5194/acp-13-11925-2013.

Neshyba, S.P., B. Lowen, M. Benning, A. Lawson, and P.M. Rowe, 2013: Roughness metrics of prismatic facets of ice. *J. Geophys. Res.* (Accepted Jan. 2013, Marked for “Editor Highlight” on the *J. Geophys. Res.* homepage and listed in the Special Research Spotlight of EOS).

Shupe, M., Turner, D. D., Walden, V. P., Bennartz, R., Cadeddu, M. P., Castellani, B. B., Cox, C., D.R. Hudak, M.S. Kulie, N.B. Miller, R.R. Neely, W. Neff, P.M. Rowe, 2013: High and Dry: New Observations of Tropospheric and Cloud Properties above the Greenland Ice Sheet, *B. Am. Meteorol. Soc.*, 169-186, DOI 10.1175/BAMS-D-11-00249.1.

Cox, C.J., V.P. Walden, and P.M. Rowe, 2012: A comparison of the atmospheric conditions at Eureka, Canada and Barrow, Alaska (2006-2008), *J. Geophys. Res.*, 117, D12204 doi: 10.1029/2011JD017164.

Mariani, Z, K. Strong, M. Wolff, P. Rowe, V. Walden, P.F. Fogal, T. Duck, G. Lesins, D.S. Turner, C. Cox, E. Eloranta, J.R. Drummond, C. Roy, D.D. Turner, D. Hudak, and I.A. Lindenmaier, 2012: Infrared measurements in the Arctic using two Atmospheric Emitted Radiance Interferometers, *Atmos. Meas. Tech.*, 5, 329-344; doi:10.5194/amt-5-329-2012.

Rowe, P.M., S. Neshyba, and V.P. Walden, 2011: Responsivity-based criterion for accurate calibration of FTIR emission spectra: Theoretical development and bandwidth estimation, *Optics Express*, 19 (7), 5930-5941; doi:10.1364/OE.19.005930.
(See www.opticsinfobase.org/abstract.cfm?uri=oe-19-7-5930.)

Rowe, P.M., S. Neshyba, C.J. Cox, and V.P. Walden, 2011: A responsivity-based

criterion for low noise in FTIR emission spectra: Identification of in-band low-responsivity wavenumbers, *Optics Express*, **19** (6), 5451-5463; doi: 10.1364/OE.19.005451. (See www.opticsinfobase.org/abstract.cfm?uri=oe-19-6-5451.)

Walden, V.P., R.L. Tanamachi, P.M. Rowe, H.E. Revercomb, D.C. Tobin, and S.A. Ackerman, 2010: Improvements in the data quality of the Interferometric Monitor of Greenhouse Gases, *Appl. Opt.*, **49**, 520-528, doi: 10.1364/AO.49.000520.

Rowe, P., and V.P. Walden, 2009: Improved measurements of the foreign-broadened continuum of water vapor in the 6.3 mm band at -30°C, *Appl. Opt.*, **48**, 1358-1365, doi: 10.1364/AO.48.001358.

Rowe, P., L.M. Miloshevich, D.D. Turner, and V.P. Walden 2008: Dry bias in radiosonde humidity profiles over Antarctica, *J. Atmos. Ocean. Tech.*, **25**, 1529-1541, doi: 10.1175/2008JTECHA1009.1

Rowe, P., V.P. Walden, and S.G. Warren, 2006: Measurements of the foreign-broadened continuum of water vapor in the 6.3- μm band at -30 C, *Appl. Opt.*, **45** (18), 4366-4382, doi: 10.1364/AO.45.004366.

Rowe, P. M., 2004: Measurements of the Foreign-Broadened Continuum of Water Vapor in the 6.3 micron band at -30 Celsius. University of Washington, Seattle, Washington, 278 pp.

Rathke, C, S. Neshyba, M. D. Shupe, P. Rowe, and A. Rivers, 2002: Radiative and microphysical properties of Arctic stratus clouds from multiangle downwelling infrared radiances, *J. Geophys. Res. A*. 107(D23), 4703, doi:10.1029/2001JD001545 (2002).

Contributed Datasets and Computer code

- Computational Guided Inquiry (CGI) modules that use Jupyter Notebooks or Excel Worksheets to give undergraduate students hands-on experience obtaining and working with polar research and data: <https://serc.carleton.edu/penguin>
- CGI module illustrating cloud-property inverse retrievals from infrared spectra: <https://bitbucket.org/cgigroup/greybodyretrieval>.
- Code for calling the Discrete Ordinates Radiative Transfer (DISORT) program:
Python: https://bitbucket.org/clarragroup/rundisort_py
Matlab/Octave: https://bitbucket.org/clarragroup/rundisort_mat
- Code for computing cloudy-sky downwelling infrared radiances using LBLRTM and DISORT: https://bitbucket.org/clarragroup/run_lblrtm_disort/
https://bitbucket.org/clarragroup/rundisort_py
- Temperature-dependent refractive indices of liquid water:
https://people.nwra.com/rowe/refractive_indices.shtml
- Temperature-dependent single-scattering properties of liquid water:
https://people.nwra.com/rowe/single_scatter.shtml
- Simulated line-by-line clear and cloudy sky infrared radiances for atmospheric profiles characteristic of the Arctic (available on request).

Research Mentoring Experience

Katie Gray: Computational Guided Inquiry for bringing polar data into undergraduate classrooms. May-June 2018.

Emma Sevier: Computational Guided Inquiry for bringing polar data into undergraduate classrooms. May-June 2018.

Mathew Fergoda: Infrared radiance of Antarctic Clouds. Summers 2017 and 2018.

Connor Krill: Infrared radiance of Antarctic Clouds. Summer 2017.

Aedin M. Wright: Temperature inversions in radiosoundings and Computational Guided Inquiry for bringing polar data into undergraduate classrooms. October 2016 – August 2018.

Edgardo Sepulveda: Clouds and atmospheric structure over King George Island, Antarctica. March 2016 – current.

U.S. and Chilean graduate and undergraduate students: Snow sampling and filtering for black carbon in the Chilean Andes, Austral winters 2015, 2017. U.S. students include Alec Pankow and Emily Stewart of the University of Puget Sound.

Alessio Spassiani: NSERCE CREATE Undergraduate Summer Internship, June - August 2011.

Public Outreach

STEM Career fair panelist at Sammamish High School, Bellevue, WA, (2017, 2018, and 2019).

Organized and implemented Spanish language translation for High-Adventure Science online educational module (HAS.concord.org; “What is the Future of Earth’s Climate?”) (Completed 2018).

Participated in the Pacific Science Center Polar Science Weekend with an exhibit “Where is the Polar Front?” Seattle, WA (2015)

Participated in the University of Puget Sound Art+Science salon hosted by the Tacoma Art Museum, Tacoma, WA (2013)

Numerous Presentations to Elementary, Middle, and High School students:

- Seabury Middle School, “The Greenhouse Effect and Climate Change,” Tacoma, WA, Oct. 11, 2016.
- Colegio Aleman de Valparaiso (High School), “Climate Change and Atmospheric Science in the Cryosphere,” Vina del Mar, Chile, June 20, 2016.
- Sammamish High School (High School chemistry class), “Infrared Spectra of Clouds and Greenhouse Gases”, Bellevue, WA, 2013.
- University of Puget Sound (Undergraduate chemistry class), “Infrared Spectra of Clouds and Greenhouse Gases”, Tacoma, WA, 2013.
- Bryant Elementary (elementary class), “Cloud in a jar,” Tacoma, WA, 2012.

Judge for the Bryant Middle School Science Fair (2011, 2012, 2014, 2015)

Invited Science Talks

- Retrievals of polar cloud properties from infrared radiance spectra, Thompson Hall Science and Mathematics Seminars, University of Puget Sound, September 19, 2013.

- Importance of new Temperature-Dependent Refractive Indices of Water for Simulated Thermal Emission from Super-Cooled Liquid Water Clouds, Noble Seminar Series. Reginald and Murial Noble Fund, University of Toronto Atmospheric Physics Group, November 5, 2012.

In the Media

- Twitter feed for Antarctic Research Group of the University of Santiago: <https://twitter.com/Antarcticacl>.
- A picture of me launching a weather balloon in Antarctica was used for the cover of the National Contest of Scientific Research and Antarctic Technology Projects 2020 (XXVI Concurso Nacional de Proyectos de Investigacion Cientifica y Tecnologica Antarctica 2020; <http://www.inach.cl/inach/wp-content/uploads/2020/01/BACH-38-N2-Pages-HQ-103.jpg>)
- Year of Polar Prediction (YOPP)
 - Chilean Antarctic Institute (INACH) Boletin Antartico Chileno, Vol. 28, N1, p. 13, 2019 (<http://www.inach.cl/inach/>).
 - Year of Polar Prediction (YOPP) PolarPredict News Newsletter #4: Describes my group's YOPP-endorsed Chilean Antarctic research project: Characterization of Low Clouds and the Atmosphere over the Antarctic Peninsula and West Antarctic Ice Sheet (CAALC): https://www.polarprediction.net/fileadmin/user_upload/www.polarprediction.net/Home/News/PolarPredictNews/PolarPredictNews04_final.pdf, November 2017.
 - Year of Polar Prediction (YOPP) PolarPredict News Newsletter #10: The cover picture shows me holding a weather balloon: https://www.polarprediction.net/fileadmin/user_upload/www.polarprediction.net/Home/PolarPredictNews/PPN_10/PolarPredictNews10_final_web.pdf, March 2019.
 - A Chilean article about our group's YOPP project, with a picture that includes my colleagues from British Antarctic Survey: Terminan exitosamente las observaciones del Año de la Predicción Polar en la Antártica, in plataforma científica, (<https://www.plataformacientifica.cl/terminan-exitosamente-las-observaciones-del-ano-de-la-prediccion-polar-en-la-antartica/>), 23 February 2019.
- Sampling black carbon in the Chilean Andes
 - A Chilean article about our sampling campaign of soot in snow in the Chilean Andes: Primer diagnóstico sobre efecto de la contaminación en la nieve de la Cordillera de Los Andes, in Centro de Estudios Avanzados en zonas aridas (<http://www.ceaza.cl/2018/04/30/primer-diagnostico-efecto-la-contaminacion-la-nieve-la-cordillera-los-andes/>), 30 April 2018.

- Científicos estudian niveles de carbón presentes en la nieve de la Cordillera de Los Andes, in Revista Química Industria & Minería, (<http://www.revistaquimica.cl/?p=3391>), 3 August 2015.
- Incluida la Región de Coquimbo: Científicos estudian niveles de carbón presentes en la nieve de la Cordillera de Los Andes, in Centro de Estudios Avanzados en zonas aridas (Ceaza.cl), 21 July 2015.
- Antarctic research at King George Island near the northern end of the Antarctic Peninsula
 - A Chilean article that includes my group's participation in the Chilean Antarctic School Trip in 2018 (in Spanish): EXPEDICIÓN ANTÁRTICA ESCOLAR: UNA EXPERIENCIA ÚNICA, in radiopolar.com, radio festival, and ovejeronoticias (http://www.radiopolar.com/noticia_146739.html and <https://www.radiofestival.cl/expedicion-antartica-escolar-una-experiencia-unica/>), 13 Dec. 2018.
 - An Article in the Chilean press about my group's research at King George Island, Antarctica, showing a picture of research student Edgardo Sepulveda: La información que entregan las nubes de la península antártica en isla Rey Jorge, in La Prensa Austral, <https://laprensaaustral.cl/ciencia/la-informacion-que-entregan-las-nubes-de-la-peninsula-antartica-en-isla-rey-jorge/>), 9 January 2018.
 - An Article in the Chilean press climate change that discusses my group's research at King George Island, Antarctica, and includes an interview of research student Edgardo Sepulveda: Explorando la Antártica: las investigaciones que ayudan a entender el cambio climático, in El Definido (<https://www.eldefinido.cl/actualidad/pais/9459/Explorando-la-Antartica-las-investigaciones-que-ayudan-a-entender-el-cambio-climatico/>), 2 January 2018.
 - **Antártica: Una experiencia fantástica**, in **Metochile Blog**, by **Juan Crespo**, (<http://blog.meteochile.gob.cl/2018/03/22/antartica-una-experiencia-fantastica/>), 22 March 2018.
 - <https://razonyfuerza.mforos.com/560583/11391590-antartida-territorio-antartico-chileno/?pag=100>
 - <https://docplayer.es/13238422-De-mendoza-hacia-el-cosmos-astronomia-astrofisica-y-actividades-espaciales-en-el-siglo-xx-pablo-antonio-pacheco-coleccion-ida-y-vuelta.html>
 - Estudian el comportamiento de las nubes en el sistema climático de la Antártida
 - <https://www.postgrado.usach.cl/es/noticias/estudian-el-comportamiento-de-las-nubes-en-el-sistema-climatico-de-la-antartida>, Vicerrectoría de posgrado, Universidad de Santiago de Chile, 13 May 2016.
 - Los drones de a poco ganan su espacio en la investigación científica, in Economía y negocios, (<http://www.economiaynegocios.cl/noticias/noticias.asp?id=259324>), 6 June 2016.

- Con dron estudian comportamiento de las nubes bajas en la Antártica, in U de Santiago al día, by Paula Godoy Bolados (<https://usach.cl/news/dron-estudian-comportamiento-las-nubes-bajas-la-antartica>), 5 October 2016.