

Dr. Joshua Laughner
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Education:

University of California, Berkeley; Berkeley, CA, USA Aug 2018
Ph.D., Chemistry
Concentrations: atmospheric chemistry, physical chemistry
Dissertation: Space-based constraints on NO_x emissions and lifetime using high-resolution NO₂ retrievals

The Pennsylvania State University; University Park, PA, USA May 2013
The Schreyer Honors College With Highest Distinction
B.S. Chemistry with Honors
Thesis: Synthesis and Transport Studies of a Delivery Mechanism for Oxidative In-Situ Remediation of Groundwater

B.M. Music Composition with Honors
Thesis: Virtual Evolving and Self-Producing Rapid Audio (V.E.S.P.R.A.)

Selected Research Experience:

Jet Propulsion Laboratory, NASA Oct 2021–present
Algorithm development for remote sensing of greenhouse gases and air pollutants.

Wennberg Group, Caltech Oct 2018–Oct 2021
Retrieval development for TCCON.

Cohen Research Lab, UC Berkeley Oct 2013–Oct 2018
NO₂ remote sensing retrieval development and space-based NO_x emissions and lifetime constraints. Developer on the BEHR retrieval (<http://behr.cchem.berkeley.edu/>).

Mallouk Research Group, Penn State June 2012–May 2013
Development of oxidative groundwater remediation using peroxide microcapsules

Merck Pharmaceuticals (Internship), Danville, PA, USA June 2011–Aug 2011
Process optimization of crystal size for product yield and purity at the Danville, PA site

Curriculum development research w/ Dr. Katherine Masters, Penn State Jan 2011–Dec 2012
Design of new curriculum for honors organic chemistry lab course

Cherokee Pharmaceuticals (Internship), Danville, PA, USA June 2010–Aug 2010
Study of the effect of antisolvent addition on product yield and purity

Awarded grants

- PI of “Validating OCO-2 and -3 retrieved profiles with TCCON partial columns,” 2023 OCO Science Team call (NNH23ZDA001N-OCOST)
- PI of “AQAware, year 2 - an ArcGIS-enabled air quality data portal,” FY24 internal JPL advanced concept funding (ACFA2024)

- Collaborator on “Constraining carbon fluxes and transport patterns using new spatiotemporal information in remotely sensed CO₂” (PI: Gretchen Keppel-Aleks), 2023 OCO Science Team call (NNH23ZDA001N-OCOST)
- JPL Co-I on “National Scale Top-down CO₂ flux Estimation for Smaller Scale Countries” (PI: Beata Bukosa, JPL PI: Junjie Liu), NASA Catalyst/New Zealand collaboration call.
- PI of “AQAware: an ArcGIS-enabled air quality data portal,” FY23 internal JPL advanced concept funding (ACFA2023)
- Co-I on “Shifting patterns of global emissions and ozone chemical regime linked to human activity and natural processes using a decadal chemical reanalysis” (PI: Kazuyuki Miyazaki), 2022 ACMAP call (NNH22ZDA001N-ACMAP)
- Co-I on “Extending the Total Carbon Column Observing Network to 20 Years” (PI: Paul Wennberg), 2022 SMD Single-Source invitation only call (SMDSS22)

Awards and service positions:

- Total Carbon Column Observing Network (TCCON) Deputy Algorithm Co-Chair, Apr 2020–present.
- Co-convener for session “Attributing, Projecting, and Linking Greenhouse Gas Emissions to Sources, Air Quality, and Climate Impact” at AGU 2023 Fall Meeting.
- Ancillary data subgroup lead, Keck Institute for Space Studies Virtual Workshop, “COVID-19: Identifying Unique Opportunities for Earth System Science,” Apr 2020–Dec 2020.
- NASA ROSES review panel
- Reviewer for *Atmos. Meas. Tech.*, *Atmos. Chem. Phys.*, *J. Geophys. Res. Atmos.*, *Geophys. Res. Lett.*, and *Nature Geosci.*
- NASA Earth and Space Science Fellowship, 2014–2017.
- Teas Scholarship, Penn State Department of Chemistry, 2012.
- 3M Fellowship, Penn State, 2012.

Publications:

- J. L. Laughner**, G. C. Toon, J. Mendonca, C. Petri, S. Roche, D. Wunch, J.-F. Blavier, D. W. T. Griffith, P. Heikkinen, R. F. Keeling, M. Kiel, R. Kivi, C. M. Roehl, B. B. Stephens, B. C. Baier, H. Chen, Y. Choi, N. M. Deutscher, J. P. DiGangi, J. Gross, B. Herkommer, P. Jeseck, T. Laemmel, X. Lan, E. McGee, K. McKain, J. Miller, I. Morino, J. Notholt, H. Ohyama, D. F. Pollard, M. Rettinger, H. Riris, C. Rousogonous, M. K. Sha, K. Shiomi, K. Strong, R. Sussmann, Y. Té, V. A. Velazco, S. C. Wofsy, M. Zhou, and P. O. Wennberg (2023). “The Total Carbon Column Observing Network’s GGG2020 Data Version”. *Earth Sys. Sci. Data Discuss.* 2023, pp. 1–86. DOI: 10.5194/essd-2023-331
- C. Chan Miller, S. Roche, J. S. Wilzewski, X. Liu, K. Chance, A. H. Souri, E. Conway, B. Luo, J. Samra, J. Hawthorne, K. Sun, C. Staebell, A. Chulakadabba, M. Sargent, J. S. Benmergui, J. E. Franklin, B. C. Daube, Y. Li, J. L. Laughner, B. C. Baier, R. Gautam, M. Omara, and S. C. Wofsy (2023). “Methane retrieval from MethaneAIR using the CO₂ Proxy Approach: A demonstration for the upcoming MethaneSAT mission”. *EGUsphere* 2023, pp. 1–40. DOI: 10.5194/egusphere-2023-1962
- D. Wu, **J. L. Laughner**, J. Liu, P. I. Palmer, J. C. Lin, and P. O. Wennberg (2023). “A simplified non-linear chemistry transport model for analyzing NO₂ column observations: STILT-NO_x”. *Geoscientific Model Development* 16.21, pp. 6161–6185. DOI: 10.5194/gmd-16-6161-2023
- J. L. Laughner**, A. Andrews, S. Roche, M. Kiel, G. Toon, D. Wunch, B. Baier, S. Biraud, H. Chen, R. Kivi, T. Laemmel, P.-Y. Quéhé, C. Rousogonous, and P. O. Wennberg (2023). “A new algorithm to generate a priori trace gas profiles for the GGG2020 retrieval algorithm”. *Atmos. Meas. Tech.* 16, pp. 1121–1146
- R. Chiarella, M. Buschmann, **J. Laughner**, I. Morino, J. Notholt, C. Petri, G. Toon, V. A. Velazco, and T. Warneke (2023). “A retrieval of xCO₂ from ground-based mid-infrared NDACC solar absorption spectra and comparison to TCCON”. *Atmos. Meas. Tech. Discuss.* 2023, pp. 1–31. DOI: 10.5194/amt-2023-32

- Y. Someya, Y. Yoshida, H. Ohyama, S. Nomura, A. Kamei, I. Morino, H. Mukai, T. Matsunaga, **J. L. Laughner**, V. A. Velazco, B. Herkommer, Y. Té, M. K. Sha, R. Kivi, M. Zhou, Y. S. Oh, N. M. Deutscher, and D. W. T. Griffith (2023). “Update on the GOSAT TANSO-FTS SWIR Level 2 retrieval algorithm”. *Atmos. Meas. Tech.* 16.6, pp. 1477–1501. DOI: 10.5194/amt-16-1477-2023
- C. G. MacDonald, J.-P. Mastrogiamomo, **J. L. Laughner**, J. K. Hedelius, R. Nassar, and D. Wunch (2023). “Estimating enhancement ratios of nitrogen dioxide, carbon monoxide and carbon dioxide using satellite observations”. *Atmos. Chem. Phys.* 23.6, pp. 3493–3516. DOI: 10.5194/acp-23-3493-2023
- N. Mostafavi Pak, J. K. Hedelius, S. Roche, L. Cunningham, B. Baier, C. Sweeney, C. Roehl, **J. Laughner**, G. Toon, P. Wennberg, H. Parker, C. Arrowsmith, J. Mendonca, P. Fogal, T. Wizenberg, B. Herrera, K. Strong, K. A. Walker, F. Vogel, and D. Wunch (2023). “Using portable low-resolution spectrometers to evaluate Total Carbon Column Observing Network (TCCON) biases in North America”. *Atmos. Meas. Tech.* 16.5, pp. 1239–1261. DOI: 10.5194/amt-16-1239-2023
- H. A. Parker, **J. L. Laughner**, G. C. Toon, D. Wunch, C. M. Roehl, L. T. Iraci, J. R. Podolske, K. McKain, B. Baier, and P. O. Wennberg (2022). “Inferring the vertical distribution of CO and CO₂ from TCCON total column values using the TARDISS algorithm”. *Atmos. Meas. Tech. Discuss.* 2022, pp. 1–49. DOI: 10.5194/amt-2022-322
- Q. Zhu, **J. L. Laughner**, and R. C. Cohen (2022b). “Estimate of OH Trends over One Decade in North American Cities”. *PNAS* 119.16, e2117399119. DOI: 10.1073/pnas.2117399119
- Q. Zhu, **J. L. Laughner**, and R. C. Cohen (2022a). “Combining Machine Learning and Satellite Observations to Predict Spatial and Temporal Variation of near Surface OH in North American Cities”. *Environ. Sci. Technol.* DOI: 10.1021/acs.est.1c05636
- J. L. Laughner**, J. L. Neu, D. Schimel, P. O. Wennberg, K. Barsanti, K. W. Bowman, A. Chatterjee, B. E. Croes, H. L. Fitzmaurice, D. K. Henze, J. Kim, E. A. Kort, Z. Liu, K. Miyazaki, A. J. Turner, S. Anenberg, J. Avise, H. Cao, D. Crisp, J. de Gouw, A. Eldering, J. C. Fyfe, D. L. Goldberg, K. R. Gurney, S. Hasheminassab, F. Hopkins, C. E. Ivey, D. B. A. Jones, J. Liu, N. S. Lovenduski, R. V. Martin, G. A. McKinley, L. Ott, B. Poulter, M. Ru, S. P. Sander, N. Swart, Y. L. Yung, and Z.-C. Zeng (2021). “Societal shifts due to COVID-19 reveal large-scale complexities and feedbacks between atmospheric chemistry and climate change”. *PNAS* 118.46. DOI: 10.1073/pnas.2109481118
- S. Roche, K. Strong, D. Wunch, J. Mendonca, C. Sweeney, B. Baier, S. C. Biraud, **J. L. Laughner**, G. C. Toon, and B. J. Connor (2021). “Retrieval of atmospheric CO₂ vertical profiles from ground-based near-infrared spectra”. *Atmos. Meas. Tech.* 14.4, pp. 3087–3118. DOI: 10.5194/amt-14-3087-2021
- A. Müller, H. Tanimoto, T. Sugita, T. Machida, S. Nakaoka, P. K. Patra, **J. Laughner**, and D. Crisp (2021). “New approach to evaluate satellite-derived XCO₂ over oceans by integrating ship and aircraft observations”. *Atmos. Chem. Phys.* 21.10, pp. 8255–8271. DOI: 10.5194/acp-21-8255-2021
- T. E. Taylor, A. Eldering, A. Merrelli, M. Kiel, P. Somkuti, Ce. Cheng, R. Rosenberg, B. Fisher, D. Crisp, R. Basilio, M. Bennett, D. Cervantes, A. Chang, L. Dang, C. Frankenberg, V. R. Haemmerle, G. R. Keller, T. Kurosu, **J. L. Laughner**, R. Lee, Y. Marchetti, R. R. Nelson, C. W. O’Dell, G. Osterman, R. Pavlick, C. Roehl, R. Schneider, G. Spiers, C. To, C. Wells, P. O. Wennberg, A. Yelamanchili, and S. Yu (2020). “OCO-3 early mission operations and initial (vEarly) XCO₂ and SIF retrievals”. *Rem. Sens. Environ.* 251, p. 112032. ISSN: 0034-4257. DOI: <https://doi.org/10.1016/j.rse.2020.112032>
- J. Lapierre, **J. Laughner**, J. Geddes, W. Koshack, R. Cohen, and S. Pusede (2020). “Observing regional variability in lightning NO₂ production rates”. *J. Geophys. Res. Atmos.* 125, e2019JD031362. DOI: 10.1029/2019JD031362
- J. L. Laughner** and R. C. Cohen (2019). “Direct observation of changing NO_x lifetime in North American cities”. *Science* 366, pp. 723–727. DOI: 10.1126/science.aax6832
- Q. Zhu, **J. L. Laughner**, and R. C. Cohen (2019). “Lightning NO₂ simulation over the contiguous US and its effects on satellite NO₂ retrievals”. *Atmos. Chem. Phys.* 19.20, pp. 13067–13078. DOI: 10.5194/acp-19-13067-2019

- R. F. Silvern, D. J. Jacob, L. J. Mickley, M. P. Sulprizio, K. R. Travis, E. A. Marais, R. C. Cohen, **J. L. Laughner**, S. Choi, J. Joiner, and L. N. Lamsal (2019). “Using satellite observations of tropospheric NO₂ columns to infer long-term trends in US NO_x emissions: the importance of accounting for the free tropospheric NO₂ background”. *Atmos. Chem. Phys.* 19.13, pp. 8863–8878. DOI: 10.5194/acp-19-8863-2019
- J. L. Laughner**, Q. Zhu, and R. Cohen (2019). “Evaluation of version 3.0B of the BEHR OMI NO₂ product”. *Atmos. Meas. Tech.* 12, pp. 129–146. DOI: 10.5194/amt-12-129-2019
- J. L. Laughner**, Q. Zhu, and R. C. Cohen (2018). “The Berkeley High Resolution Tropospheric NO₂ Product”. *Earth System Science Data* 10, pp. 2069–2095. DOI: 10.5194/essd-10-2069-2018
- R. F. Silvern, D. J. Jacob, K. R. Travis, T. Sherwen, M. J. Evans, R. C. Cohen, **J. L. Laughner**, S. R. Hall, K. Ullmann, J. D. Crouse, P. O. Wennberg, J. Peischl, and I. B. Pollack (2018). “Observed NO/NO₂ Ratios in the Upper Troposphere Imply Errors in NO-NO₂-O₃ Cycling Kinetics or an Unaccounted NO_x Reservoir”. *Geophys. Res. Lett.* 45, pp. 4466–4474. DOI: 10.1029/2018GL077728
- J. L. Laughner** and R. C. Cohen (2017). “Quantification of the effect of modeled lightning NO₂ on UV-visible air mass factors”. *Atmos. Meas. Tech.* 10, pp. 4403–4419. DOI: 10.5194/amt-10-4403-2017
- B. A. Nault, **J. L. Laughner**, P. J. Wooldridge, J. D. Crouse, J. Dibb, G. Diskin, J. Peischl, J. R. Podolske, I. B. Pollack, T. B. Ryerson, E. Scheuer, P. O. Wennberg, and R. C. Cohen (2017). “Lightning NO_x Emissions: Reconciling Measured and Modeled Estimates With Updated NO_x Chemistry”. *Geophys. Res. Lett.* 44, pp. 9479–9488. DOI: 10.1002/2017GL074436
- J. L. Laughner**, A. Zare, and R. C. Cohen (2016). “Effects of daily meteorology on the interpretation of space-based remote sensing of NO₂”. *Atmos. Chem. Phys.* 16.23, pp. 15247–15264. DOI: 10.5194/acp-16-15247-2016
- K. R. Travis, D. J. Jacob, J. A. Fisher, P. S. Kim, E. A. Marais, L. Zhu, K. Yu, C. C. Miller, R. M. Yantosca, M. P. Sulprizio, A. M. Thompson, P. O. Wennberg, J. D. Crouse, J. M. St. Clair, R. C. Cohen, **J. L. Laughner**, J. E. Dibb, S. R. Hall, K. Ullmann, G. M. Wolfe, I. B. Pollack, J. Peischl, J. A. Neuman, and X. Zhou (2016). “Why do models overestimate surface ozone in the Southeast United States?” *Atmos. Chem. Phys.* 16.21, pp. 13561–13577. DOI: 10.5194/acp-16-13561-2016
- S. E. Pusede, K. C. Duffey, A. A. Shusterman, A. Saleh, **J. L. Laughner**, P. J. Wooldridge, Q. Zhang, C. L. Parworth, H. Kim, S. L. Capps, L. C. Valin, C. D. Cappa, A. Fried, J. Walega, J. B. Nowak, A. J. Weinheimer, R. M. Hoff, T. A. Berkoff, A. J. Beyersdorf, J. Olson, J. H. Crawford, and R. C. Cohen (2016). “On the effectiveness of nitrogen oxide reductions as a control over ammonium nitrate aerosol”. *Atmos. Chem. Phys.* 16.4, pp. 2575–2596. DOI: 10.5194/acp-16-2575-2016

Selected presentations:

- Laughner, J.L.**, Toon, G.C., Wunch, D., Wennberg, P. (29–31 May 2024) *The GGG2020.1 TCCON dataset*. In-person talk at IWGGMS-20.
- Laughner, J.L.** and 9 others. 11–13 Dec 2023. *Implementation of a joint thermal & near IR retrieval of CO from TROPOMI and CrIS under the TROPES project*. In-person talk at the 2023 AGU Fall Meeting.
- Laughner, J.L.**, Toon, G.C., Roehl, C.M., Wunch, D., Wennberg, P. (31 July–3 Aug 2023) *Using solar-viewing FTS observations to inform spectroscopic parameters*. Invited, in-person talk at the 2023 Optical FTS Congress.
- Laughner, J.L.**, Marchetti, C., Toon, G.C., Wunch, D., Wennberg, P. (12–16 June 2023) *Roadmap for future GGG development and application of machine learning to XCO₂ diurnal cycles*. In-person talk at the NDACC-IRWG-TCCON-COCCON 2023 annual meeting.
- Laughner, J.L.** and 8 others. (1–5 May 2023) *Understanding local pollutants from a global perspective: contributions from the TROPES project*. In-person poster at the TEMPO/GEO-XO/TOLNET meeting.

- Laughner, J.L.** and 6 others. (1–5 May 2023) *Application of TCCON data to TEMPO validation*. In-person poster at the TEMPO/GEO-XO/TOLNET meeting.
- Laughner, J.L.** and 8 others. (12 Dec 2022) *Updating TCCON GGG2020 data to the WMO X2019 CO₂ scale and applications to satellite validation*. In-person poster at the 2022 AGU Fall Meeting.
- Laughner, J.L.**, Kiel, M., Kulawik, S. (21 June 2022) *Ongoing and Future Validation Activities Using TCCON Data*. Talk at the TCCON/COCCON/NDACC 2022 Joint Meeting (virtual).
- Laughner, J.L.** and 23 others. (17 Dec 2021) *A comparison of the GGG2014 and GGG2020 TCCON data products*. Poster at the 2021 AGU Fall Meeting (hybrid).
- Laughner, J.L.**, Toon, G., Wunch, D., Roehl, C., Roche, S., Wennberg, P.O. (15 June 2021) *Summary of advancements in the GGG2020 TCCON retrieval*. Virtual talk at the 17th IWGGMS meeting.
- Laughner, J.L.** (1 Mar 2021) *NO_x lifetime and background concentrations during the COVID-19 pandemic: a first look from TROPOMI (invited)*. Virtual talk for the National Center for Atmospheric Research: Atmospheric Chemistry Observations and Modeling group seminar series.
- Laughner, J.L.**, Croes, B., Gentemann, G., Crichton, D., Chatila, I. (8 Dec 2020) *The COVID-19 Atmospheric Ancillary Data Portal (invited)*. Virtual talk at the AGU 2020 Fall Meeting (1–17 Dec 2020).
- Laughner, J.L.** and 32 others. (16 Dec 2020) *The GGG2020 TCCON Data Product*. Virtual talk at the AGU 2020 Fall Meeting (1–17 Dec 2020).
- Laughner, J.L.** and 11 others. (5 June 2020) *GGG2020 prior profile design*. Virtual talk at the 16th IWGGMS meeting (2–5 June 2020).
- Laughner, J.L.**, Kiel, M., Andrews, A., Wunch, D., Toon, G., Wennberg, P.O. (13 May 2020) *GGG2020 prior profile design: the “ginput” package*. Virtual talk at the TCCON network meeting (13–14 May 2020).
- Laughner, J.L.**, and 11 others. (13 Dec 2019) *Testing the separation of diurnal and seasonal variation in XCO₂ measured by OCO-3 with TCCON data*. Talk at AGU Fall Meeting in San Francisco, CA, (9–13 Dec 2019).
- Laughner, J.L.** and Cohen, R.C. (28 Aug 2019) *Direct observation of changing NO_x lifetime in North American cities*. Talk at Aura science team meeting at in Pasadena, CA (27–29 Aug 2019).
- Laughner, J.L.** and Cohen, R.C. *Direct observation of changing NO_x lifetime in North American cities*. Poster at Gordon Research Conference for Atmospheric Chemistry in Newry, ME (28 Jul to 2 Aug 2019).
- Laughner, J.L.** (26 Jul 2019) *Direct observation of changing NO_x lifetime in North American cities*. Talk at ACCESS XV meeting at Brookhaven National Lab, 24–26 Jul 2019.
- Laughner, J.L.**, and Kiel, M. (20 May 2019) *Updates to GGGNext priors: CO₂, N₂O, CH₄, HF, CO*. Talk at the Joint NDACC-IRWG and TCCON meeting, Wanaka, New Zealand, 20–24 May 2019.
- Laughner, J.L.** (20 May 2019) *Bias correction sensitivity to available TCCON data*. Talk at the Joint NDACC-IRWG and TCCON meeting, Wanaka, New Zealand, 20–24 May 2019.
- Laughner, J.L.** and Cohen, R.C. (11 Dec 2018) *Direct space-based observations of decadal changes in NO_x emissions and lifetime: implications for oxidative capacity*. Talk at AGU Fall Meeting in Washington, D.C. (10–14 Dec 2018).
- Laughner, J.L.** (19 Sept 2018) *Direct observation of NO_x lifetime from space: challenges and applications*. Invited talk in Berkeley Atmospheric Science Center seminar series, Berkeley, CA.
- Laughner, J.L.** and Cohen, R.C. (15 Dec 2017) *The Next-generation Berkeley High Resolution NO₂ (BEHR NO₂) Retrieval: Design and Preliminary Emissions Constraints.*, Poster at American Geophysical Union Fall Meeting, New Orleans, LA, 11–15 Dec 2017.
- Laughner, J.L.** and Canfield-Dafilou, E. (22 June 2017) *Illustrating trends in nitrogen oxides across the*

United States using sonification, Talk at International Conference for Auditory Display, University Park, PA, 20–23 June 2017.

Laughner, J.L., Zare, A., and Cohen, R.C. (3 Feb 2017) *Effects of daily, high resolution a priori profiles on satellite-derived NO_x emissions and lifetime*, Poster at Berkeley Atmospheric Science Symposium, Berkeley, CA, 2–3 Feb 2017.

Laughner, J.L., Zare, A., and Cohen, R.C. (16 Dec 2016) *Effects of daily, high resolution a priori profiles on satellite-derived NO_x emissions and lifetime*, Poster at American Geophysical Union Fall Meeting, San Francisco, CA, 12–16 Dec 2016.

Laughner, J.L., Zare, A., and Cohen, R.C. (30 Aug 2016) *Effects of daily meteorology on satellite a priori and implications for constraint of NO_x chemistry from space*, Talk at Aura Science Team Meeting, Rotterdam, Netherlands, 30 Aug–1 Sept 2016.

Laughner, J.L., Zare, A., and Cohen, R.C. (14 Dec 2015) *The impact of day-to-day variability in input assumptions on regional satellite retrievals of NO_2* ,

Laughner, J.L. and Cohen, R.C. (7 May 2015) *Aerosol effects on NO_2 retrievals: an assessment using DISCOVER observations*, Talk at DISCOVER-AQ Science Team Meeting, Boulder, CO, 3–8 May 2015.

Laughner, J.L. and Mallouk, T. (Aug. 2012) *Synthesis of PLGA Microcapsules for Groundwater Remediation*, Presentation of research at conclusion of 3M Summer Fellowship.

Laughner, J.L. and Mallouk, T. (Apr. 2012) *Oxidation of Groundwater Contaminants with Hydrogen Peroxide Containing Microcapsules*, Penn State Undergraduate Research Exposition.

Teaching Experience:

NASA Global Learning and Observation to Benefit the Environment (GLOBE) Dec 2014–Feb 2018

Visit high school classes to discuss my research and help students with their own research projects.

Bay Area Scientists in Schools (BASIS) Jan 2014–Mar 2018

Science lessons with elementary students in Oakland and Berkeley, CA, USA

Graduate Student Instructor, Chem 15, UC Berkeley Aug 2015–Dec 2015

Analytical chemistry: instructor for 25-student lab section; office hours on lab and lecture material

Graduate Student Instructor, Chem 4A, UC Berkeley Aug 2013–Dec 2013

Aug 2014–Dec 2014

General chemistry: instructor for 20-student lab section; office hours on lab and lecture material

Tutor for undergraduate resource room, Penn State Sept 2010–May 2013

Individual to small group tutoring on general and organic chemistry

Mentor for high school student lab experience during summer leadership camp Aug 2012

Led high-school students in water filtration lab, discussion of relevance

Undergraduate Instrument Room TA, Penn State Aug 2011–Dec 2011

Instructed student use of NMR, IR, GC, and data interpretation

Skills:

- *Programming*: fluent in Python, Matlab, Julia, Rust, Bash, Git, Mercurial; conversant with Fortran, C, C++, C#, Supercollider.
- *Atmospheric remote sensing*: development of UV-visible & IR retrieval algorithms; application of NO₂ remote sensing for emissions and lifetime constraints.
- *Atmospheric chemical transport modeling*: experienced with GEOS-Chem and WRF-Chem.
- *Radiative transfer modeling*: conversant with SCIATRAN.
- *Typesetting and visualization*: fluent with Latex, GIMP (GNU Image Manipulation Program), Inkscape (open source vector image editor), and Blender (open source 3D modeling program).

Selected programming examples:

- ginput, a trace gas a priori profile generator: <https://github.com/TCCON/py-ginput>
- COVID Atmospheric Ancillary Data Agglomerator (CAADA): <https://github.com/joshua-laughner/CAADA>
- BEHR Retrieval: <https://github.com/CohenBerkeleyLab/BEHR-core> and dependencies
- Modification of WRF-Chem to automatically scale anthropogenic emissions to the run year: https://github.com/CohenBerkeleyLab/WRF-Chem-R2SMH/commits/conv_emiss_racm2-r2smh, esp. commits b7a4f62 & 64225f2
- Code to automate configuration, compilation, input preparation, and execution of WRF-Chem: <https://github.com/CohenBerkeleyLab/AutoWRFChem-Base>
- Matlab-Python data type interface: <https://github.com/firsttempora/MatlabPythonInterface>