

Dr. Joshua L. Laughner

📍 Tropospheric Composition Group, Jet Propulsion Laboratory
 ✉ josh.laughner@jpl.nasa.gov
 ☎ 1 (626) 989-2170
 🔗 joshua-laughner.io
 in joshua-laughner
 🌐 joshua-laughner

Education

- | | |
|---|-------------------|
| Ph.D. University of California, Berkeley, Chemistry | Aug 2013–Aug 2018 |
| <ul style="list-style-type: none"> • Concentrations: atmospheric chemistry, physical chemistry • Dissertation: Space-based constraints on NO_x emissions and lifetime using high-resolution NO₂ retrievals | |
| B.S. Pennsylvania State University, Chemistry with Honors | Aug 2008–May 2013 |
| <ul style="list-style-type: none"> • With Highest Distinction • Thesis: Synthesis and Transport Studies of a Delivery Mechanism for Oxidative In-Situ Remediation of Groundwater | |
| B.M. Pennsylvania State University, Music Composition with Honors | Aug 2008–May 2013 |
| <ul style="list-style-type: none"> • With Highest Distinction • Thesis: Virtual Evolving and Self-Producing Rapid Audio (V.E.S.P.R.A.) | |

Research Experience

- | | |
|---|--|
| Jet Propulsion Laboratory, NASA/Caltech: Algorithm scientist | Pasadena, CA, USA
Oct 2021–present |
| <ul style="list-style-type: none"> • Algorithm development for remote sensing of atmospheric trace gases | |
| Wennberg Group, Caltech: Postdoctoral scholar | Pasadena, CA, USA
Oct 2018–Oct 2021 |
| <ul style="list-style-type: none"> • Retrieval development for the Total Carbon Column Observing Network | |
| Cohen Research Lab, UC Berkeley: Graduate student researcher | Berkeley, CA, USA
Oct 2013–Oct 2018 |
| <ul style="list-style-type: none"> • Development and maintenance of the BEHR NO₂ retrieval (https://behr.cchem.berkeley.edu/) • Application of NO₂ remote sensing to derive constraints on NO_x lifetime and emissions | |
| Mallouk Research Group, Penn State: Undergraduate student researcher | University Park, PA, USA
June 2012–May 2013 |
| <ul style="list-style-type: none"> • Development of oxidative groundwater remediation using peroxide microcapsules | |
| Merck Pharmaceuticals: Intern | Danville, PA, USA
June 2011–Aug 2011 |
| <ul style="list-style-type: none"> • Process optimization of crystal size for product yield and purity | |
| Curriculum development w/Dr. Katherine Masters: Undergraduate student researcher | University Park, PA, USA
Jan 2011–Dec 2012 |
| <ul style="list-style-type: none"> • Design of new curriculum for honor organic chemistry lab course | |
| Cherokee Pharmaceuticals: Intern | Danville, PA, USA
June 2010–Aug 2010 |
| <ul style="list-style-type: none"> • Study of the effect of antisolvent addition on product yield and purity | |

Funded projects

- | | |
|---|-----------|
| PI: OCO Science Team call | beg. 2024 |
| <ul style="list-style-type: none"> • Title: “Validating OCO-2 and -3 retrieved profiles with TCCON partial columns” • Call number: NNH23ZDA001N-OCOST | |
| PI: Internal JPL advanced concept funding | FY24 |

- **Title:** “AQAware, year 2 - an ArcGIS-enabled air-quality data portal”
- **Call number:** ACFA2024

Collaborator: OCO Science Team call

beg. 2024

- **Title:** “Constraining carbon fluxes and transport patterns using new spatiotemporal information in remotely sensed CO₂”
- **PI:** Gretchen Keppel-Aleks, U. Michigan
- **Call number:** NNH23ZDA001N-OCOST

JPL Co-I: NASA Catalyst/New Zealand Collaboration call

2024

- **Title:** “National Scale Top-down CO₂ Flux Estimation for Smaller Scale Countries”
- **PI:** Beata Bukosa, NIWA
- **JPL PI:** Junjie Liu

PI: Internal JPL advanced concept funding

FY23

- **Title:** “AQAware: an ArcGIS-enabled air-quality data portal”
- **Call number:** ACFA2023

Co-I: Atmospheric Composition Modelling and Analysis Program (ACMAP) call

beg. 2023

- **Title:** “Shifting patterns of global emissions and ozone chemical regime linked to human activity and natural processes using a decadal chemical reanalysis”
- **PI:** Kazuyuki Miyazaki, JPL
- **Call number:** NNH22ZDA001N-ACMAP

Co-I: 2022 SMD single-source invitation only call

2022–2025

- **Title:** “Extending the Total Carbon Column Observing Network to 20 Years”
- **PI:** Paul Wennberg, Caltech
- **Call number:** SMDSS22

Awards and service positions

Total Carbon Column Observing Network (TCCON) Algorithm Co-Chair	Oct 2024–present
Total Carbon Column Observing Network (TCCON) Deputy Algorithm Co-Chair	Apr 2020–Oct 2024
Co-convener for the session “Forcings, responses and feedbacks in the Earth System” at the 2024 AGU Fall Meeting	2024
Co-convener for the session “Attributing, Projecting, and Linking Greenhouse Gas Emissions to Sources, Air Quality, and Climate Impact” at the AGU 2023 Fall Meeting.	2023
JPL internal award: “Explore Societal Benefits with ESRI (ESBE) Team” for work to explore opportunities to leverage ESRI technology and JPL data for the common good.	2022
JPL internal award: “Voyager Award” for outstanding contributions to OCO-2 in multiple areas of the project.	2022
Ancillary data subgroup lead, Keck Institute for Space Studies Virtual Workshop, “COVID-19: Identifying Unique Opportunities for Earth System Science”	Apr 2020–Dec 2020
Reviewer on multiple NASA ROSES/unsolicited panels	2021–present
Reviewer for Atmos. Meas. Tech., Atmos. Chem. Phys., J. Geophys. Res. Atmos., Geophys. Res. Lett., J. Quant. Spectrosc. Ra., and Nature Geosci.	ongoing
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**, S.S. Kulawik, and V.H. Payne (in prep.). “An algorithm to retrieve peroxyacetyl nitrate from AIRS”. *Atmos. Meas. Tech.*
- C. Rousogenuous, C. Petri, T. Quéhé P.-Y. Laemmel, J.L. Laughner, **M. Desservettaz**, M. Pikridas, M. Ramonet, E. Bourtsoukidis, M. Buschmann, J. Notholt, T. Warneke, J.-D. Paris, J. Sciare, and M. Vrekoussis (in prep.). “Extension of the Total Carbon Column Observing Network (TCCON) over the Eastern Mediterranean and Middle East: The Nicosia site in Cyprus”. *Atmos. Meas. Tech.*
- L.E. Stevenson, **J.L. Laughner**, M. Okumura, J.T. Hodges, and E.M. Adkins (in review). “Contributions of argon, nitrogen, and oxygen to air broadening in the oxygen A-band”. *J. Quant. Spectrosc. Ra.*
- C. Marchetti, J. Hobbs, P. Somkuti, and **J.L. Laughner** (in review). “A Study on Inferring Diurnal Cycles of XCO₂ from Current and Future Space-Based Missions”. *Earth Space Sci.*
- D. Wunch, **J. Laughner**, G. C. Toon, C. M. Roehl, P. O. Wennberg, L.F. Millán, N. M. Deutscher, T. Warneke, D.F. Pollard, D. G. Feist, K. Strong, E. McGee, S. Roche, J. Mendonca, R. Kivi, P. Heikkinen, F. Hase, M. K. Sha, M. De Mazière, R. Sussmann, M. Rettinger, N.M. Pak, I. Morino, V.A. Velazco, D.W.T. Griffith, J. Notholt, C. Petri, M. Buschmann, J. Hachmeister, S. Doniki, D. Weidmann, C. Rousogenuous, M. Vrekoussis, H. Ohyama, Y.-S. Oh, O. E. García, J. Robinson, M. Dubey, Z. Mingqiang, P. Wang, Y. Té, P. Jeseck, L. Iraci, J. Podolske, K. Shiomi, and S. Kawakami (2025). “The Total Carbon Column Observing Network’s GGG2020 Data Version: Data Quality, Comparison with GGG2014, and Future Outlook”. doi: [10.14291/TCCON.GGG2020.DOCUMENTATION.R1](https://doi.org/10.14291/TCCON.GGG2020.DOCUMENTATION.R1) 
- 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. Rousogenuous, M.K. Sha, K. Shiomi, K. Strong, R. Sussmann, Y. Té, V.A. Velazco, S.C. Wofsy, M. Zhou, and P.O. Wennberg (May 2024). “The Total Carbon Column Observing Network’s GGG2020 data version”. *Earth System Science Data* 16.5, pp. 2197–2260. ISSN: 1866-3516. doi: [10.5194/essd-16-2197-2024](https://doi.org/10.5194/essd-16-2197-2024) 
- C.D. Fredrickson, S.J. Janz, L.N. Lamsal, U.A. Jongebloed, **J.L. Laughner**, and J.A. Thornton (Sept. 2024). “Remote Sensing Estimates of Time-Resolved HONO and NO₂ Emission Rates and Lifetimes in Wildfires”. *Atmos. Meas. Tech. Discuss.* doi: [10.5194/amt-2024-158](https://doi.org/10.5194/amt-2024-158) 
- 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 (Sept. 2024). “Methane retrieval from MethaneAIR using the CO₂ proxy approach: a demonstration for the upcoming MethaneSAT mission”. *Atmospheric Measurement Techniques* 17.18, pp. 5429–5454. ISSN: 1867-8548. doi: [10.5194/amt-17-5429-2024](https://doi.org/10.5194/amt-17-5429-2024) 
- 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](https://doi.org/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. Rousogenuous, 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](https://doi.org/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](https://doi.org/10.5194/amt-16-1477-2023) 
- C. G. MacDonald, J.-P. Mastrogriaco, **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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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. Crounse, 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](https://doi.org/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](https://doi.org/10.5194/amt-10-4403-2017) 

- B. A. Nault, **J. L. Laughner**, P. J. Wooldridge, J. D. Crounse, 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](https://doi.org/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](https://doi.org/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. Crounse, 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](https://doi.org/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](https://doi.org/10.5194/acp-16-2575-2016) 

Selected/recent presentations

- Laughner, J.L.**, Toon, G.C., Wunch, D., Millán, L., Wennberg, P. (9–13 Dec. 2024) *GGG2020.1 – the latest TCCON greenhouse gas data product*. E-lightning talk at the 2024 AGU Fall Meeting.
- Laughner, J.L.** and 11 others. (9–13 Dec. 2024) *Progress towards a joint thermal & near IR retrieval of CO from TROPOMI and CrIS under the TROPESS project*. Poster at the 2024 AGU Fall Meeting.
- Laughner, J.L.**, Payne, V.H., Kulawik, S.S. (24–27 Sep 2024) *Progress towards an AIRS PAN product consistent with CrIS PAN*. Talk at the 2024 NASA Joint AIRS/Sounder Science Team Meeting.
- Laughner, J.L.**, and 9 others. (16–18 Sep 2024). *Current methods to link space-based GHG missions to in situ standards through ground-based FTIR observations*. Invited virtual talk at the CIPM-STG-CENV Stakeholder Meeting.
- Laughner, J.L.**, Millán, L., Toon, G.C., Kiel, M., Wunch, D., Wennberg, P. (9–13 Sep 2024) *Validating OCO-2 and -3 retrieved profiles with TCCON partial columns*. PI talk at the 2024 OCO Science Team Meeting.
- Laughner, J.L.**, Toon, G.C., Wunch, D., Millán, L., Hedelius, J., Wennberg, P. (8–12 July 2024) *A roadmap for GGG2020.1, GGG2020.2, EGI, and MIR TCCON product updates*. In-person talk at the NDACC-IRWG-TCCON-COCCON 2024 annual meeting.
- 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 TROPESS 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 Optica 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 TROPESS 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.**, 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 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. (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.

Open Science Projects

GGG: github.com/TCCON/GGG 

- Suite of programs to retrieve column amounts of trace gases from direct-sun spectra

GGG-RS: github.com/TCCON/ggg-rs 

- Extension programs for GGG, rewritten in Rust, to improve support for post-processing of TCCON and EM27/SUN data.

EGI-RS: github.com/TCCON/egi-rs 

- Redesign of a suite of wrapper programs that streamline retrieval of trace gases from EM27/SUN spectra with GGG
- Documentation provided through GitHub Pages (tccon.github.io/egi-rs/ )

ginput: github.com/TCCON/py-ginput 

- Program to generate *a priori* trace gas profiles for retrievals
- Available as a [PyPI package](#)  with documentation provided through readthedocs.io .

fortformat: github.com/joshua-laughner/fortformat 

- Rust crate to read and write data following Fortran-style fixed text format
- Available through crates.io  with documentation provided through docs.rs .

PECANS: github.com/joshua-laughner/PECANS 

- Multibox chemical model with idealized transport
- Designed to be easily modifiable

jrep: github.com/joshua-laughner/jrep 

- Rust program to search Jupyter notebooks from the command line, à la grep
- Available on crates.io 

COVID Ancillary Atmospheric Data Agglomerator CAADA: github.com/joshua-laughner/CAADA 

- Tools to collect and combine useful datasets to understand the impact of the COVID pandemic and associated lockdowns on atmospheric composition

Berkeley High Resolution (BEHR) NO₂ retrieval: github.com/CohenBerkeleyLab/BEHR-core 

- A NO₂ retrieval for OMI data that adopts a priori inputs with high spatial and temporal resolution.

Modifications to WRF-Chem: github.com/CohenBerkeleyLab/WRF-Chem-R2SMH [↗](#)

- Modified a branch of WRF-Chem to automatically scale anthropogenic emissions by year (see commits [b7a4f62](#) [↗](#) and [64225f2](#) [↗](#))

AutoWRFChem: github.com/CohenBerkeleyLab/AutoWRFChem-Base [↗](#)

- Wrapper programs to automate execution of WRF-Chem and supporting programs

Selected teaching experience

Internship Mentor: JPL

2022–present

- Mentored students in various JPL internship programs including development of their research projects.

NASA Global Learning and Observation to Benefit the Environment (GLOBE)

Dec 2014–Feb 2018

- Visited 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

- Gave science lessons to elementary students in Oakland and Berkeley, CA, USA

Graduate Student Instructor: UC Berkeley

Aug 2013–Dec 2013

- Instructor for a 20-student general chemistry lab section in 2013 and 2014 including office hours on both lab and lecture material

Aug 2014–Dec 2014

- Instructor for a 25-student analytical chemistry lab section in 2014 including office hours on both lab and lecture material

Aug 2015–Dec 2015

Undergraduate resource room tutor: Penn State

Sep 2010–May 2013

- Provided individual to small group tutoring on general and organic chemistry

Undergraduate instrument room TA: Penn State

Aug 2011–Dec 2011

- Instructed students in use of NMR, IR, and GC instruments as well as data interpretation

Skills

Programming/version control:

- Fluent in Python, Matlab, Julia, Rust, Bash, Git, and Mercurial
- Conversant with Fortran, Go, C, C++, C#, Supercollider

Atmospheric remote sensing:

- Developer contributing to (currently or in the past) trace gas retrieval algorithms in the visible, near IR, and thermal IR wavelengths.

Atmospheric chemical transport modelling:

- Previous experience using GEOS-Chem and WRF-Chem
- Developed an idealized multibox model, [PECANS](#) [↗](#)

Radiative transfer modelling:

- Previous experience running SCIATRAN

Typesetting and visualization:

- Fluent with Latex for typesetting
- Experienced with the GNU Image Manipulation Program (GIMP) and Inkscape for raster and vector image editing
- Capable using Blender for 3D modelling