

Dr. Joshua L. Laughner

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Education

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| <p>Ph.D. University of California, Berkeley, Chemistry</p> <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 | Aug 2013–Aug 2018 |
| <p>B.S. Pennsylvania State University, Chemistry with Honors</p> <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 | Aug 2008–May 2013 |
| <p>B.M. Pennsylvania State University, Music Composition with Honors</p> <ul style="list-style-type: none"> • With Highest Distinction • Thesis: Virtual Evolving and Self-Producing Rapid Audio (V.E.S.P.R.A.) | Aug 2008–May 2013 |

Research Experience

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

Funded projects

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| <p>PI: OCO Science Team call</p> <ul style="list-style-type: none"> • Title: “Validating OCO-2 and -3 retrieved profiles with TCCON partial columns” • Call number: NNH23ZDA001N-OCOST | beg. 2024 |
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PI: Internal JPL advanced concept funding	FY24
<ul style="list-style-type: none"> • Title: “AQAware, year 2 - an ArcGIS-enabled air-quality data portal” • Call number: ACFA2024 	
Collaborator: OCO Science Team call	beg. 2024
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • Title: “AQAware: an ArcGIS-enabled air-quality data portal” • Call number: ACFA2023 	
Co-I: Atmospheric Composition Modelling and Analysis Program (ACMAP) call	beg. 2023
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • Title: “Extending the Total Carbon Column Observing Network to 20 Years” • PI: Paul Wennberg, Caltech • Call number: SMDSS22 	

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
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

Awards





NASA Exceptional Public Achievement Medal for exceptional achievement in algorithm development for ground-based and satellite atmospheric remote sensing, enabling high-quality results across multiple NASA missions.	2026
JPL internal award: “Voyager Award” for exceptional contributions to satellite validation efforts through software and open science for ground-based remote sensing networks.	2024


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
NASA Earth and Space Science Fellowship	2014–2017
Teas Scholarship, Penn State Department of Chemistry	2012
3M Fellowship, Penn State	2012







Publications

- N. Parazoo, D. Carroll, J.B. Abshire, Y.M. Bar-On, R.A. Birdsey, A.A. Bloom, K.W. Bowman, R.K. Braghiere, L.M. Bruhwiler, B. Byrne, A. Chatterjee, D. Crisp, L. Duncanson, A.F. Feldman, A.M. Fox, C. Frankenberg, B.A. Gay, F. Hopkins, F.M. Hoffman, J.R. Holmquist, L.R. Hutya, M. Keller, C.D. Koven, **J.L. Laughner**, J. Liu, N.S. Lovenduski, N. Macbean, G.A. McKinley, G. McNicol, D. Menemenlis, A.M. Michalak, C.E. Miller, H. Nesser, T. Oda, E.M. Ordway, L.E. Ott, K. Paustian, Z.A. Pierrat, B. Poulter, S.C. Reed, D.S. Schimel, S.P. Serbin, S.S. Saatchi, H. Suto, L. Windham-Myers, and D. Wunch (2026). “A U.S. scientific community review of carbon cycle science gaps and opportunities to better support earth system science and carbon management”. *Earth Sci. Rev.*, p. 105493. doi: [10.1016/j.earscirev.2026.105493](https://doi.org/10.1016/j.earscirev.2026.105493) 
- C. Rousogonous, C. Petri, P.-Y. Quehe, T. 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 (2026). “Extension of the Total Carbon Column Observing Network (TCCON) over the Eastern Mediterranean and Middle East: The Nicosia site in Cyprus”. *Atmos. Meas. Tech.* 19, pp. 565–581. doi: [10.5194/amt-19-565-2026](https://doi.org/10.5194/amt-19-565-2026) 
- J. L. Laughner**, S. S. Kulawik, and V. H. Payne (2026). “An algorithm to retrieve peroxyacetyl nitrate from AIRS”. *Atmos. Meas. Tech.* 19.1, pp. 249–276. doi: [10.5194/amt-19-249-2026](https://doi.org/10.5194/amt-19-249-2026) 
- Mahesh Kumar Sha, Saswati Das, Matthias M. Frey, Darko Dubravica, Carlos Alberti, Bianca C. Baier, Dimitrios Balis, Alejandro Bezanilla, Thomas Blumenstock, Hartmut Boesch, Zhaonan Cai, Jia Chen, Alexandru Dandocsi, Martine De Mazière, Stefani Foka, Omaira García, Lawson David Gillespie, Konstantin Gribanov, Jochen Gross, Michel Grutter, Philip Handley, Frank Hase, Pauli Heikkinen, Neil Humpage, Nicole Jacobs, Sujong Jeong, Tomi Karppinen, Matthäus Kiel, Rigel Kivi, Bavo Langerock, **Joshua Laughner**, Morgan Lopez, Maria Makarova, Marios Mermigkas, Isamu Morino, Nasrin Mostafavipak, Anca Nemuc, Timothy Newberger, Hirofumi Ohyama, William Okello, Gregory Osterman, Hayoung Park, Razvan Pirloaga, David F. Pollard, Uwe Raffalski, Michel Ramonet, Eliezer Sepúlveda, William R. Simpson, Wolfgang Stremme, Colm Sweeney, Noemie Taquet, Chrysanthi Topaloglou, Qiansi Tu, Thorsten Warneke, Debra Wunch, Vyacheslav Zakharov, and Minqiang Zhou (2025). “Fiducial Reference Measurements for Greenhouse Gases (FRM4GHG): Validation of Satellite (Sentinel-5 Precursor, OCO-2, and GOSAT) Missions Using the Collaborative Carbon Column Observing Network (COCCON)”. *Remote Sensing* 17.5. doi: [10.3390/rs17050734](https://doi.org/10.3390/rs17050734) 
- N. Parazoo, D. Carroll, J. B. Abshire, Y. M. Bar-On, R. A. Birdsey, A. A. Bloom, K. W. Bowman, R. K. Braghiere, L. M. Bruhwiler, B. Byrne, A. Chatterjee, D. Crisp, L. Duncanson, A. F. Feldman, A. M. Fox, C. Frankenberg, B. A. Gay, F. Hopkins, F. M. Hoffman, J. R. Holmquist, L. R. Hutya, M. Keller, C. D. Koven, **J. L. Laughner**, J. Liu, N. S. Lovenduski, N. Macbean, G. A. McKinley, G. McNicol, D. Menemenlis, A. M. Michalak, C. E. Miller, H. Nesser, T. Oda, E. M. Ordway, L. E. Ott, K. Paustian, Z. A. Pierrat, B. Poulter, S. C. Reed, D. S. Schimel, S. P. Serbin, S. S. Saatchi, H. Suto, L. Windham-Myers, and D. Wunch (2025). “A U.S. Scientific Community Vision for Sustained Earth Observations of Greenhouse Gases to Support Local to Global Action”. *AGU Advances* 6.6, e2025AV001914. doi: <https://doi.org/10.1029/2025AV001914> 
- W. Keely, S. Mauceri, R. Nelson, **J. Laughner**, C.W. O’Dell, S. Massie, D. Baker, M. Kiel, O. Lamminpää, J. Hobbs, A. Chatterjee, T. Taylor, P. Wennberg, S. Crowell, B. Stephens, and V. Payne (2025). “Uncertainty-Aware Machine Learning Bias Correction and Filtering for OCO-2. 2”. *Earth Space Sci.* 12.11. e2025EA004329. doi: <https://doi.org/10.1029/2025EA004329>  eprint: <https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2025EA004329>
- F. Werner, K.W. Bowman, S. Lee, **J.L. Laughner**, V.H. Payne, and J.L. McDuffie (Oct. 2025). “A hybrid optimal estimation and machine learning approach to predict atmospheric composition”. *EGUsphere*. doi: [10.5194/egusphere-2025-4864](https://doi.org/10.5194/egusphere-2025-4864) 

- S. Mauceri, W. Keely, **J. Laughner**, C. W. O'Dell, S. Massie, R. Nelson, D. Baker, M. Kiel, O. Lamminpää, J. Hobbs, A. Chatterjee, T. Taylor, P. Wennberg, S. Crowell, B. Stephens, and V. H. Payne (July 2025). "Uncertainty-Aware Machine Learning Bias Correction and Filtering for OCO-2: 1". *Earth and Space Science* 12.7. ISSN: 2333-5084. DOI: [10.1029/2025ea004328](https://doi.org/10.1029/2025ea004328)
- C.D. Fredrickson, S.J. Janz, L.N. Lamsal, U.A. Jongebloed, **J.L. Laughner**, and J.A. Thornton (Sept. 2025). "Remote Sensing Estimates of Time-Resolved HONO and NO₂ Emission Rates and Lifetimes in Wildfires". *Atmos. Meas. Tech. Discuss.* DOI: [10.5194/amt-18-3669-2025](https://doi.org/10.5194/amt-18-3669-2025)
- S. Das, M. Kiel, **J. Laughner**, G. Osterman, C.W. O'Dell, T.E. Taylor, B. Fisher, F. Chevallier, N.M. Deutscher, M.K. Dubey, D.G. Feist, O. Garcia, D.W.T. Griffith, F. Hase, L.T. Iraci, R. Kivi, I. Morino, J. Notholt, H. Ohyama, D. Pollard, S. Roche, C.M. Roehl, C. Rousogenuous, M.K. Sha, K. Shiomi, K. Strong, R. Sussmann, Y. Té, G. Toon, M. Vrekoussis, P. Wang, T. Warneke, P. Wennberg, A. Chatterjee, V.H. Payne, and D. Wunch (2025). "Comparisons of the v11.1 Orbiting Carbon Observatory-2 (OCO-2) XCO₂ Measurements With GGG2020 TCCON". *Earth Space Sci.* 12.7. e2024EA003935 2024EA003935, e2024EA003935. DOI: <https://doi.org/10.1029/2024EA003935>
- C. Marchetti, J. Hobbs, P. Somkuti, and **J.L. Laughner** (2025). "A Study on Inferring Diurnal Cycles of XCO₂ from Current and Future Space-Based Missions". *Earth Space Sci.* 12, e2024EA003947. DOI: [10.1029/2024EA003947](https://doi.org/10.1029/2024EA003947)
- L.E. Stevenson, **J.L. Laughner**, M. Okumura, J.T. Hodges, and E.M. Adkins (2025). "Contributions of argon, nitrogen, and oxygen to air broadening in the oxygen A-band". *J. Quant. Spectrosc. Ra.* DOI: [10.1016/j.jqsrt.2025.109480](https://doi.org/10.1016/j.jqsrt.2025.109480)
- 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. Laemmle, 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. 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)
- T. E. Taylor, C. W. O'Dell, D. Baker, C. Bruegge, A. Chang, L. Chapsky, A. Chatterjee, C. Cheng, F. Chevallier, D. Crisp, L. Dang, B. Drouin, A. Eldering, L. Feng, B. Fisher, D. Fu, M. Gunson, V. Haemmerle, G. R. Keller, M. Kiel, L. Kuai, T. Kurosu, A. Lambert, **J. Laughner**, R. Lee, J. Liu, L. Mandrake, Y. Marchetti, G. McGarragh, A. Merrelli, R. R. Nelson, G. Osterman, F. Oyafuso, P. I. Palmer, V. H. Payne, R. Rosenberg, P. Somkuti, G. Spiers, C. To, B. Weir, P. O. Wennberg, S. Yu, and J. Zong (2023). "Evaluating the consistency between OCO-2 and OCO-3 XCO₂ estimates derived from the NASA ACOS version 10 retrieval algorithm". *Atmos. Meas. Tech.* 16.12, pp. 3173–3209. DOI: [10.5194/amt-16-3173-2023](https://doi.org/10.5194/amt-16-3173-2023)
- 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. Laemmle, 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. DOI: [10.5194/amt-16-1121-2023](https://doi.org/10.5194/amt-16-1121-2023)
- 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.* 16.17, pp. 3987–4007. DOI: [10.5194/amt-16-3987-2023](https://doi.org/10.5194/amt-16-3987-2023)
- 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. 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](https://doi.org/10.5194/acp-23-3493-2023) 
- 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 (2023). “Inferring the vertical distribution of CO and CO₂ from TCCON total column values using the TARDISS algorithm”. *Atmos. Meas. Tech.* 16, pp. 2601–2625. doi: [10.5194/amt-16-2601-2023](https://doi.org/10.5194/amt-16-2601-2023) 
- 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) 
- 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) 
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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 TROPES 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 IWGMS-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 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 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.**, 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.
- Documentation provided through GitHub Pages (<https://tcon.github.io/ggg-rs/> 



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 (tcon.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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • Gave science lessons to elementary students in Oakland and Berkeley, CA, USA 	
Graduate Student Instructor: UC Berkeley	Aug 2013–Dec 2013 Aug 2014–Dec 2014 Aug 2015–Dec 2015
<ul style="list-style-type: none"> • Instructor for a 20-student general chemistry lab section in 2013 and 2014 including office hours on both lab and lecture material • Instructor for a 25-student analytical chemistry lab section in 2014 including office hours on both lab and lecture material 	
Undergraduate resource room tutor: Penn State	Sep 2010–May 2013
<ul style="list-style-type: none"> • Provided individual to small group tutoring on general and organic chemistry 	
Undergraduate instrument room TA: Penn State	Aug 2011–Dec 2011
<ul style="list-style-type: none"> • 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