Dustin D. Roten, Ph.D.
Atmospheric Scientist || STEM Educator
droten@jpl.nasa.gov || dustinroten.com

ORCID: 0000-0001-7697-7588

PROFESSIONAL EXPERIENCE

Postdoctoral Research Fellow [January 2023 - *current*]
Earth Science Division – Tropospheric Composition
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

Adjunct Instructor, Physics [Spring 2016, Fall 2023 - *current*]
Division of Arts and Sciences
Wilkes Community College, Wilkesboro, NC

Graduate Research Assistant [Fall 2018 – Fall 2022]
Department of Atmospheric Sciences
The University of Utah, Salt Lake City, UT

Adjunct Instructor, Math [Fall 2020 – Spring 2022]
Department of Mathematics
Forsyth Technical Community College, Winston Salem, NC

Graduate Fellow [Fall 2018 – Spring 2019]
Global Change & Sustainability Center
The University of Utah, Salt Lake City, UT

Graduate Research Assistant [Fall 2016 – Spring 2018]
Department of Mathematical Sciences
Appalachian State University, Boone, NC

Academic Instructor [Summers 2016 - 2018]
Upward Bound
Appalachian State University, Boone, NC

High School Teacher, Mathematics [Fall 2015 – Spring 2016]
Ashe County High School, West Jefferson, NC

EDUCATION

Ph.D. – Atmospheric Sciences [Fall 2018 – Spring 2023]
Emphases: carbon cycle science, remote sensing of CO_2, CO_2 observing networks
University of Utah, Salt Lake City, UT

M.S. – Engineering Physics [Fall 2016 – Summer 2018]
Concentration: systems and laboratory automation
Appalachian State University, Boone, NC

M.A. – Mathematics [Fall 2016 – Summer 2018]
Emphases: mathematical modeling, college teaching
Appalachian State University, Boone, NC

B.S. – Physics & Mathematics [Fall 2010 – Spring 2015]
Concentrations: mathematical physics, general mathematics
Appalachian State University, Boone, NC

TECHNICAL SKILLS

⇒ **Instrumentation**

Ultra-high vacuum systems, time of flight mass spectroscopy (TOFMS), data loggers, analog circuits, digital circuits, microcontrollers, environmental sensors, DAQ boards, Arduino, laboratory/instrumentation automation, EM27/SUNs, weather-based instrumentation.

⇒ **Modeling/Programming/Scripting Skills**

R/RStudio, MATLAB, Arduino, C, Assembly, LaTeX, X-STILT, HYSPLIT, data acquisition, data analytics, hardware/software interfacing, parallel processing, workflow development, version control

PUBLICATIONS

⇒ **Peer-Reviewed Publications**

D. Roten, T. Wilmot, J. C. Lin, A. Chatterjee. *How well do OCO-2 and OCO-3 Constrain CO_2 over the United States? Implications for Current and Future Space-based Carbon-observing Systems.* (*in preparation*)

D. Roten, J. C. Lin, D. Wu, T. Oda, E. Kort. *Constraining Sector-specific CO_2 Fluxes using Space-based XCO_2 Observations over the Los Angeles Basin*. Geophysical Research Letters. 2023. (DOI: 10.1029/2023GL104376)

D. Roten, J. C. Lin, L. Kunik, D. Mallia, D. Wu, T. Oda, E. Kort. *The Information Content of Dense Carbon Dioxide Measurements from Space: An Urban-Focused Inversion Approach with Simulated Data from the OCO-3 Instrument*. Atmospheric Chemistry and Physics Discussions. 2022. (DOI: 10.5194/acp-2022-315)

D. Roten, D. Wu, B. Fasoli, T. Oda, J. C. Lin. *An Interpolation Method to Reduce the Computational Time in the Stochastic Lagrangian Particle Dispersion Modeling of Spatially Dense XCO_2 Retrievals*. Earth and Space Science. 2021. (DOI: 10.1029/2020EA001343)

M. Kiel, A. Eldering, **D. Roten**, J. C. Lin, S. Feng, R. Lei, T. Lauvaux, T. Oda, C. M. Roehl, J. Blavier, L T. Iraci. *Urban-focused satellite CO_2 Observations from the Orbiting Carbon Observatory-3: A First Look at the Los Angeles Megacity*. Remote Sensing of Environment – Remote Sensing of Greenhouse Gas Emissions [Special Issue]. 2021. (DOI: 10.1016/j.rse.2021.112314)

S. Hogue, **D. Roten**, E. Marland, G. Marland. *Gridded Estimates of CO_2 Emissions: Uncertainty as a Function of Grid Size.* Mitigation and Adaptation Strategies for Global Change. 2018. (DOI: 10.1007/s11027-017-9770-z)

⇒ **Book Chapters**

D. Roten, R. Andrew, G. Marland, R. Bun, M. Crippa, D. Gilfillan, M. Jones, G. Janssens-Maenhout, E. Marland, R. Quadrelli. *CO_2 Emissions from Energy Systems and Industrial Processes: Inventories from Data- and Proxy-driven Approaches* in *Balancing Regional Greenhouse Gas Budgets: Accounting for Natural and Anthropogenic Flows of CO_2 and other Trace Gases*. Elsevier. 2022. (ISBN: 978-0-12-814952-2)

⇒ **Peer Review Activity**

Advances in Space Research (Elsevier)
Geoscientific Model Development (European Geophysical Union)
Geophysical Research Letters (American Geophysical Union)
Remote Sensing of Environment (Elsevier)
Scientific Data (Springer)

PRESENTATIONS

⇒ **Lead Author Presentations** [*presenter]

Physical and Environmental Factors Limiting the Measurement of Anthropogenic Carbon Dioxide Emissions from Space
D. Roten* and A. Chatterjee
15) 20th International Workshop on Greenhouse Gas Measurements from Space (IWGGMS), Boulder, CO (*upcoming*; May, 2024)

Zooming in on the Carbon Cycle: Monitoring Urban CO2 emissions from Space
D. Roten*
14) NASA-JPL Center for Climate Sciences, Pasadena, CA. (Oral; Mar. 29, 2024)

How Well do OCO-2 and OCO-3 Monitor the United States? Implications for Current and Future Space-based Carbon-observing Systems
D. Roten*, T. Wilmot, J. C. Lin, S. Das, E. A. Kort, A. Chatterjee
13) American Geophysical Union (AGU) 2023 Fall Meeting, San Francisco, CA. (Oral; Dec. 15, 2023)

Detecting Changes in Sector-specific CO_2 Emissions Using OCO-3: A Case Study in the Los Angeles Basin
D. Roten*, T. Wilmot, J. C. Lin, A. Chatterjee, E. Kort
12) 19th International Workshop on Greenhouse Gas Measurements from Space (IWGGMS), Paris, France (Oral; July 6, 2023)

Detecting Changes in Sector-specific CO_2 Emissions from Space: an Application of OCO-3 over the Los Angeles Basin
D. Roten*, J. C. Lin, E. A. Kort
11) American Geophysical Union (AGU) 2022 Fall Meeting, Chicago, IL (Oral; Dec. 12, 2022)

The Information Content of Dense Carbon Dioxide Measurements from Space: A Case Study with OCO-3
D. Roten*, J. C. Lin, L. Kunik, D. Mallia, D. Wu, T. Oda, E. Kort
10) 18th International Workshop on Greenhouse Gas Measurements from Space (IWGGMS), Virtual (Poster; Jul. 13, 2022)

The Information Content of Dense XCO_2 Retrievals: The Potential of Extracting Sector-Specific Fluxes with OCO-3
D. Roten*, D. Wu, B. Fasoli, L. Kunik, D. Mallia, J. C. Lin, T. Oda, E. Kort
9) American Geophysical Union (AGU) 2021 Fall Meeting, New Orleans, LA (Oral; Dec. 17, 2021)

Quantifying CO_2 Emissions from World Megacities with Emerging Dense Urban CO_2 Satellite Data: Using Lagrangian Particle Dispersion Modeling in a Los Angeles Case Study
D. Roten*, D. Wu, J.C. Lin, T. Oda, M. Kiel, E. Kort
8) American Geophysical Union (AGU) 2020 Fall Meeting, Virtual (Oral; Dec. 16, 2020)

Spatiotemporal Metrics for the Characterization of Point Source $FFCO_2$ Emissions and Dispersion
D. Roten*, P. Spell, S. Hogue, E. Marland, G. Marland, C. Thaxton
7) American Geophysical Union (AGU) 2017 Fall Meeting, New Orleans, LA. (Poster; Dec. 13, 2017)
6) Celebration of Student Research and Creative Endeavors at Appalachian State University Boone, NC. (Poster; April 2017)

Modeling with 9-12 Mathematics
D. Roten*
5) North Carolina Council of Teachers of Mathematics (NCCTM) 2016 State Conference, Greensboro, NC. (Oral; Oct. 28, 2016)

Production & Storage of Ne^{3+} for Radiative Lifetime Measurements
D. Roten*, T. Dula*, C. Patteson, B. Johnson, A. G. Calamai
4) Celebration of Student Research and Creative Endeavors at Appalachian State University, Boone, NC. (Poster; April 2015)
3) State of North Carolina Undergraduate Research and Creativity Symposium (SNCURCS) at North Carolina State University. Raleigh, NC. (Poster; Nov. 22, 2014)

A Search for Multiply-Charged Ion Production in a Low Energy Ion Trap
D. Roten*, J. Meyer, B. Johnson, A. G. Calamai
2) Celebration of Student Research and Creative Endeavors at Appalachian State University Boone, NC. (Poster; April 2014)
1) State of North Carolina Undergraduate Research and Creativity Symposium (SNCURCS) at the University of North Carolina - Charlotte. Charlotte, NC. (Poster; Nov. 16, 2013)

$\Rightarrow$ **Contributions to Presentations** [*presenter]
Keeping a Finger on the Pulse of the Earth: NASA's Orbiting Carbon Observatory-3 (OCO-3) Mission on the International Space Station
T. Kurosu*, A. Chatterjee, B. Fisher, M. Kiel, R. Nelson, Z. Pierrat, **D. Roten**, G. Spiers, V. Payne, OCO Science Team
International Space Station Research and Development Conference, Boston, MA (*upcoming*; July, 2024)

Are Our Greenhouse Gas (GHG) Emissions Inventories Truly Application Ready for Science and Climate Mitigation Actions?
T. Oda*, R. Bun, E. Puliafito, L. Feng, P. Palmer, Z. Wang, J. Lin, **D. Roten**, E. Kort, T. Lauvaux, B. Weir, L. Ott
11th International Carbon Dioxide Conference (ICDC11), Manaus Amazonas, Brazil (*upcoming*; July, 2024)

Monitoring Urban CO2 Emissions from Space: Insights from NASA's Orbiting Carbon Observatory-3 (OCO-3) Mission

A. Chatterjee*, M. Kiel, R. Nelson, D. Wu, **D. Roten**, A. Danjou, R. Lei, T. Kurosu, S. Pandey, J. Laughner, T. Taylor, J. C. Lin, J. Liu, P. Wennberg, T. Lauvaux, S. Feng, T. Oda, C. O'Dell, V. Payne, G. Spiers
American Geophysical Union (AGU) 2022 Fall Meeting, Chicago, IL (Oral; Dec. 14, 2022)

Urban CO2 Emissions from Cities around the World and their Scaling Relationships with Socioeconomic Variables, determined with Orbiting Carbon Observatory-2
T. Y. Wilmot*, J. C. Lin, D. Wu, **D. Roten**, T. Oda, E. A. Kort
American Geophysical Union (AGU) 2022 Fall Meeting, Chicago, IL (Oral; Dec. 12, 2022)

Monitoring Anthropogenic Emissions: Insights from OCO-3's Snapshot Area Mapping (SAM) Mode
A. Chatterjee*, R. Nelson, M. Kiel, S. Pandey, B. Fisher, G. Spiers, E. Bell, A. Eldering, T. Kurosu, J. C. Lin, J. Liu, C. O'Dell, V. Payne, **D. Roten,** T. Taylor, P. Wennberg, D. Wu, C. Cheng, R. Basilio
18th International Workshop on Greenhouse Gas Measurements from Space, Virtual (Oral; Jul. 13, 2022)

Urban-focused Satellite CO$_2$ Observations from the Orbiting Carbon Observatory-3: a First Look at the Los Angeles Megacity
M. Kiel*, A. Eldering, **D. Roten**, R. Lei, S. Feng, J. C. Lin, T. Lauvaux, C. M. Roehl, T. Oda.
European Geosciences Union (EGU) General Assembly 2021, Virtual. (Oral; April 2021)

OCO-3 SAM mode: Spatiotemporal Variability of XCO$_2$ Over the Los Angeles Megacity
M. Kiel*, A. Eldering, **D. Roten**, R. Lei, S. Feng, J. C. Lin, T. Lauvaux, C. M. Roehl, T. Oda.
American Geophysical Union (AGU) 2020 Fall Meeting, Virtual. (Oral; Dec. 16, 2020)

Overcoming challenges in using satellite-based CO$_2$ data to understand carbon emissions from cities around the world
J. C. Lin*, D. Wu, **D. Roten**, B. Fasoli, T. Oda, E. Kort
American Geophysical Union (AGU) 2019 Fall Meeting, San Francisco, CA. (Oral; Dec. 13, 2019)

Utah-Atmospheric Trace Gas & Air Quality Lab (U-ATAQ).
R. Bares*, L. E. Mitchell, B. Fasoli, D. Eriksson, A. Meldrum, **D. Roten**, J. C. Lin
The Air We Breathe: A Multidisciplinary Perspective on Air Quality, University of Utah, Salt Lake City, UT. (Poster; Oct. 3, 2019)

TEACHING

⇒ **Wilkes Community College**
Physics I (Mechanics) [PHY-131] and Laboratory – Mechanics course for Engineering Technology students [hybrid; non-transferrable]
General Physics I [PHY-251] and Laboratory – Calculus-based course focusing on classical mechanics [online/asynchronous; transferable to 4-year university]
General Physics II [PHY-252] and Laboratory – Calculus-based course focusing on electricity and magnetism [online/asynchronous; transferrable to 4-year university]

⇒ **Forsyth Technical Community College**
Statistical Methods I [MAT-152] and Laboratory – Prerequisite statistics course for multiple majors [online/asynchronous; transferrable to a 4-year university]

⇒ **Upward Bound** [Grades 10 – 12]
Design and Problem Solving – A one week hands-on course requiring students to work with design constraints
Brief Statistics – A four week "preview" course designed to prepare students for AP Statistics
Brief Physics – A four week "preview" course designed to prepare student for AP Physics
Brief Pre-Calculus – A four week "preview" course designed to prepare student for high school Pre-Calculus
Brief Calculus – A four week "preview" course designed to prepare student for AP Calculus

⇒ **Ashe County High School**
Math III – NC Common Core Curriculum (similar to a Pre-Calculus course)
Advanced Functions and Modeling (AFM) – Application-based advanced mathematics course

LEADERSHIP, AWARDS, AND MEMBERSHIPS (PAST & PRESENT)

⇒ **Leadership**
National President-Elect/President, Technology & Engineering Education Collegiate Association (TEECA) (2010-2013)
President, Physics and Astronomy (PandA) Club, Appalachian State University (2013-2014)
Vice-President, Physics and Astronomy (PandA) Club, Appalachian State University (2012-2013)

⇒ **Awards**
TEECA Special Recognition Award of Outstanding Service as President (Columbus, Ohio; 2013)
TEECA Special Recognition Award of Outstanding Service as President-Elect (Long Beach, California; 2012)

⇒ **Membership (Past & Present)**
NASA Orbiting Carbon Observatory (OCO-2/3) Science Team Affiliation
Land-Atmosphere Interactions Research (LAIR) Group, University of Utah, Salt Lake City, UT
American Association for the Advancement of Science (AAAS)
American Geophysical Union (AGU)
American Meteorological Society (AMS)
Sigma Pi Sigma (SPS)
International Technology and Engineering Educators' Association (ITEEA)
Technology & Engineering Education Collegiate Association (TEECA)
Technology Student Association (TSA) [high school]