

Dien Wu

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Education

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|---|---|-------------|--------------------|
| University of Utah | Ph.D. in Atmospheric Sciences Advisor: Prof. John C. Lin | 2016 – 2020 | Salt Lake City, US |
| University of Utah | M.S. in Atmospheric Sciences Advisor: Prof. John C. Lin | 2014 – 2016 | Salt Lake City, US |
| Florida State University | B.S. in Meteorology Advisor: Prof. Jon E. Ahlquist | 2012 – 2014 | Tallahassee, US |
| Nanjing University of Information Science and Technology | B.S. in Meteorology | 2010 – 2012 | Nanjing, China |

Employment

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| Staff Scientist (Supervisor: Prof. Paul Wennberg) | Division of Geological and Planetary Sciences, California Institute of Technology | July 2023 – present |
| Postdoctoral Scholar Research Associate (Supervisor: Prof. Paul Wennberg) | Division of Geological and Planetary Sciences, California Institute of Technology | July 2020 – July 2023 |
| Graduate Research Assistant | Dept. of Atmospheric Sciences, University of Utah | Aug 2014 – June 2020 |

Professional Experience

NASA Orbiting Carbon Observatory (OCO-2/3) Science Team Member, 2016 – present

Co-convenor of Global Environmental Change session, AGU 2023

“Attributing, Projecting, and Linking Greenhouse Gas Emissions to Sources, Air Quality and Climate Impacts.”

List of Peer-Reviewed Publications [[Google Scholar](#)]

In review/in prep

22. **Wu, D.**, Cawse-Nicholson, K., Liu, J., and Wennberg, P. O.: Quantifying irrigation impacts on crop productivity and evapotranspiration at the ranch scale from Space, In prep.
21. **Wu, D.**, Liu, J., Laughner, J. L., Miyazaki, K., Hasheminassab, S., and Wennberg, P. O.: Simultaneous quantifications of anthropogenic CO, CO₂, and NO_x emissions from space. In prep (*manuscript available upon request*).
20. Wilmot, Y. T., Lin C. J., **Wu, D.**, Oda, T., and Kort A. E.: Toward a satellite-based monitoring system for urban CO₂ emissions in support of emission reduction targets, *Environ. Res. Lett*, in review.

Published

19. Madsen, S., **Wu, D.**, Halim, M. A., Wunch D.: CO₂ Fluxes of Vegetation in the Greenbelt of Ontario and Ecosystem Emissions Associated with its Removal, *Elem. Sci. Anth.*, 12, <https://doi.org/10.1525/elementa.2023.00102>, 2024.
18. Li, M., Kort, E.A., Bloom, A.A., **Wu, D.**, Plant, G., Gerlein-Safdi, C. and Pu, T.: Underestimated Dry Season Methane Emissions from Wetlands in the Pantanal. *Environ. Sci. Technol.* 58, 7, 3278–3287, <https://doi.org/10.1021/acs.est.3c09250>, 2024.
17. **Wu, D.**, Laughner, J. L., Liu, J., Palmer, P. I., Lin, J. C., and Wennberg, P. O.: A simplified non-linear chemistry transport model for analyzing NO₂ column observations: STILT-NO_x, *Geosci. Model Dev.*, 16, 6161–6185, <https://doi.org/10.5194/gmd-16-6161-2023>, 2023.

16. Zazzeri, G., Graven, H., Xu, X., Saboya, E., Blyth, L., Manning, A.J., Chawner, H., **Wu, D.** and Hammer, S.: Radiocarbon measurements reveal underestimated fossil CH₄ and CO₂ emissions in London. *Geophys. Res. Lett.*, 50(15), p.e2023GL103834, <https://doi.org/10.1029/2023GL103834>, 2023.
15. Mallia, D.V., Mitchell, L.E., Gonzalez Vidal, A.E., **Wu, D.**, Kunik, L. and Lin, J.C.: Can We Detect Urban-Scale CO₂ Emission Changes Within Medium-Sized Cities? *J. Geophys. Res.-Atmos.*, 128(11), p.e2023JD038686, <https://doi.org/10.1029/2023JD038686>, 2023.
14. Wu, K., Palmer, P. I., **Wu, D.**, Jouglet, D., Feng, L., and Oda, T.: Theoretical assessment of the ability of the MicroCarb satellite city-scan observing mode to estimate urban CO₂ emissions, *Atmos. Meas. Tech.*, 16, 581–602, <https://doi.org/10.5194/amt-16-581-2023>, 2023.
13. **Wu, D.**, Liu, J., Wennberg, P. O., Palmer, P. I., Nelson, R. R., Kiel, M., and Eldering, A.: Towards sector-based attribution using intra-city variations in satellite-based emission ratios between CO₂ and CO, *Atmos. Chem. Phys.*, 22, 14547–14570, <https://doi.org/10.5194/acp-22-14547-2022>, 2022.
12. Roten, D., Lin, J. C., Kunik, L., Mallia, D., **Wu, D.**, Oda, T., and Kort, E. A.: The Information Content of Dense Carbon Dioxide Measurements from Space: A High-Resolution Inversion Approach with Synthetic Data from the OCO-3 Instrument, *Atmos. Chem. Phys. Discuss.* [preprint], <https://doi.org/10.5194/acp-2022-315>, in review, 2022.
11. Lei, R., Feng, S., Danjou, A., Broquet, G., **Wu, D.**, Lin, J.C., O'Dell, C.W. and Lauvaux, T.: Fossil fuel CO₂ emissions over metropolitan areas from space: A multi-model analysis of OCO-2 data over Lahore, Pakistan. *Remote Sens. Environ.*, 264, p.112625, <https://doi.org/10.1016/j.rse.2021.112625>, 2021.
10. **Wu, D.**, Lin, J. C., Duarte, H. F., Yadav, V., Parazoo, N. C., Oda, T., and Kort, E. A.: A model for urban biogenic CO₂ fluxes: Solar-Induced Fluorescence for Modeling Urban biogenic Fluxes (SMUrF v1), *Geosci. Model Dev.*, 14, 3633–3661, <https://doi.org/10.5194/gmd-14-3633-2021>, 2021.
9. Qu, Z., **D. Wu**, Henze, D. K., Li, Y., Sonenberg, M., and Mao, F.: Transboundary transport of ozone pollution to a US border region: a case study of Yuma. *Environmental Pollution*, 273, Pp. 116421, <https://doi.org/10.1016/j.envpol.2020.116421>, 2021.
8. Roten, D., **Wu, D.**, Fasoli, B., Oda, T., & Lin, J. C.: An interpolation method to reduce the computational time in the Stochastic Lagrangian particle dispersion modeling of spatially dense XCO₂ retrievals. *Earth and Space Science*, 8, e2020EA001343. <https://doi.org/10.1029/2020EA001343>, 2021.
7. Ye, X., T. Lauvaux, E.A. Kort, T. Oda, S. Feng, J.C. Lin, E. Yang, and **D. Wu**: Constraining fossil fuel CO₂ emissions from urban area using OCO-2 observations of total column CO₂. *J. Geophys. Res.-Atmos.*, 125, e2019JD030528. <https://doi.org/10.1029/2019JD030528>, 2020.
6. Yang, E.G., E.A. Kort, **D. Wu**, J.C. Lin, T. Oda, X. Ye, and T. Lauvaux: Using space-based observations and Lagrangian modeling to evaluate urban carbon dioxide emissions in the Middle East. *J. Geophys. Res.-Atmos.*, 125, e2019JD031922. <https://doi.org/10.1029/2019JD031922>, 2020.
5. **Wu, D.**, J.C. Lin, T. Oda, and E.A. Kort: Space-based quantification of per capita CO₂ emissions from cities, *Environ. Res. Lett.*, <https://doi.org/10.1088/1748-9326/ab68eb>, 2020. ([NASA media coverage](#))
4. Hernandez, A.J., Morales-Rincon, L.A., **Wu, D.**, Mallia, D., Lin, J.C. and Jimenez, R.: Transboundary transport of biomass burning aerosols and photochemical pollution in the Orinoco River Basin. *Atmos. Environ.*, <https://doi.org/10.1016/j.atmosenv.2019.01.051>, 2019.
3. **Wu, D.**, Lin, J. C., Fasoli, B., Oda, T., Ye, X., Lauvaux, T., Yang, E. G., and Kort, E. A.: A Lagrangian approach towards extracting signals of urban CO₂ emissions from satellite observations of atmospheric column CO₂ (XCO₂): X-Stochastic Time-Inverted Lagrangian Transport model (“X-STILT v1”), *Geosci. Model Dev.*, 11, 4843–4871, <https://doi.org/10.5194/gmd-11-4843-2018>, 2018.
2. Mallia, D.V., A. Kochanski, **D. Wu**, C. Pennell, W. Oswald, and J.C. Lin: Wind-Blown Dust Modeling Using a Backward-Lagrangian Particle Dispersion Model. *J. Appl. Meteor. Climatol.*, 56, 2845–2867, <https://doi.org/10.1175/JAMC-D-16-0351.1>, 2017.

1. Lin, J. C., Mallia, D. V., **Wu, D.**, and Stephens, B. B.: How can mountaintop CO₂ observations be used to constrain regional carbon fluxes?, *Atmos. Chem. Phys.*, 17, 5561-5581, <https://doi.org/10.5194/acp-17-5561-2017>, 2017.

Past Research Grants

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| Aug 2021 – July 2024 | NASA A.51 Science Team for the OCO Missions: <i>Beyond quantification of carbon emissions from global cities: attribution to socioeconomic sectors using the OCO missions and multiple remote sensing products</i> (PI: Eric Kort, UMichigan); My Role: Co-I |
| 2021 - 2023 | NASA Research and Technology Development Fund: Quantification of Urban Emissions using OCO-3 Snapshot Area Maps (PI: Annmarie Eldering, NIST); My Role: Co-I |
| June 2021 – May 2024 | NASA A.5 Carbon Cycle Science: <i>2020 California Carbon Dioxide Budget in a Changing Environment</i> (PI: Seongeun Jeong, LBNL); My Role: Collaborator |
| Not selected | NASA A.31 Science Team for the OCO Missions; submitted in Jun 2023; My Role: Science PI |

Invited Talks

3. Colloquia at Dept. of Atmospheric Science, Colorado State University, “Seeing Human Impacts on the Environment Through Satellite Lenses”, https://www.atmos.colostate.edu/dept/abstracts/2024spring/2.15.24_Wu_abstract.pdf, Feb 15, **2024**.
2. Annual seminar series at Institute of Atmospheric Physics of Chinese Academy of Sciences: “Constraining urban CO₂ emissions using satellites”, June **2023**.
1. Noble seminar series, Earth, Atmospheric, and Planetary Physics (EAPP) at the University of Toronto: “Monitoring urban CO₂ emissions from space: from city-level towards sector-level”, <https://www.physics.utoronto.ca/research/eapp/atmospheric-physics-seminars/dien/>, Oct 31, **2022**.

Teaching and mentoring experiences

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| Guest lecture, Course on GIS & RS, @NYU (~75 mins, 20+ undergrads) “Remote sensing of trace gases and aerosols” | April 2024 |
| Guest lecture, ESE 104, @Caltech “Seeing Urban Emissions through Satellite Lenses” | Feb 2024 |
| Caltech’s Center for Teaching, Learning, and Outreach (CTLO) workshop “Transforming your research into classes” | Spring, Summer, 2023 |
| Kevin Do (undergraduate student, Dept. of Computer Sciences, Caltech) Project: Estimation of global CO ₂ mass using TCCON | 2023 |
| Zixuan Xiao (graduate student, Dept. of Physics, University of Toronto) Project: Power plant CO ₂ emission estimates using X-STILT | 2023 |
| Dr. Ariana Tribby (former graduate student, Dept. of Env Sci & Eng, Caltech) Project: CH ₄ emission estimates for oil & gas using TCCON | 2023 |

Peer Review Activities

Proposal Reviewer: NOAA [Atmospheric Chemistry, Carbon Cycle and Climate \(AC4\)](#) Calls (FY23)

Paper Reviewer: Journal of Geophysical Research: Atmospheres (JGR-A), Geophysical Research Letters (GRL), Environmental Research Letters (ERL), Remote Sensing of Environment (RSE), Atmospheric Chemistry and Physics (ACP), Atmospheric Measurement Techniques (AMT), Biogeosciences (BG), Scientific Reports, and Environmental Science & Technology (EST), Earth’s Future.

Selected Conference Presentations

Wu, D., Cawse-Nicholson, K., Liu, J., Duarte, F. H., Wennberg, P.: Interpreting Atmospheric Imprints of Intensive Agricultural Activities using Multiple Satellites, *AGU Fall Meeting*, San Francisco, CA, Dec 11-15, **2023** (oral).

Wu, D., Liu, J., Wennberg, P., Palmer, P. I., Nelson, R. R., Laughner, J. L., and Eldering, A.: Informing intra-city emission characteristics using satellite observations of CO₂ and co-emitted species, *AGU Fall Meeting*, Chicago, IL, Dec 12-16, **2022** (poster).

Wu, D., Liu, J., Wennberg, P., Palmer, P. I., Nelson, R. R., Laughner, J. L., and Eldering, A.: Towards the quantification of emission ratios between CO₂ and CO and linkage to sectoral activities, IWGGMS-17, Virtual, **2021** (poster).

Wu, D., J.C. Lin, B. Fasoli, T. Oda, E.A. Kort, and Duarte, H., Towards quantifying urban CO₂ emissions for global cities using column CO₂ and SIF data, *AGU Fall Meeting*, San Francisco, CA, Dec 09-13, **2019** (eLightning).

Wu, D., J.C. Lin, H. Duarte, G. Wei, K. Wu, S. Richardson, N. Miles, K. Davis, E. A. Kort: Towards improving the modeling of urban biosphere using Solar-induced Fluorescence (SIF), *AGU Chapman Conference on understanding carbon climate feedbacks*, San Diego, CA, Aug 26-29, **2019** (poster).

Wu, D., J. C. Lin, T. Oda, and E. A. Kort: Do denser cities emit less CO₂? A first estimate using a CO₂ satellite, *OCO-2/OCO-3 Science Team telecon*, May 14, **2019** (oral).

Wu, D., J. C. Lin, Oda, T., Ye, X., Lauvaux, T., Yang, E., and Kort, E. A., Towards Interpreting the Signal of CO₂ Emissions from Megacities by Applying a Lagrangian Receptor-oriented Model to OCO-2 XCO₂ data, *AGU Fall Meeting*, New Orleans, LA, Dec 11-15, **2017** (oral).

Mallia, D. V., A. Kochanski, **D. Wu**, S. Urbanski, and J. C. Lin, Integrating wildfire plume rises within atmospheric transport models, *AGU Fall meeting*, San Francisco, CA, Dec 12-16, **2016**.

Wu, D., D. V. Mallia, S. P. Urbanski, J. C. Lin, Top-down Constraints on CO Emissions from Wildfire Inventories Using a Receptor-oriented Lagrangian Particle Dispersion Model, *AMS Third Conference on Biogeoscience*, Salt Lake City, UT, June 20-25, **2016** (oral).

Lin, J. C., B. B. Stephens, D. V. Mallia, **D. Wu**, H. Duarte, S. Urbanski, and J. Ehleringer, How can we constrain regional carbon fluxes in the American Rockies from atmospheric measurements? *5th NCAP and AmeriFlux Joint Meeting*, Washington, D.C, Jan 26-29, **2015**.

Lin, J. C., D. V. Mallia, **D. Wu**, S. Urbanski, and B. B. Stephens, Quantifying the influence of biomass burning on measurements site in the western U.S., *AGU Fall Meeting*, San Francisco, CA, Dec 15-19, **2014**.

Master Thesis

Wu, D. Top-down constraints on CO emissions from wildfire inventories using a receptor-oriented Lagrangian particle dispersion model, [Link](#).

Outreach activities

Conference co-convenor: Phillips, C.A., Laughner, J., **Wu, D.** and Sadai, S.: December. Attributing, Projecting, and Linking Greenhouse Gas Emissions to Sources, Air Quality, and Climate Impacts I Oral. In *AGU23*.

Media coverage: “NASA Satellite Offers Urban Carbon Dioxide Insights”, <https://www.nasa.gov/centers-and-facilities/jpl/nasa-satellite-offers-urban-carbon-dioxide-insights/>, March 2020

Technical Skills

Programming languages and skills: R, Fortran, Python, Bash, LaTeX, Machine Learning (neural network)

Modeling experience: HYSPLIT-STILT, WRF-ARW, WRF-Chem

Model Assets

1. Column-Stochastic Time-Inverted Lagrangian Transport (X-STILT) model
Github: <https://github.com/uataq/X-STILT> with DOI: [10.5281/zenodo.1241515](https://doi.org/10.5281/zenodo.1241515)
2. Solar-Induced Fluorescence for Modeling Urban biogenic Fluxes (SMUrF) model
Github: <https://github.com/wde0924/SMUrF> with DOI: [10.5281/zenodo.4018124](https://doi.org/10.5281/zenodo.4018124)
Data citation: Wu, D., and J.C. Lin. 2021. Urban Biogenic CO₂ fluxes: GPP, R_{eco} and NEE Estimates from SMUrF, 2010-2019. ORNL DAAC, Oak Ridge, Tennessee, USA. <https://doi.org/10.3334/ORNLDAAC/1899>
3. Stochastic Time-Inverted Lagrangian Transport model for NO_x chemistry (STILT-NO_x)
DOI: <https://zenodo.org/records/8057850>

Professional Association

American Geophysical Union

NASA Orbiting Carbon Observatory (OCO-2/3) Science Team Member

Scholarships and Honors

- Edward J. Zipser Award, Excellence in Graduate Research, University of Utah, May 2020
- Pass the Graduate Qualifying Exam with distinction, University of Utah, May 2015
- Graduate with Magna cum laude, Florida State University, May 2014
- Dean's List, Florida State University, Fall 2012, Spring 2013, Fall 2013, Spring 2014
- Prize for being one of the excellent class leaders, NUIST, June 2012
- Second-tier scholarship (top 10%), NUIST, 2010, 2011