Daniel L. Goldberg, Ph.D.

Assistant Research Professor
Milken Institute School of Public Health
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Academic Degrees

2015	Ph.D.	University of Maryland, Atmospheric & Oceanic Science
2013	M.S.	University of Maryland, Atmospheric & Oceanic Science
2009	B.S.	Lafayette College, Chemical Engineering

Professional Appointments

2021–present	Assistant Research Professor	George Washington University
2019–2021	Staff Research Scientist	George Washington University
2019–2021	Staff Research Scientist	Argonne National Laboratory
2016–2019	Postdoctoral Scientist	Argonne National Laboratory
2010–2015	Graduate Research Assistant	University of Maryland
2009–2010	Environmental Engineer	TRC Solutions

Scientific and Technical Background

Dr. Goldberg quantifies air pollution in cities worldwide using satellite data combined with model output and *in situ* monitoring data. His most recent work involves using the TROPOMI satellite instrument to identify near-real-time changes in air pollution emissions and concentrations. Results from his ongoing analyses have allowed the scientific and policy communities to gain better insight on the emissions of nitrogen oxides (NOx) and greenhouse gases, and to better estimate pollutant exposures for health impact assessments. He held a "Tiger Team" leadership position on the NASA Health and Air Quality Applied Sciences Team, and has made impactful contributions to several additional NASA science teams, including DISCOVER-AQ, KORUS-AQ, and STAQS. He actively collaborates with scientists and policymakers at NASA, NOAA, EPA, IHME, multi-jurisdictional organizations, state agencies, non-profit organizations, and other academic institutions.

Service & Leadership

2021–2023	Technical Advisory	Metro Washington DC Air Quality Committee
2021	Mentor	NASA DEVELOP Internship Program
2021	Session Organizer	American Meteorological Society
2019–2020	Session Organizer	American Geophysical Union
2016–2018	Executive Board Member	Argonne Postdoctoral Society
2016–2017	Mentor	ACT-SO High School Science Competition
2011–2013	Executive Board Member	UMD Atmospheric Science Graduate Students
2007–2008	Student President	Lafayette College Environmental Club

Awards & Honors

2020	Impact Argonne Award for Extraordinary Effort
2015	Outstanding Graduate Assistant Award for top 2% of all graduate students
2012	Service Award for dedicated service to UMD Atmospheric Science Dept
2009	American Chemical Society (ACS) Award for top chemical engineer in class
2008	Tau Beta Pi Engineering Honor Society for top 20% of engineering class

Teaching Experience

2023 – 2024 George Washington University, Sustainable Energy and Environmental Health
3-credit undergraduate class for juniors and seniors (30 students)

2020 – 2022 George Washington University, Global Climate Change and Air Pollution
Guest Lecture on using measurements and models to estimate air pollution

2012 – 2013 University of Maryland, AOSC200: Introduction to Weather and Climate
Head TA. Taught 2 lectures per week. Graded all exams, quizzes, and projects.

Junior Scientists Advised

Postdoc: Dr. Arash Mohegh (2019 – 2021), Dr. Gaige Kerr (2020 – present), Dr. Doyeon Ahn (2021 – present), Dr. Katelyn O'Dell (2021 – 2023), Dr. Tess Carter (2022 – 2023), Dr. Omar Nawaz (2023 – present), Dr. Daniel Huber (2023 – present)

Post-Bachelors: Nigel Martis (2021 – 2022), Xavier Nogueira (2021 – 2022), Perrin Krisko (2021 – 2023), Rishabh Khanna (2022), Ziyad Maknojia (2022), Sara Runkel (2023 – 2024), Erin Campbell (2024 – present)

Undergraduate: Emily Richardt (2022 – 2023), Duncan Quevedo (2020 – 2021)

Professional Membership

American Geophysical Union (AGU)
American Meteorological Society (AMS)

Related Professional Experience

2012 – 2014   National Atmospheric Deposition Program Primary Site Operator
2012 – 2014   Clean Air Status & Trends Network Primary Site Operator

Editorial Review

Peer reviewer for academic journals: Atmospheric Chemistry and Physics (8); Atmospheric Environment (7); Atmospheric Measurement Techniques (1); Atmosphere (3); Earth and Space Science (1); Environmental Research Letters (4); Environmental Science and Technology (4); Elementa (3); Geophysical Research Letters (2); Journal of Atmospheric and Oceanic Technology (1); Journal of Geophysical Research – Atmospheres (5); Nature Communications (1); Remote Sensing (2); Remote Sensing of the Environment (2); Science of the Total Environment (1); Scientific Advances (1)

Peer reviewer for academic proposals: NASA Research Opportunities in Space and Earth Science (ROSES), NASA Earth System Explorers (ESE), NASA Postdoctoral Program (NPP), National Science Foundation (NSF), Netherlands Organization for Scientific Research: Innovational Research Incentives Scheme

Skills & Proficiencies

Satellite data for atmospheric composition: TROPOMI (NO_2, HCHO, CO, CH_4), OMI (NO_2, HCHO), OCO-2 (CO_2), OCO-3 (CO_2), MODIS AOD (Dark Target, Deep Blue, & MAIAC)
Chemical transport models: CAMx, CMAQ, WRF-Chem
Programming: IDL, Linux, HDF & NetCDF file formats, Python, C-shell, Fortran

Peer-Reviewed Publications (14 first-author, 42 total; h-index: 22)

1. Kerr., G. H., R. V. Martin, A. van Donkelaar, M. Brauer, K. Burkart, S. Wozniak, **D. L., Goldberg**, S. C. Anenberg: Increasing disparities in air pollution health burden in the United States, *Environmental Health Perspectives*, **accepted**.

2. **Goldberg, D. L.,** Tao, M., Kerr, G. H., Ma, S., Tong, D. Q., Fiore, A. M., Dickens, A. F., Adelman, Z. E., and Anenberg, S. C.: Evaluating the spatial patterns of U.S. urban NOx emissions using TROPOMI NO2, Remote Sens Environ, 300, 113917, https://doi.org/10.1016/j.rse.2023.113917, **2024**.

3. O'Dell, K., Kondragunta, S., Zhang, H., **Goldberg, D. L.,** Kerr, G. H., Wei, Z., Henderson, B. H., and Anenberg, S. C.: Public Health Benefits From Improved Identification of Severe Air Pollution Events With Geostationary Satellite Data, *Geohealth*, 8, https://doi.org/10.1029/2023GH000890, **2024**.

4. Bechle, M. J., Bell, M. L., **Goldberg, D. L.,** Hankey, S., Lu, T., Presto, A. A., Robinson, A. L., Schwartz, J., Shi, L., Zhang, Y., and Marshall, J. D.: Intercomparison of Six National Empirical Models for PM2.5 Air Pollution in the Contiguous US, *Findings*, https://doi.org/10.32866/001c.89423, **2023**.

5. Kerr, G. H., **Goldberg, D. L.**, Harris, M. H., Henderson, B. H., Hystad, P., Roy, A., and Anenberg, S. C.: Ethnoracial Disparities in Nitrogen Dioxide Pollution in the United States: Comparing Data Sets from Satellites, Models, and Monitors, *Environ Sci Technol*, https://doi.org/10.1021/acs.est.3c03999, **2023**.

6. Tzortziou, M., Loughner, C. P., **Goldberg, D. L.**, Judd, L., Nauth, D., Kwong, C. F., Lin, T., Cede, A., and Abuhassan, N.: Intimately tracking NO_2 pollution over the NYC - Long Island Sound land-water continuum: An integration of shipboard, airborne, satellite observations, and models, *Science of The Total Environment*, 165144, https://doi.org/10.1016/j.scitotenv.2023.165144, **2023**.

7. Larkin, A., Anenberg, S., **Goldberg, D. L.,** Mohegh, A., Brauer, M., and Hystad, P.: A global spatial-temporal land use regression model for nitrogen dioxide air pollution, *Front Environ Sci*, 11, 484, https://doi.org/10.3389/FENVS.2023.1125979, **2023**.

8. Ahn, D. Y., **Goldberg, D. L.,** Coombes, T., Kleiman, G., Anenberg, S. C.: CO_2 Emissions from C40 Cities: Citywide Emission Inventories and Comparisons with Global Gridded Emission Datasets, *Environmental Research Letters*, 18, 034032, doi:10.1088/1748-9326/acbb91, **2023**.

9. Nawaz, M. O., Henze, D. K., Anenberg, S. C., Ahn, D. Y., **Goldberg, D. L.,** Tessum, C. W., and Chafe, Z. A.: Sources of air pollution-related health impacts and benefits of radially applied transportation policies in 14 US cities, Frontiers in Sustainable Cities, 5, https://doi.org/10.3389/frsc.2023.1102493, **2023**.

10. **Goldberg, D. L.,** Harkey, M., de Foy, B., Judd, L., Johnson, J., Yarwood, G. and Holloway, T.: Evaluating NOx emissions and their effect on O3 production in Texas using TROPOMI NO2 and HCHO, Atmos. Chem. Phys., 22(16), 10875–10900, doi:10.5194/acp-22-10875-2022, **2022**.

11. Kerr, G. H., **Goldberg, D. L.**, Knowland, K. E., Keller, C. A., Oladini, D., Kheirbek, I., Mahoney, L., Lu, Z. and Anenberg, S. C.: Diesel passenger vehicle shares influenced

COVID-19 changes in urban nitrogen dioxide pollution, *Environ. Res. Lett.*, 17(7), 074010, doi:10.1088/1748-9326/AC7659, **2022**.

12. Ahn, D. Y., Salawitch, R. J., Canty, T. P., He, H., Ren, X. R., **Goldberg, D. L.,** Dickerson, R. R. The U.S. power sector emissions of CO2 and NOx during 2020: Separating the impact of the COVID-19 lockdowns from the weather and decreasing coal in fuel-mix profile, Atmospheric Environment: X, Volume 14, doi: 10.1016/j.aeaoa.2022.100168, **2022**.

13. Tzortziou, M., Kwong, C. F., **Goldberg, D. L.,** Schiferl, L., Commane, R., Abuhassan, N., Szykman, J. and Valin, L.: Declines and peaks in NO_2 pollution during the multiple waves of the COVID-19 pandemic in the New York metropolitan area, Atmos. Chem. Phys., 1–30, doi:10.5194/ACP-2021-592, **2022**.

14. Jing, P. and **Goldberg, D. L.:** Influence of conducive weather on ozone in the presence of reduced NOx emissions: A case study in Chicago during the 2020 lockdowns, Atmos. Pollut. Res., 13(2), 101313, doi:10.1016/J.APR.2021.101313, **2022**.

15. Anenberg, S. C., Mohegh, A., **Goldberg, D. L.,** Kerr, G. H., Brauer, M., Burkart, K., Hystad, P., Larkin, A., Wozniak, S. and Lamsal, L.: Long-term trends in urban NO_2 concentrations and associated paediatric asthma incidence: estimates from global datasets, Lancet Planet. Heal., 6(1), e49–e58, doi:10.1016/S2542-5196(21)00255-2, **2022**.

16. Nawaz, M. O., Henze, D. K., Harkins, C., Cao, H., Nault, B., Jo, D., Jimenez, J., Anenberg, S. C., **Goldberg, D. L.** and Qu, Z.: Impacts of sectoral, regional, species, and day-specific emissions on air pollution and public health in Washington, DC, Elem. Sci. Anthr., 9(1), doi:10.1525/elementa.2021.00043, **2021**.

17. Laughner, J. L., …, **Goldberg, D. L.,** …, Zeng, Z.-C.: Societal shifts due to COVID-19 reveal large-scale complexities and feedbacks between atmospheric chemistry and climate change, *Proc. Natl. Acad. Sci.,* 118(46), doi:10.1073/PNAS.2109481118, **2021**.

18. **Goldberg, D. L.,** Anenberg, S. C., Lu, Z., Streets, D. G., Lamsal, L., McDuffie, E. and Smith, S.: Urban NOx emissions around the world declined faster than anticipated between 2005 and 2019, *Environ. Res. Lett.,* doi:10.1088/1748-9326/AC2C34, **2021**.

19. **Goldberg, D. L.,** Anenberg, S. C., Kerr, G. H., Lu, Z. and Streets, D. G.: TROPOMI: A revolutionary new satellite instrument measuring NO_2 air pollution, *Environ. Manag.,* **2021**.

20. Anenberg, S., Kerr, G. H. and **Goldberg, D. L.:** Leveraging satellite data to address air pollution inequities, *Environ. Manag.,* **2021**.

21. Kondragunta, S., Wei, Z., McDonald, B. C., **Goldberg, D. L.** and Tong, D. Q.: COVID-19 Induced Fingerprints of a New Normal Urban Air Quality in the United States, *J. Geophys. Res. Atmos.,* e2021JD034797, doi:10.1029/2021JD034797, **2021**.

22. Kerr, G. H., **Goldberg, D. L.** and Anenberg, S. C.: COVID-19 pandemic reveals persistent disparities in nitrogen dioxide pollution, *Proc. Natl. Acad. Sci.,* 118(30), e2022409118, doi:10.1073/pnas.2022409118, **2021**.

23. **Goldberg, D. L.,** Anenberg, S. C., Mohegh, A., Lu, Z. and Streets, D. G.: TROPOMI NO_2 in the United States: A detailed look at the annual averages, weekly cycles, effects of temperature, and correlation with surface NO_2 concentrations, *Earth's Future,* doi: 10.1029/2020EF001665, **2021**.

24. Gorris, M. E., Anenberg, S. C., **Goldberg, D. L.,** Kerr, G. H., Stowell, J. D., Tong, D. and Zaitchik, B. F.: Shaping the future of science: COVID-19 highlighting the importance of GeoHealth, GeoHealth, 5(5), e2021GH000412, doi:10.1029/2021gh000412, **2021.**

25. **Goldberg, D. L.,** Anenberg, S. C., Griffin, D., McLinden, C. A., Lu, Z. and Streets, D. G.: Disentangling the Impact of the COVID-19 Lockdowns on Urban NO_2 From Natural Variability, *Geophys. Res. Lett.,* 47(17), doi:10.1029/2020GL089269, **2020.**

26. Mohegh, A., **Goldberg, D. L.,** Achakulwisut, P. and Anenberg, S. C.: Sensitivity of estimated NO_2 -attributable pediatric asthma incidence to grid resolution and urbanicity, *Environ. Res. Lett.,* doi:10.1088/1748-9326/abce25, **2020.**

27. Anenberg, S. C., Bindl, M., Brauer, M., Castillo, J. J., Cavalieri, S., Duncan, B. N., Fiore, A. M., Fuller, R., **Goldberg, D. L.,** Henze, D. K., Hess, J., Holloway, T., James, P., Jin, X., Kheirbek, I., Kinney, P. L., Liu, Y., Mohegh, A., Patz, J., Jimenez, M. P., Roy, A., Tong, D., Walker, K., Watts, N. and West, J. J.: Using Satellites to Track Indicators of Global Air Pollution and Climate Change Impacts: Lessons Learned From a NASA-Supported Science-Stakeholder Collaborative, *GeoHealth,* 4(7), doi:10.1029/2020GH000270, **2020.**

28. Saide, P. E., Gao, M., Lu, Z., **Goldberg, D. L.,** Streets, D. G., ... , and Crawford, J. H.: Understanding and improving model representation of aerosol optical properties for a Chinese haze event measured during KORUS-AQ, *Atmos. Chem. Phys.*, 20(11), 6455–6478, doi:10.5194/acp-20-6455-2020, **2020.**

29. Liu, F., Duncan, B. N., Krotkov, N. A., Lamsal, L. N., Beirle, S., Griffin, D., McLinden, C. A., **Goldberg, D. L.** and Lu, Z.: A methodology to constrain carbon dioxide emissions from coal-fired power plants using satellite observations of co-emitted nitrogen dioxide, *Atmos. Chem. Phys.,* 20(1), 99–116, doi:10.5194/acp-20-99-2020, **2020.**

30. **Goldberg, D. L.,** Saide, P. E., Lamsal, L. N., De Foy, B., Lu, Z., Woo, J.-H., Kim, Y., Kim, J., Gao, M., Carmichael, G. and Streets, D. G.: A top-down assessment using OMI NO_2 suggests an underestimate in the NOx emissions inventory in Seoul, South Korea, during KORUS-AQ, *Atmos. Chem. Phys.,* 19(3), doi:10.5194/acp-19-1801-2019, **2019.**

31. **Goldberg, D. L.,** Lu, Z., Streets, D. G., de Foy, B., Griffin, D., McLinden, C. A., Lamsal, L. N., Krotkov, N. A. and Eskes, H.: Enhanced Capabilities of TROPOMI NO_2 : Estimating NOx from North American Cities and Power Plants, *Environ. Sci. Technol.,* acs.est.9b04488, doi:10.1021/acs.est.9b04488, **2019.**

32. **Goldberg, D. L.,** Lu, Z., Oda, T., Lamsal, L. N., Liu, F., Griffin, D., McLinden, C. A., Krotkov, N. A., Duncan, B. N. and Streets, D. G.: Exploiting OMI NO_2 satellite observations to infer fossil-fuel CO_2 emissions from U.S. megacities, Sci. Total Environ., 695, 133805, doi:10.1016/j.scitotenv.2019.133805, **2019.**

33. **Goldberg, D. L.,** Gupta, P., Wang, K., Jena, C., Zhang, Y., Lu, Z. and Streets, D. G.: Using gap-filled MAIAC AOD and WRF-Chem to estimate daily PM 2.5 concentrations at 1 km resolution in the Eastern United States, *Atmos. Environ.,* 199, 443–452, doi:10.1016/j.atmosenv.2018.11.049, **2019.**

34. Ring, A. M., Canty, T. P., Anderson, D. C., Vinciguerra, T. P., He, H., **Goldberg, D. L.,** Ehrman, S. H., Dickerson, R. R. and Salawitch, R. J.: Evaluating commercial marine emissions and their role in air quality policy using observations and the CMAQ model,

Atmos. Environ., 173(June 2017), 96–107, doi:10.1016/j.atmosenv.2017.10.037, **2018.**

35. **Goldberg, D. L.,** Lamsal, L. N., Loughner, C. P., Swartz, W. H., Lu, Z. and Streets, D. G.: A high-resolution and observationally constrained OMI NO_2 satellite retrieval, *Atmos. Chem. Phys.,* 17(18), 11403–11421, doi:10.5194/acp-17-11403-2017, **2017.**

36. Ren, X., Luke, W. T., Kelley, P., Cohen, M. D., Artz, R., Olson, M. L., Schmeltz, D., Puchalski, M., **Goldberg, D. L.,** Ring, A., Mazzuca, G. M., Cummings, K. A., Wojdan, L., Preaux, S. and Stehr, J. W.: Atmospheric mercury measurements at a suburban site in the Mid-Atlantic United States: Inter-annual, seasonal and diurnal variations and source-receptor relationships, *Atmos. Environ.,* 146, 141–152, doi:10.1016/j.atmosenv.2016.08.028, **2016.**

37. **Goldberg, D. L.,** Vinciguerra, T. P., Anderson, D. C., Hembeck, L., Canty, T. P., Ehrman, S. H., Martins, D. K., Stauffer, R. M., Thompson, A. M., Salawitch, R. J. and Dickerson, R. R.: CAMx ozone source attribution in the eastern United States using guidance from observations during DISCOVER-AQ Maryland, *Geophys. Res. Lett.,* 43(5), 2249–2258, doi:10.1002/2015GL067332, **2016.**

38. **Goldberg, D. L.,** Vinciguerra, T. P., Hosley, K. M., Loughner, C. P., Canty, T. P., Salawitch, R. J. and Dickerson, R. R.: Evidence for an increase in the ozone photochemical lifetime in the eastern United States using a regional air quality model, *J. Geophys. Res. Atmos.,* 120(24), 12778–12793, doi:10.1002/2015JD023930, **2015.**

39. Canty, T. P., Hembeck, L., Vinciguerra, T. P., Anderson, D. C., **Goldberg, D. L.,** Carpenter, S. F., Allen, D. J., Loughner, C. P., Salawitch, R. J. and Dickerson, R. R.: Ozone and NOx chemistry in the eastern US: Evaluation of CMAQ/CB05 with satellite (OMI) data, *Atmos. Chem. Phys.,* 15(19), 10965–10982, doi:10.5194/acp-15-10965-2015, 2015.

40. Stauffer, R. M., Thompson, A. M., Martins, D. K., Clark, R. D., **Goldberg, D. L.,** Loughner, C. P., Delgado, R., Dickerson, R. R., Stehr, J. W. and Tzortziou, M. A.: Bay breeze influence on surface ozone at Edgewood, MD during July 2011, *J. Atmos. Chem.,* 72(3–4), 335–353, doi:10.1007/s10874-012-9241-6, **2015.**

41. **Goldberg, D. L.,** Loughner, C. P., Tzortziou, M., Stehr, J. W., Pickering, K. E., Marufu, L. T. and Dickerson, R. R.: Higher surface ozone concentrations over the Chesapeake Bay than over the adjacent land: Observations and models from the DISCOVER-AQ and CBODAQ campaigns, *Atmos. Environ.,* 84, 9–19, doi:10.1016/j.atmosenv.2013.11.008, **2014.**

42. Loughner, C. P., Tzortziou, M., Follette-Cook, M., Pickering, K. E., **Goldberg, D. L.,** Satam, C., Weinheimer, A., Crawford, J. H., Knapp, D. J., Montzka, D. D., Diskin, G. S. and Dickerson, R. R.: Impact of bay-breeze circulations on surface air quality and boundary layer export, *J. Appl. Meteorol. Climatol.,* 53(7), 1697–1713, doi:10.1175/JAMC-D-13-0323.1, **2014.**

Manuscripts Under Review (4 currently)

1. Kerr., G. H., Meyer, M., **Goldberg, D. L.,** Miller, J., Anenberg, S. C.: Satellite data uncover nationwide air pollution impacts from warehousing, Submitted to *Nature Communications.*

2. Nawaz, M. O., Johnson, J., Yarwood, G., de Foy, B., Judd, L. M., **Goldberg, D. L**. An intercomparison of satellite, airborne, and ground-level observations with WRF-CAMx simulations of NO_2 columns over Houston, TX during the September 2021 TRACER-AQ campaign, Submitted to *Atmospheric Chemistry and Physics.*
3. Kim, E. J., Kokandakar, A., Harkey, M., Elkins S., **Goldberg D. L.,** Heck, C., Holloway, T. A. A Comparison of Regression Methods for Quantifying Near-Surface NO_2 with Satellite Data, Submitted to *Journal of Geophysical Research – Atmospheres*
4. O'Dell, K., S. Kondragunta, H. Zhang, Z. Wei, G. Kerr; D. L. Goldberg, S. C. Anenberg: Short-term pollution exposure and environmental justice implications, Submitted to *Environmental Science & Technology Letters*.

Competitive Grants Selected for Funding (11 total)

1. "Assessing environmental justice air quality, and health co-benefits of transport interventions in US urban areas", NASA, November 2023 – October 2026, *Co-Investigator* (PI: Gaige Kerr)
2. "Pushing the boundaries of fine-scale NO_x emission quantification from remote sensing instruments", NASA, April 2023– March 2026, $750,000, *Principal Investigator*
3. "Source-sector NOx emissions analysis with sub-kilometer scale airborne observations in Houston during TRACER-AQ", Air Quality Research Program (AQRP), August 2022– August 2023, $ 248,146, *Principal Investigator*
4. "Air Quality Modeling to Investigate Environmental Injustice in Washington, DC & Baltimore", George Washington University Research Innovation Award, July 2022– June 2024, $50,000, *Principal Investigator*
5. "Value of GeoXO atmospheric composition data for estimating air pollution-related health impacts", NOAA, August 2021 – July 2024, $600,000, *Co-Investigator* (PI: Susan Anenberg, George Washington University).
6. "Using satellite NO_2 observations for public health surveillance and environmental policy planning at global, national, and urban scales", NASA HAQAST, December 2020 – November 2024, $800,000, *Co-Investigator* (PI: Susan Anenberg, George Washington University).
7. "Inconsistent effects of social distancing on air quality in global cities: lessons for protecting near-term public health and designing longer-term urban transportation policies", NASA Rapid Response, June 2020 – May 2021, $100,000, *Co-Principal Investigator* (Co-PI: Susan Anenberg, George Washington University).
8. "Updating the Wisconsin Horizontal Interpolation Program for Satellites (WHIPS)", Texas Commission on Environmental Quality Research Program, June 2020 – November 2021, *Co-Investigator* (PI: Tracey Holloway, University of Wisconsin).
9. "Integrating satellites, ground monitoring, and modeling to estimate long-term NO_2 exposures and associated pediatric asthma impacts", Health Effects Institute, November 2019 – November 2021, $120,000, *Co-Investigator* (PI: Susan Anenberg, George Washington University).

10. "The Changing Atmosphere in North America for 2000 – 2020: High-resolution modeling and satellite analysis", NASA ACMAP, May 2019 – April 2023, $300,000, *Co-Investigator* (PI: Greg Carmichael, University of Iowa).
11. "Taking OMI NO_2 to the next level: Inferring global fossil fuel CO_2 emissions using OMI NO_2 Data Improved with Critical Algorithm Updates", NASA ACMAP, June 2017 – May 2020, $225,000, *Co-Investigator* (PI: Nick Krotkov, NASA Goddard)

Competitive Grants Pending (1 total)

1. "Center for Action-Oriented Research on Climate and Health", Submitted Nov 2023 to NIH, *Co-Investigator*

Competitive Grants Not Selected for Funding (11 total)

1. *"Investigating urban anthropogenic CO_2 and NO_x emissions from the C40 Cities using the synergy of the OCO-2/3 and NO_2-observing missions", Submitted June 2023, **Principal Investigator***
2. "Structural Racism: Assessing and Addressing Community Exposures to Environmental Contaminants", Submitted August 2021, Not Selected, *Co-Investigator* (co-PIs: Susan Anenberg, George Washington University and Sacoby Wilson, University of Maryland)
3. "From space to the street: Using satellite remote sensing to address environmental injustice from transportation-related air pollution", Submitted June 2021, *Co-Investigator* (PI: Susan Anenberg, George Washington University)
4. "A comparative study of atmospheric impacts due to changes in anthropogenic activity during the COVID-19 pandemic in the greater Chicago and New York City regions", Submitted November 2020, *Co-Principal Investigator* (co-PIs Greg Carmichael and Charles Stanier, University of Iowa)
5. "Developing a near-real-time satellite-based framework to estimate urban NOX emissions in preparation for the TEMPO satellite mission: Using TROPOMI and model simulations as test-beds", Submitted September 2020, *Principal Investigator*
6. "Using Satellites to Monitor Energy Usage and Inform Responses to Disasters", Submitted June 2020, Not Selected, *Co-Investigator* (PI: Jason West, UNC-Chapel Hill)
7. "Application of Remote Sensing Tools to Verify, Validate, and Improve Emissions of NO_2 and SO_2 for Texas Air Quality Modeling", Submitted January 2020, *Co-Investigator* (PI: Nathan Pavlovic, Sonoma Technology)
8. *"Preparing for TEMPO: Considering future applications of the HCHO/NO_2 ratio using lessons learned from OMI and TROPOMI", NASA Aura Science Team, Submitted Sept 2019, **Principal Investigator***
9. "Assessing tropospheric ozone pollution and precursors in African cities using OMI", NASA Aura Science Team, Submitted Sept 2019, *Co-Investigator* (PI: Susanne Bauer, NASA GSFC).
10. "Quantification of Air Pollution from Natural Gas Development and Relationship to Health Outcomes: A Quasi-Experimental Investigation", Submitted Sept 2018 & Sept 2019, *Co-Investigator* (PI: Charlotte Ward, Dartmouth College).

11. "Coupled Energy-Air Quality-Health System: A Data-Driven Decision Tool for Cost-Benefit Assessment", NASA Applied Sciences, Submitted Nov 2017, *Co-Investigator* (PI: Yang Zhang, North Carolina State University).

<u>Media Interactions</u>

1. WUSA9, February 23, 2023, Did toxic plumes from an Ohio train derailment impact DC?, https://www.wusa9.com/article/news/verify/verify-derailed-train-toxic-plumes-did-not-reach-dc-area/65-13b9b112-4bc5-45b5-9147-bc1e6c7990e1
2. WUSA9, February 24, 2022, Humans are driving climate change but they can also fight against it, https://www.wusa9.com/article/tech/science/environment/dnp-yes-humans-are-contributing-to-climate-change-global-warming-greenhouse-gas-emissions/65-8a6e9b6a-faa2-4560-80a3-cfcfbadf56f5
3. NASA Earth Observatory, October 28, 2021, Scientific Questions Arrive in Ports, https://earthobservatory.nasa.gov/images/149004/scientific-questions-arrive-in-ports
4. NBC Connecticut, July 26, 2021, A Look at How Western Wildfire Smoke Makes Its Way to Connecticut, http://nbcct.co/Czz0Ari
5. New York Times, April 15, 2021, Subject Matter Expert for Freelance Journalist Lisa Collins, https://www.linkedin.com/in/lisa-m-collins-3162815/
6. Washington Post, June 16, 2020, Commentary in, "Washington has yet to see unhealthful pollution levels this year. That's a record", https://www.washingtonpost.com/weather/2020/06/16/washington-dc-record-low-pollution/
7. WAMU 88.5, NPR Radio, May 19, 2020, Subject Matter Expert for The Kojo Nnamdi Show, https://thekojonnamdishow.org/audio/#/shows/2020-05-19/reducing-air-pollution-during-the-pandemic/116753/@00:00
8. Washington Post, April 22, 2020, Commentary in, "Washington has its cleanest spring air in 25 years: How air quality has improved during the coronavirus crisis", https://www.washingtonpost.com/weather/2020/04/22/washington-dc-air-quality-coronavirus/
9. Nature, April 10, 2020, Commentary in, "Why pollution is plummeting in some cities — but not others", https://www.nature.com/articles/d41586-020-01049-6
10. New York Times, April 3, 2020, Subject Matter Expert for Visual Investigations Journalist Christoph Koettl, https://www.nytimes.com/by/christoph-koettl
11. WTOP Radio, April 1, 2020, Commentary in, "Despite telework, stay-at-home orders, not much change to air quality in DC area", https://wtop.com/local/2020/04/despite-telework-stay-at-home-orders-not-much-change-to-air-quality-in-dc-area/
12. Science Magazine, February 12, 2020, Commentary in, "Deadly air pollution is blowing into your state from a surprisingly large source", https://www.sciencemag.org/news/2020/02/deadly-air-pollution-blowing-your-state-surprisingly-large-source
13. Washington Post, February 3, 2020, Commentary in, "Why a toxic brown haze loomed over the Capitol on Monday",

https://www.washingtonpost.com/weather/2020/02/03/how-toxic-brown-haze-loomed-over-capitol-monday/

14. Washington Post, July 5, 2019, Commentary in, "Lost in a wall of smoke: Why so many people couldn't see Washington's Fourth of July fireworks", https://www.washingtonpost.com/weather/2019/07/05/lost-wall-smoke-why-so-many-people-couldnt-see-washingtons-july-th-fireworks/

15. Washington Post, February 4, 2019, Commentary in, "There's an air quality alert in Washington, the sky is hazy and it's February. What's going on?", https://www.washingtonpost.com/weather/2019/02/04/theres-an-air-quality-alert-washington-sky-is-hazy-its-february-whats-going/

16. Washington Post, July 10, 2018, Commentary in, "Washington posted first Code Red day since 2012 on Monday due to 'unhealthy' pollution levels", https://www.washingtonpost.com/news/capital-weather-gang/wp/2018/07/10/washington-posted-first-code-red-day-since-2012-monday-due-to-unhealthy-pollution-levels/

First-Author Oral Presentations (61 total)

2024

1. **Goldberg, D. L.**, et al. Policy- and health-relevant applications of NO_2 satellite measurements. Presented at the SESS-NOAA Air Composition Meeting. Fairfax, VA. **Feb 2024,** *Invited*

2. **Goldberg, D. L.**, et al. Investigating Hyper-Local NOx emissions in Houston and New York City using GCAS, TROPOMI and Sub-kilometer Model Simulations. Presented at the American Meteorological Society Annual Meeting. Baltimore, MD. **Jan 2024,** *Invited*

2023 (parental leave June – Sept 2023)

3. **Goldberg, D. L.**, et al. Evaluating the trends and spatial patterns of NOx emissions in urban areas using TROPOMI. Presented at the HAQAST Fall Meeting. Salt Lake City, UT. **Oct 2023**

4. **Goldberg, D. L.**, et al. Source-sector NOx emissions analysis with sub-kilometer scale airborne observations in Houston during TRACER-AQ. Presented at the TRACER-AQ Science Team call. Virtually. **Oct 2023**

5. **Goldberg, D. L.**, et al. How will TEMPO data improve our current research? Understanding NOx emissions for environmental health applications. Presented at the TEMPO Science Team Meeting. Huntsville, AL. **May 2023,** *Invited*

6. **Goldberg, D. L.**, et al. Policy and Health Relevant Applications of TROPOMI NO_2 in Urban Areas. Presented at the MDE Photochemical Modeling and Data Analysis Seminar Series. **March 2023,** *Invited*

2022

7. **Goldberg, D. L.**, et al. Applications of TROPOMI NO_2 to understand urban NO_2 and NO_X emissions. Presented at the AGU Fall Meeting. Chicago, IL. **Dec 2022**

8. **Goldberg, D. L.,** et al. Applications of satellite data to understand the concentrations and emission rates of NO_2 air pollution. Presented at the City College of New York (CCNY),

Earth and Atmospheric Sciences Weekly Seminar Series. New York City, NY. **Nov 2022,** *Invited*

9. **Goldberg, D. L.**, et al. Policy and Health Relevant Applications of TROPOMI NO_2. Presented at the HAQAST Fall Meeting. Madison, WI. **Oct 2022**

10. **Goldberg, D. L.**, et al. Policy and Health Relevant Applications of TROPOMI NO_2 in the United States. Presented at the Sentinel 5-Precursor 5th Anniversary Conference. Taormina, Italy. **Oct 2022**

11. **Goldberg, D. L.**, et al. Policy and Health Relevant Applications of TROPOMI NO_2: Preparing for TEMPO. Presented at the HAQAST Summer Meeting. Houston, TX. **June 2022**

12. **Goldberg, D. L.**, et al. Pushing the methodological limits on satellite use in health applications. Presented at the HEI Health Applications for Satellite-Derived Air Quality Virtual Workshop. **May 2022,** *Invited*

13. **Goldberg, D. L.**, et al. Applications of satellite remote sensing to better understand global air quality. Presented at Rutgers University. **April 2022,** *Invited*

14. **Goldberg, D. L.**, et al. Elucidating the "new normal" of NOx emissions in urban areas. Presented at Boston University. **Feb 2022,** *Invited*

15. **Goldberg, D. L.**, et al. Using NO_2 satellite data for urban planning. Presented at the HAQAST Winter 2022 Meeting. **Jan 2022**

16. **Goldberg, D. L.**, et al. Using NO_2 satellite data for urban environmental justice applications and lessons learned during the COVID-19 lockdowns. Presented at the New York State BAQAR/NYSERDA Seminar. **Jan 2022,** *Invited*

2021
17. **Goldberg, D. L.**, et al. Reconciling differences between satellite-inferred NOx emissions and inventories in global cities. Presented at the AGU Fall Meeting. New Orleans, LA. **Dec 2021**

18. **Goldberg, D. L.**, et al. Estimating NOx emissions from cities using satellite data. Presented at the WESTER Council Annual Meeting. Santa Fe, New Mexico. **Dec 2021,** *Invited*

19. **Goldberg, D. L.**, et al. Satellite-derived NOx emissions for 80 global megacities between 2005 and 2019. Presented at the IGAC Biannual Meeting. **Sept 2021**

20. **Goldberg, D. L.**, et al. Estimating NOx emissions from global cities using satellite data. Presented at the NCAR ACOM Weekly Seminar. **April 2021,** *Invited*

21. **Goldberg, D. L.**, et al. Changes in NO_2 following the COVID-19 lockdowns: Disentangling anthropogenic changes from natural variability. Presented at the MARAMA Mobile Sources Workshop. **March 2021,** *Invited*

22. **Goldberg, D. L.**, et al. Top-down NOx emissions estimates for 50 global cities during the last 15 years. Presented at the AMS Annual Meeting. **Jan 2021**

2020 (parental leave June – Aug 2020)
23. **Goldberg, D. L.**, et al. Using TROPOMI and re-analysis meteorology to disentangle the impact of the COVID-19 lockdowns on urban NO_2 natural variability. Presented at the AGU Fall Meeting. **Dec 2021**

24. **Goldberg, D. L.**, et al. Changes in NO_2 following the COVID-19 lockdowns: Disentangling anthropogenic changes from natural variability. Presented at the MARAMA Science Team Meeting. **Dec 2020**
25. **Goldberg, D. L.**, et al. Health impacts of NO_2 and its changes during the COVID-19 lockdowns. Co-presentation at the OTC Annual Meeting. **Nov 2020,** *Invited*
26. **Goldberg, D. L.**, et al. Oversampling TROPOMI NO_2 in the US & using it to estimate effects of COVID-19 lockdowns on urban NOx emissions. Presented at the OMI-TROPOMI Science Team Meeting. **Oct 2020**
27. **Goldberg, D. L.**, et al. Disentangling the impact of the COVID-19 lockdowns on urban NO_2 from natural variability. Presented at the 19th Annual CMAS Conference. **Oct 2020**
28. **Goldberg, D. L.**, et al. Health impacts of NO_2 and its changes during the COVID-19 lockdowns. NCAR Climate and Health Seminar Series. **Sept 2020,** *Invited*
29. **Goldberg, D. L.**, et al. The satellite data revolution: How new satellite instruments can provide better estimates of NOx pollution. Presented at the ISEE Annual Meeting. **Aug 2020**
30. **Goldberg, D. L.**, et al. Estimating air pollution emissions, exposures, and public health impacts in cities worldwide. Presented at the TOLNET and Pandora Science Team Meeting. **June 2020**
31. **Goldberg, D. L.**, et al. Using models and satellite data to estimate air pollution in the Baltimore-Washington area. Presented at The Baltimore-Washington Regional Air Quality Symposium. College Park, MD. **Feb 2020,** *Invited*
32. **Goldberg, D. L.**, et al. Using satellite data to estimate air pollution at high spatiotemporal resolution. Presented at The Applications for Big Data and the Environment. Davis, CA. **Jan 2020,** *Invited*
33. **Goldberg, D. L.**, et al. Estimating air pollution emissions, exposures, and public health impacts in cities worldwide. Presented at the American Meteorological Society Annual Meeting, Boston, MA. **Jan 2020**

2019
34. **Goldberg, D. L.**, et al. Using NASA satellite data to estimate exposure to air pollution. Presented at the George Washington University Environmental and Occupational Health Seminar. Washington, DC. **Dec 2019,** *Invited*
35. **Goldberg, D. L.**, et al. Estimating air pollution emissions, exposures, and public health impacts in cities worldwide. Presented at the New Applications in the Use of Satellite Data Monitoring for Population Health. Huntsville, AL. **Oct 2019,** *Invited*
36. **Goldberg, D. L.**, et al. Using OMI NO_2 to infer fossil-fuel emissions of CO_2 from large metropolitan areas in the United States. Presented at the Aura Science Team Meeting. Pasadena, CA. **Aug 2019**
37. **Goldberg, D. L.**, et al. Policy-relevant applications of satellite data: Estimating air pollution emissions, exposures, and public health impacts in cities worldwide. Presented at the HAQAST Summer 2019 Meeting. Pasadena, CA. **July 2019**
38. **Goldberg, D. L.**, et al. Investigating NO_X emissions from megacities using re-processed OMI NO_2 and TROPOMI NO_2. Presented at the OWLETS Science Team Meeting. College Park, MD. **May 2019**

39. **Goldberg, D. L.,** et al. Using satellite data to estimate air pollution at high spatiotemporal resolution. Presented at The Workshop in Environmental Economics and Data Science (TWEEDS). Portland, OR. **March 2019,** *Invited*

2018
40. **Goldberg, D. L.,** et al. Recent Advances in Deriving NOx Emission Estimates from Satellite Data. Presented at the AGU Fall Meeting. Washington, D.C. **Dec 2018**
41. **Goldberg, D. L.,** et al. Linking Surface Monitors, Satellite Data, and Emissions Inventories to Investigate Regional Haze Trends in the Eastern U.S. Presented at the American Geophysical Union (AGU) Fall Meeting. Washington, D.C. **Dec 2018**
42. **Goldberg, D. L.,** et al. Using MAIAC AOD and WRF-Chem to estimate daily $PM_{2.5}$ concentrations at 1 km resolution in the eastern United States. Presented at the CMAS Conference. Chapel Hill, NC. **Oct 2018**
43. **Goldberg, D. L.,** et al. A top-down assessment using OMI NO_2 suggests an underestimate in the NO_x emissions inventory in Seoul, Korea during KORUS-AQ. Presented at the KORUS-AQ Science Team Meeting. Irvine, CA. **Aug 2018**
44. **Goldberg, D. L.,** et al. Recent advances in estimating NO_x emissions from OMI. Presented at the HAQAST Summer 2018 Meeting. Madison, WI. **July 2018**

2017
45. **Goldberg, D. L.,** et al. Estimating NO_x emissions and surface concentrations at high spatial resolution. Presented at the AGU Fall Meeting. New Orleans, LA. **Dec 2017**
46. **Goldberg, D. L.,** et al. Estimating NO_x emissions and surface concentrations at high spatial resolution. Presented at the HAQAST Fall 2017 Meeting. Palisades, NY. **Nov 2017**
47. **Goldberg, D. L.,** et al. Ground measurements, satellite observations, and model simulations of air quality in the Chesapeake Bay region. Presented at the OWLETS Science Team Meeting. Baltimore, MD. **Oct 2017,** *Invited*
48. **Goldberg, D. L.,** et al. A new satellite technique to derive high-resolution tropospheric NO_2 columns in the eastern United State. Presented at the OMI Science Team Meeting. Greenbelt, MD. **Sept 2017,** *Invited*
49. **Goldberg, D. L.,** et al. Innovative techniques to observe and model air pollution in the eastern United States. Presented at Northwestern University. Evanston, IL. **Aug 2017,** *Invited*
50. **Goldberg, D. L.,** et al. Innovative techniques to observe and model air pollution in the eastern United States. Presented at the University of Wisconsin-Madison. Madison, WI. **June 2017,** *Invited*
51. **Goldberg, D. L.,** et al. Validation of a satellite technique to derive high-resolution tropospheric NO_2 columns in Korea. Presented at the KORUS-AQ Science Team Meeting. Seogwipo, Jeju, South Korea. **Feb 2017**

2016
52. **Goldberg, D. L.,** et al. High-resolution OMI satellite retrievals of tropospheric NO_2 in the eastern United States. Presented at the 15th Annual CMAS Conference. Chapel Hill, NC. **Oct 2016**

53. **Goldberg, D. L.**, et al. Lifetime and distribution of ozone air pollution in the eastern United States. Presented at Carnegie Mellon University. Pittsburgh, PA. **Feb 2016,** *Invited*

<u>2015</u>

54. **Goldberg, D. L.**, et al. Evidence for an increasing geographic region of influence on ozone air pollution in the eastern United States. Presented at the CMAS Conference. Chapel Hill, NC. **Oct 2015**
55. **Goldberg, D. L.**, et al. Recent ozone modeling results in the Mid-Atlantic. Presented at the MARAMA Science Team Meeting. Richmond, VA. **July 2015**
56. **Goldberg, D. L.**, et al. Evidence for an increasing geographic region of influence on ozone air pollution in the Eastern United States. Presented at the NASA AQAST Summer 2015 Meeting. St Louis, MO. **June 2015**
57. **Goldberg, D. L.**, et al. Scientific insight from CAMx OSAT modeling. Presented at the OTC Spring Meeting. Washington, DC. **April 2015**
58. **Goldberg, D. L.**, et al. The Impact of the Chesapeake Bay Climate and Boundary Layer Dynamics on Air Pollutant Concentrations during Smog Episodes. Presented at the AMS Annual Meeting. Phoenix, AZ. **Jan 2015**

<u>2014</u>

59. **Goldberg, D. L.**, et al. Recent Improvements in Regional Air Quality Models and their Impacts on Ozone Source Attribution. Presented at the CMAS Conference. Chapel Hill, NC. **Oct 2014**
60. **Goldberg, D. L.**, et al. Increased Air Pollution over the Chesapeake Bay and its Effect on Deposition to the Bay. Presented at the NADP Fall Meeting. Indianapolis, IN. **Oct 2014**
61. **Goldberg, D. L.**, et al. Higher surface ozone concentrations over the Chesapeake Bay than over adjacent land: Observations and models from DISCOVER-AQ. Presented at the DISCOVER-AQ Science Team Meeting. Newport News, VA. **Feb 2014**

<u>First-Author Poster Presentations (10 total)</u>

1. **Goldberg, D. L.**, et al. Evaluating the spatial patterns of NOx emissions in polluted areas with TROPOMI NO_2. Presented at the TEMPO Science Team Meeting. Huntsville, AL. **May 2023**
2. **Goldberg, D. L.**, et al. High-resolution NO_2 exposure estimates and top-down NO_X emissions using OMI NO_2 and TROPOMI NO_2. Presented at the AGU Fall Meeting. San Francisco, CA. **Dec 2019**
3. **Goldberg, D. L.**, et al. Using MAIAC AOD to estimate daily PM2.5 and its long-term trends (2008 – 2018) at 1 km resolution in the Eastern United States. Presented at the EPA ACE Annual Meeting. Pittsburgh, PA. **June 2019**
4. **Goldberg, D. L.**, et al. Using MAIAC AOD to estimate daily PM2.5 and its long-term trends (2008 – 2018) at 1 km resolution in the Eastern United States. Presented at the OWLETS Science Team Meeting. College Park, MD. **May 2019**

5. **Goldberg, D. L.**, et al. Using MODIS AOD and WRF-Chem to infer daily PM2.5 concentrations at 1 km resolution in the eastern United States. Presented at the HAQAST Summer 2018 Meeting. Madison, WI. **July 2018**
6. **Goldberg, D. L.**, et al. High resolution satellite retrievals of NO_2 and Aerosol Optical Depth for health impact studies. Presented at the AGU Fall 2016 Meeting. San Francisco, CA. **Dec 2016**
7. **Goldberg, D. L.**, et al. CAMx Ozone Source Attribution in the Eastern United Sates using Guidance from Observations during DISCOVER-AQ Maryland. Presented at the NASA AQAST Winter 2016 Meeting. RTP, NC. **Jan 2016**
8. **Goldberg, D. L.**, et al. Using Source Apportionment to Evaluate the Cross State Transport of Ozone in the Eastern United States. Presented at the AGU Fall Meeting. San Francisco, CA. **Dec 2014**
9. **Goldberg, D. L.**, et al. Using CAMx and CMAQ to Investigate Cross-state Transport of Ozone in the Eastern United States. Presented at the NASA AQAST Summer 2014 Meeting. Boston, MA. **June 2014**
10. **Goldberg, D. L.**, et al. CAMx and CMAQ Model Intercomparison for July 2007 in the Baltimore-Washington Metropolitan Region. Presented at the AGU Fall Meeting. San Francisco, CA. **Dec 2013**