

XINRONG REN

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EDUCATION

Ph.D. in Environmental Sciences, Peking University, 2001
B.S. in Applied Chemistry, Peking University, 1996

APPOINTMENTS

08/2020 – present Physical Scientist, NOAA Air Resources Laboratory
10/2012 – 07/2020 Research Scientist & Aircraft Program Director, Department of Atmospheric and Oceanic Science, University of Maryland College Park
01/2011 – 07/2020 Affiliate Scientist, NOAA Air Resources Laboratory
01/2011 – 09/2012 Associate Scholar, Department of Earth, Ocean, and Atmospheric Science, Florida State University
08/2007 – 12/2010 Research Associate Professor, RSMAS, University of Miami
10/2005 – 07/2007 Research Associate, Departmental of Meteorology, Penn State University
06/2001 – 09/2005 Post-doctoral fellow, Departmental of Meteorology, Penn State University
09/1996 – 06/2001 Research Assistant, Center for Environmental Sciences, Peking University

RESEARCH INTERESTS

Atmospheric chemistry, air pollution, atmospheric photochemical oxidation, greenhouse gas measurement, climate change, ground-based and aircraft monitoring of atmospheric pollutants and greenhouse gases, laser spectroscopic and chromatograph methods for environmental monitoring, model simulation of atmospheric oxidation.

RESEARCH PROJECTS

1. “Aircraft observations for the Tracers of Opportunity project”, NOAA Air Resources Laboratory
2. “Participation in Climate Research Activities at the NOAA Air Resources Laboratory”, PI, University of Maryland funded by NOAA, NOAA Air Resources Laboratory, \$100k, renewable annually.
3. “Air Pollution in Maryland – RAMMPP”, co-PI (PI: Russell Dickerson), University of Maryland, funded by Maryland Department of Environment, ~\$300,000, renewable annually.
4. “Tracers of Opportunity: Aircraft observations to evaluate HYSPLIT”, PI, funded by NOAA Air Resources Laboratory, \$43,000, 10/01/2018-09/30/2019.
5. “Aircraft observations of and analysis of trace gases and meteorology over the Long Island Sound during LISTOS”, co-PI (PI: Russell Dickerson), University of Maryland, funded by Northeast States for Coordinated Air Use Management, \$160,000, 04/01/2018-12/31/2019.
6. “Hart-Miller Island Measurements and Data Analysis during OWLETS-II”, co-PI (PI: Russell Dickerson), University of Maryland, funded by Maryland Department of Environment, \$100,000, 04/01/2018-12/31/2019.
7. “Fluxes of Greenhouse Gases in Maryland: FLAGG-MD”, co-PI (PI: Russell Dickerson), University of Maryland, funded by NIST, \$658,000, 10/01/2016 – 09/30/2018.

8. “Air Chemistry Research In Asia, ARIAs: Aerosol and Trace Gas Emissions and Transformations over the North China Plain”, co-PI (PI: Russell Dickerson), University of Maryland, funded by NSF, \$550,000, 04/01/2016 – 03/31/2019.
9. “Operation of NADP/MDN Beltsville, MD Station”, PI, University of Maryland, funded by Maryland Department of Natural Resources, \$26,500, renewable annually.
10. “Analysis of Ozone Production and Its Sensitivity in Houston Using the Data Collected during DISCOVER-AQ”, PI, University of Maryland, funded by Taxes Commission on Environmental Quality, \$70,000, 02/01/2015 – 09/30/2015.
11. “Operation of Passive GOM Sample at the Beltsville Station and Data Analysis”, PI, University of Maryland, funded by Maryland Department of Natural Resources, \$15,000, 1/1/2014 – 6/30/2015.
12. “Regional Air Quality Impact of Natural Gas Production Operations”, co-I (PI: Sheryl Ehrman), University of Maryland, funded by NSF, \$300,000, 10/01/2014 – 09/30/2017.
13. “Climate Maryland: Measurements of Methane (CH₄), Carbon Dioxide (CO₂), and Other Emissions from Natural Gas Operations (Climate RAMMPP)”, co-PI (PI: Russell Dickerson), University of Maryland, funded by Maryland Department of Environment, \$100,000, 06/20/2014 – 09/30/2015.
14. “Aircraft Observations in Support of GOES-R/VIIIRS”, co-PI (PI: Russell Dickerson), funded by NOAA, University of Maryland, \$60,000, 05/19/2014 – 06/30/2015.
15. “Surface Measurements of Trace Gases in Support of DISCOVER-AQ in Houston in Summer 2013”, PI, University of Maryland, sponsored by Texas Commission on Environmental Quality (TCEQ), \$90,444, 10/01/2012 – 11/30/2013.
16. “Data Analysis for the Dallas-Fort Worth Field Study in 2011”, co-I (PI: Dr. Barry Lefer), University of Maryland, sponsored by Texas Commission on Environmental Quality (TCEQ), \$245,000 (\$29,308 towards University of Maryland), 10/01/2012 – 07/31/2013.
17. “Aircraft Measurement of Atmospheric Mercury and Trace Gases, co-I (PI: Dr. William Landing), Florida State University, subcontract from University of Tennessee Space Institute, \$25,000, 07/01/2012 – 06/30/2013.
18. “Deep Convective Clouds and Chemistry (DC3)” project, co-I (PI: William Brune), NOAA Air Resources Laboratory /Penn State University, funded by NSF/NASA, 1/1/2012 – 12/31/2013.
19. “American Mercury Network (AMNet)” for ambient mercury monitoring at 3 sites, co-I (PI: Winston Luke), NOAA Air Resources Laboratory, sponsored by US EPA, ~\$100,000/yr, 07/01/2012 – 06/30/2017.
20. “Southeastern Atmospheric Mercury Consortium”, co-I (PI: William Landing), Florida State University, funded by NOAA, \$1,000,000, 08/2009 – 08/2012.
21. “SHARP data analysis: Radical Budget and Ozone Production”, co-PI, University of Miami, funded by TCEQ, \$248,652 (\$64,789 towards University of Miami), 08/2010 – 11/2011.
22. “Measurements of Nitrous Acid and Nitric Acid during BEARPEX 2009”, PI, University of Miami, funded by NSF, \$97,600, 06/01/2009 – 11/30/2011.
23. “Laboratory Study of Nitrous Acid Formation through surface Photolysis of Nitric Acid and Nitrate”, PI, University of Miami, Provost Research Award, \$15,300, 06/2010–05/2011.
24. “Deployment of HONO Calibration System and HONO Instrument during Study of Houston Atmospheric Radical Precursor (SHARP) 2009”, PI, University of Miami, funded by Houston Advanced Research Center (HARC), \$18,000, 03/2009–12/2009.
25. “Air Quality Monitoring in the Coastal Environment of Miami, FL”, PI, University of Miami, Summer Research Award, \$9,300, 05/2008–12/2008.
26. “Hydroxyl, Hydroperoxyl, and OH Reactivity: Development of the Airborne Tropospheric Hydrogen Oxides Sensor (ATHOS) on the NASA DC-8 during ARCTAS and Analysis of the results”, PI, University of Miami, NASA subcontract through Penn State University, \$35,688, 08/2007–12/2008.

27. “Texas Air Quality Study II (TexAQS II) 2006”, Co-I (PI: William H. Brune), Penn State University, funded by Houston Advanced Research Center (HARC), 1/1/2006–12/31/2007.
28. “Measurements of OH, HO₂, RO₂, OH Reactivity and Naphthalene from the NASA DC-8 during INTEX-B”, co-I, (PI: William H. Brune), Penn State University, funded by NASA, ~\$450,000, 09/2005–08/2007.
29. “Experimental and Observational Investigation of the Sensitivity of Ozone and Aerosol Formation to NO_x and VOCs”, co-I, (PI: William Brune), Penn State University, funded by the Camille and Henry Dreyfus Foundation, \$126,000, 1/2004–12/2005.
30. “Measurements of OH, HO₂, and Naphthalene from the NASA DC-8 during INTEX-A”, co-I (PI: Dr. William Brune), Penn State University, funded by NASA, ~\$400,000, 9/2003–08/2005.
31. US EPA “Experimental Evaluation of Observation Based Methods for Assessing the Sensitivity of Ozone to VOC and NO_x”, acted as a co-I, (Co-PIs: Drs. Gail Tonnesen, William Carter, and William Brune), Penn State University, funded by US EPA, \$240,000, 8/2003–12/2004
32. “Tropospheric Oxidation Chemistry: Atmospheric Observations and Laboratory Study of OH, HO₂, RO₂, and OH Reactivity, and the Response of Atmospheric Air Perturbations,” co-I (PI: William Brune), Penn State University, funded by NSF, \$1,006,776, 09/2002–08/2007.
33. “Intercomparison of peroxy radical measurements at a rural site using laser-induced fluorescence (LIF) and Peroxy Radical Chemical Ionization Mass Spectrometer (PerCIMS) techniques,” Co-I (PI: William Brune), Penn State University, funded by NSF.
34. “PM_{2.5} Technology Assessment and Characterization Study-New York” project funded by U.S. EPA, Co-I (PI: William Brune), Penn State University, funded by US EPA.
35. “Determination and Study of Atmospheric Hydroxyl and Hydroperoxy Radicals”, co-I (PI: Huixiang Wang), Peking University, funded by NSF of China, RMB200,000, 01/2001–12/2002.

TEACHING EXPERIENCE

- 2015 Spring Air Sampling and Analysis, co-Instructor, University of Maryland College Park
 2010 Fall Tropospheric Chemistry II (MAC661), Instructor, University of Miami
 2009 Fall Introduction to Marine Science Lab (MSC112), co-Instructor, University of Miami
 2009 Fall Tropospheric Chemistry I (MAC650), Instructor, University of Miami
 2004 Fall The Chemistry of Atmosphere (METEO532), co-Instructor, Penn State University

HONORS AND AWARDS

1. NASA Group Achievement Award for ACT-America, 2020
2. NASA Group Achievement Award for OWLETS, 2018
3. NASA Group Achievement Award for DISCOVER-AQ, 2015
4. University of Miami Provost Research Award, 2010
5. NASA Group Achievement Award for ARCTAS, 2009
6. University of Miami Summer Research Award, 2008
7. NASA Group Achievement Award for INTEX-B, 2007
8. NOAA Research Outstanding Scientific Paper Award (Cooper et al, JGR, 2006), 2007
9. NASA Group Achievement Award for INTEX-A, 2005

PEER-REVIEWED PUBLICATIONS

H-Index: 32, Citations: ~3500 (as of December 2020). See <https://publons.com/researcher/2413166/xinrong-ren/>.

1. Gaubert, B., L. K. Emmons, K. Raeder, S. Tilmes, K. Miyazaki, A. F. Arellano Jr, N. Elguindi, C. Granier, W. Tang, J. Barré, H. M. Worden, R. R. Buchholz, D. P. Edwards, P. Franke, J. L. Anderson, M. Saunois, J. Schroeder, J.-H. Woo, I. J. Simpson, D. R. Blake, S. Meinardi, P. O. Wennberg, J. Crouse, A. Teng, M.

- Kim, R. R. Dickerson, H. He, and X. Ren, Correcting model biases of CO in East Asia: impact on oxidant distributions during KORUS-AQ, *Atmos. Chem. Phys.*, 20, 14617–14647, 2020.
2. Benish, S. E., H. He, X. Ren, S. J. Roberts, R. J. Salawitch, Z. Li, F. Wang, Y. Wang, F. Zhang, M. Shao, S. Lu, and R. R. Dickerson, Aircraft Observations of Ozone, Nitrogen Oxides, and Volatile Organic Compounds over Hebei Province, China, *Atmos. Chem. Phys.*, 20, 14523–14545, 2020,
 3. Sullivan, J., J. Dreessen, T. Berkoff, R. Delgado, X. Ren, and T. Aburn, OWLETS: An Enhanced Monitoring Strategy Directly within the Chesapeake Bay, *EM: Air and Waste Management Association's Magazine for Environmental Managers*, October 2020.
 4. Jeon, B., J. V. Cizdziel, J. S. Brewer, W. Luke, M. Cohen, X. Ren, P. Kelley, Gaseous elemental mercury concentrations along the northern Gulf of Mexico using passive air sampling, with a comparison to active sampling, *Atmosphere*, 11, 1034, 2020, doi:10.3390/atmos11101034.
 5. Shi, X., Y. Ge, J. Zheng, Y. Ma, X. Ren, and Y. Zhang, Budget of nitrous acid and its impacts on atmospheric oxidative capacity at an urban site in the central Yangtze River Delta region of China, *Atmos. Environ.*, 238, 117725, 2020, <https://doi.org/10.1016/j.atmosenv.2020.117725>
 6. Ahn, D., J. R. Hansford, Shaun Howe, X. Ren, R. J. Salawitch, N. Zeng, M. D. Cohen, B. Stunder, O. E. Salmon, and P. B. Shepson, K. R. Gurney, T. Oda, A. Karion, I. Lopez-Coto, R. R. Dickerson, Fluxes of Atmospheric Greenhouse-Gases in Maryland (FLAGG-MD): Emissions of Carbon Dioxide in the Baltimore-Washington area, *Geophys. Res. – Atmos.*, 125, e2019JD032004. <https://doi.org/10.1029/2019JD032004>, 2020.
 7. Hall, D. L., D. C. Anderson, C. R. Martin, X. Ren, R. J. Salawitch, T. Canty, J. C. Hains, D. Krask, R. Day, R. R. Dickerson, Using ambient observations of CO and NO_y to infer emissions from vehicles: Evidence for a strong temperature dependence, *Atmos. Environ.*, 232, 117558, 2020.
 8. Zheng, J., X. Shi, Y. Ma, X. Ren, H. Jabbour, Y. Diao, W. Wang, Y. Ge, Y. Zhang, and W. Zhu, Contribution of HONO to the atmospheric oxidation capacity in an industrial zone in the Yangtze River Delta region of China, *Atmos. Chem. Phys.*, 20, 5457–5475, <https://doi.org/10.5194/acp-20-5457-2020>, 2020.
 9. Tang, W., H. M. Worden, M. N. Deeter, D. P. Edwards, L. K. Emmons, S. Martínez-Alonso, B. Gaubert, R. R. Buchholz, G. S. Diskin, R. R. Dickerson, X. Ren, H. He, and Y. Kondo, Assessing MOPITT carbon monoxide retrievals over urban versus non-urban regions, *Atmos. Meas. Tech.*, 13, 1337–1356, 2020, doi: 10.5194/amt-13-1337-2020.
 10. Ren, X., W. T. Luke, P. Kelley, M. D. Cohen, M. L. Olson, J. Walker, R. Cole, M. Archer, R. Artz, and A. A. Stein, Long-term observations of atmospheric speciated mercury at a coastal site in the northern Gulf of Mexico during 2007–2018, *Atmosphere*, 11, 268, 2020, doi:10.3390/atmos11030268.
 11. Lopez-Coto, I., X. Ren, O. E. Salmon, A. Karion, P. B. Shepson, R. R. Dickerson, A. Stein, K. Prasad, and J. Whetstone, Wintertime CO₂, CH₄ and CO emissions estimation for the Washington DC/Baltimore metro area using an inverse modeling technique, *Environ. Sci. Technol.*, 54 (5), 2606–2614, 2020, doi: 10.1021/acs.est.9b06619.
 12. Halliday, H. S., J. P. DiGangi, Y. Choi, G. S. Diskin, S. E. Pusede, M. Rana, J. B. Nowak, C. Knote, X. Ren, H. He, R. R. Dickerson, and Z. Li, Using short-term CO/CO₂ ratios to assess air mass differences over the Korean Peninsula during KORUS-AQ, *J. Geophys. Res. – Atmos.*, 124, doi: 10.1029/2018JD029697, 2019.
 13. Barkley, Z. R., T. Lauvaux, K. J. Davis, A. Deng, A. Fried, P. Weibring, D. Richter, J. G. Walega, J. P. DiGangi, S. Ehrman, X. Ren, R. R. Dickerson, Estimating methane emissions from underground coal and natural gas production in southwestern Pennsylvania. *Geophys. Res. Lett.*, 46, 4531–4540. <https://doi.org/10.1029/2019GL082131>, 2019.
 14. Ren, X., D. L. Hall, T. Vinciguerra, S. E. Benish, P. R. Stratton, D. Ahn, J. R. Hansford, M. D. Cohen, S. Sahu, H. He, C. Grimes, J. D. Fuentes, P. B. Shepson, R. J. Salawitch, S. H. Ehrman, and R. R. Dickerson,

- Methane emissions from the Marcellus Shale in southwestern Pennsylvania and northern West Virginia Based on Airborne Measurements, *J. Geophys. Res. – Atmos.*, 124(3), 1862–1878, 2019, <https://doi.org/10.1029/2018JD029690>.
15. Qu, Z., D. K. Henze, C. Li, N. Theys, Y. Wang, J. Wang, W. Wang, J. Han, C. Shim, R. R. Dickerson, and X. Ren, SO₂ emission estimates using OMI SO₂ retrievals for 2005–2017, *J. Geophys. Res. – Atmos.*, 124, 8336–8359, doi: 10.1029/2019JD030243, 2019.
 16. Dickerson, R. R., D. C. Anderson, and X. Ren, On the use of data from commercial NO_x analyzers for air pollution studies, *Atmos. Environ.*, 214, 116873, doi: 10.1016/j.atmosenv.2019.116873, 2019.
 17. Wang, Y., S. Dörner, S. Donner, S. Böhnke, I. De Smedt, R. R. Dickerson, Z. Dong, H. He, Z. Li, Z. Li, D. Li, D. Liu, X. Ren, N. Theys, Y. Wang, Y. Wang, Z. Wang, H. Xu, J. Xu, and T. Wagner, Vertical profiles of NO₂, SO₂, HONO, HCHO, CHOCHO, and aerosols derived from MAX-DOAS measurements at a rural site in the central-western North China Plain and their relation to emission sources and effects of regional transport, *Atmos. Chem. Phys.*, 19, 5417–5449, 2019, <https://doi.org/10.5194/acp-19-5417-2019>.
 18. Brune, W. H., Ren, X., Zhang, L., Mao, J., Miller, D. O., Anderson, B. E., Blake, D. R., Cohen, R. C., Diskin, G. S., Hall, S. R., Hanisco, T. F., Huey, L. G., Nault, B. A., Peischl, J., Pollack, I., Ryerson, T. B., Shingler, T., Sorooshian, A., Ullmann, K., Wisthaler, A., and Wooldridge, P. J., Atmospheric Oxidation in the Presence of Clouds during the Deep Convective Clouds and Chemistry (DC3) Study, *Atmos. Chem. Phys.*, 18, 14,493–14,510, 2018, doi: 10.5194/acp-18-14493-2018
 19. Ren, X., O. E. Salmon, J. R. Hansford, D. Ahn, D. Hall, S. E. Benish, P. R. Stratton, H. He, S. Sahu, C. Grimm, A. M. F. Heimbürger, M. D. Cohen, B. Stunder, R. R. Salawitch, S. H. Ehrman, P. B. Shepson, and R. R. Dickerson, Methane emissions from the Baltimore-Washington area based on airborne observations: Comparison to emissions inventories, *J. Geophys. Res. – Atmos.*, 123, 8869–8882, doi: 10.1029/2018JD028851, 2018.
 20. Salmon, O. E., P. B. Shepson, X. Ren, R. R. Dickerson, B. H. Stirm, S. S. Brown, D. L. Fibiger, E. E. McDuffie, K. R. Gurney, J. A. Thornton, Top-down estimates of NO_x and CO emissions from Washington, D.C.-Baltimore during WINTER, *J. Geophys. Res. – Atmos.*, 123, 7705–7724, doi:10.1029/2018JD028539, 2018.
 21. Wang, F. Z. Li, X. Ren, Q. Jiang, H. He, R. R. Dickerson, X. Dong, F. Lv Vertical distributions of aerosol optical properties during the spring 2016 ARIAs airborne campaign in the North China Plain, *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2017-1021>, 2018.
 22. Christian, K. E., W. H. Brune, J. Mao, and X. Ren, Global sensitivity analysis of GEOS-Chem modeled ozone and hydrogen oxides during the INTEX campaigns, *Atmos. Chem. Phys.*, 18, 2443–2460, 2018, doi:10.5194/acp-18-2443-2018
 23. Li, C., C. McLinden, V. Fioletov, N. Krotkov, S. Carn, J. Joiner, D. Streets, H. He, X. Ren, R. Dickerson, India is overtaking China as the world’s largest emitter of anthropogenic sulfur dioxide, *Scientific Report*, 7: 14304, doi:10.1038/s41598-017-14639-8, 2017.
 24. Salmon, O. E., P. B. Shepson, X. Ren, A. B. M. Collow, M. A. Miller, A. G. Carlton, M. O. L. Cambaliza, A. Heimbürger, K. L. Morgan, J. D. Fuentes, B. H. Stirm, R. Grundman II, R. R. Dickerson, Urban emissions of water vapor in winter, *J. Geophys. Res. – Atmos.*, 122, doi:10.1002/2016JD026074, 2017.
 25. Martin, C. R., N. Zeng, A. Karion, R. R. Dickerson, X. Ren, B. N. Turpie, K. J. Weber, Evaluation and enhancement of a low-cost NDIR CO₂ sensor, *Atmos. Meas. Tech.*, 10, 2383–2395, doi: 10.5194/amt-10-2383-2017, 2017.
 26. Bieser, J., F. Slemr, J. Ambrose, C. Brenningkmeijer, S. Brooks, A. Dastoor, F. DeSimone, R. Ebinghaus, C. N. Gencarelli, B. Geyer, L. E. Gratz, I. M. Hedgecock, D. Jaffe, P. Kelley, C. Lin, L. Jaegle, V. Matthias, A. Ryjkov, N. E. Selin, S. Song, O. Travnikov, A. Weigelt, W. Luke, X. Ren, A. Zahn, X. Yang, Y. Zhu, N. Pirrone, Multi-model study of mercury dispersion in the atmosphere: Vertical distribution of mercury species, *Atmos. Chem. Phys.*, 17, 6925–6955, doi: 10.5194/acp-17-6925-2017, 2017.

27. Ren, X., W. T. Luke, P. Kelley, M. D. Cohen, R. Artz, M. L. Olson, D. Schmeltz, M. Puchalski, D. L. Goldberg, A. Ring, G. M. Mazzuca, K. A. Cummings, L. Wojdan, S. Preaux, and J. W. Stehr, 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.
28. Mazzuca, G. M., X. Ren, C. P. Loughner, M. Estes, J. H. Crawford, K. E. Pickering, A. J. Weiheimer, and R. R. Dickerson, Ozone production and its sensitivity to NO_x and VOCs: results from the DISCOVER-AQ field experiment, Houston 2013, *Atmos. Chem. Phys.*, 16, 14,463–14,474, doi: 10.5194/acp-16-14463-2016, 2016.
29. Ma, Y., Y. Diao, B. Zhang, W. Wang, X. Ren, D. Yang, M. Wang, X. Shi, and J. Zheng, Detection of formaldehyde emissions from an industrial zone in the Yangtze-River-Delta region of China using a proton transfer reaction ion-drift chemical ionization mass spectrometer, *Atmos. Meas. Tech.*, 9, 6101-6116, doi: 10.5194/amt-9-6101-2016, 2016.
30. Lyman, S., C. Jones, T. O'Neil, T. Allen, M. Miller, M. S. Gustin, A. M. Pierce, W. Luke, X. Ren, P. Kelley, Automated calibration of atmospheric oxidized mercury measurements, *Environ. Sci. Technol.*, 50, 12,921–12,927, doi: 10.1021/acs.est.6b04211, 2016.
31. Mok, J., N. A. Krotkov, A. Arola, O. Torres, H. Jethva, M. Andrade, G. Labow, T. F. Eck, Z. Li, R. R. Dickerson, G. L. Stenchikov, S. Osipov, and X. Ren, Impacts of brown carbon from biomass burning on surface UV and ozone photochemistry in the Amazon Basin. *Sci. Rep.*, 6, 36940, doi: 10.1038/srep36940, 2016.
32. Cohen, M. D., R. R. Draxler, R. S. Artz, C. Banic, P. Blanchard, M. S. Gustin, Y.-J. Han, T. M. Holsen, D. A. Jaffe, P. Kelly, H. Lei, C. P. Loughner, W. T. Luke, S. N. Lyman, D. Niemi, J. M. Pacyna, M. Pilote, L. Poissant, D. Ratte, X. Ren, F. Steenhuisen, A. Steffen, R. Tordon, and S. Wilson, Modeling the global atmospheric transport and deposition of mercury to the Great Lakes, *Elementa*, 4:000118, doi: 10.12952/journal.elementa.000118, 2016.
33. Barth, M. C., M. M. Bela, A. Fried, P. O. Wennberg, J. D. Crouse, J. M. St. Clair, N. J. Blake, D. R. Blake, C. R. Homeyer, W. H. Brune, L. Zhang, J. Mao, X. Ren, T. B. Ryerson, I. B. Pollack, J. Peischl, R. C. Cohen, B. A. Nault, L. G. Huey, X. Liu and C. A. Cantrell, Convective Transport of Peroxides by Thunderstorms Observed over the Central U.S. during DC3, *J. Geophys. Res. – Atmos.*, 121 (8), 4272–4295, doi: 10.1002/2015JD024570, 2016.
34. Brune, W. H., B. C. Baier, J. Thomas, X. Ren, R. C. Cohen, S. E. Pusede, E. Browne, A.H. Goldstein, D. R. Gentner, F. N. Keutsch, J. Thornton, S. Harrold, F. Lopez-Hilfiker, P. O. Wennberg, Ozone Production Chemistry in the Presence of Urban Plumes, *Faraday Discuss.*, 189, 169-189, 2016, doi: 10.1039/c5fd00204d.
35. Nowlan, C. R., X. Liu, J. W. Leitch, K. Chance, G. González Abad, C. Liu, P. Zoogman, J. Cole, T. Delker, W. Good, F. Murcray, L. Ruppert, D. Soo, M. B. Follette-Cook, S. Janz, M. Kowalewski, C. Loughner, K. Pickering, J. Herman, M. Beaver, R. Long, J. Szykman, L. Judd, X. Ren, W. Luke, P. Kelly, and J. Al-Saadi, Nitrogen dioxide observations from the Geostationary Trace gas and Aerosol Sensor Optimization airborne instrument: Retrieval algorithm and measurements during DISCOVER-AQ Texas 2013, *Atmos. Meas. Tech.* 9, 2647–2668, doi:10.5194/amt-9-2647-2016, 2016.
36. Nault, B. A., C. Garland, P. J. Wooldridge, W. H. Brune, P. Campuzano-Jost, J. D. Crouse, D. A. Day, J. Dibb, S. R. Hall, G. Huey, J. L. Jimenez, X. Liu, J. Mao, T. Mikoviny, J. Peischl, I. B. Pollack, X. Ren, T. B. Ryerson, E. Scheuer, K. Ullmann, P. O. Wennberg, A. Wisthaler, Li Zhang, and Ronald C. Cohen, Observational Constraints on the Oxidation of NO_x in the Upper Troposphere, *J. Chem. Phys. A*, 120(9), 1468-1478, doi:10.1021/acs.jpca.5b07824, 2016.
37. Pusede, S. E., T. C. VandenBoer, J. G. Murphy, M. Z. Markovic, C. J. Young, P. R. Veres, J. M. Roberts, R. A. Washenfelder, S. S. Brown, X. Ren, C. Tsai, J. Stutz, W. H. Brune, E. C. Browne, P. J. Wooldridge, A. R. Graham, R. Weber, A. H. Goldstein, S. Dusanter, S. M. Griffith, P. S. Stevens, B. L. Lefer, and R. C. Cohen,

- An atmospheric constraint on the NO₂ dependence of daytime near-surface nitrous acid (HONO), *Environ. Sci. Technol.*, 49(21), 12,774–12,781 doi:10.1021/acs.est.5b02511, 2015.
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