**Michael Vermeuel**

Purdue University

Department of Earth, Atmospheric, and Planetary Sciences

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**Academic Appointment**

**Assistant Professor** Dept. of Earth, Atmospheric, and Planetary Sciences, Purdue University, 2024-

**Education**

**Ph.D.**, University of Wisconsin – Madison, Chemistry, 2021

*Dissertation Title*: The Influence of Complex Meteorology and Surface Heterogeneity on Oxidation in the Troposphere

**M.S.**, University of Wisconsin – Madison, Chemistry, 2017

**B.S.**, The College of New Jersey, Chemistry, 2015

**Research and Training**

**Postdoctoral Associate** Dept. of Soil, Water, and Climate, University of Minnesota – Twin Cities, 2021-2024

Advisor: Professor Dylan B. Millet

Joint Advisor: Professor Delphine K. Farmer, Dept. of Chemistry, Colorado State University, 2023-2024

**Graduate Researcher** Dept. of Chemistry, University of Wisconsin – Madison, 2015-2021

Advisor: Professor Timothy H. Bertram

**Summer Research Staff** Dept. of Chemistry, University of Wisconsin – Madison, 2015

Advisor: Professor Randall H. Goldsmith

**Undergraduate Research** Dept. of Chemistry, The College of New Jersey, 2013-2015

Advisors: Professor Michelle R. Bunagan and Professor David McGee

**Summer Research Experience for Undergraduates** Dept. of Mat. Sci. & Eng., University of Wisconsin – Madison, 2014

Advisor: Professor Padma Gopalan

**Teaching**

**Instructor**, EAPS 117, Introduction to Atmospheric Sciences, Fall 2024

**Teaching Assistant**, CHEM 524, Chemical Instrumentation, Spring 2016, Spring 2018

**Teaching Assistant**, CHEM 104, General Chemistry II, Fall 2015

**Student Mentorship**

**Ph.D. Advisor**

Carter Swenson (Purdue EAPS)

 Fall 2024 – present

**Undergraduate Research mentor**

Sophie Abou-Rizk (UW Madison Chemistry)

Katherine Koets (UW Madison Chemistry)

Eowyn Liu (UW Madison Chemistry)

Spring 2020 – Spring 2021

Summer 2019 – Spring 2020 Fall 2018 – Spring 2019

Ashley Hallfrisch (UW Madison Chemistry)

Spring 2017

Elliot Brabant (UW Madison Chemistry)

Spring 2016 – Spring 2017

**Awards**

James R. Holton Award, American Geophysical Union, 2024

Outstanding Oral Presentation, 5th American Meteorological Society Biogeosciences Meeting, 2021

American Institute of Chemists Student Award, 2015

**University and Professional Activities**

**Committee Member** Purdue EAPS Field Committee, 2024

**Early Career Advisory Board Member** *ACS ES&T Air*, 2023-

**Primary Convener**Terrestrial Biosphere-Atmosphere Interactions and Atmospheric Chemistry, AGU 2024 Meeting

**Convener** Biosphere-Atmosphere Interactions of Reactive Carbon, Oxidants, and Aerosols, AGU 2023 Meeting

**Convener** Biosphere-Atmosphere Exchange of Reactive Carbon, Oxidants, and Aerosols, AGU 2022 Meeting

**Reviewer** Atmospheric Chemistry and Physics, Atmospheric Measurement Techniques, Journal of Geophysical Research: Atmospheres, Geophysical Research Letters, Earth System Science Data, ACS ES&T Air, Journal of Hazardous Materials

**Proposal Reviewer** NSF

**Member** American Geophysical Union 2018-

**Funding**

10/2023 – 09/2026: *MRI Track 1: Acquisition of a Dual-Reagent Chemical Ion Mass Spectrometer for Direct and Detailed Measurements of Atmospheric Chemical Fluxes*, Dylan Millet (PI), Timothy Griffis (co-PI), Christopher Hogan (co-PI), Michael Vermeuel (co-PI), Jannell Bazurto (co-PI), NSF AGS 2320421, $1,161,665.00

**Outreach**

**Primary organizer,** educational program for 25 homeschooled students that included hands on atmospheric chemistry projects and organized tours of chemistry labs throughout the department, 2017

**Volunteer**, Chemistry Opportunities (CHOPs) program that brings high school students from underrepresented groups to explore a graduate school program, 2016-2018

**Atmospheric Chemistry Field Research Studies**

**FROG-NY/AEROMMA**, direct measurements of the emissions of urban pollutants, Mineola, NY, 2023-2024

**Flux Closure Study (FluCS)**, detailed reactive carbon exchange over a pine forest, Manitou Forest, CO, 2021

**WLEF-TV Tower**, observations of reactive carbon flux during the summer to autumn transition, Park Falls, WI, 2020

**CHEESEHEAD19**, terrestrial ozone and oxidized carbon forest-atmosphere exchange, Park Falls, WI, 2019

**Center for Limnology**, multiple reactive gas air-lake exchange studies, Madison, WI, 2016-2019

**Scripps Institute of Oceanography Mem. Pier**, ozone and marine sulfur air-sea exchange, San Diego, CA, 2018

**LMOS 2017**, ambient measurements of ozone precursors and oxidation products and impacts on air quality, Zion, IL, 2017

**Publications**

**In Review**

1. Franklin, E.B., Rossell, R., **Vermeuel, M.P.** and 12 others, Emerging Drivers of North American Urban Aerosol Increase Global Change Vulnerability, *Sci. Adv.*, In Revision

**In Press**

1. **Vermeuel, M.P.**, Millet, D.B., Farmer, D.K., and 15 others, A vertically-resolved canopy improves chemical transport model predictions of ozone deposition to north temperate forests, *J. Geophys. Res. Atmos.*, <https://doi.org/10.22541/essoar.172313458.86659538/v1>, Accepted

**Published**

1. Ratdke, J.A. and 13 others including **Vermeuel, M.P.**, Observing Low Altitude Features in Ozone Concentrations in a Shoreline Environment via Unmanned Aerial Systems, *Atmos. Meas. Tech.*, <https://doi.org/10.5194/amt-2023-143>, 2024
2. Link, M.F., Pothier, M.A., **Vermeuel, M.P.**, Riches, M., Millet, D.B., Farmer, D.K., In-Canopy Chemistry, Emissions, Deposition, and Surface Reactivity Compete to Drive Bi-Directional Forest-Atmosphere Exchange of VOC Oxidation Products, *Environ. Sci. Technol. Air*, <https://doi.org/10.1021/acsestair.3c00074>, 2024
3. Riches, M., Berg, T.C., **Vermeuel, M.P.**, Millet, D.B., Farmer, D.K., Wildfire Smoke Directly Changes Biogenic Volatile Organic Emissions and Photosynthesis of Ponderosa Pines, *Geophys. Res. Lett,* <https://doi.org/10.1029/2023GL106667>, 2024
4. **Vermeuel, M.P.**, Millet, D.B., Farmer, D.K., Link, M.F., Pothier, M.A., Riches, M., Williams, S., Garofalo, L.A., Closing the reactive carbon flux budget: Observations from dual mass spectrometers over a coniferous forest, *J. Geophys. Res. Atmos.*, <https://doi.org/10.1029/2023JD038753>, 2023
5. **Vermeuel, M.P.**, Novak, G.A., Kilgour, D.B., Claflin, M.S., Lerner, B.M, Thom, J., Cleary, P.A., Desai, A.R., Bertram, T.H., Observations of biogenic volatile organic compounds over a mixed temperate forest during the summer to autumn transition, *Atmos. Chem. Phys.*, <https://doi.org/10.5194/acp-23-4123-2023>, 2023
6. Novak, G. A., Kilgour, D. B., Jernigan, C. M., **Vermeuel, M. P.**, Bertram, T.H., Oceanic emissions of dimethyl sulfide and methanethiol and their contribution to sulfur dioxide production in the marine atmosphere, *Atmos. Chem. Phys.*, <https://doi.org/10.5194/acp-22-6309-2022>, 2022
7. Novak, G.A. and 34 others including **Vermeuel, M.P.**,Rapid cloud removal of dimethyl sulfide oxidation products limits SO2 and cloud condensation nuclei production in the marine boundary layer, *Proc. Natl. Acad. Sci.*, <https://doi.org/10.1073/pnas.2110472118>, 2021
8. Stanier, C. and 30 others including **Vermeuel, M.P.**, Overview of the Lake Michigan Ozone Study (LMOS 2017), *Bull. Am. Meteorol. Soc.*, BAMS-D-20-0061, 2021
9. Doak, A.G. and 18 others including **Vermeuel, M.P.**, Characterization of ground-based atmospheric pollution and meteorology sampling stations during the Lake Michigan Ozone Study 2017, *J. Air Waste Manag. Assoc.*, <https://doi.org/10.1080/10962247.2021.1900000>, 2021
10. **Vermeuel, M.P.**, Cleary, P.A., Desai, A.R., Bertram, T.H., Simultaneous measurements of O3 and HCOOH vertical fluxes indicate rapid in-canopy terpene chemistry enhances O3 removal over mixed temperate forests, *Geophys. Res. Lett,* <https://doi.org/10.1029/2020GL090996>, 2021
11. Butterworth, B.J. and 44 others including **Vermeuel, M.P.**, Connecting Land-Atmosphere Interactions to Surface Heterogeneity in CHEESEHEAD19, *Bull. Am. Meteorol. Soc.*, 1-71, <https://doi.org/10.1175/BAMS-D-19-0346.1>, 2020
12. Hughes, D.D., Christiansen, M., Milani A., **Vermeuel, M.P.**, Novak, G. A., et al. PM2.5 chemistry, organosulfates, and SOA formation during the 2017 Lake Michigan Ozone Study, *Atmos. Environ.*, <https://doi.org/10.1016/j.atmosenv.2020.117939>, 2020
13. **Vermeuel, M.P.**, Novak, G.A., Jernigan, C.J., Bertram, T.H., The Diel Profile of Hydroperoxymethyl Thioformate: Evidence for Surface Deposition and Multiphase Chemistry, *Environ. Sci. Technol.*, 54, 12521-12529, <https://doi.org/10.1021/acs.est.0c04323>, 2020.
14. Leon, D., **Vermeuel, M.P.**, Gupta, P., Bunagan, M.R., The effect of salt and temperature on the conformational changes of P1LEA-22, a repeat unit of plant Late Embryogenesis Abundant proteins, *J Pep Sci.*, 26, <http://dx.doi.org/10.1002/psc.3247>, 2020.
15. Novak, G. A., **Vermeuel, M. P.**, and Bertram, T. H., Simultaneous detection of ozone and nitrogen dioxide by oxygen anion chemical ionization mass spectrometry: a fast-time-response sensor suitable for eddy covariance measurements, *Atmos. Meas. Tech.*, 13, 1887–1907, <https://doi.org/10.5194/amt-13-1887-2020>, 2020.
16. **Vermeuel, M. P.**, Novak, G.A., Alwe, H.D., Hughes, D.D., Kaleel, R., Dickens, A.F., et al. Sensitivity of Ozone Production to NOx and VOC Along the Lake Michigan Coastline. *J. Geophys. Res. Atmos*., 124, 10989-11006, <https://doi.org/10.1029/2019JD030842>, 2019.
17. Lavi, A., **Vermeuel, M.P.**, Novak, G.A., and Bertram, T.H., The sensitivity of benzene cluster cation chemical ionization mass spectrometry to select biogenic terpenes, *Atmos. Meas. Tech.*, 11, 3251–3262, <https://doi.org/10.5194/amt-11-3251-2018>, 2018

**Technical Reports**

1. **Vermeuel, M.P.**, Bertram, T.H., Investigating the O3-NOx-VOC Sensitivity of Plumes Advecting over Lake Michigan during LMOS 2017, Final Memo for Lake Michigan Air Directors Consortium (LADCO), [report link](https://www.ladco.org/wp-content/uploads/Projects/Ozone/2020_WI-DNR_OBM_Analysis/LADCO_FinalReport_2020.pdf), 2020

**First Author Presentations**

1. Unraveling the complexity of local VOC sources over an urban site in New York, American Chemical Society Spring Meeting, San Diego, CA, 2025 (***Invited talk***)
2. Combining Measurements and Models to Understand the Influence of Biosphere-Atmosphere Interactions on Atmospheric Chemistry, American Geophysical Union Fall Meeting, Washington D.C., 2024 (***Invited talk*)**
3. VOC Source Apportionment in an Urban Environment Using Eddy Covariance Flux Measurements, American Geophysical Union Fall Meeting, Washington D.C., 2024 (*Talk***)**
4. Exploring the Role of Surface-Atmosphere Interactions in Atmospheric Chemistry with Direct Observations and Chemical Transport Modeling, Environmental Science Seminar Series, Indiana University, Bloomington, IN, 2024 (***Invited talk***)
5. A vertically-resolved canopy improves chemical transport model predictions of ozone deposition to north temperate forests, 11th International GEOS-Chem Meeting, St. Louis, MO, 2024 (*Talk*)
6. VOC source apportionment in an urban environment using eddy covariance flux measurements, AGES+ Workshop, Boulder, CO 2024 (*Talk*)
7. Investigating the fate of reactive gases in the atmosphere through direct observations and chemical transport modeling, The College of New Jersey Department of Chemistry Seminar, 2024, (***Invited talk***)
8. Direct quantification of VOC flux over an urban footprint during the Fluxes of Reactive Organic Gases in New York (FROG-NY) project, American Geophysical Union Fall Meeting, San Francisco, CA, 2023, (*Poster*)
9. A vertically-resolved canopy significantly improves chemical transport model ozone predictions over north temperate forests, American Geophysical Union Fall Meeting, San Francisco, CA, 2023, (*Poster*)
10. Closing the ozone flux budget over a temperate coniferous forest using comprehensive observations and 1D vertical canopy modeling, American Meteorological Society Sixth Conference on Atmospheric Biogeosciences, Minneapolis, MN, 2023, (*Talk*)
11. Unraveling the fate of atmospheric chemicals through state-of-science observations and multidimensional modeling, Purdue University Earth, Atmospheric, and Planetary Sciences Department Seminar, West Lafayette, IN, 2023, (***Invited talk***)
12. Applying dual mass spectrometers to close the VOC budget over a coniferous ecosystem, American Geophysical Union Fall Meeting, Chicago, IL, 2022, (*Poster*)
13. The contribution of chemical sinks to ozone fluxes over a temperate coniferous forest, American Geophysical Union Fall Meeting, Chicago, IL, 2022, (*Poster*)
14. How well can we understand and model VOC fluxes over coniferous forests? New insights from dual mass spectrometers, 10th International GEOS-Chem Meeting (IGC10), St. Louis, MO, 2022, (*Talk*)
15. Comprehensive Observations of the Biosphere-Atmosphere Exchange of Reactive Carbon during the Flux Closure Study (FluCS), American Geophysical Union Fall Meeting, New Orleans, LA, 2021, (*Poster*)
16. Observations of the Biosphere-Atmosphere Exchange of Reactive Carbon over a Colorado Pine Forest, Augsburg University Department of Chemistry, Minneapolis, MN, 2021 (***Invited talk***)
17. Evidence of Enhanced Ozone Removal Over Mixed Temperate Forests due to In-Canopy Terpene Chemistry, American Meteorological Society Fifth Conference on Atmospheric Biogeosciences, Remote, 2021 (*Talk,* ***won award****)*
18. Forest-Atmosphere Exchange of Ozone and Reactive Carbon Over a Mixed Temperate Forest in Northern Wisconsin, Improving understanding of land-atmosphere interactions through integration of surface flux and atmospheric boundary layer measurements, Ameriflux Workshop, Remote, 2021 (*Poster)*
19. Eddy covariance measurements of O3 and HCOOH indicate rapid in-canopy terpene chemistry drives O3 deposition in mixed temperate forests, American Geophysical Union Fall Meeting, Remote, 2020 *(Poster)*
20. Summertime Observations of Forest-Atmosphere Exchange of Ozone and Formic Acid over a Mixed Temperate Forest in Northern Wisconsin, Spatial heterogeneity in land-atmosphere interactions and boundary-layer development: A CHEESEHEAD virtual mini-session, Remote, 2020 *(Talk)*
21. Observations of Ozone Deposition to a Temperate Forest, American Geophysical Union Fall Meeting, San Francisco, CA 2019 *(Poster)*
22. Measurements of O3, HNO3, and SO2 over the ocean and a eutrophic freshwater lake, National Atmospheric Deposition Program Spring Meeting, Madison, WI 2019 (*Poster*).
23. and model‐based constraints on ozone production along the Lake Michigan coastline: Insights from intensive field experiments and long‐term monitoring data, American Geophysical Union Fall Meeting, Washington D.C., 2018 *(Poster)*
24. Theoretical Insight on Benzene Cluster Cation Chemistry and the Detection of Biogenic Terpenes, CIMS User Meeting, Seattle, WA, 2018 *(Talk)*
25. Measurements of H2O2 and HNO3 at the Zion Field Site during LMOS, 2017, LMOS 2017 Data Workshop, Metcalfe Federal Building, Chicago, IL 2017 *(Talk)*
26. Studying the Folding Pathway of Truncated and Full-Length Human Serum Albumin via FCS, ACS Fall Meeting, San Francisco, 2014 (*Poster*)