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Education:

Ph. D., Chemistry (physical), 1999

University of Colorado, Boulder
Program in Atmospheric and Oceanic Sciences
Atmospheric Chemistry Program
Boulder, Colorado

B.A., Chemistry, 1994

Rice University
Houston, Texas

Research Positions:

2014- Associate Professor, Department of Civil and Environmental Engineering, Princeton University

Associated Faculty:

Dept. of Atmospheric and Oceanic Sciences, Princeton University
Center for Mid-Infrared Technologies for Health and the Environment (MIRTHE)
Princeton Institute for the Science and Technology of Materials (PRISM)
Princeton Environmental Institute (PEI)
Andlinger Center for Energy and the Environment (ACEE)

Research activities focus on the sources, sinks, and distributions of trace gases important for cloud and aerosol chemistry, the nitrogen cycle, and the carbon cycle. My group develops and deploys new optical-based sensors to make innovative measurements in air quality and climate and bridge spatiotemporal scales from in-situ to remote sensing measurements.

2008-2014 Assistant Professor, Department of Civil and Environmental Engineering, Princeton University

2002-2007 Senior Research Scientist, Southwest Sciences, Inc., Santa Fe, New Mexico. Examined the feasibility of laser-based detection of atmospheric trace gases using vertical cavity surface emitting lasers, quantum cascade lasers, and interband cascade lasers. Principal Investigator for the development of the VCSEL hygrometer on the NSF Gulfstream-V research aircraft.

1999-2002 Advanced Study Program Postdoctoral Fellow, National Center for Atmospheric Research, Boulder, Colorado. An aircraft-based, tropospheric nitric acid instrument was developed and deployed during the NASA TRACE-P field experiment in spring 2001. The partitioning of nitric acid to total nitrogen including aerosol was investigated.

1994-1999 Graduate research assistant under the direction of Professor Margaret A. Tolbert at the University of Colorado, Boulder. Doctoral studies involved laboratory measurements of heterogeneous reaction rates, mechanisms, and condensed phase products of nitrogen-species and acids on thin films representative of polar stratospheric clouds and cirrus clouds.

1992-1993 Summer undergraduate research assistant, Professor F. Sherwood Rowland at the University of California, Irvine. Estimated the biomass burning source strength of methyl bromide from air samples taken from field campaigns.

Funding at Princeton (lead PI or at nominal indirect rates unless explicitly noted):

DOE NETL FE0029059, "Remote methane sensor for emissions from pipelines and compressor stations using Chirped-laser Dispersion Spectroscopy", October 1, 2016-September 30, 2019.

NASA NNX16AQ90G, “Spatiotemporal variability of ammonia through syntheses of in-situ, ground-based, and remote sensing instruments”, Aug. 17, 2016-Aug. 16, 2019.

DOE STTR IP 00021004, “Compact laser hygrometer for in-situ measurements of water vapor from small unammed aerial vehicles”, February 19, 2016-December 1, 2016.

DOE ARPA-E SC67232-1867, “RMLD™ Sentry for Upstream Natural Gas Leak Monitoring” for ARPA-E Methane Observation Networks with Innovative Technology to Obtain Reductions (MONITOR), Subcontract via Physical Sciences, Inc., April 24, 2015-April 17, 2018.

NOAA NA14OAR4320106 (co-I), “Reactive nitrogen biogeochemical cycling in the GFDL Earth System Models: Advancing understanding of atmosphere-land interactions under changing climate and land use”, July 1, 2013-6/30/2018.

NASA NNX14AT36G, “Quantifying ammonia emissions from agriculture and cities during DISCOVER-AQ”, Oct. 1, 2014-Sept. 30, 2015.

NASA NNX14AT32G, “Understanding spatial variability of methane by comparing bottom-up and top-down methods during DISCOVER-AQ Colorado”, Oct. 1, 2014-Sept. 30, 2015.

NSF IIP-1445031, “Partnerships for Innovation: Accelerating Innovation Research-Technology Transfer: Prototype mid-infrared, methane sensor for natural gas leak detection on small unmanned aerial systems”, Sept. 15, 2014-February 29, 2016.

NSF DEB-1359538, “EAGER: Collaborative research: development of a new technique to measure ecosystem-level soil nitrous oxide fluxes using micrometeorological towers”, August 4, 2014-August 3, 2016.

NOAA Climate Program Office, Atmospheric Chemistry, Carbon Cycle, and Climate, #NA14OAR4310134, “Distribution of fugitive methane emissions in the Marcellus Shale”, August 1, 2014-July 31, 2017.

DOE Biological and Environmental Research, DE-SC0011288, “Portable nitrous oxide sensor for understanding agricultural and soil emissions”, February 17, 2014-November 16, 2016.

Environmental Defense Fund, Barnett Shale Methane Emissions Coordinated Campaign, “Methane emissions from near field sources using an electric aircraft”, August 1, 2013-July 31, 2014.

NSF EEC-0540832, “Urban emissions of greenhouse gases and air pollutants”, May 1, 2013-April 30, 2014.

NSF EEC-0540832, “Fugitive Methane Sensing from Petrochemical Activities”, May 1, 2013-April 30, 2014.

Utah State University, “Demonstration of MIRTHER mobile sensing”, May 1, 2013-August 31, 2013.

Princeton Council for International Teaching and Research (co-I; PI Prof. Denise Mauzerall, CEE/WWS), “Collaboration between Princeton University and Beijing University”.

Office of Technology Licensing, Princeton University, Intellectual Property Accelerator Fund, “Portable nitrous oxide sensor for understanding greenhouse gas emissions”, Dec. 17, 2012-Dec. 31, 2013.

NSF IIP-1263579, “I-Corps: Open-path, Compact Nitrous Oxide Sensor Using Quantum Cascade Laser Spectroscopy”, Oct. 1, 2012-March 31, 2013.

NASA NNX12AN64H, “Validation of TES Ammonia Using an Open-path Quantum Cascade Laser Based Spectrometer (student: Kang Sun)”, NASA Earth and Space Science Graduate Fellowship, Sept. 1, 2012-Aug. 31, 2015.

NSF EEC-0540832, “Breath analyses of ammonia for disease detection”, May 1, 2012-April 30, 2013.

NSF AGS-1063466, “Supplement: Environmental Conditions and Characteristics of Ice Supersaturated Regions in Deep Convective Clouds and Chemistry (DC3)”, April 7, 2012-April 30, 2014 (returned to NSF due NSF’s cancellation of their involvement in the NASA SEAC4RS field study).

NSF AGS-1063466, “Environmental conditions and characteristics of ice supersaturated regions in Deep Convective Clouds and chemistry (DC3)”, Apr. 7, 2011-Apr. 30, 2014.

Thomas and Lynn Ou Foundation, “New advances in urban air quality monitoring: A China-Princeton collaboration”, April 1, 2011-March 31, 2014.

NSF AGS-1036275, “RAPID: Ice supersaturated regions and distribution of water vapor during the third HIPPO deployment”, Aug. 15, 2010-July 31, 2012.

NSF IIP-1038825, “High precision, range-resolved remote gas sensing”, July 1, 2010-June 30, 2012.

NSF EEC-0540832, “Nitrous oxide measurements using a quantum cascade laser near 4.54 microns”, May 1, 2010-Apr. 30, 2013.

Office of the Dean of Research, Princeton University, “Development of a high-performance trace gas sensor for unoccupied aerial vehicles”, Lead PI, April 22, 2010-April 21, 2011.

NASA NNX09AO51H, “Aircraft-based measurements of ice supersaturated regions in the upper troposphere and lower stratosphere and comparison to AIRS climatologies (student: Minghui Diao)”, NASA Earth and Space Science Graduate Fellowship, Sept. 1, 2009-Aug. 31, 2012.

NSF IIP-0646479, “Phase IIR: Balloon-based instrument for measurements of atmospheric water vapor and methane”, July 2, 2009-Jan. 31, 2011.

NSF EEC-0540832, “Ultrasensitive ammonia sensor for urban air quality”, May 1, 2009-Apr. 30, 2013.

NSF EEC-0540832 (co-I), “Integrating MIRTHER sensors into wireless meteorological networks”, May 1, 2009-Apr. 30, 2010.

High Meadows Sustainability Fund (co-PI), Princeton University, “A Sensor Network over Princeton”, Apr. 1, 2009-Mar. 31, 2011.

USDA 2009-35112-05274, Air Quality, “Nitrous oxide measurements using a quantum cascade laser near 4.54 microns”, Feb. 1, 2009-July 31, 2010.

NSF ATM-0840732, “SGER: Water vapor measurements from the G-V VCSEL hygrometer during START08/PreHIPPO”, Sep. 1, 2008-Aug. 31, 2009.

NSF MIRTHER, “Nitrous oxide measurements using a quantum cascade laser near 4.54 microns”, May 1, 2008-Apr. 30, 2009.

Teaching Experience / Curriculum Development

CEE/CHM/GEO 311, “Global Air Pollution”, new course development, Spring 2009, Fall 2010, Spring 2012, Spring 2013, Spring 2014, Spring 2015, Princeton University.

ELE/CEE/MAE/MSE 455, “Mid-Infrared Technologies for Health and the Environment”, Spring 2011, Fall 2012, Fall 2013, Princeton University.

CEE/AOS 593, “Aerosol Observations and Modeling”, new course development, Fall 2009 (CEE 599B), Fall 2011, Fall 2014, Princeton University.

CEE 501, “Environmental Engineering Fundamentals I: Atmospheric and Surface Processes”, Fall 2008-2011, Princeton University. Designed and developed the course in collaboration with other faculty members, taught 12 of 26 classes in 2008; 13 of 24 classes in 2009; 12 of 24 classes in 2010; 11 of 24 classes in 2011.

CEE 445/578, “Air Quality and Aerosol Processes”, new course development, Spring 2009, Princeton University.

Santa Fe Community College, HB 365, “Understanding Global Climate Change”, Continuing Education. Developed and taught a new course offering for Continuing Education. Course offering started in Spring 2006, Spring 2007, and Fall 2007.

University of Colorado, Boulder, teaching assistant, Physical Chemistry laboratory and lecture, 1994-1995.

PI Awards/Honors:

2016-2019 NASA Health and Air Quality Applied Sciences Team
2014 Outstanding Engineering Teaching Faculty, Princeton University, Spring 2014
2013 Nomination for *Popular Mechanics* 100 Breakthrough Innovations, NSF Engineering Directorate
2001-2002 NCAR ACD Visiting Scientist
1999-2001 NCAR Advanced Study Program Postdoctoral Fellowship
1996-1998 NASA Earth Systems Science Graduate Fellowship
1995-1996 NASA Global Change Graduate Fellowship
1994-1995 University of Colorado Chancellor's Fellowship

Group Awards/Honors:

2016:

Da Pan (3rd year PhD student), PEI-STEP Fellowship
Levi Golston, 2016 NSF Partnership for Innovation: Accelerating Technology Transition Grantees Workshop, 1st place, elevator pitch contest for graduate students and postdoctoral researchers, Atlanta, Georgia, June 8, 2016.
Haley Lane, Christine Trmal Prize for Outstanding Environmental Engineering Senior Thesis

2015:

Levi Golston (3rd year PhD student), Princeton Energy and Climate Scholar

2014:

Victor Fu, MIRTHER Best Student Poster Award (NSF REU), 2014 MIRTHER Summer Workshop, Princeton, New Jersey

2013:

Minghui Diao, Advanced Study Program Postdoctoral Fellowship, National Ctr. for Atmospheric Research
Lei Tao, Postdoctoral Researcher, Innovation Forum, 1st prize
John Buglione, MIRTHER Best Student Poster Award (NSF REU), 2013 MIRTHER Summer Workshop

2012:

NASA Earth and Space Science Fellowship, Kang Sun (4th year graduate student), “Validation of TES Ammonia Using an Open-Path Quantum Cascade Laser Based Spectrometer”
MIRTHER Best Poster Award, Levi Stanton (rising junior), MIRTHER Annual Workshop, Baltimore, Maryland, August 9, 2012.
MIRTHER Best Flash Presentation, Victor Fu (NSF Research Assistantships for High School Students), MIRTHER Annual Workshop, Baltimore, Maryland, August 9, 2012.

Walbridge Fund Graduate Award, "Ice Supersaturation and Cirrus Cloud Formation by Global In-Situ Aircraft Observations and Relationships with Anthropogenic Emissions", Minghui Diao (4th year Ph.D. student)

2011:

MIRTHE Student-Led Independent Project, David Miller, PI (3rd year Ph.D. student), \$100,000
Michelle Goudie Senior Thesis Award, Emma Bedard (Chemical and Biological Engineering major)
Princeton Energy and Climate Scholar, Minghui Diao (4th year Ph.D. student)
AGU Student Travel Grant, Garnet Abrams (senior undergraduate Geosciences major)

2010:

Outstanding Student Paper Award, Minghui Diao (3rd year Ph.D. student), Fall 2010 AGU Meeting (Atmospheric Sciences), "Ice supersaturated regions formed by the inhomogeneities of water vapor field in the upper troposphere in START08 and HIPPO Global campaigns", San Francisco, California.
MIRTHE Best Student Presentation, Caitlyn Puzio (NSF Research Assistantships for High School Students), MIRTHE 2010 Annual Workshop, Houston, Texas, August 2010.

2009:

Outstanding Student Paper Award (Atmospheric Sciences), Minghui Diao (1st year graduate student), "*In-situ* measurements of ice supersaturation in the upper troposphere in START08 campaign", 2009 AGU Joint Assembly, Toronto, Canada.
NASA Earth and Space Science Fellowship, Minghui Diao (2nd year graduate student), "Aircraft-based measurements of ice supersaturated regions in the upper troposphere and lower stratosphere and comparison to AIRS climatologies"
NSF Graduate Fellowship, David Miller (Ph.D. candidate)

Student Advising

current:

Levi Goldston (4th year Ph.D. candidate, Dept. of Civil and Environmental Engineering)
Da Pan (4th year Ph.D. candidate, Dept. of Civil and Environmental Engineering)
Xuehui Guo (2nd year Ph.D. candidate, Dept. of Civil and Environmental Engineering)
Rui Wang (1st year Ph.D. candidate, Dept. of Civil and Environmental Engineering)

past:

Kang Sun, Ph.D., Civil and Environmental Engineering, 2015
David Miller, Ph.D., Civil and Environmental Engineering, 2014
Minghui Diao, Ph.D., Civil and Environmental Engineering, 2013
Qiushi Zhang, MSE Civil and Environmental Engineering, 2013
Loayeh Jumbam, MSE Civil and Environmental Engineering, 2010

Other Ph.D./Masters thesis committees:

Hagar ElBishlwai, Ph.D., Civil and Environmental Engineering, 2014
Matthew Reid, Ph.D., Civil and Environmental Engineering, 2014
Yin Wang, Ph.D., Electrical Engineering, November 2013
Jeff Paull, Ph.D., Electrical Engineering, November 2012
Tracy Tsai, Ph.D., Electrical Engineering, September 2012
Lauren Crandell, Ph.D., Civil and Environmental Engineering, May 2012
Zhihua Wang, Ph.D., Civil and Environmental Engineering, August 2011
Ekua Bentil, Ph.D., Electrical Engineering, April 2011
Richard Cendejas, Ph.D., Electrical Engineering, April 2011
Scott Sheridan Howard, Ph.D., Electrical Engineering, May 2008
Afusat Dirisu, Ph.D., Electrical Engineering, December 2008
Fatima Toor, Ph.D., Electrical Engineering, May 2009

Senior Thesis Advisor:

Jessica Lu, Civil and Environmental Engineering, 2016-2017
Haley Lane, Civil and Environmental Engineering, 2015-2016
Levi Stanton, Civil and Environmental Engineering, 2014-2015
Kevin Ross, Civil and Environmental Engineering, 2013-2014
Michelle L. Yakubisin, Chemical and Biological Engineering, 2013-2014
Brian Pourciau, Civil and Environmental Engineering, 2012-2013
Garnet Abrams, Geosciences, 2011-2012
Otavio Fleury, Civil and Environmental Engineering, 2011-2012
Nicole McAndrew, Chemical and Biological Engineering, 2010-2011
Emma Bedard, Chemical and Biological Engineering, 2010-2011

Undergraduate research students:

- 2016: Jessica Lu, CEE / Princeton University
Tanvir Mangat, University of Massachusetts, MIRTHERU
Kira Olander, MIRTHERU, Wheaton College
- 2015: Haley Lane, CEE / Princeton University
Jessica Lu, CEE / Princeton University
Tanvir Mangat, University of Massachusetts, MIRTHERU
Stephanie Paredes Mesa, City College of New York, MIRTHERU
- 2014: Victor Fu, Univ. Southern California, MIRTHERU
Naomi Pohl, Univ. Of Pennsylvania, MIRTHERU
Levi Stanton, PEI Summer Intern
- 2013: John Buglione, Villanova, MIRTHERU
Victor Fu, Univ. Southern California, MIRTHERU
Levi Stanton, CEE / Princeton University, MIRTHERU
- 2012: John Buglione, Villanova, MIRTHERU
Andrew Ortiz, SUNY-Buffalo, MIRTHERU
Kathryn Nicolich, Bucknell University, PCCM REU
Levi Stanton, CEE / Princeton University, PEI intern
Christopher Hamm, CEE / Princeton University, PEI intern
- 2011: Garnet Abrams, GEO / Princeton University, PEI intern
Oshare Mcrae, Vanderbilt University, MIRTHERU
Caitlyn Puzio, Northeastern University, MIRTHERU
- 2010: Kristine Rafferty, Univ. of Notre Dame, MIRTHERU
George Apfelbach, Boston College, PCCM REU
Jeff Schreiber, University of Dayton, MIRTHERU
- 2009: Alex Trevisan, CHM / Princeton University
Kristine Rafferty, Univ. of Notre Dame, MIRTHERU
Elise Pusateri, Rensselaer Polytechnic Institute, PCCM REU
David Tersegno, St. Lawrence University, MIRTHERU
- 2008: David Tersegno, St. Lawrence University, MIRTHERU

High school research advisor:

- 2015: Brancis Leal, Raritan-Bridgewater High School (NJ), YSAP/MIRTHERU
2013: Namoi Pohl, high school student, Morristown (NJ) High School, YSAP/MIRTHERU

- 2012: Joel Martin, Bridgewater-Raritan High School (NJ), YSAP/MIRTHE
Victor Fu, The Peddy School (NJ), MIRTHE
- 2010: Caitlyn Puzio, Pennington High School (NJ), MIRTHE
Marissa Portenti, Bayonne High School (NJ), YSAP/MIRTHE
- 2009: Humaira Admani, William L. Dickinson High School, YSAP/MIRTHE

K-12 teacher research advisor:

2013-2016: Lars Wendt, teacher at Hunterdon Central Regional High School, Flemington, NJ

University Service:

Associate Director of External Partnerships, Andlinger Center for Energy and the Environment, 2016-2019
Chair, SEAS Self-Study: Relationships with External Entities Committee, 2014-2015
Member, Committee on Library and Computing, 201
Undergraduate advisor, Environmental-track majors, Dept. of Civil and Environmental Engineering, 2013-2014
Freshman Advisor, School of Engineering and Applied Sciences, 2013-2014
Coordinator, Dept. of Civil and Environmental Engineering, 2008-2010
Princeton SEAS Leadership Council, panel member, April 18, 2008
Princeton University-China Workshop on Energy and the Environment, panel member, April 18, 2008

Outside Professional Activities:

Chair, Conference on Lasers and Optics A&T 4: Photonic Instrumentation for Energy and Environment, 2014-2016
Scientific Steering Committee, NSF DOWNSTREAM field experiment in 2016 on NSF Gulfstream-V research aircraft (“Dynamics and Observations of the Waveguide: North-South Transport and Rossby wave Excitation over Atlantic Midlatitudes)
EUMETRISPEC, Participating Member, European Spectral Data for Metrology Analyses, 2012-present
Program Committee, Energy and Environment, CLEO: Applications and Technology, 2011-2013
Coordinator, Dept. of Civil and Environmental Engineering, 2008-2010
Princeton SEAS Leadership Council, panel member, April 18, 2008
Princeton University-China Workshop on Energy and the Environment, panel member, April 18, 2008
NSF Facilities Users Workshop, Session Chair and Discussion leader, Upper Tropospheric and Lower Stratospheric Science, Sept. 24-26, 2007
Environmental Technology Advisory Committee, Santa Fe Community College, 2007.
NSF Facilities Users Workshop, Session Chair and Discussion leader, Upper Tropospheric and Lower Stratospheric Science, Sept. 24-26, 2007
Expert Working Group on Turbulence and Thermodynamics, European Fleet for Airborne Research, December 2006 – present
Electricity and Chemistry Working Group, NSF Storm Penetrating Aircraft workshop, October 23-25, 2006, Rapid City, South Dakota
Co-chair, “Dynamics and Chemistry of the Upper Troposphere and Lower Stratosphere, A31G”, AGU Fall Meeting, December 10, 2005
Convener, Organizer, and Chair, Special Session, “Cloud Chemistry and Processing”, Fall AGU Meeting, December 13-17, 2004
Chair, NCAR Advanced Study Program 2000-2001 Seminar Series
Reviewer for *Journal of Geophysical Research-Atmospheres*, *Journal of Geophysical Research-Biogeosciences*, *Geophysical Research Letters*, *Physical Chemistry Chemical Physics*, *Aerosol Science and Technology*, *Journal of Atmospheric and Oceanic Technology*, *Journal of Physical Chemistry*, *Atmospheric Chemistry and Physics*, *Atmospheric Measurement Techniques*, *Sensors*, *Optics Express*, *J. Breath Research* in the past two years; also reviewer for NASA Science Mission Directorate, DOE Biological and Environmental Research, NOAA Atmospheric Composition and Climate program, and NSF Geosciences Directorate proposals in the past two years

Community Service

Director of Mentoring and Program Strategy, Young Science Achievers Program (2008-present), 501c3 non-profit
Member, Board of Directors, Young Science Achievers Program (2008-present), 501c3 non-profit
Transportation Advisory Council, Member, Montgomery Township, New Jersey (2014-present)

Board Member, Montgomery Friends of Open Space (2015-present)

Principal Investigator for Field Experiments:

NSF LTER Kellogg Biological Station, PI for open-path, eddy covariance nitrous oxide sensor (2015-2016)
EPA/NPS Rocky Mountain Nitrogen Study, PI for open-path, eddy covariance ammonia sensor (2015-2016)
NASA DISCOVER-AQ Colorado, PI for Mobile mapping of NH₃/CO/CO₂/CH₄ (2014)
EDF Barnett Shale Methane Emissions Coordinated Campaign, PI for drone-based methane measurements (2013)
NASA DISCOVER-AQ Houston, PI for Mobile mapping of NH₃/CO and greenhouse gas measurements (2013)
CAREBEIJING-North Coastal Plain, PI for Mobile greenhouse gas and air pollutant measurements (2013)
NASA DISCOVER-AQ California, PI for Mobile mapping of NH₃/CO and greenhouse gas measurements (2013)
NASA Southeast Asia Cloud, Climate, Coupling and Composition Regional Study (SEAC4RS), PI for VCSEL hygrometer (NSF-cancelled their participation in 2012)
NSF Deep Convection and Cloud Chemistry (DC3), PI for VCSEL hygrometer (2012)
NSF Tropical Ocean Troposphere Exchange of Reactive Halogen Species and Oxygenated VOCs, PI for VCSEL hygrometer (2012)
NSF Pre-Depression Investigation of Cloud Systems in the Tropics, PI for VCSEL hygrometer (2010)
NOAA Nexus of Climate Change and Air Quality (CalNex 2010), PI for open-path ammonia measurements (2010)
NSF HIAPER Pole-to-Pole Observations, PI for VCSEL hygrometer (2009-2011)
NSF Pre-Depression Investigation of Cloud-systems in the Tropics, PI for VCSEL hygrometer (2010)
NSF Stratosphere-Troposphere Analyses of Regional Transport, PI for VCSEL hygrometer (2008)
AquaVIT International Water Vapour Intercomparison, Karlsruhe, Germany, PI for VCSEL hygrometer (2008)

Professional Organizations:

American Geophysical Union, 1994-2016
Optical Society of America, 2011-2016
American Chemical Society, 2015-2016

Public Relations / Media:

Article, *Daily Princetonian*, “University researchers receive grant from Department of Energy”, Oct. 10, 2016.
Feature, *Optics and Photonics News*, “Air-Quality Monitoring in the Mid-Infrared”, November 2015, Optical Society of America, http://www.osa-opn.org/home/articles/volume_26/november_2015/features/air-quality_monitoring_in_the_mid-infrared/#.VjJAIN5-U0
Feature, *Yale Environment 360*, “On fracking front, a push to reduce leaks of methane”, April 7, 2014, http://e360.yale.edu/feature/on_fracking_front_a_push_to_reduce_leaks_of_methane/2754/
Feature, Princeton Alumni Weekly, “Engineering: Aloft, Zondlo tracks greenhouse gases”, 114 (7), Feb. 5, 2014, <http://paw.princeton.edu/issues/2014/02/05/pages/4049/index.xml>
Feature, *Discovery Research at Princeton*, “Inventions bridge the gap between lab and marketplace”, 2013 issue, November 3, 2013, <https://discovery.princeton.edu/2013/11/03/inventions-bridge-the-gap-between-lab-and-marketplace/>
Press release, NASA, September 25, 2013: “Mobile laboratories measure air quality in Houston”, http://www.nasa.gov/mission_pages/discover-aq/news/mobile-laboratories-measure-air-quality-in-houston/#.UwubMP0vuUM
Feature, NSF GEO Innovation Call Newsletter, <http://www.nsf.gov/geo/innovation/2013-geo-innovation.pdf>
Feature, Princeton homepage, “Researchers' entrepreneurial skills shine at Innovation Forum”, posted March 19, 2013, <http://www.princeton.edu/main/news/archive/S36/36/42153/index.xml?section=topstories>
Feature, *Fondriest Environmental Monitor*, “Mobile air sensor lab takes a California road trip”, February 27, 2013, <http://www.fondriest.com/news/mobile-air-sensor-lab-takes-a-california-road-trip.htm>
Feature, Princeton SEAS homepage, “Launchpad helps blast new teams into business”, <https://www-dept-edit.princeton.edu/engineering/news/archive/?id=9556>
Feature, Princeton homepage, “Fund bridges gap between lab and marketplace”, posted January 24, 2013, <http://www.princeton.edu/main/news/archive/S35/89/52G24/index.xml?section=topstories>
Interview, German Public Radio, on methane emissions from fracking, January 4, 2013 <http://www.dradio.de/dlf/sendungen/forschak/1968450/>
Press release highlighting two papers from the Zondlo group: Miller et al. (field ammonia measurements) and Khan et al. (UAV greenhouse gas sensors) at CLEO 2012 in San Jose, California, May 10, 2012

Morristown Green Sustainability series, “Cloudy World of Climate Change”, April 29, 2010, invited community lecture (story in online version of Newark Star-Ledger, nj.com on April 30, 2010)
 Research highlighted on Princeton University homepage, July 14, 2010
 Research featured in Princeton Alumni Weekly, April 2010, “Nothing Succeeds like Failure”, April 7, 2010
 Research in highlighted in story in EQuad News, “Round-the-world mission puts greenhouse gases in laser focus”, Winter 2010
 NSF 09-01 press release on HIPPO Global field campaign (Jan. 7, 2009) and media advisory (Jan. 27, 2009) that mentioned the PI as part of the field experiment
 MIRTHER REU Summer Outreach story on Princeton University home page, July 14-17, 2008

Peer-reviewed Publications:

53. Sun, K., L. Tao, D.J. Miller, D. Pan, L.M. Golston, **M.A. Zondlo**, R.J. Griffin, H.W. Wallace, Y.J. Leong, M.M. Yang, Y. Zhang, D.L. Mauzerall, and T. Zhu (2016), “Vehicle emissions as an important urban ammonia source in the United States and China”, *Envi. Sci. Technol.*, doi:10.1021/acs.est.6b02805.
52. Tan, X., Y. Huang, M. Diao, A. Bansemer, **M.A. Zondlo**, J.P. DiGangi, R. Volkamer, and Y. Hu (2016), “An assessment of the radiative effects of ice supersaturation based on in-situ observations”, *Geophys. Res. Lett.*, 43, 11039-11047, doi:10.1002/2016GL071144.
51. Eilerman, S.J., J. Peischl, J.A. Neuman, T.B. Ryerson, K.C. Aikin, M.W. Holloway, **M.A. Zondlo**, L.M. Golston, D. Pan, C. Floerchinger, and S. Herndon (2016), “Characterization of ammonia, methane, and nitrous oxide emissions from concentrated animal feeding operations in northeastern Colorado”, *Envi. Sci. Technol.*, 50, 10885-10893, doi:10.1021/acs.est.6b02851.
50. Michel, A.P.M., D.J. Miller, K. Sun, L. Tao, L. Stanton, and **M.A. Zondlo** (2016), “Open path, quantum cascade laser-based sensor for path-integrated, in-situ methane measurements”, *J. Atmospheric and Oceanic Technology*, 33, 2373-2384, doi:10.1175/JTECH-D-16-0024.1
49. Whitburn, S., M. Van Damme, L. Clarisse, S. Bauduin, C.L. Heald, J. Hadji-Lazaro, D. Hurtmans, **M.A. Zondlo**, C. Clerbaux, and P.-F. Coheur (2016), “A flexible and robust neural network IASI-NH₃ retrieval algorithm”, *J. Geophys. Res.-Atmos.*, 121, 6581-6599, doi:10.1002/2016JD024828.
48. Miller, D.J., K. Sun, L. Tao, J.B. Nowak, Z. Liu, and **M.A. Zondlo** (2015), “Ammonia and methane dairy emissions in the San Joaquin Valley of California from individual feedlot to regional-scale plumes”, *J. Geophys. Res.-Atmos.*, 120, 9718-9738, doi:10.1002/2015JD023241.
47. Sun, K., L. Tao, **M.A. Zondlo**, K. Shonkwiler, C. Nash, and J.M. Ham (2015), “Open-path eddy covariance measurements of ammonia fluxes from a beef cattle feedlot”, *Agric. Forest Meteorol.*, 213, 193-202, doi:10.1016/j.agrformet.2015.06.007.
46. Wang, S., J.A. Schmidt, S. Baidar, S. Coburn, B. Dix, T.K. Koenig, E.C. Apel, D. Bowdalo, T.L. Campos, E. Eloranta, M.J. Evans, J.P. DiGangi, **M.A. Zondlo**, R. Gao, J.A. Haggerty, S.R. Hall, R.S. Hornbrook, D.J. Jacob, B. Morley, B.R. Pierce, M. Reeves, P.A. Romashkin, A. ter Schure, and R. Volkamer (2015), “Active and Widespread Halogen Chemistry in the Tropical and Subtropical Free Troposphere”, *Proc. Natl. Acad. Sci.*, 112, 9281-9286, doi:10.1073/pnas.1505142112.
45. Sun, K., D. Li, L. Tao, Z. Zhao, and **M.A. Zondlo** (2015), “Quantifying the influence of random errors in turbulence measurements on scalar similarity in the atmospheric surface layer”, *Boundary Layer Meteorology*, 157, 61-80, doi:10.1007/s10546-015-0047-3.
44. Nathan, B.J., L.M. Golston, A.S. O’Brien, K. Ross, W.A. Harrison, L. Tao, D.J. Lary, D.R. Johnson, A.N. Covington, N.N. Clark, and **M.A. Zondlo** (2015), “Near-field characterization of methane emission variability from a compressor station using a model aircraft”, *Environ. Sci. Technol.*, 49, 7896-7903, doi:10.1021/acs.est.5b00705.

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Manuscripts in review:

D'Alessandro, J.J., M. Diao, C. Wu, X. Liu, M. Chen, H. Morrison, T. Eidhammer, J.B. Jensen, A. Bansemer, M.A. Zondlo, and J.P. DiGangi, "Dynamical conditions of ice supersaturation in convective systems: a comparative analysis between in-situ aircraft observations and WRF simulations", manuscript #2016JD025994, submitted to *J. Geophys. Res.-Atmos.*, Sept. 23, 2016.

Intellectual Property:

Patent:

K. Sun, L. Tao, D. Miller; M.A. Khan, M.A. Zondlo, "Multi-Harmonic Inline Reference Cell for Optical Trace Gas Sensing", United States Patent and Trademark Office, US 8,970,842, March 3, 2015.

Invention disclosures:

M.A. Zondlo, L. Tao, and K. Sun, Invention # 13-2843-1, "Open-Path, Optical Trace Gas Sensor with Integrated Three Dimensional Wind Speed and Temperatures Measurements", Office of Technology Licensing and Intellectual Property, Princeton University, August 6, 2012.

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Significant Presentations:

- M.A. Zondlo, “Role of drones in air quality monitoring and natural gas leak detection”, Symposium on Regional Air Quality, Monitoring, and Urban Sensing in Safety and Security Applications, New York, New York, Oct. 4, 2016 (INVITED).
- M.A. Zondlo, “Ammonia emissions, transport, and deposition downwind of agricultural areas at local to regional scales”, European Geophysical Union General Assembly, Vienna, Austria, April 18, 2016.
- M.A. Zondlo, “Validation of IASI NH₃ columns at the single-pixel scale from airborne- and ground-based measurements”, Infrared Atmospheric Sounding Interferometer Conference, Antibes Juan-Les-Pins, France, April 14, 2016.
- M.A. Zondlo, “Mid-infrared sensor development for quantifying fugitive emissions from gas/oil extraction”, Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany, Dec. 10, 2015 (INVITED).
- M.A. Zondlo, “Laser-based sensors on UAVs for quantifying local emissions of greenhouse gases”, European Geophysical Union General Assembly, Vienna, Austria, April 16, 2015 (INVITED).
- M.A. Zondlo, “Why does commercialization of mid-infrared, environmental sensors lag behind other markets”, MIRTHER Summer Workshop, August 8, 2014 (INVITED).
- M.A. Zondlo, “Ammonia emissions from agricultural and vehicular sources”, 16th Global Emissions Initiative Conference, Boulder, Colorado, June 10, 2014.
- M.A. Zondlo, “Ammonia, automobiles, and agriculture: new insights into precursor emissions of fine particulate matter”, Department of Geosciences seminar, Princeton, New Jersey, March 4, 2014 (INVITED).
- M.A. Zondlo, “Ambient pressure detection to overcome breath ammonia sampling challenges”, Optical Society of America Workshop on Precision Monitoring of Human Metabolism, Princeton, New Jersey, February 17, 2014 (INVITED).
- M.A. Zondlo, “Near-field measurements of CH₄ from the Ponder compression station area”, Environmental Defense Fund Barnett Coordinated Campaign Science Team meeting, Denver, Colorado, January 23, 2014 (INVITED).
- M.A. Zondlo, “Fracking, climate change, and lasers: new tools to reduce fugitive methane emissions”, Laser Focus World Webinar, October 30, 2013 (INVITED).
- M.A. Zondlo, “Shale gas methane emissions from UAV- and vehicle-based systems”, MIRTHER Workshop on Air Monitoring in Energy Extraction, also panelist for discussion, August 9, 2013 (INVITED).
- Panelist, New York City Regional Innovative Node and I-Corps Kickoff Event, July 24, 2013.
- M.A. Zondlo, “From the surface to the stratosphere: microscale processes of cloud formation, air pollutants, and greenhouse gases”, College of Environmental Science and Engineering, Peking University, Beijing, China, July 2, 2013 (INVITED).
- M.A. Zondlo, “Methane emissions from near-field sources using a model electric aircraft”, Environmental Defense Fund Barnett Shale Coordinated Campaign, Richardson, Texas, June 24, 2013 (INVITED).
- M.A. Zondlo, “Measuring water vapor in the UT/LS: Challenges, advances, and outstanding issues”, William E. Heraeus Seminar on "Water Vapor and Ice in the Atmosphere", Bad Honnef, Germany, June 11, 2013 (INVITED).
- M.A. Zondlo, “Primer on laser-based CH₄ sensors”, Environmental Defense Fund Methane Monitoring Workshop, Houston, Texas, June 6, 2013 (INVITED).

- M.A. Zondlo, “Water vapor variability and cirrus cloud formation from NSF/NCAR G-V field campaigns”, HIAPER HALO Workshop, Mainz, Germany, April 16, 2013 (INVITED).
- M.A. Zondlo, “Ammonia emissions and variability through mobile mapping with a suite of chemical tracers”, California Air Resources Board, Sacramento, California, January 31, 2013 (INVITED).
- M.A. Zondlo, “Water vapor variability and cirrus cloud formation from global field experiments”, Department of Geophysical Sciences, University of Chicago, January 11, 2013 (INVITED)
- M.A. Zondlo, “Fugitive methane emissions from gas/oil activities near Dish, Texas”, American Geophysical Union Fall Meeting, San Francisco, California, Dec. 5, 2012.
- M.A. Zondlo, “Atmospheric trace gas sensing: Community needs with respect to spectral line data”, EUMETRISPEC Stakeholder Workshop, Wolfenbüttel, Germany, November 15, 2012 (INVITED).
- M.A. Zondlo, “Overcoming the Sampling Challenges of Ammonia in Exhaled Breath”, International Breath Analysis Meeting, Sonoma, California, October 29, 2012 (INVITED).
- M.A. Zondlo, “Water vapor, ice supersaturation, and stratospheric mixing in TORERO”, TORERO Science Team Mtg. July 24, 2012 (INVITED).
- M.A. Zondlo, “Ice supersaturated regions from global aircraft observations: new insights into cirrus cloud formation”, Department of Chemistry, University of British Columbia, July 19, 2012 (INVITED).
- M.A. Zondlo, “Laser-Based Sensors From the Surface to the Stratosphere: New Insights Into Air Pollution and Global Climate Change”, CMOS Conference on Emerging Technologies, Vancouver, Canada, July 18, 2012 (INVITED).
- M.A. Zondlo, “Compact and lightweight sensors for air quality and greenhouse gas measurements”, EPA Apps and Sensors for Air Pollution (ASAP) Workshop, Research Triangle Park, North Carolina, March 26, 2012 (INVITED).
- M.A. Zondlo, “UAV methane measurements using VCSELs, fast sampling QCLs”, DOE Advanced Research Projects Energy, Workshop on “Ubiquitous methane leak detection through novel sensors and sensing platforms”, Washington, DC, March 29, 2012 (INVITED).
- M.A. Zondlo, “Ice supersaturated regions from global aircraft observations: new insights into cirrus cloud formation”, School of Engineering and Applied Sciences Colloquium in Climate Science (SCiCS), Columbia University, Feb. 23, 2012 (INVITED).
- M.A. Zondlo, “Atmospheric field studies: Atmospheric chemistry field experiments from UAVs to stratospheric aircraft”, 2012 Earth and Planetary Sciences Lecture Series, Massachusetts Institute of Technology, Cambridge, Massachusetts, January 9, 2012 (INVITED).
- M.A. Zondlo, “Quantifying ammonia and nitrous oxide emissions from agricultural activities”, The National Academies Keck Futures Initiative, Ecosystem Services: Charting a Path to Sustainability, Irvine, California, November 11 (INVITED).
- M.A. Zondlo, “Cloud formation in the tropics: insights from HIPPO and PREDICT”, TORERO Science Team Meeting, Boulder, Colorado, November 1, 2011 (INVITED).
- M.A. Zondlo, “Open-path atmospheric detection: new insights into cloud and aerosol formation”, Field Laser Applications in Industry and Research (FLAIR), Murnau, Germany, September 16, 2011 (INVITED).

- M.A. Zondlo, “Low power trace gas sensors for clouds, climate, and air quality”, University of Alaska-Fairbanks, Fairbanks, Alaska, August 23, 2011 (INVITED).
- M.A. Zondlo, “Sensing the Atmosphere”, MIRTHE Summer Workshop, Princeton, New Jersey, August 1, 2011 (INVITED).
- M.A. Zondlo, “Fine-scale ice supersaturated regions observed from airborne campaigns”, Gordon Research Conference on Atmospheric Chemistry, Mount Snow, Vermont, July 23, 2011.
- M.A. Zondlo, “Supersaturations during HIPPO”, HIPPO Science Team Meeting, Boulder, Colorado, March 18, 2011 (INVITED).
- M.A. Zondlo, NASA Sounder Science Team Meeting, “Ice supersaturations with AIRS and NSF G-V VCSEL hygrometer”, Greenbelt, Maryland, Nov. 3, 2010 (INVITED).
- M.A. Zondlo, “Nitrous oxide emissions with a 4.54 μm quantum cascade laser”, USDA Air Quality Project Directors Meeting, Amarillo, Texas, August 23, 2010 (INVITED).
- M.A. Zondlo, “Characteristics of ice supersaturation in the upper troposphere”, Department of Atmospheric Sciences, Texas A&M University, College Station, Texas, Aug. 3, 2010 (INVITED).
- D.J. Miller and M.A. Zondlo, “Open-path ammonia measurements with a 9 micron quantum cascade laser”, CLEO-QELS, San Jose, California, May 20, 2010.
- Zondlo, M.A. and M. Diao, “Ice supersaturations during HIPPO Global”, HIPPO Science Team Meeting, May 25, 2010 (INVITED).
- Zondlo, M.A., M. Diao, and L. Jumbam, “Climatologies of ice supersaturated regions”, NOAA GFDL, Princeton, New Jersey, December 2, 2009 (INVITED).
- Zondlo, M.A., L. Jumbam, M. Diao, J. Sheffield, and E.F. Wood, “Comparison of water vapor from AIRS and VCSEL hygrometer during START08/HIPPO Global”, NASA Sounder Science Team Meeting, Greenbelt, Maryland, Oct. 14, 2009.
- Zondlo, M.A., “Laser spectroscopy for understanding air quality and global climate change”, CEE Brown Bag Seminar, Princeton, New Jersey, Sept. 25, 2009.
- Zondlo, M.A., “When clouds should be present but are not: the puzzle of ice supersaturation”, Dept. of Environmental Sciences, Rutgers University, New Brunswick, New Jersey, Sept. 18, 2009 (INVITED).
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- Zondlo, M.A., Tersegno, D., and M. Diao, “New measurement technologies for understanding cloud microphysics and aerosol chemistry”, School of Engineering and Applied Sciences and NOAA GFDL workshop, Princeton, New Jersey October 29, 2008 (INVITED).

- Zondlo, M.A., “Atmospheric laser-based spectroscopy”, Tutorial for the MIRTHE summer workshop, Baltimore, Maryland, August 4, 2008 (INVITED).
- Zondlo, M.A., “Low power sensors in atmospheric research and the need for low power communication”, Supélec-Princeton workshop on Wireless Sensors and the Environment, June 23, 2008.
- Zondlo, M.A., M.E. Paige, J.A. Silver, and S.M. Massick, “NSF G-V VCSEL hygrometer during AquaVIT: description, performance, and calibrations”, Aqua-VIT Data Workshop, Zurich, Switzerland, May 29, 2008.
- Zondlo, M.A., “Global field experiments using laser-based sensors onboard the NSF G-V research aircraft”, IBM-Princeton Energy and the Environment Day, Princeton, New Jersey, May 23, 2008.
- Zondlo, M.A., “Ice supersaturations: how high can they be?”, NOAA Geophysical Fluid Dynamics Laboratory, Aerosol Pause Café, Princeton, New Jersey, April 28, 2008.
- Zondlo, M.A., “Laser spectroscopy from the laboratory to the stratosphere: new instrumentation for understanding global climate change”, PRISM/PCCM/MIRTHE/CNSA University and Industry Annual Research Symposium, March 17, 2008
- Zondlo, M.A., D.S. Bomse, and J.A. Silver, “Assessment of aircraft-based water vapor instruments”, The Boeing Company, Everett, Washington, March 5, 2008 (INVITED).
- Zondlo, M.A., “Toward a new understanding of cirrus cloud and aerosol chemistry with laser-based sensors”, MIRTHE Industrial Advisory Board, January 28, 2008.