Dr. David W. Fahey

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NOAA Chemical Sciences Laboratory
National Oceanic and Atmospheric Administration (NOAA)
325 Broadway R/CSL l Boulder, Colorado 80305 l United States

EXPERTISE

- Leadership and management of research teams in the laboratory and in airborne field campaigns.
- Written and oral communication of atmospheric science results to experts and non-experts.
- Evaluation of scientific results for use in national and international assessments of contemporary atmospheric issues, including climate change and stratospheric ozone depletion.
- *In situ* measurements of trace gases and aerosols in the troposphere and stratosphere using airborne instrumentation, with emphases on black carbon aerosol, ozone, water vapor, and reactive nitrogen gases.
- Interpretation of *in situ* observations of gas and aerosol abundances to address climate and air quality issues in the troposphere and stratosphere.

EXPERIENCE

Director, NOAA Chemical Sciences Laboratory — December 2014 – present
Boulder, CO

Acting Director, Chemical Sciences Division — January 2014 – December 2014
NOAA Earth System Research Laboratory, Boulder, CO

Senior Scientist, Climate & Climate Change — February 2013 - January 2014
Atmospheric Composition and Chemical Processes Group
Program Leader (2008 – present)
NOAA Earth System Research Laboratory, Boulder, CO

Research Physicist — September 1982 – February 2013
Atmospheric Composition and Chemical Processes Group
Program Leader (2008 – present)
NOAA Earth System Research Laboratory, Boulder, CO

Research Associate — 1981 - 1982
Cooperative Institute for Research in Environmental Sciences
University of Colorado, Boulder, CO

National Research Council Postdoctoral Research Associate — 1979 - 1981
Ion Chemistry Program, NOAA Aeronomy Laboratory, Boulder, CO

EDUCATION

Ph.D. in Physics, 1979, Missouri University of Science and Technology (formerly University of Missouri), Rolla, Missouri
B.A. in Physics, 1975, University of Wisconsin, Madison, Wisconsin

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HONORS, RESPONSIBILITIES, and PROFESSIONAL ASSOCIATIONS

Chair, Advisory Committee, 2019 Dan David Prize for *Combatting Climate Change*, December 2018.
Honorary Doctor of Science Degree from the University of Wisconsin-Madison, 11 May 2018.
Ozone Awards 2017, Montreal Protocol Ozone Secretariat, Scientific Leadership Award to Guus Velders' Team, 24 November 2017.
Visiting Professor, Centre for Aviation, Transport and the Environment, Manchester Metropolitan University, Manchester, UK, 2017 - present.
Co-Chair of the Scientific Assessment Panel of the Montreal Protocol on Substances that Deplete the Ozone Layer, November 2015 - present.
2013 Distinguished Alumni Award, Physics Department, University of Wisconsin, Madison, WI, 3 May 2013.
Co-recipient of the U. S. Department of Commerce Bronze Medal for Superior Federal Service, January 2013, for 'For the successful demonstration of the Global Hawk Unmanned Aircraft Systems for NOAA's Climate Goal.'
Colorado Governor's Award for High-Impact Research, Member of a team of 34 scientists honored "for providing exceptional scientific service, in a time of urgent national need, by assessing the potential air quality risks posed by the 2010 oil spill

in the Gulf of Mexico, and calculating independent estimates of the oil leak rate and analyses of the fate of the leaked oil in the environment," 2012.

Federal Player of the Week. Washington Post and Partnership for Public Service, Washington, DC, 9 March 2010.

Graphical System Design Achievement Award (Wireless Category), Co-recipient with Laurel Watts, Steven Ciciora, Troy Thornberry, and Ru-Shan Gao, National Instruments (NI) Inc., for monitoring atmospheric ozone on the Global Hawk Unmanned Aeronautical Vehicle with the NI CompactRIO, 2009.

Recipient of the 2009 Dr. Daniel L. Albritton Outstanding Science Communicator Award from the NOAA Office of Oceanic and Atmospheric Research.

Co-recipient, NASA Group Achievement Awards:
• For outstanding accomplishments by the successful Mid-latitude Airborne Cirrus Properties Experiment (MACPEX) to better understand the role of cirrus clouds in climate models, 2012.
• For outstanding accomplishments for NASA and Earth science during the successful Global Hawk Pacific Mission (GloPac), 2011.
• For outstanding achievements in atmospheric science during the Tropical Compositions, Cloud, and Climate Coupling (TC4) Mission in Costa Rica and Panama, 2008.

Co-recipient of the 2008 Level II Scientific and Technological Achievement Award (STAA) from the U.S. Environmental Protection Agency (EPA) for Synthesis and Communication of Stratospheric Ozone and Climate Science, February 2009.

Co-recipient of the 2008 Stratospheric Ozone Protection Award from the U.S. Environmental Protection Agency (EPA) to the Climate Co-Benefits of the Montreal Protocol Protection Team for 'Motivating action on climate.'

Recipient of the 2008 Stratospheric Ozone Protection Award from the U.S. Environmental Protection Agency (EPA) for 'Outstanding scientific contributions to stratospheric ozone protection.'

Co-recipient of the NOAA Administrator's Award in July 2008 for 'Outstanding dedication to developing U.S. Climate Change Science Program (CCSP) Synthesis & Assessment Products integrating climate research for decision support.'

Co-author of the 2007 climate science assessment of the Intergovernmental Panel on Climate Change (IPCC), that shared the 2007 Nobel Peace Prize with Albert Arnold (Al) Gore Jr. 'For their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change.'

Co-recipient of the U. S. Department of Commerce Bronze Medal for Superior Federal Service, April 2008, for 'For leadership in planning, preparing, and reviewing the 2006 scientific state-of-understanding update on the ozone layer for the Montreal Protocol.'

Best New Paper on a Montreal Protocol Related Topic: Science Category, Awarded by the United Nations Environment Programme in September 2007 for "The importance of the Montreal Protocol in protecting climate," by Velders *et al.*, *Proc. Nat. Acad. Sci,* 2007.

Co-recipient of the U. S. Department of Commerce Bronze Medal for Superior Federal Service, May 2007, for 'Demonstrating the usefulness of unmanned aircraft systems in accomplishing NOAA's mission, including operation and research goals.'

Highly Cited Researcher, ISI Web of Knowledge (ISI-Thomson Scientific, Philadelphia, PA), 2002, one of the top 100 cited researchers in Geosciences between 1980 and 2000.

Recipient of the U. S. Department of Commerce Silver Medal for Meritorious Federal Service, December 1996, for 'Leadership in making the first direct measurements of supersonic aircraft emissions and analyzing the atmospheric implications.'

Recipient of the American Meteorological Society Henry G. Houghton Award, January 1996, for 'Outstanding contributions to our understanding of the ozone layer through airborne observations and theoretical analyses.'

Outstanding Scientific Paper Award, Office of Oceanic and Atmospheric Research, National Oceanic and Atmospheric Administration: 1995, 1997, 1998, 2002, 2005.

Kavli Frontiers of Science Symposium Speaker, US National Academy of Sciences, Topic: *Atmospheric Science: Ozone Holes: Causes and Effects of Polar Ozone Depletion*, Title: *The Science of Ozone Depletion: Results from Aircraft Measurements in the Polar Stratospheres,* Irvine, CA, 5-7 November 1992.

Distinguished Authorship Award, Office of Oceanic and Atmospheric Research, National Oceanic and Atmospheric Administration, October 1990, November 1990.

National Research Council Research Associateship, 1979-1980.

Member of the Impacts and Science Group (ISG) of the Committee on Aviation Environmental Protection (CAEP) of the International Civil Aviation Organization (ICAO), July 2011 – present.

Member of the "Montreal Protocol Who's Who" listing: http://www.theozonehole.com/whowho.htm, March 2013.

Member of the Scientific Steering Group of the Stratospheric Processes and their Role in Climate (SPARC) program, 2007 – 2013.

Member of the Chemistry Climate Model Validation (CCMVal) working group, 2003 – 2012.

Member of the NOAA Unmanned Aircraft System (UAS) Team and High-Altitude Long-Endurance (HALE) Working Group, 2008 - 2010.
Member of the International Ozone Commission (IO_3C), July 2008 – September 2016.
Member of the Observing Facilities Assessment Panel (OFAP), National Center for Atmospheric Research, Boulder, CO, November 2007 – May 2011.
U.S. Congressional Hearing Witness, Committee on Transportation and Infrastructure, Subcommittee on Aviation, Chaired by Rep. Costello, Topic: Aviation and the Environment: Emissions, 6 May 2008.
Chair, Atmospheric Chemistry Gordon Research Conference, 4 – 9 September 2005, Big Sky, MT.
Associate Editor, Journal of Geophysical Research-Atmospheres, American Geophysical Union, 1997-2001.
Editorial Board, Journal of Atmospheric Chemistry, Kluwer Academic Publishers, Dordrecht, The Netherlands, 1994 – 2008.

Fellow of the Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, Colorado, April 2003 - September 2017. CIRES Committee responsibilities: Careertrack (2003), Careertrack Guidelines, Chair (2004), New Fellows (2005), Visiting Fellows (2006), Fellows Reappointment (2007), Innovative Research Program (2012).
Fellow of the American Geophysical Union, 2002, for 'Elucidating the role of nitrogen oxides in the stratosphere via field measurements and interpretations.'
Member, American Physical Society, 1978 - present.
Member, American Geophysical Union, 1991 – present.
Member, American Meteorological Society, May 2016 to present.

AIRBORNE SCIENCE RESPONSIBILITIES

Mission Science Group, NASA Atmospheric Tomography Mission (ATom), 2015-2019.
Co-Platform Scientist for the NASA Global Hawk Unmanned Aircraft System (UAS) in the NASA Airborne Tropical TRopopause Experiment (ATTREX), 2010 - 2015.
Co-Project Scientist for the NASA Global Hawk Pacific (GloPac) Mission using the NASA Global Hawk Unmanned Aircraft System (UAS), March - April 2010.
Co-Referee for the AquaVIT-1 ground-based intercomparison of airborne water-vapor instruments at the AIDA test chamber at the Institute for Meteorology and Climate Research, Forschungszentrum Karlsruhe, Karlsruhe, Germany, October 2007; Member of the Organizing Committee for AquaVIT-2 in April 2013.
Co-Project Scientist for the NOAA UAV Flight Demonstration Project in April-May 2005 involving the Altair Unmanned Aerial Vehicle (UAV) of General Atomics Aeronautical Systems, Inc.
Co-Project Scientist for the NASA Aura Validation Experiment (AVE) campaigns in January and October-November 2004, June 2005, and January-February 2006 with the NASA WB-57F high-altitude aircraft.
Co-Project Scientist for the 1997 Photochemistry of Ozone Loss in the Arctic Region in Summer (POLARIS) campaign with the NASA ER-2 high-altitude aircraft sponsored by NASA.

Principal Investigator for *in situ* nitric acid (HNO_3) and/or hydrochloric acid (HCl) measurements on the NASA WB-57F high-altitude aircraft in the following NASA campaigns:

2004 - 2006	Aura Validation Experiment Campaigns (AVE)
July 2002	Cirrus Regional Study of Tropical Anvils and Cirrus Layers-Florida Area Cirrus Experiment (CRYSTAL/FACE)
Sept. 1999	Atmospheric Chemistry of Combustion Emissions Near the Tropopause (ACCENT)

Principal Investigator for *in situ* reactive nitrogen measurements on the NASA ER-2 high-altitude aircraft in the following NASA campaigns:

1999-2000	SAGE III Ozone Loss and Validation Experiment (SOLVE)
1995	Stratospheric Tracers of Atmospheric Transport (STRAT)
1994	Airborne Southern Hemisphere Ozone Experiment/Measurements for Assessing the Effects of Stratospheric Aircraft (ASHOE/MAESA)
1992-1993	Stratospheric Photochemistry, Aerosols and Dynamics Expedition (SPADE)
1991-1992	Second Airborne Arctic Stratospheric Expedition (AASE-II)
1989	Airborne Arctic Stratospheric Expedition (AASE)
1987	Airborne Antarctic Ozone Experiment (AAOE)
1986-1987	Stratosphere Troposphere Exchange Project (STEP)

NATIONAL and INTERNATIONAL ASSESSMENT PARTICIPATION

Scientific Steering Committee Member for the Scientific Assessment of Ozone Depletion: 2018, Global Ozone Research and Monitoring Project - Report No. 58, 588 pp., World Meteorological Organization, Geneva, Switzerland, 2018.

Lead author or co-author of '*20 Questions and Answers about the Ozone Layer*, the outreach component of the Scientific Assessment of Ozone Depletion, Global Ozone Research and Monitoring Project, World Meteorological Organization, Geneva, Switzerland, 2018, 2014, 2010, 2006, 2002.

Coordinating Lead Author (with D. Wuebbles and K. Hibbard) of the Climate Science Special Report (CSSR) of the US 4th National Climate Assessment, 2016-2017.

Lead author of Aviation and Climate: State of the Science (white papers), Impacts and Science Group (ISG) of the Committee on Aviation Environmental Protection (CAEP) of the International Civil Aviation Organization (ICAO), November 2012 and November 2015.

Co-Lead Author of Chapter 3, '*Future ozone and its Impact on Surface UV*,' and Co-Coordinating Lead Author of '*20 Questions and Answers about the Ozone Layer: 2010 Update*, Scientific Assessment of Ozone Depletion: 2010, Global Ozone Research and Monitoring Project – Report No. 52, World Meteorological Organization, Geneva, 2011.

Coauthor of Chapter 4, *How Do Climate Change and Stratospheric Ozone Loss Interact?*, in the U.S. Climate Change Science Program (CCSP) Synthesis and Assessment Product 2.4, Trends in Emissions of Ozone-Depleting Substances, Ozone Layer Recovery, and Implications for Ultraviolet Radiation Exposure, November 2008.

Coauthor of Chapter 6, '*The ozone layer in the 21st century*,' and Lead Author of '*20 Questions and Answers about the Ozone Layer: 2006 Update*; Scientific Assessment of Ozone Depletion: 2006, Global Ozone Research and Monitoring Project – Report No. 50, World Meteorological Organization, Geneva, 2007.

Lead Author of Chapter 2, *Changes in Atmospheric Constituents and in Radiative Forcing*, in Climate Change 2007: The Physical Science Basis, Working Group I, Intergovernmental Panel on Climate Change, 2007.

Coordinating Lead Author of '*Aviation-produced aerosols and cloudiness*', Chapter 3, Aviation and the Global Atmosphere, Intergovernmental Panel on Climate Change, May 1999.

Participating author in the 1995 Scientific Assessment of the Atmospheric Effects of Stratospheric Aircraft, National Aeronautics and Space Administration, NASA Reference Publication 1381, November 1995.

Lead Author of '*Atmospheric processes responsible for the observed changes in ozone: Polar ozone*', Chapter 3, Scientific Assessment of Ozone Depletion: 1994, Global Ozone Research and Monitoring Project, Report No. 37, World Meteorological Organization, Geneva, 1995.

NATIONAL PANEL PARTICIPATION

Committee on Atmospheric Chemistry, Board on Atmospheric Sciences and Climate, National Research Council, 2000-2001. Published report: *Global Air Quality: An Imperative for Long-Term Observational Strategies*, M. M. Molina (Chair), J. H. Seinfeld (Vice-Chair).

RECENT INVITED PRESENTATIONS

Earth Observations & Modeling for Decision Making, Course lecture in ATMS 491: Climate and Weather Policy: Building Capacity for Urban Sustainability at the University of Illinois-Champaign-Urbana, Champaign-Urbana, Illinois, 4 March 2020

Future changes to stratospheric composition and their impacts, American Meteorological Society Meeting, Middle Atmosphere Symposium, Boston, Massachusetts, 14 January 2020

Climate intervention: A scientific perspective, NOAA Chemical Sciences Laboratory Seminar, 23 January 2020

A Human Forest in New York City and Implications on Urban Air Quality: Are urban terpene emissions from vegetation or people?, Summary presentation of CSL research at the Advisory Board Meeting of International Joint Laboratory of Regional Pollution Control (IJRC), Peking University, Beijing, China, 7 September 2019

Improving our knowledge of the climate system with observations, DLR-Climate Change Conference 2018: Atmospheric Research for Understanding and Mitigating Climate Change, Cologne, Germany, 17 - 19 April 2018

PEER-REVIEWED PUBLICATIONS

Over 260 peer-reviewed publications with over 18000 citations and Hirsch index of 69 (Web of Science, Researcher ID: G-4499-2013, December 2020) (** indicates 48 papers with more than 100 citations)

A. Principal Publications as Lead Author

Aviation and climate change: A scientific perspective
David W. Fahey and David S. Lee
Carbon and Climate Law Review, 2, 97-104, 2016.

Twenty Questions and Answers About the Ozone Layer: 2014 Update
Michaela I. Hegglin (Lead Author), David. W. Fahey, Mack McFarland, Stephen A. Montzka, and Eric R. Nash
Scientific Assessment of Ozone Depletion: 2014, Report No. 55, World Meteorological Organization, Geneva, Switzerland, 2015.

The AquaVIT-1 intercomparison of atmospheric water vapor measurement techniques
D. W. Fahey, R. -S. Gao, O. Möhler, H. Saathoff, C. Schiller, V. Ebert, M. Krämer, T. Peter, N. Amarouche, L. M. Avallone, R. Bauer, Z. Bozóki, L. E. Christensen, S. M. Davis, G. Durry, C. Dyroff, R. L. Herman, S. Hunsmann, S. M. Khaykin, P. Mackrodt, J. Meyer, J. B. Smith, N. Spelten, R. F. Troy, H. Vömel, S. Wagner, F. G. Wienhold
Atmospheric Measurement Techniques, 7, 3177–3213, doi:10.5194/amt-7-3177-2014, 2014.

The Montreal Protocol Protection of Ozone and Climate
David W. Fahey
Theoretical Inquires in Law, 14, 21 - 42, DOI:10.1515/til-2013-004*,* 2013.

Twenty questions and answers about ozone depletion: 2010 Update
D. W. Fahey and M. I. Hegglin, Coordinating Lead Authors
Scientific Assessment of Ozone Depletion: 2006, Global Ozone Research and Monitoring Project – Report No. 52, 516 pp., World Meteorological Organization, Geneva, Switzerland, 2011.

Twenty questions and answers about ozone depletion: 2006 Update
D. W. Fahey, Lead Author
Scientific Assessment of Ozone Depletion: 2006, Global Ozone Research and Monitoring Project – Report No. 50, 572 pp., World Meteorological Organization, Geneva, Switzerland, 2007.

Altair unmanned aircraft system achieves demonstration goal
D. W. Fahey, J. H. Churnside, J. W. Elkins, A. J. Gasiewski, K. H. Rosenlof, S. Summers, M. Aslaksen, T. A. Jacobs, J. D. Sellars, C. D. Jennison, L. C. Freudinger, M. Cooper
Eos Transactions, American Geophysical Union, 87, No. 20, pp. 197 and 201, 2006.

Twenty questions and answers about ozone depletion
D. W. Fahey, Lead Author
Scientific Assessment of Ozone Depletion: 2002, Global Ozone Research and Monitoring Project, – Report No. 47, 498 pp., World Meteorological Organization, Geneva, Switzerland, 2003.

**The detection of large HNO_3-containing particles in the winter Arctic stratosphere
D. W. Fahey, R. S. Gao, K. S. Carslaw, J. Kettleborough, P. J. Popp, M. J. Northway, J. C. Holecek, S. J. Ciciora, R. J. McLaughlin, T. L. Thompson, R. H. Winkler, D. G. Baumgardner, B. Gandrud, P. O. Wennberg, S. Dhaniyala, K. McKinney, Th. Peter, R. J. Salawitch, T. P. Bui, J. W. Elkins, C. R. Webster, E. L. Atlas, H. Jost, J. C. Wilson, R. L. Herman, A. Kleinböhl, M. von König
Science, 291, 1026-1031, 2001.

Ozone destruction and production rates between spring and autumn in the Arctic stratosphere
D. W. Fahey, R. S. Gao, L. A. Del Negro, E. R. Keim, S. R. Kawa, R. J. Salawitch, P. O. Wennberg, T. F. Hanisco, E. J. Lanzendorf, K. K. Perkins, S. A. Lloyd, W. H. Swartz, M. H. Proffitt, J. J. Margitan, J. C. Wilson, R. M. Stimpfle, R. C. Cohen, C. T. McElroy, C. R. Webster, M. Loewenstein, J. W. Elkins, T. P. Bui
Geophysical Research Letters 27, 2605-2608, 2000.

Summer in the stratosphere
D. W. Fahey and A. R. Ravishankara
Science 285, 208-210, 1999.

Aviation-produced aerosols and cloudiness
D. W. Fahey and U. Schumann (Coordinating Lead Authors), S. Ackerman, P. Artaxo, O. Boucher, M. Y. Danilin, B. Kärcher, P. Minnis, T. Nakajima, O. B. Toon
IPCC Special Report on Aviation and the Global Atmosphere, Cambridge University Press, Cambridge, UK, May 1999.

In situ observations of NO_y, O_3, and the NO_y/O_3 ratio in the lower stratosphere
D. W. Fahey, S. G. Donnelly, E. R. Keim, R. S. Gao, R. C. Wamsley, L. A. Del Negro, E. L. Woodbridge, M. H. Proffitt, K. H. Rosenlof, M. K. W. Ko, D. K. Weisenstein, C. J. Scott, C. Nevison, S. Solomon, K. R. Chan
Geophysical Research Letters 23, 1653-1656, 1996.

**Emission measurements of the Concorde supersonic aircraft in the lower stratosphere
D. W. Fahey, E. R. Keim, K. A. Boering, C. A. Brock, J. C. Wilson, S. Anthony, T. F. Hanisco, P. O. Wennberg, R. C. Miake-Lye, R. J. Salawitch, N. Louisnard, E. L. Woodbridge, R. S. Gao, S. G. Donnelly, R. Wamsley, L. A. Del Negro, B. C. Daube, S. C. Wofsy, C. R. Webster, R. D. May, K. K. Kelly, M. Loewenstein, J. R. Podolske, K. R. Chan
Science 270, 70-74, 1995.

In situ observations in aircraft exhaust plumes in the lower stratosphere at mid-latitudes
D. W. Fahey, E. R. Keim, E. L. Woodbridge, R. S. Gao, K. A. Boering, B. C. Daube, S. C. Wofsy, R. P. Lohmann, E. J. Hintsa, A. E. Dessler, C. R. Webster, R. D. May, C. A. Brock, J. C. Wilson, P. O. Wennberg, R. C. Cohen, R. C. Miake-Lye, R. C. Brown, J. M. Rodriguez, M. Loewenstein, M. H. Proffitt, R. M. Stimpfle, S. Bowen, K. R. Chan
Journal of Geophysical Research 100, 3065-3074, 1995.

Atmospheric processes responsible for the observed changes in ozone (Part 2): Polar ozone (Chapter 3)
D. W. Fahey (Lead Author), G. Braathen, D. Cariolle, Y. Kondo, W. A. Matthews, M. J. Molina, J. A. Pyle, R. B. Rood, J. M. Russell III, U. Schmidt, D. W. Toohey, J. W. Waters, C. R. Webster, S. C. Wofsy
WMO, '*Scientific Assessment of Ozone Depletion: 1994*,' Global Ozone Research and Monitoring Project, Report No. 37, World Meteorological Organization, Geneva, 1995.

***In situ* measurements constraining the role of sulphate aerosols in mid-latitude ozone depletion
D. W. Fahey, S. R. Kawa, E. L. Woodbridge, P. Tin, J. C. Wilson, H. H. Jonsson, J. E. Dye, D. Baumgardner, S. Borrmann, D. W. Toohey, L. M. Avallone, M. H. Proffitt, J. Margitan, M. Loewenstein, J. R. Podolske, R. J. Salawitch, S. C. Wofsy, M. K. W. Ko, D. E. Anderson, M. R. Schoeberl, K. R. Chan
Nature 363, 509-514, 1993.

Polar Stratospheric Clouds
D. W. Fahey and S. R. Kawa
Encyclopedia of Earth System Science, Volume 3, Academic Press, Inc., 1992.

**A diagnostic for denitrification in the winter polar stratospheres
D. W. Fahey, S. Solomon, S. R. Kawa, M. Loewenstein, J. R. Podolske, S. E. Strahan, K. R. Chan
Nature 345, 698-702, 1990.

**Observations of denitrification and dehydration in the winter polar stratospheres
D. W. Fahey, K. K. Kelly, S. R. Kawa, A. F. Tuck, M. Loewenstein, K. R. Chan, L. E. Heidt
Nature 344, 321-324, 1990.

Polar stratospheric clouds
D. W. Fahey and S. R. Kawa
Encyclopedia of Earth System Science (Academic Press, San Diego, CA) 3, 661-672, 1992.

Nitric oxide measurements in the Arctic winter stratosphere
D. W. Fahey, S. R. Kawa, K. R. Chan
Geophysical Research Letters 17, 489-492, 1990.

***In situ* measurements of total reactive nitrogen, total water, and aerosol in polar stratospheric clouds in the Antarctic stratosphere
D. W. Fahey, K. K. Kelly, G. V. Ferry, L. R. Poole, J. C. Wilson, D. M. Murphy, M. Loewenstein, K. R. Chan
Journal of Geophysical Research 94, 11299-11315, 1989.

Measurements of nitric oxide and total reactive odd-nitrogen in the Antarctic stratosphere: Observations and chemical implications
D. W. Fahey, D. M. Murphy, K. K. Kelly, M. K. W. Ko, M. H. Proffitt, C. S. Eubank, G. V. Ferry, M. Loewenstein, K. R. Chan
Journal of Geophysical Research 94, 16665-16681,1989.

**Reactive nitrogen species in the troposphere: Measurements of NO, NO_2, HNO_3, particulate nitrate, peroxyacetyl nitrate (PAN), O_3, and total reactive odd nitrogen (NO_y) at Niwot Ridge, Colorado
D. W. Fahey, G. Hübler, D. D. Parrish, E. J. Williams, R. B. Norton, B. A. Ridley, H. B. Singh, S. C. Liu, F. C. Fehsenfeld
Journal of Geophysical Research 91, 9781-9793, 1986.

**Evaluation of a catalytic reduction technique for the measurement of total reactive odd-nitrogen NO_y in the atmosphere
D. W. Fahey, C. S. Eubank, G. Hübler, F. C. Fehsenfeld
Journal of Atmospheric Chemistry 3, 435-468, 1985.

A calibrated source of N_2O_5
D. W. Fahey, C. S. Eubank, G. Hübler, F. C. Fehsenfeld
Atmospheric Environment 19, 1883-1890, 1985.

B. Publications with Lead Authors from the Atmospheric Composition and Chemical Processes Group and others in the NOAA Chemical Sciences Laboratory and former NOAA Aeronomy Laboratory

Current and former CIRES Research Associates and Bachelor's students: J. Ballard, S. G. Donnelly, C. S. Eubank, R. S. Gao, J. Holecek, G. Hübler, S. R. Kawa, E. R. Keim, T. P. Marcy, M. Markovic, D. M. Murphy, J. A. Neuman, A. E. Perring, P. J. Popp, A. W. Rollins, J. P. Schwarz, J. R. Spackman, Hagen Telg, T. D. Thornberry, R. C. Wamsley, L. A. Watts, E. L. Woodbridge

Former CIRES graduate students: L. A. Del Negro, M. J. Northway (in collaboration with Prof. Margaret Tolbert of the University of Colorado, Boulder)

The role of sulfur dioxide in stratospheric aerosol formation evaluated using in-situ measurements in the tropical lower stratosphere
A. W. Rollins, T. D. Thornberry, L. A. Watts, P. Yu, K. H. Rosenlof, M. Mills, E. Baumann, F. R. Giorgett, T. V. Bui, M. Höpfner, K. A. Walker, C. Boone, P. F. Bernath, P. R. Colarco, P. A. Newman, D. W. Fahey, and R. S. Gao
Geophysical Research Letters, 44, DOI: 10.1002/2017GL072754, 2017.

Fluorescence calibration method for single-particle aerosol fluorescence instruments
Ellis Shipley Robinson, Ru-Shan Gao, Joshua P. Schwarz, David W. Fahey, and Anne E. Perring
Atmospheric Measurement Technique, 10, 1755–1768, 2017, doi:10.5194/amt-10-1755-2017.

In situ measurements of water uptake by black carbon-containing aerosol in wildfire plumes
Anne E. Perring, Joshua P. Schwarz, Milos Z. Markovic, David W. Fahey, Jose L. Jimenez, Pedro Campuzano-Jost, Brett D. Palm, Armin Wisthaler, Tomas Mikoviny, Glenn Diskin, Glen Sachse, Luke Ziemba, Bruce Anderson, Taylor Shingler, Ewan Crosbie, Armin Sorooshian, Robert Yokelson, Ru-Shan Gao
Journal of Geophysical Research-Atmospheres, 122, 1086–1097, doi:10.1002/2016JD025688, 2017.

Observational constraints on the efficiency of dehydration mechanisms in the tropical tropopause layer
A. W. Rollins, T. D. Thornberry, R. S. Gao, S. Woods, R. P. Lawson, T. P. Bui, E. J. Jensen, D. W. Fahey
Geophysical Research Letters, 43, 2912-2918, 2016, https://doi.org/10.1002/2016GL067972.

Instrumentation and measurement strategy for the NOAA SENEX aircraft campaign as part of the Southeast Atmosphere Study 2013
Carsten Warneke, et al.
Atmospheric Measurement Technique, 9, 3063-3093, 2016, https://doi.org/10.5194/amt-9-3063-2016.

Global atmospheric response to emissions from a proposed reusable space launch system
Erik J. Larson, R.W. Portmann, K. H. Rosenlof, D.W. Fahey, J. S. Daniel, and M. N. Ross
Earth's Future, 4, doi:10.1002/2016EF000399, 2016.

A laser-induced fluorescence instrument for aircraft measurements of sulfur dioxide in the upper troposphere and lower stratosphere
Andrew W. Rollins, Troy D. Thornberry, Steven J. Ciciora, Richard J. McLaughlin, Laurel A. Watts, Thomas F. Hanisco, Esther Baumann, Fabrizio R. Giorgetta, Thaopaul V. Bui, David W. Fahey, Ru-Shan Gao
Atmospheric Measurement Technique, 9, 4601–4613, 2016, doi:10.5194/amt-9-4601-2016.

A light-weight, high-sensitivity particle spectrometer for PM2.5 aerosol measurements
R.S. Gao, H. Telg, R.J. McLaughlin, S. J. Ciciora, L.A. Watts, M. S. Richardson, J.P. Schwarz, A.E. Perring, T.D. Thornberry, A.W. Rollins, M.Z. Markovic, T. Bates, J.E. Johnson, D.W. Fahey
Aerosol Science and Technology, 50, 88-99, DOI: 10.1080/02786826.2015.1131809, 2016.

Persistent water-nitric acid condensate with saturation water vapor pressure greater than hexagonal ice
Ru-Shan Gao, Tomasz Gierczak, Troy D. Thornberry, Andrew W. Rollins, James B. Burkholder, Hagen Telg, Christiane Voigt, Thomas Peter, and David W. Fahey
Journal of Physical Chemistry A, 120, 1431−1440, DOI: 10.1021/acs.jpca.5b06357, 2015.
James G. Anderson Festschrift Special Issue

Technique and theoretical approach for quantifying the hygroscopicity of black-carbon-containing aerosol using a single particle soot photometer
J. P. Schwarz, A. E. Perring, M. Z. Markovic, R. S. Gao, S. Ohata, J. Langridge, D. Law, R. McLaughlin, and D. W. Fahey
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