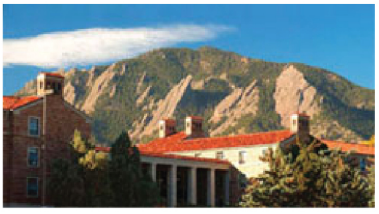
NOAA Earth System Research Laboratory
Chemical Sciences Division
Boulder, Colorado

Supporting Information
Chemical Sciences Division Review
2008—2014

March 30—April 1, 2015

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

CIRES



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Supporting Information
Chemical Sciences Division Review
2008—2014

This document presents information and data in support of the review of the Chemical Sciences Division covering the period 2008 – 2014. The document was developed and edited by Christine A. Ennis with input from John S. Daniel, Cathy Burgdorf Rasco, Debra Dailey-Fisher, Libby Samuelson, Jeanne S. Waters, and the scientific staff of CSD.

March 2015

Contents

[Information is for the time period since the last CSD Review (2008—present) unless otherwise noted.]

Staff Information

Staff Listing

Director's Office

Director:	David W. Fahey
Deputy Director, Management:	John S. Daniel
Deputy Director, Planning:	Eric J. Williams
Executive Administrative Assistant:	Suzette Milano-Schoser (STC Contractor)
Instrument Design/Fabrication Support:	Richard J. McLaughlin (CIRES)
Scientific and Technical Assistant:	Christine A. Ennis (CIRES)
Webmaster:	Catherine Burgdorf Rasco (CIRES)
Outreach/Writer/Editor:	Debra A. Dailey-Fisher
Emeritus Scientists:	Dan Albritton, Fred Fehsenfeld, "Ravi" Ravishankara

Cloud and Aerosol Processes

Program Leader: Daniel M. Murphy

Administrative Support: Ronda Knott (STC Contractor)

Gabriela Adler (CIRES)
Charles A. Brock
Frank Erdesz (CIRES)
Barbara Ervens (CIRES)
Graham Feingold
Karl Froyd (CIRES)
Timothy D. Gordon (CIRES)
Jan Kazil (CIRES)
Daniel C. Law (CIRES)
Zachary Lebo (CIRES)
Jin Liao (CIRES)
Bernard Mason (CIRES)
Ann Middlebrook
Mathews Richardson (CIRES)
Elisa Sena (Guest Researcher)
Nicholas Wagner (CIRES)
Takanobu Yamaguchi (CIRES)

Atmospheric Remote Sensing

Program Leader: W. Alan Brewer

Administrative Support: Ronda Knott (STC Contractor)

Raul J. Alvarez, II
Sunil Baidar (Guest Researcher)
Robert M. Banta
James H. Churnside
Aditya Choukulkar (CIRES)
Wynn Eberhard (CIRES)
R. Michael Hardesty (CIRES)
Guillaume Kirgis (CIRES)
Andrew O. Langford
Richard D. Marchbanks (CIRES)
Brandi J. McCarty (CIRES)
Yelena Pichugina (CIRES)
Scott P. Sandberg
Christoph J. Senff (CIRES)
Ann M. Weickmann (CIRES)

Regional Chemical Modeling

Program Leader: Michael K. Trainer

Administrative Support: Jane August

Ravan Ahmadov (CIRES)
Wayne M. Angevine (CIRES)
Owen R. Cooper (CIRES)
Yuyan Cui (CIRES)
Gregory J. Frost
Eirh Yu Hsie (CIRES)
Si-Wan Kim (CIRES)
Hyo-Jung Lee (CIRES)
Brian C. McDonald (CIRES)
Stuart A. McKeen (CIRES)
Rokjin Park (Guest Researcher)

Chemical Processes and Instrument Development

Program Leader: James B. Burkholder

Administrative Support: Madeline Sturgill

François Bernard (CIRES)
Yong Liu (CIRES)
Max R. McGillen (CIRES)
Dimitrios Papanastasiou (CIRES)
James M. Roberts
Ranajit K. Talukdar (CIRES)
Bartek Witkowski (CIRES)

Atmospheric Composition and Chemical Processes

Program Leader: Ru-Shan Gao

Administrative Support: Madeline Sturgill

Steven J. Ciciora
Joseph Katich (CIRES)
Anne E. Perring (CIRES)
Ellis Robinson (CIRES)
Andrew Rollins (CIRES)
Joshua P. Schwarz
Hagen Telg (CIRES)
Troy Thornberry (CIRES)
Laurel A. Watts (CIRES)

Chemistry and Climate Processes

Program Leader: Karen Rosenlof

Administrative Support: Madeline Sturgill

Amy Butler (CIRES)
John Daniel
Sean M. Davis (CIRES)
Charles S. Eubank (CIRES)
Claire Granier (CIRES)
Birgit Hassler (CIRES)
Erik Larson (CIRES)
H. Leroy Miller (CIRES)
Ryan Neely (CIRES)
Robert W. Portmann
Eric Ray (CIRES)

Computing and Networking Resources

Senior Information Technology Manager: Joan M. Brundage

Gabrielle Accatino (CIRES)
Jennifer Fox
Kenneth Jamieson
Richard J. Tisinai (CIRES)

Tropospheric Chemistry

Program Leader: Thomas Ryerson

Administrative Support: Jane August

Kenneth C. Aikin (CIRES)
Steven S. Brown
Joost A. de Gouw (CIRES)
William P. Dubé (CIRES)
Scott Eilerman (CIRES)
Dorothy L. Fibiger (NSF Postdoctoral Fellow)
Jessica Gilman (CIRES)
John Holloway (CIRES)
Maxwell Holloway (CIRES)
Gerhard F.W. Hübler (CIRES)
Abigail Koss (CIRES)
William C. Kuster (CIRES)
Brian M. Lerner (CIRES)
Erin McDuffie (CIRES)
Sarah Monks (CIRES)
J. Andrew Neuman (CIRES)
David D. Parrish (CIRES)
Jeff Peischl (CIRES)
Steven Sjostedt (CIRES)
Chelsea Thompson (NSF Postdoctoral Fellow)
Travis Tokarek (Guest Researcher)
Patrick Veres (CIRES)
Carsten Warneke (CIRES)
Rebecca Washenfelder (CIRES)
Robert Wild (CIRES)
Bin Yuan (CIRES)
Kyle Zarzana (CIRES)

Administrative Office

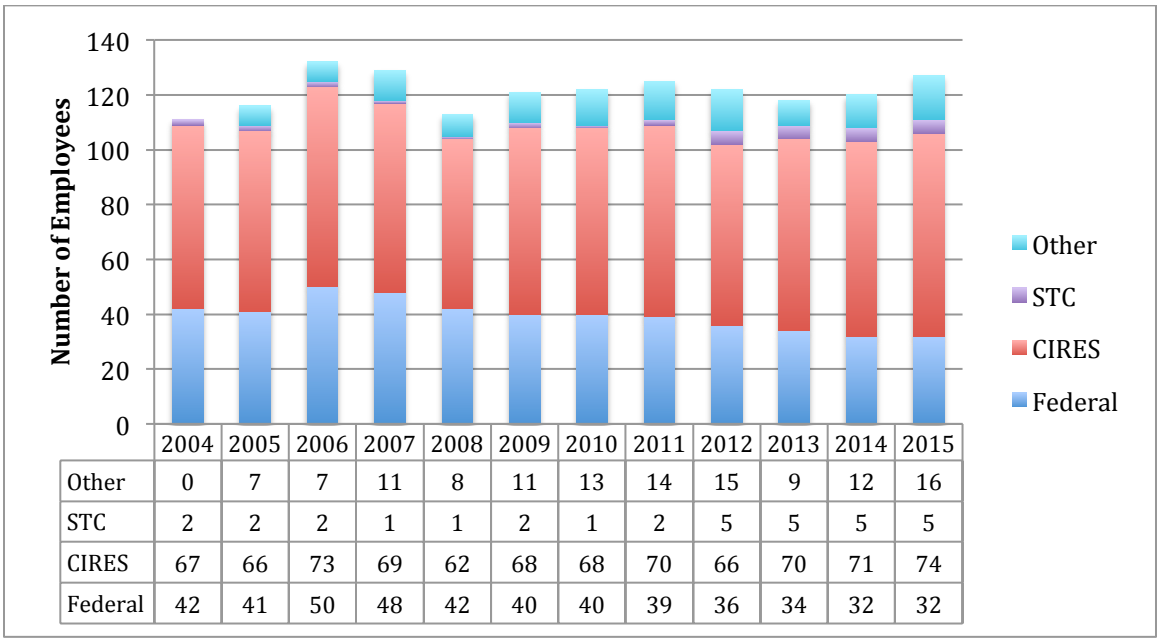
Administrative Officer: Angela Nyul

Dorothea Cowan (STC Contractor)
Samantha Grauberger
Nanette Serkes (STC contractor)
Jeanne S. Waters

Names without an affiliation above (e.g., STC Contractor, CIRES) are federal employees. CIRES is the NOAA and University of Colorado-Boulder Cooperative Institute for Research in Environmental Sciences. STC is the Science and Technology Corporation. The previous listing is current as of March 2015. All subsequent analysis is based on our February 2015 staff composition.

Staff Numbers and Affiliation Since 2004

The number of federal employees has declined from 50 in 2006 to 32 today. Nevertheless, the total number of people working at CSD has remained relatively constant since CSD was formed in 2006. "Other" includes students, postdoctoral fellows, and visitors.

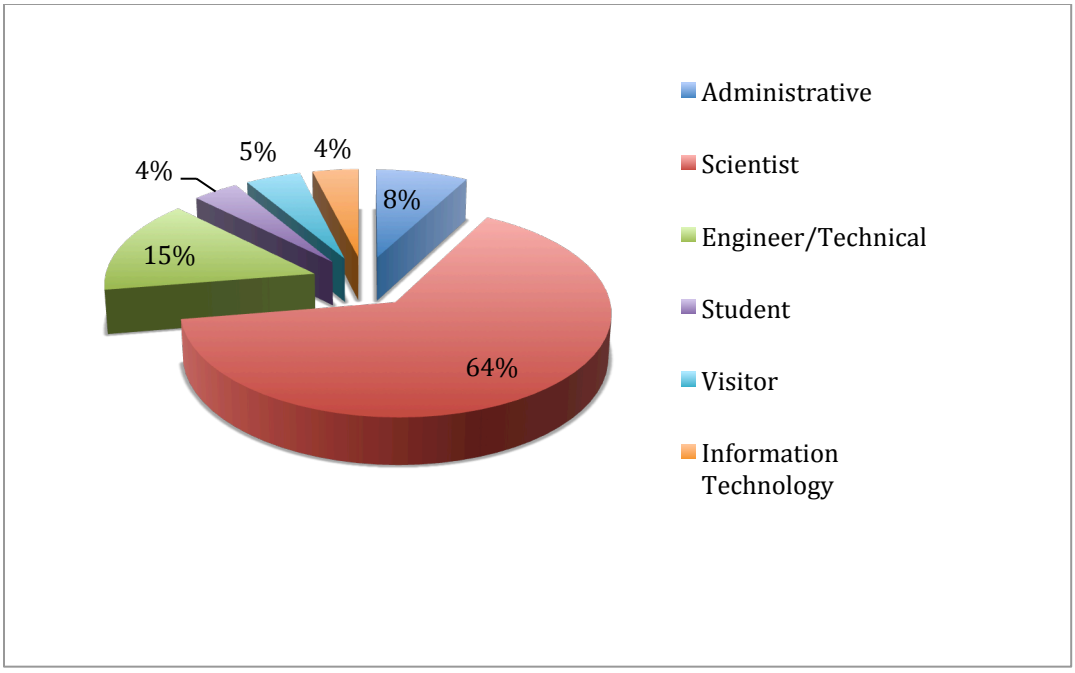


	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Other	0	7	7	11	8	11	13	14	15	9	12	16
STC	2	2	2	1	1	2	1	2	5	5	5	5
CIRES	67	66	73	69	62	68	68	70	66	70	71	74
Federal	42	41	50	48	42	40	40	39	36	34	32	32

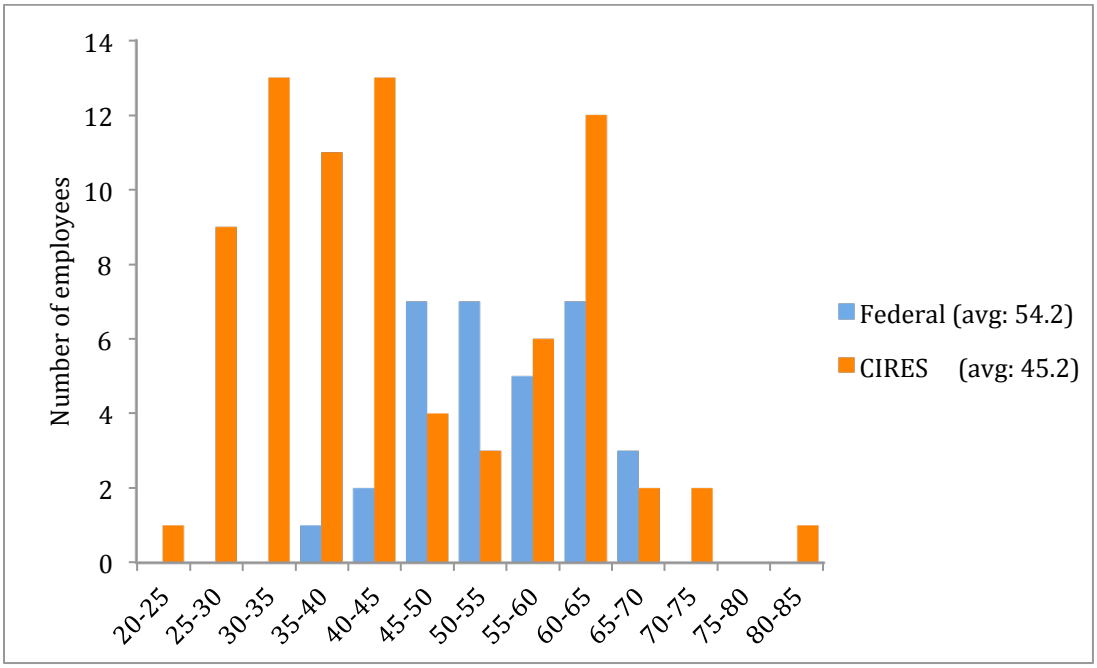
CIRES is the Cooperative Institute for Research in Environmental Sciences. STC is the Science and Technology Corporation.

Staff Analysis by Job Function

A large majority of our staff perform scientific or engineering/technical work.



Age Distribution of CIRES and Federal Staff



The average age of the total work force in FY2014 was 47.8 years. This average was 40 and 45 years in FY1998 and FY2008, respectively.

Composition of Staff: Gender and Ethnicity

Gender Composition

	Total	Men	Women	% Women
Total	127	88	39	31
All Federal	32	23	9	28
All CIRES	75	56	19	25
STC Contractors	5	1	4	80
Other	15	8	7	47
Federal Scientists	22	20	2	9
CIRES Scientists	53	42	11	21

The percent of women in CSD's staff in FY2014 and FY2008 was 31 and 35%, respectively.

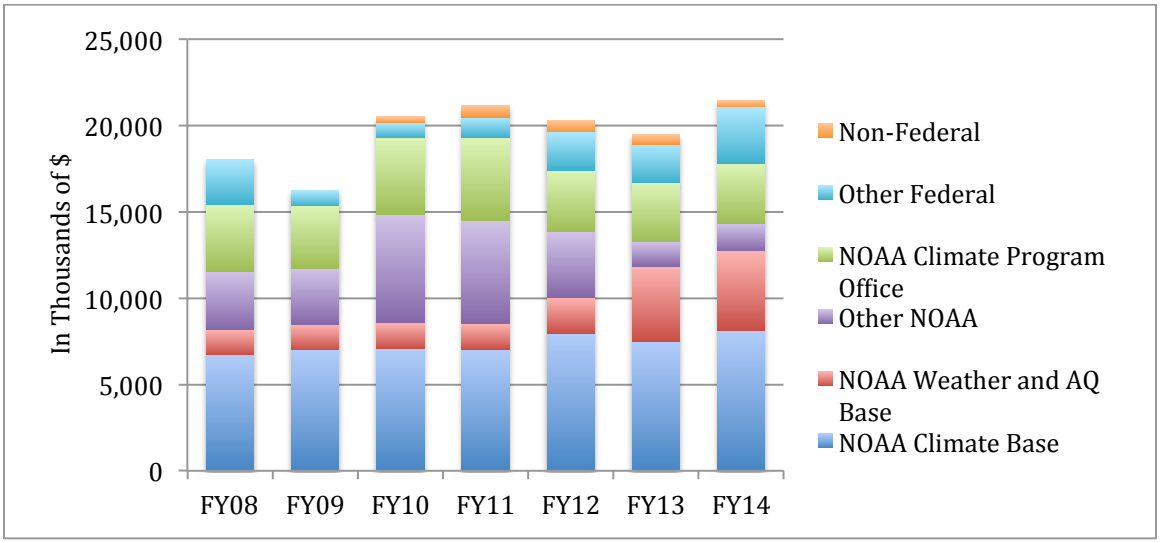
Ethnicity Composition (in percentages)

	Federal	CIRES
Whites not of Hispanic or Latin Origin	91	88
Asian	3	12
Hispanic	6	0
Other	0	0

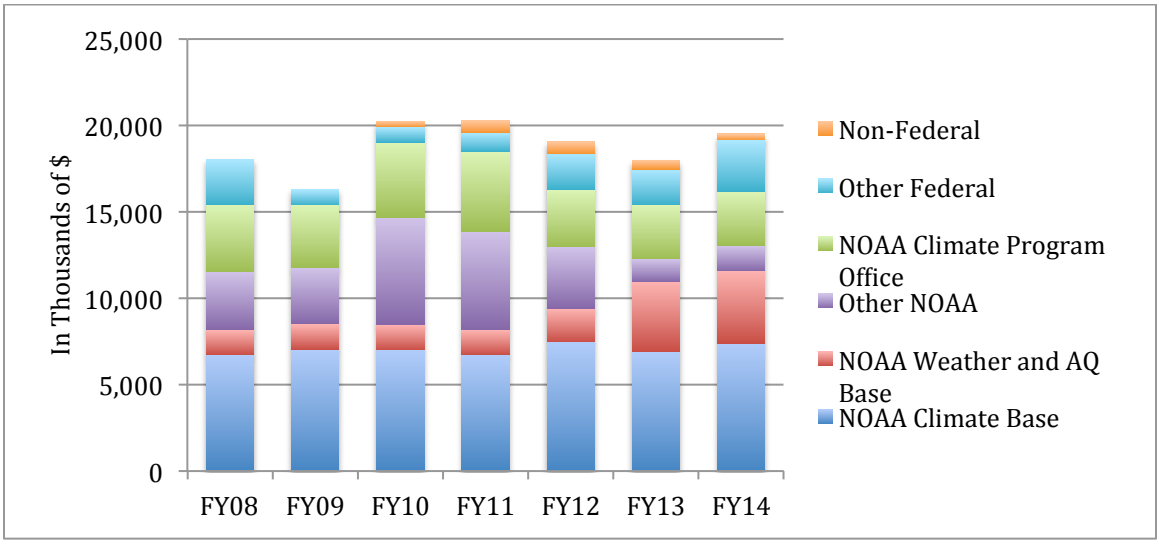
Budget Information

Income Evolution and Attribution Since FY2008

Sources of CSD income since 2008. In FY2013, some income that had been classified as "Other NOAA" was moved into our "Weather and Air Quality Base".

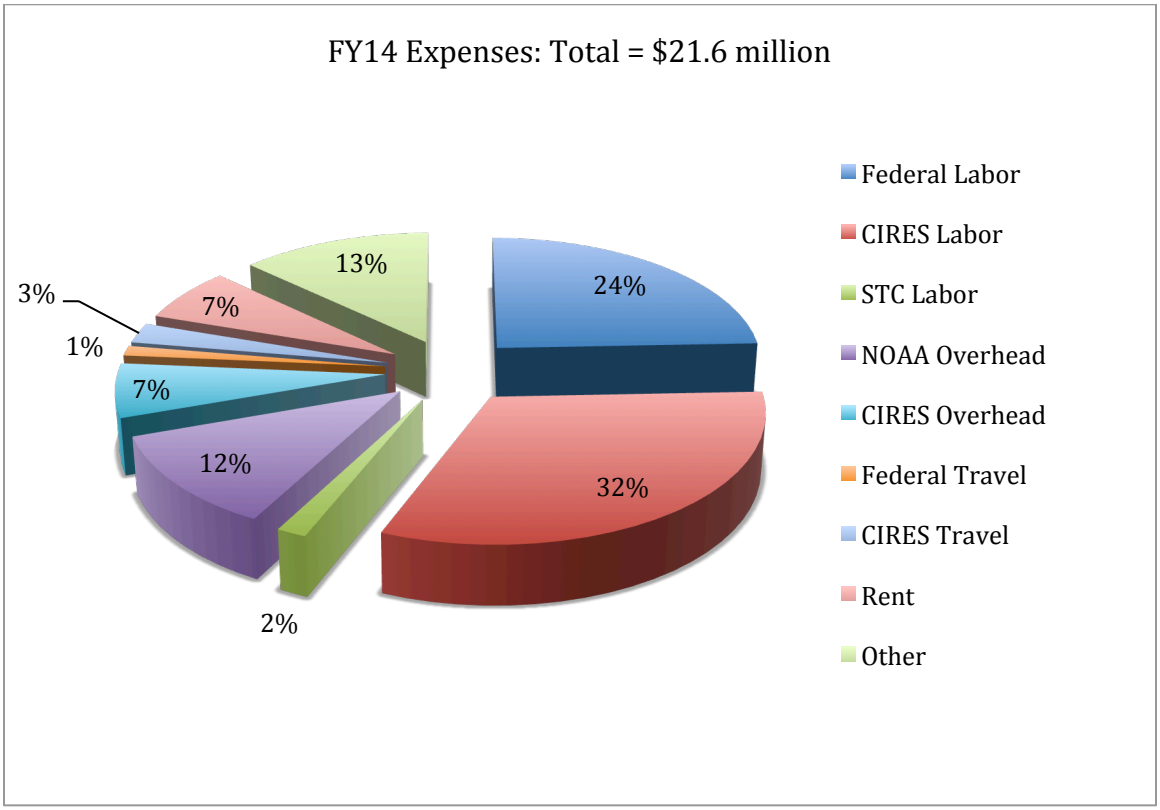


Sources of CSD income since 2008, converted to "2008 dollars" using the consumer price index for all urban consumers. Notice that "real income" in these terms has shown no increase since FY2010.



Attribution of Expenses in FY2014

Labor, federal and CIRES overhead, travel expenses, and rent represent 87% of our FY2014 expenses.



Recognition

Honorary and Prestigious Memberships

Member, U.S. National Academy of Sciences: **Susan Solomon** (1992), **A.R. Ravishankara** (2000).

Foreign Associate, French Academy of Sciences: **Susan Solomon** (1995).

Fellow, Royal Society of London (U.K.): **Susan Solomon** (2008).

Fellow, Royal Society of Chemistry (U.K.): **A.R. Ravishankara** (2005); **Susan Solomon** (2006).

Fellow, International Union of Pure and Applied Chemistry: **A.R. Ravishankara** (2008).

Fellow, Geological Society of London: **Susan Solomon** (2008).

Fellow, American Geophysical Union: **David Fahey** (2002), **Fred Fehsenfeld** (1988), **Graham Feingold** (2013), **Daniel Murphy** (2012), **David Parrish** (2014), **A.R. Ravishankara** (1997), **Susan Solomon** (1985).

Fellow, American Meteorological Society: **Robert Banta** (2010), **R. Michael Hardesty** (1996), **Karen Rosenlof** (2014), **Susan Solomon** (1992).

Fellow, American Association for the Advancement of Science: **A.R. Ravishankara** (2001).

Fellow, American Academy of Arts and Sciences: **Susan Solomon** (1993).

Chevalier (knight), French Legion of Honor: **Susan Solomon** (2008).

Fellow, Optical Society of America: **Jim Churnside** (1989), **R. Michael Hardesty** (1989).

Fellow, International Society for Optical Engineering (SPIE): **Jim Churnside** (2013).

Fellow, American Philosophical Society: **Susan Solomon** (2008).

Fellow, CIRES (Cooperative Institute for Research in Environmental Sciences, NOAA, and University of Colorado-Boulder): **Joost de Gouw** (2008), **David W. Fahey** (2003), **Fred C. Fehsenfeld** (1983), **Graham Feingold** (2003), **R. Michael Hardesty** (1989).

Fellow, CIRA (Cooperative Institute for Research in the Atmosphere, NOAA, and Colorado State University): **Graham Feingold** (2006).

Awards

International Awards

David Fahey, Montreal Protocol Who's Who, United Nations Environment Programme, 2013.

A.R. Ravishankara, Festschrift, *Journal of Physical Chemistry* Special Tribute Issue, 2012.

James Churnside, George W. Goddard Award, International Society for Optics and Photonics, for creativity and leadership in developing and advancing the airborne fish lidar technique, and for wide-ranging contributions to optical propagation in the atmosphere and ocean, 2011.

Susan Solomon, Volvo Environment Prize, for pioneering scientific contributions that have had major impacts on crucial environmental policies, 2009.

David Parrish, Harold Schiff Memorial Lecturer, University of York, Canada, 2009.

Sean Davis, scholarship to attend the Cargèse International School on Water Vapor in the Climate System, Cargèse, France, 2009

Susan Solomon, Grande Medaille, French Academy of Sciences, for groundbreaking work on stratospheric ozone depletion and for leadership of the Intergovernmental Panel on Climate Change, 2008.

Susan Solomon, John Scott Award, John Scott Foundation Trust, for discoveries related to the Antarctic ozone hole, 2008.

A.R. Ravishankara, Crandell Lecturer, University of Texas, 2013; Harold Schiff Memorial Lecturer, University of York, Canada, 2012; Hinshelwood Lecturer, University of Oxford, United Kingdom, 2011; Morino Foundation Fellow and Morino Lecturer, Tokyo Institute of Technology and the National Institute for Environmental Studies, Japan 2009; Welch Foundation Lecturer, Texas, 2009; Centenary Lecturer, Indian Institute of Science, 2008.

Presidential Awards

Rebecca Washenfelder, Presidential Early Career Award for Scientists and Engineers, for pioneering work in developing and applying new measurement techniques to study atmospheric chemistry related to climate and air quality and for commitment to science education and outreach, 2012.

Susan Solomon, DOC Distinguished Presidential Rank Award, for work on the global environmental challenges related to climate change and the depletion of the Earth's ozone layer, for leadership of the science working group of the international Intergovernmental Panel on Climate Change, and for over 25 years of pioneering research at NOAA, 2008.

DOC/NOAA/OAR Awards

A.R. Ravishankara, NOAA Distinguished Career Award, for excellence in managing and providing scientific vision for NOAA's atmospheric research programs, and in leading international science and assessment, 2015.

A.R. Ravishankara and **Graham Feingold**, NOAA Administrator's Award, for work on the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, 2014.

R. Michael Hardesty, NOAA Distinguished Career Award, for his scientific achievement and leadership in the field of atmospheric remote sensing throughout 37 years of service to NOAA, 2014.

David Fahey, **Steven Ciciora**, **Richard McLaughlin**, **Ru-Shan Gao**, and **Karen Rosenlof**, NOAA Bronze Medal, for the successful demonstration of the Global Hawk Unmanned Aircraft Systems for NOAA's Climate Goal, 2013.

Jim Churnside and Jim Jordan, award from OAR's Office of Research and Technology Applications, for their patent on "Detection of Transient Signals in Doppler Spectra," 2012.

James Meagher, NOAA Distinguished Career Award, for extraordinary leadership of NOAA's Air Quality Program and the Chemical Sciences Division of the Earth System Research Laboratory, 2011.

Paul Sandifer, John Adler, Terry Bevels, Jamon Bollock, James Chang, Cynthia Decker, Randall Dole, Jana Goldman, Dana Hanselman, Patricia Hathaway, Alexander (Sandy) MacDonald, Rob Magnien, Gary Matlock, Thomas Minello, David Novak, Derek Parks, **A.R. Ravishankara**, Rick Rosen, Lois Schiffer, Dian Seidel, Avery Sen, Thomas Street, Michael Vecchione, Andrew Winer, and Jiayu Zhou, group NOAA Bronze Medal, for developing a NOAA Administrative Order on Scientific Integrity Policy and accompanying Handbook on Scientific Misconduct, 2011.

Several CSD scientists, NOAA Award for Exceptional Efforts in the *Deepwater Horizon* disaster, 2011.

Susan Solomon, NOAA Gold Medal for Customer Service, team award, for producing a comprehensive and authoritative scientific report of the U.S. Global Change Research Program on the impacts of global climate change in the United States, 2010.

Dan Murphy, **Chuck Brock**, and **Tom Ryerson**, NOAA Bronze Medal, for leadership of the Aerosol, Radiation, and Cloud Processes affecting Arctic Climate (ARCPAC) field mission, 2010.

David Fahey, NOAA/OAR Daniel L. Albritton Outstanding Science Communicator Award, for extraordinary work in communicating scientific information about the ozone layer to decision makers, educators, and

the public worldwide through his leadership of a document known as *Twenty Questions and Answers About the Ozone Layer*, 2009.

Richard McLaughlin, NOAA Distinguished Career Award, for sustained, outstanding, and diverse contributions to the success of airborne sampling instruments requiring creative design skills and mechanical craftsmanship, 2009.

Daniel Lack, recognition by Rear Admiral Jonathon Bailey, NOAA Office of Marine and Aviations Operations, for the development of the NOAA Research Fleet Air Emissions Study, 2009.

Debra Wilson, NOAA Distinguished Career Award, for sustained excellence in administrative and budgetary leadership for the Aeronomy Lab and Chemical Sciences Division throughout 25 years of service to NOAA, 2008.

Debra Wilson, OAR Employee of the Year Award, for sustained and cumulative contributions to administrative and budgetary management that are absolutely vital to the functioning and success of the Chemical Sciences Division, 2008.

Arun Kumar, Martin Hoerling, Chad McNutt, Pedro Restrepo, **Graham Feingold**, Patricia Quinn, **David Fahey**, **John Daniel**, Stephen Montzka, V. Ramaswamy, Brian D. Keller, Isaac M. Held, Alice Gilliland, M. Daniel Schwarzkopf, Larry W. Horowitz, Stephen K. Gill, Christopher D. Miller, David H. Levinson, David M. Anderson, David R. Easterling, Eileen Shea, and Glenn Tallia, NOAA Administrator's Award, for outstanding dedication to developing U.S. CCSP Synthesis & Assessment Products integrating climate research for decision support, 2008.

Randall Dole, **A. R. Ravishankara**, Hiram (Chip) Levy, Thomas Karl, Krisa Arzayus, Lisa Vaughan, and Nancy Beller-Simms, NOAA Administrator's Award, for outstanding leadership in and dedication to developing U.S. CCSP Synthesis & Assessment Products integrating climate research for decision support, 2008.

A.R. Ravishankara, **John S. Daniel**, **David W. Fahey**, and **Debra Dailey-Fisher**, NOAA Bronze Medal, Team Award, for leadership in planning, preparing, and reviewing the 2006 scientific state-of-understanding update on the ozone layer for the Montreal Protocol, 2008.

CIRES Awards

Yelena Pichugina, CIRES Outstanding Performance in Science and Engineering, for groundbreaking research focusing on dynamic atmospheric processes at the heights of modern wind turbine rotors, work that has helped to characterize the atmospheric phenomena, turbulence, and boundary layer processes important to the wind energy industry, 2014.

Carsten Warneke, CIRES Outstanding Performance in Science and Engineering, for coordinating and leading the instrumentation of NOAA's WP-3D research aircraft for the very successful SENEX 2013 field study, which will advance the understanding of secondary pollution formation in the southeastern U.S., 2014.

Troy Thornberry, **Laurel Watts**, and **Eric Ray**, CIRES Bronze Medal, for the successful demonstration of the Global Hawk Unmanned Aircraft Systems for NOAA's Climate Goal, 2013.

Dan Lack, CIRES Outstanding Performance in Science and Engineering Award, for his work putting black carbon emissions inventories for shipping on a sound scientific basis, which has had a major impact on policy decisions for regulation of international shipping, 2012.

Troy Thornberry, **Andrew Rollins**, and **Laurel Watts**, CIRES Outstanding Performance in Science and Engineering Award, for designing and demonstrating an airborne chemical ionization mass spectrometer (CIMS) for ultra-low water vapor measurements in the lower stratosphere, that will advance our understanding of water vapor in the climate system, 2012.

Kenneth Aikin, CIRES Outstanding Performance in Service Award, for development of the data archive for 27 field missions involving the Tropospheric Chemistry Program of CSD, 2012.

Kenneth Aikin, **Roya Bahreini**, **John Holloway**, **Gerhard Hübler**, **Daniel Lack**, **Justin Langridge**, **J. Andrew Neuman**, **John Nowak**, **Jeff Peischl**, **Ann Perring**, **Ilana Pollack**, **Harald Stark**, and **Carsten Warneke**, CIRES Outstanding Science and Engineering Achievement Award, for work during the 2010 Deepwater Horizon Oil Spill crisis, awarded 2011.

John Holloway, CIRES Outstanding Performance in Science and Engineering Award, for developing and applying an instrument using vacuum UV florescence to measure CO from an aircraft, 2009.

Eric Williams, CIRES Bronze Award, for leadership of the International Polar Year Field Mission ICEALOT, 2009.

Christine Ennis, CIRES Director's Award, for outstanding leadership and dedication to U.S. Climate Change Science Program (CCSP) Synthesis and Assessment Products, 2009.

Allison McComiskey, CIRES Outstanding Performance in Science and Engineering Award, for leadership of observational efforts in the field of aerosol-cloud interactions and their impacts on climate change, for the DOE Atmospheric Radiation Measurements project, 2008.

Christine Ennis, CIRES Outstanding Performance in Service Award, for work as coordinator and technical editor of the 2006 international scientific assessment of ozone depletion produced for the U.N. Montreal Protocol under the auspices of the United Nations Environment Programme and the World Meteorological Organization, 2008.

CIRES Innovative Research Program competitive grants awardees

- **Sean Davis**, Russell Chadwick, Lars Kalnajs, Dale Hurst, **Karen Rosenlof**, Randy Collander, and Joan Alexander, "Blowing in the wind: Fiber optic temperature profiler measurements from drifting high altitude balloons," 2014.
- **Barbara Ervens** and Veronica Vaida, "Modification of aerosol air/water interfaces due to aqueous and surface chemical reactions," 2014.
- **Carsten Warneke**, **Patrick Veres**, and **Joost de Gouw**, "Fast time-response detection of small alkanes from oil and natural gas extraction using mass spectrometry," 2014.
- **Andrew Rollins**, **Troy Thornberry**, **Ryan Neely**, and **Ru-Shan Gao**, "A compact, sensitive LIF instrument for the measurement of SO_2," 2013.
- Noah Fierer, Joanne Emerson, **Anne Perring**, **Joshua Schwarz**, and **David Fahey**, "Are microbes a significant component of free tropospheric aerosol," 2013.
- **Carsten Warneke** and **Martin Graus**, "Emissions of hydrogen sulfide and other air toxics associated with natural gas production using hydraulic fracturing," 2012.
- **Eric Williams**, **Bill Dubé**, **Peter Edwards**, and **Steven Brown**, "A new approach to NO_x: Applications to diesel engines, biofuels, and oil and gas emissions," 2012.
- **Sara Lance**, Maggie Tolbert, and Josh Gordon, "Contact freezing on demand: Measurement of contact nuclei with a novel instrument using single droplets levitated in an optical trap," 2011.
- Christopher Williams, Laura Bianco, Paul Johnston, **Daniel Law**, and Scott Palo, "Developing a lower boundary layer radar for renewable energy research," 2011.
- Xinzhao Chuy, John Smith, and Wentao Huang, with collaborators **R. Michael Hardesty** and Hanli Liu, "Marrying two novel lidar technologies to profile the whole atmosphere," 2011.
- **Joost de Gouw** and Jose Jimenez, "Secondary organic aerosol formation from evaporated crude oil," 2011.
- **R. Michael Hardesty** and **Christoph Senff**, "Three-dimensional aircraft-based measurement of wind profiles for quantifying ozone transport," 2010.

- Veronica Vaida, **Cora Young**, **Rebecca Washenfelder**, and **Greg Frost**, "Measurements of weak absorptions by O_3 and O_3-H_2O clusters using cavity enhanced spectroscopy," 2010.
- **Barbara Ervens** and Ranier Volkamer, "Secondary organic aerosol formation from glyoxal: Linking laboratory, field, and model studies," 2009.
- **Brandi McCarty**, "How will global climate changes affect ocean productivity in the tropics," 2009.
- Russ Monson, **Joost de Gouw**, and Noah Fierer, "Soil emissions of volatile organic compounds in response to pine beetle attacks," 2009.
- **Joost de Gouw**, **Carsten Warneke**, and **Jim Roberts**, "Emissions of acidic trace gases from forest fires," 2008.
- **Troy Thornberry**, **Ru-Shan Gao**, and **David Fahey**, "Measurement of low water-vapor missing ratios using mass spectrometry," 2008.

Other U.S. Awards

Colorado Governor's Award for High-Impact Research, to a **team of 64 federal and CIRES scientists**, for helping the public and policy makers understand the air quality and other atmospheric effects of oil and gas activities in Colorado, Utah, Wyoming, and beyond, 2014. [Awarded to: **Ravan Ahmadov**, **Ken Aikin**, Arlyn E. Andrews, **Robert Banta**, **Jerome Brioude**, **Alan Brewer**, **Steve Brown**, **Joost DeGouw**, **William Dubé**, Edward J. Dlugokencky, **Pete Edwards**, **Joost de Gouw**, **Gregory J. Frost**, **Jessica B. Gilman**, **Martin Graus**, Douglas Guenther, Bradley Hall, **R. Michael Hardesty**, **J.S. Holloway**, Bryan Johnson, Anna Karion, Jonathan Kofler, **Abigail Koss**, **William Kuster**, Patricia Lang, **Andy Langford**, **Brian Lerner**, **Rui Li**, **Stuart McKeen**, Thomas Mefford, Benjamin R. Miller, John B. Miller, Stephen A. Montzka, **Ryan R. Neely**, Tim Newberger, Bill Neff , Paul Novelli, Joseph Olson, Samuel J. Oltmans, **David Parrish**, **Jeff Peischl**, **Yelena Pichugina**, Gabrielle Pétron, **James Roberts**, **Thomas Ryerson**, Russell Schnell, **Christoph Senff**, Susan Buhr Sullivan, Colm Sweeney, Pieter Tans, Jennifer Taylor, **Michael Trainer**, **Patrick Veres**, **Carsten Warneke**, **Rebecca Washenfelder**, **Robert Wild**, **Eric Williams**, Allen B. White, David Welsh, Dan Wolfe, Sonja Wolter, **Cora Young**, **Bin Yuan**, and Robert Zamora]

Kenneth Aikin, **Charles A. Brock**, **David Fahey**, **Karl Froyd**, **Ru-Shan Gao**, **Tim Gordon**, **John Holloway**, **Daniel Lack**, **Daniel Law**, **Jin Liao**, **Milos Markovic**, **Richard McLaughlin**, **Daniel M. Murphy**, **J. Andrew Neuman**, **John Nowak**, **Jeff Peischl**, **Anne Perring**, **Ilana Pollack**, **Eric Ray**, **Mathews Richardson**, **Andrew Rollins**, **Karen Rosenlof**, **Tom Ryerson**, **Joshua Schwarz**, **Troy Thornberry**, **Nicholas Wagner**, and **Laurel Watts**, NASA Group Achievement Award, for the Studies of Emissions and Atmospheric Composition, Clouds and Climate Coupling by Regional Surveys (SEAC4RS) field mission, 2014.

Nanette Serkes, Unsung Hero in Federal Service Award, Rocky Mountain Region of Federally Employed Women, for her accomplishments as CSD's Administrative Officer and in her prior federal service, 2013.

Colorado Governor's Award for High-Impact Research, to a **team of 34 federal and CIRES CSD scientists**, 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. [Awarded to: **Kenneth C. Aikin**, **Ravan Ahmadov**, **Wayne M. Angevine**, **Roya Bahreini**, **Jerome Brioude**, **Charles A. Brock**, **Joost A. de Gouw**, **Barbara Ervens**, **David W. Fahey**, **Fred C. Fehsenfeld**, **Gregory J. Frost**, **Ru-Shan Gao**, **John S. Holloway**, **Daniel A. Lack**, **Justin M. Langridge**, **Stuart A. McKeen**, **James F. Meagher**, **Ann M. Middlebrook**, **Daniel M. Murphy**, **J. Andrew Neuman**, **John B. Nowak**, **David D. Parrish**, **Jeffrey Peischl**, **Anne E. Perring**, **Ilana B. Pollack**, **A.R. Ravishankara**, **James M. Roberts**, **Thomas B. Ryerson**, **Joshua P. Schwarz**, **Ryan Spackman**, **Harald Stark**, **Michael Trainer**, **Carsten Warneke**, **and Laurel A. Watts**]

Steven Ciciora, **David W. Fahey**, **Karl D. Froyd**, **Ru-Shan Gao**, **Mary Gutierrez**, **Gerd Hübler**, **Richard J. McLaughlin**, **Daniel M. Murphy**, **Anne Perring**, **Andrew Rollins**, **Karen H. Rosenlof**, **Joshua P. Schwarz**, **J. Ryan Spackman**, **Troy Thornberry**, and **Laurel A. Watts**, NASA Group Achievement Award, for outstanding accomplishments by the successful Mid-latitude Airborne Cirrus Properties Experiment (MACPEX) to better understand the role of cirrus clouds in climate models, awarded 2012.

Steven J. Ciciora, **David W. Fahey**, **Ru-Shan Gao**, **Mary Gutierrez**, **Richard J. McLaughlin**, **Eric Ray**, **Karen Rosenlof**, **Troy Thornberry**, and **Laurel Watts**, NASA Group Achievement Award, for outstanding accomplishments for NASA and Earth science during the successful Global Hawk Pacific Mission (GloPac) in 2010, awarded 2011.

Laurel Watts, NASA Group Achievement Award, for outstanding accomplishments for NASA and Earth science during the Genesis and Rapid Intensification Processes (GRIP) Airborne Earth Science Mission in 2010, awarded in 2011.

Susan Solomon, Career Achievement Award, Samuel J. Heyman Service to America Medals of the Partnership for Public Service, 2010.

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

Joshua Schwarz, **Laurel Watts**, and **Ru-Shan Gao**, NASA Group Achievement Award, for the successful completion of this "first of its kind," innovative flight test program for airborne earth science instruments in Newly-Operating and Validated Instruments Comparison Experiment (NOVICE), awarded 2009.

Catherine Burgdorf Rasco, **Gerhard Hübler**, and **Karen Rosenlof**, NASA Group Achievement Award, "for outstanding accomplishments in the successful Arctic Research of the Composition of the Troposphere from Aircraft and Satellites (ARCTAS) mission in Alaska and Canada," awarded 2009.

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

David Fahey and **John S. Daniel**, Co-recipients 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, awarded 2009.

Joshua B. Ballard, **David W. Fahey**, **Karl D. Froyd**, **Ru-Shan Gao**, **Brenda Irish**, **Kenneth K. Kelly**, **Richard J. McLaughlin**, **Daniel M. Murphy**, **Mark W. Paris**, **Peter J. Popp**, **Eric A. Ray**, **Karen H. Rosenlof**, **Todd J. Sanford**, **Joshua P. Schwarz**, **J. Ryan Spackman**, **Thomas L. Thompson**, **David S. Thomson**, **Troy Thornberry**, **Adrian F. Tuck**, and **Laurel A. Watts**, NASA Group Achievement Award, for outstanding achievements in atmospheric science during the Tropical Compositions, Cloud, and Climate Coupling (TC4) Mission in Costa Rica and Panama in 2007, awarded 2008.

David Fahey, **John Daniel**, and others, group award, U.S. Environmental Protection Agency Stratospheric Ozone Protection Award, for coauthoring a groundbreaking 2007 paper that calculated the climate benefits of the Montreal Protocol, 2008.

David Fahey, individual award, U.S. Environmental Protection Agency Stratospheric Ozone Protection Award, for his work on many aspects of stratospheric ozone depletion and the impact of aviation on ozone and climate, 2008.

Dan Murphy, Benjamin Liu award for aerosol instrumentation, American Association for Aerosol Research, 2008.

Susan Solomon, Time Magazine's 100 World's Most Influential People, 2008.

Susan Solomon, American Geological Institute Award for Outstanding Contribution to Public Understanding of the Geosciences, 2008.

Robert Banta, American Meteorological Society, first Mountain Meteorology Award by the Mountain Meteorology Committee of the AMS, for outstanding contributions to mountain meteorology, 2008.

Refereeing/Reviewing Awards

Amy Butler, Editor's Citation for Excellence in Refereeing, *Journal of Geophysical Research-Atmospheres,* 2014.

Owen Cooper, Editor's Citation for Excellence in Refereeing, *Journal of Geophysical Research-Atmospheres,* 2014.

Yelena Pichugina, Editor's Appreciation award for reviewing, *Journal of Applied Remote Sensing*, 2014.

Barbara Ervens, Editors' Citation for Excellence in Refereeing for *Environmental Science and Technology*, 2013.

Dan Murphy, Editors' Appreciation Award for reviewing, American Chemical Society, 2011.

Ilana Pollack, Editors' Appreciation Award for reviewing, American Chemical Society, 2011.

Recognition from Academia

Steve Brown and **Joost de Gouw**, elected as Professor Adjoint in the Department of Chemistry and Biochemistry at the University of Colorado Boulder, 2014.

Abigail Koss, Carol B. Lynch Graduate Fellowship, University of Colorado-Boulder, 2014.

David Fahey, Distinguished Alumni Award, University of Wisconsin-Madison Physics Department, 2013.

Susan Solomon, honorary doctorates: University of Athens (2010), University of Paris (2010), University of Pennsylvania (2009), Reading University, U.K. (2009), Butler University (2008).

Recognition of Publications

Individuals: Highly Cited

Daniel Murphy and **Ann Middlebrook** are among the Most Highly Cited Researchers in the geosciences over the 2000-2012 period, according to Thompson Reuters. The list covers the top 1% of cited papers published in that time period. Eight others in NOAA are also on the geosciences list.

Specific Publications: Highly Cited/High Impact

Geophysical Research Letters, selection as one of the 40 most cutting-edge papers over the 1974-2014 period, for the journal's 40th Anniversary special section:

- Ubiquity and Dominance of Oxygenated Species in Organic Aerosols in Anthropogenically-Influenced Northern Hemisphere Midlatitudes, Q. Zhang, J.L. Jimenez, M.R. Canagaratna, J.D. Allan, H. Coe, I. Ulbrich, M.R. Alfarra, A. Takami, **A.M. Middlebrook**, Y. L. Sun, K. Dzepina, **E. Dunlea**, K. Docherty, P. F. DeCarlo, D. Salcedo, T. Onasch, J.T. Jayne, T. Miyoshi, A. Shimono, S. Hatakeyama, N. Takegawa, Y. Kondo, J. Schneider, F. Drewnick, S. Borrmann, S. Weimer, K. Demerjian, P. Williams, K. Bower, **R. Bahreini**, L. Cottrell, R.J. Griffin, J. Rautiainen, J.Y. Sun, Y.M. Zhang and D.R. Worsnop, *Geophysical Research* Letters, *34*, L13801, 2007. Awarded in 2014.

Atmospheric Science and Technology, most highly cited papers of 2011-2013: CSD scientists are authors on 2 of the top 5 papers:

- Evaluation of Composition-Dependent Collection Efficiencies for the Aerodyne Aerosol Mass Spectrometer Using Field Data, **A.M. Middlebrook**, **R. Bahreini**, J.L. Jimenez, and M.R. Canagaratna, *Aerosol Science and Technology*, 46, 3, 2012.
- Heterogeneous Atmospheric Chemistry, Ambient Measurements, and Model Calculations of N_2O_5: A Review, W.L. Chang, P.V. Bhave, **S.S. Brown**, N. Riemer, J. Stutz, and D. Dabdub, *Aerosol Science and Technology*, 45, 6, 2011. Awarded in 2014.

Elsevier publishers, number 14 of the top-25 most downloaded articles published in *Atmospheric Environment* for the first half of 2013, and one of the top-50 most cited articles published in *Atmospheric*

Environment from January 2006 to February 2011: Aviation and Global Climate Change in the 21st Century, D.S. Lee, **D.W. Fahey**, P.M. Forster, P.J. Newton, R.C.N. Wit, L.L. Lim, B. Owen, and R. Sausen, *Atmospheric Environment*, 43, 22-23, 3520-3537, 2009. Awarded 2011 and 2013.

Cited by AMS Journals as a top-10 most read article of 2012: Doppler Lidar-Based Wind Profile Measurement System for Offshore Wind Energy and Other Marine Boundary Layer Applications, **Y. Pichugina**, **R. Banta**, **A. Brewer**, **S. Sandberg**, and **R. Hardesty**, *Journal of Applied Meteorology and Climatology*, 51, doi: 10.1175/JAMC-D-11-040.1, 2012.

Cited by AMS Journals as a top-10 most read article of 2012: Turbulence Regimes and Turbulence Intermittency in the Stable Boundary Layer during CASES-99, J. Sun, L. Mahrt, **R. Banta**, and **Y. Pichugina**, *Journal of Atmospheric Sciences,* 69, 338-351, doi: 10.1175/JAS-D-11-082.1, 2012.

New Hot Paper in the field of Geosciences (one of the most cited papers in its discipline in the last two years), Thomson Reuters *ScienceWatch.com*: Organic Aerosol Components Observed in Northern Hemispheric Datasets from Aerosol Mass Spectrometry, N.L. Ng, M.R. Canagaratna, Q. Zhang, J.L. Jimenez, J. Tian, I.M. Ulbrich, J.H. Kroll, K.S. Docherty, P.S. Chhabra, **R. Bahreini**, S.M. Murphy, J.H. Seinfeld, L. Hildebrandt, N.M. Donahue, P.F. DeCarlo, V.A. Lanz, A.S.H. Prévôt, E. Dinar, Y. Rudich, and D.R. Worsnop, *Atmospheric Chemistry and Physics,* 10*,* 4625-4641, doi: 10.5194/acp-10-4625-2010, 2010. Awarded in 2011.

Taylor and Francis Group publisher, one of the top-10 most cited papers in *Aerosol Science and Technology* in 2010: Collection Efficiencies in an Aerodyne Aerosol Mass Spectrometer as a Function of Particle Phase for Laboratory Generated Aerosols, **B. Matthew**, **A.M. Middlebrook**, and B. Onasch, *Aerosol Science and Technology*, 42, 11884-11898, 2008. Awarded in 2010.

New Hot Paper in the field of Geosciences (one of the most cited papers in its discipline in the last two years), Thomson Reuters Essential Science IndicatorsSM: Irreversible Climate Change Due to Carbon Dioxide Emissions, **S. Solomon**, G.-K. Plattner, R. Knutti, and P. Friedlingstein, *Proceedings of the National Academy of Sciences*, 106, 6, 2009. Awarded in 2010.

New Hot Paper in the field of Geosciences (one of the most cited papers in its discipline in the last two years), Thomson Reuters *ScienceWatch.com*: Evolution of Organic Aerosols in the Atmosphere, J.L. Jimenez, M.R. Canagaratna, N.M. Donahue, A.S.H. Prévôt, Q. Zhang, J.H. Kroll, P.F. DeCarlo, J.D. Allan, H. Coe, N.L. Ng, A.C. Aiken, K.D. Docherty, I.M. Ulbrich, A.P. Grieshop, A.L. Robinson, J.Duplissy, J.D. Smith, K.R. Wilson, V.A. Lanz, C. Hueglin, Y.L. Sun, J. Tian, A. Laaksonen, T. Raatikainen, J. Rautiainen, P. Vaattovaara, M. Ehn, M. Kulmala, J.M. Tomlinson, D.R. Collins, M.J. Cubison , E.J. Dunlea, J.A. Huffman, T.B. Onasch, M.R. Alfarra, P.I. Williams, K. Bower, Y. Kondo, J. Schneider, F. Drewnick, S. Borrmann, S. Weimer, K. Demerjian, D. Salcedo, L. Cottrell, R. Griffin, A. Takami, T. Miyoshi, S. Hatakeyama, A. Shimono, J.Y Sun, Y.M. Zhang, K. Dzepina, J.R. Kimmel, D. Sueper, J.T. Jayne, S.C. Herndon, A.M. Trimborn, L.R. Williams, E.C. Wood, C.E. Kolb, **A.M. Middlebrook**, U. Baltensperger, and D.R. Worsnop, *Science, 326*, 1525-1529, doi: 10.1126/science.1180353, 2009. Awarded in 2010.

Elsevier publishers, 8th most-cited paper in *Atmospheric Environment* since 2008: Atmospheric Composition Change – Global and Regional Air Quality, P.S. Monks, **C. Granier**, S. Fuzzi, A. Stohl, M. Williams, H. Akimoto, M. Amman, A. Baklanov, U. Batltensperger, I. Bey, N. Blake, R.S. Blake, K. Carslaw, **O.R. Cooper**, F. Dentener, E. Fragkou, **G. Frost**, S. Generoso, P. Ginoux, V. Grewe, A. Guenther, H.C. Hansson, S. Henne, J. Hjorth, A. Hofzumahaus, H. Huntrieser, M.E. Jenkin, J. Kaiser, M. Kankidou, Z. Kilmont, M. Kulmala, M.G. Lawrence, J.D. Lee, C. Liousse, G. MgFiggans, A. Metzger, A. Mieville, N. Moussiopoulos, J.J. Orlando, P.I. Palmer, **D. Parrish**, A. Petzold, U. Platt, U. Poeschl, A.S.H. Prévôt, C.E. Reeves, S. Reiman, Y. Rudich, K. Sellegri, R. Steinbrecher, D. Simpson, H. ten Brink, J. Theloke, G. van der Werf, R. Vautard, V. Vestreng, C. Vlachokostas, and R. von Glasow, *Atmospheric Environment*, 43, 33, 5268-5350, doi:10.1016/j.atmosenv.2009.08.021, 2009.

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Taylor and Francis Group publisher, one of the top-10 most cited papers in *Aerosol Science and Technology* in 2009, An Inter-Comparison of Instruments Measuring Black Carbon Content of Soot Particles, J.G. Slowik, E.S. Cross, J.-H. Han, P. Davidovits, T.B. Onasch, J.T. Jayne, L.R. Williams, M.R. Canagaratna, D.R. Worsnop, R.K. Chakrabarty, H. Moosmüller, W.P. Arnott, **J.P. Schwarz**, **R.-S. Gao**, **D.W. Fahey**, G.L. Kok, and A. Petzold, *Aerosol Science and Technology*, 41(3), 295-314, 2007. Awarded in 2009.

Taylor and Francis Group publisher, one of the top-10 most cited papers in *Aerosol Science and Technology* in 2009, Design and Application of a Pulsed Cavity Ring-Down Aerosol Extinction Spectrometer for Field Measurements, **T. Baynard**, E.R. Lovejoy, **A. Pettersson**, **S.S. Brown**, **D. Lack**, **H. Osthoff**, **P. Massoli**, **S. Ciciora**, **W.P. Dubé**, and **A.R. Ravishankara**, *Aerosol Science and Technology,* 41, 4, 447-462, 2007. Awarded in 2009.

Publication Awards

3rd Place Winner of the NASA Henry J.E. Reid Award for an outstanding paper: Aerosol Classification Using Airborne High Spectral Resolution Lidar Measurements – Methodology and Examples, S.P. Burton, R.A. Ferrare, C.A. Hostetler, J.W. Hair, R.R. Rogers, M.D. Obland, C.F. Butler, A.L. Cook, D.B. Harper, and **K.D. Froyd**, *Atmospheric Measurement Techniques*, 5, 73-98 doi:10.5194/amt-5-73-2012, 2012.

NOAA/OAR Outstanding Scientific Paper Award: An Observationally Based Energy Balance for the Earth since 1950, **D.M. Murphy**, **S. Solomon**, **R.W. Portmann**, **K.H. Rosenlof**, P.M. Forster, and T. Wong, *Journal of Geophysical Research*, 114, D17107, doi:10.1029/2009JD012105, 2009. Awarded in 2011.

NOAA/OAR Outstanding Scientific Paper Award: Nitrous Oxide (N_2O): The Dominant Ozone-Depleting Substance Emitted in the 21st Century, **A.R. Ravishankara**, **J.S. Daniel**, and **R.W. Portmann**, *Science*, 326, 5949, 123-125, 2009. Awarded in 2010.

Editor's Choice Award, *Electrical Engineering Times*: Monitoring Atmospheric Ozone on the Global Hawk Unmanned Aeronautical Vehicle with NI Compactrio, **L. Watts**, **S. Ciciora**, **T. Thornberry**, **D. Fahey**, and **R.-S. Gao**, National Instruments, 2009. Awarded in 2010.

Naval Research Laboratories, Alan Berman Research Publication Award: Directly Measured Heating Rates of a Tropical Subvisible Cirrus Cloud, A. Bucholtz, D.L. Hlavka, M.J. McGill, K.S. Schmidt, P. Pilewskie, **S.M. Davis**, E.A. Reid, and A.L. Walker, *Journal of Geophysical Research*, 115(D00J09), 2010. Awarded in 2010.

Nature editors, one of the top-10 papers published elsewhere in 2009: Nitrous Oxide (N_2O): The Dominant Ozone-Depleting Substance Emitted in the 21st Century, **A.R. Ravishankara**, **J.S. Daniel**, and **R.W. Portmann**, *Science*, 326, 5949, 123-125, 2009. Awarded in 2009.

Editor's Highlight

Editor's Highlight, *Journal of Geophysical Research*: Quantifying Atmospheric Methane Emissions from the Haynesville, Fayetteville, and Northeastern Marcellus Shale Gas Production Regions, **J. Peischl**, **T.B. Ryerson**, **K.C. Aikin**, **J.A. de Gouw**, **J.B. Gilman**, **J.S. Holloway**, **B.M. Lerner**, R. Nadkarni, **J.A. Neuman**, **J.B. Nowak**, **M. Trainer**, **C. Warneke**, and **D.D. Parrish**, *Journal of Geophysical Research*, doi: 10.1002/2014JD022697, 2015.

Editor's Highlight, *Geophysical Research Letters*: Trends in Sulfate and Organic Aerosol Mass in the Southeast U.S.: Impact on Aerosol Optical Depth and Radiative Forcing, **A. Attwood**, **R.A. Washenfelder**, **C.A. Brock**, W. Hu, K. Baumann, P. Campuzano-Jost, D.A. Day, E.S. Edgerton, **D.M. Murphy**, B.B. Palm, **A. McComiskey**, **N.L. Wagner**, S.S. de Sa, A. Ortega, S.T. Martin, J.L. Jimenez, and **S.S. Brown**, *Geophysical Research Letters*, 41, doi:10.1029/2014GL061669, 2014.

Editor's Highlight, *Journal of Geophysical Research*: Long-Term Changes in Lower Tropospheric Baseline Ozone Concentrations: Comparing Chemistry Climate Models and Observations at Northern Midlatitudes, **D.D. Parrish**, J.-F. Lamarque, V. Naik, L. Horowitz, D.T. Shindell, J. Staehelin, R. Derwent, **O.R. Cooper**, H. Tanimoto, A. Volz-Thomas, S. Gilge, H.-E. Scheel, M. Steinbacher, and M. Frülich, *Journal of Geophysical Research*, 119, 5719-5736, doi:10.1002/2013JD021435, 2014.

Editor's Highlight and Research Spotlight, *Journal of Geophysical Research*: Trends in Ozone, Its Precursors, and Related Secondary Oxidation Products in Los Angeles, California: A Synthesis of Measurements from 1960 to 2010, **I.B. Pollack**, **T.B. Ryerson**, **M. Trainer**, **J.A. Neuman**, **J.M. Roberts**, and **D.D. Parrish**, *Journal of Geophysical Research*, 118, 5893-5911, 2013.

Editor's Highlight, *Atmospheric Chemistry and Physics*: The MACC Reanalysis: An 8 yr Data Set of Atmospheric Composition, A. Inness, F. Baier, A. Benedetti, I. Bouarar, S. Chabrillat, H. Clark, C. Clerbaux, P. Coheur, R. J. Engelen, Q. Errera, J. Flemming, M. George, **C. Granier**, J. Hadji-Lazaro, V. Huijnen, D. Hurtmans, L. Jones, J. W. Kaiser, J. Kapsomenakis, K. Lefever, J. Leitão, M. Razinger, A. Richter, M.G. Schultz, A. J. Simmons, M. Suttie, O. Stein, J.-N. Thépaut, V. Thouret, M. Vrekoussis, C. Zerefos, and the MACC team, *Atmospheric Chemistry and Physics*, 13, 8, 4073-4109, 2013.

Editor's Highlight and Research Spotlight, *Journal of Geophysical Research*: Transport of Asian Ozone Pollution into Surface Air over the Western United States in Spring, M. Lin, A.M. Fiore, L.W. Horowitz, **O.R. Cooper**, V. Naik, **J. Holloway**, B.J. Johnson, **A.M. Middlebrook**, S.J. Oltmans, **I.B. Pollack**, **T.R. Ryerson**, J.X. Warner, C. Wiedinmyer, J. Wilson, and B. Wyman, *Journal of Geophysical Research*, 117, DV00V07, 2012.

Editor's Highlight, *Journal of Geophysical Research*: Multiyear Trends in Volatile Organic Compounds in Los Angeles, California: Five Decades of Decreasing Emissions, **C. Warneke**, **J.A. de Gouw**, **J.S. Holloway**, **J. Peischl**, **T.B. Ryerson**, E. Atlas, D. Blake, **M. Trainer**, and **D.D. Parrish**, *Journal of Geophysical Research*, 117, doi:10.1029/2012JD017899, 2012.

Editor's Highlight, *Geophysical Research Letters*: Gasoline Emissions Dominate Over Diesel in Formation of Secondary Organic Aerosol Mass, **R. Bahreini**, **A.M. Middlebrook**, **J.A. de Gouw**, **C. Warneke**, **M. Trainer**, **C.A. Brock**, **H. Stark**, **S.S. Brown**, **W.P. Dubé**, **J.B. Gilman**, **K. Hall**, **J.S. Holloway**, **W.C. Kuster**, **A.E. Perring**, A.S.H. Prévôt, **J.P. Schwarz**, **J.R. Spackman**, S. Szidat, **N.L. Wagner**, R.J. Weber, P. Zotter, and **D.D. Parrish**, *Geophysical Research Letters,* 39, doi:10.1029/2011GL050718, 2012.

Editor's Highlight, *Geophysical Research Letters*: Ammonia Sources in the California South Coast Air Basin and Their Impact on Ammonium Nitrate Formation, **J.B. Nowak**, **J.A. Neuman**, **R. Bahreini**, **A.M. Middlebrook**, **J.S. Holloway**, **S.A. McKeen**, **D.D. Parrish**, **T.B. Ryerson**, and **M. Trainer**, *Geophysical Research Letters*, doi:10.1029/2012GL051197, 2012.

Editor's Highlight*, Climate Change*: The RCP Greenhouse Gas Concentrations and Their Extensions from 1765 to 2300, M. Meinshausen, S.J. Smith, K. Calvin, **J.S. Daniel**, M.L.T. Kainuma, J.-F. Lamarque, K. Matsumoto, S.A. Montzka, S.C.B. Raper, K. Riahi, A. Thomson, G.J.M. Velders, and D.P.P. van Vuuren, *Climate Change*, 109, 1-2, Special Issue: SI, 213-241, 2011.

Editor's highlight, *Journal of Geophysical Research*: An Assessment of Changing Ozone Loss Rates at South Pole: Twenty-five Years of Ozonesonde Measurements, **B. Hassler**, **J.S. Daniel**, B.J. Johnson, **S. Solomon**, and S.J. Oltmans, *Journal of Geophysical Research*, 116, D22301, doi: 10.1029/2011JD016353, 2011.

Editor's Highlight and Research Spotlight, *Geophysical Research Letters*: Atmospheric Emissions from the Deepwater Horizon Spill Constrain Air-Water Partitioning, Hydrocarbon Fate, and Leak Rate, **T. Ryerson**, **K.C. Aikin**, **W.M. Angevine**, E.L. Atlas, D.R. Blake, **C.A. Brock**, **F.C. Fehsenfeld**, **R.-S. Gao**, **J.A. de Gouw**, **D.W. Fahey**, **J.S. Holloway**, **D.A. Lack**, R.A. Lueb, S. Meinardi, **A.M. Middlebrook**, **D.M. Murphy**, **J.A. Neuman**, **J.B. Nowak**, **D.D. Parrish**, **J. Peischl**, **A.E. Perring**, **I.B. Pollack**, **A.R. Ravishankara**, **J.M. Roberts**, **J.P. Schwarz**, **J.R. Spackman**, **H. Stark**, **C. Warneke**, and **L.A. Watts**, *Geophysical Research Letters*, 38, doi:10.1029/2011GL046726, 2011.

Editor's highlight, *Journal of Geophysical Research*: Stratospheric Water Vapor Trends over Boulder, Colorado: Analysis of the 30 Year Boulder Record, D.F. Hurst, S.J. Oltmans, H. Vömel, **K.H. Rosenlof**, **S. Davis**, **E.A. Ray**, E. Hall and A. Jordan, *Journal of Geophysical Research*, 116, D02306, doi:10.1029/2010JD015065, 2011.

Editor's Highlight, *Journal of Geophysical Research*: The Glyoxal Budget and Its Contribution to Organic Aerosol for Los Angeles, California during CalNex 2010, **R.A. Washenfelder**, **C J. Young**, **S.S. Brown**, **W.M. Angevine**, E.L. Atlas, D.R., Blake, **D.M. Bon**, M.J. Cubison, **J.A. de Gouw**, S. Dusanter, J. Flynn, **J.B. Gilman**, **M. Graus**, S. Griffith, N. Grossberg, P.L. Hayes, J.L. Jimenez, **W.C. Kuster**, B.L. Lefer, **I.B. Pollack**, **T.B.**

Ryerson, H. Stark, P.S. Stevens, and **M.K. Trainer**, *Journal of Geophysical Research*, 116, doi: 10.1029/2011JD016314, 2011.

Editor's Highlight, *Nature Geoscience*: Signatures of the Antarctic Ozone Hole in Southern Hemisphere Surface Climate Change, D.W.J. Thompson, **S. Solomon**, P.J. Kushner, M.H. England, K.M. Grise, and D.J. Karoly, *Nature Geoscience*, 4, 11, 741-749, 2011.

Editor's Highlight, *Climatic Change*: Evolution of Anthropogenic and Biomass Burning Emissions of Air Pollutants at Global and Regional Scales during the 1980-2010 period, **C. Granier**, B. Bessagnet, T. Bond, A. D'Angiola, H. Denier van der Gon, **G.J. Frost**, A. Heil, J.W. Kaiser, S. Kinne, Z. Klimont, S. Kloster, J.-F. Lamarque, C. Liousse, T. Masui, F. Meleux, A. Mieville, T. Ohara, J.-C. Raut, K. Riahi, M.G. Schultz, S.J. Smith, A. Thompson, J. van Aardenne, G.R. van der Werf, and D.P. van Vuuren, *Climatic Change*, 109, 1-2, Special Issue: SI, 163-190, 2011.

Editor's Highlight, *Science*: The Persistently Variable "Background" Stratospheric Aerosol Layer and Global Climate Change, **S. Solomon**, **J.S. Daniel**, **R.R. Neely**, J.P. Vernier, E.G. Dutton, and L.W. Thomason, *Science*, 333, 6044, 866-870 doi: 10.1126/science.1206027, 2011.

Editor's Highlight*, Geoscientific Model Development*: Description and Evaluation of the Model for Ozone and Related chemical Tracers, version 4 (MOZART-4), L.K. Emmons, S. Walters, P.G. Hess, J-F. Lamarque, G.G. Pfister, D. Fillmore, **C. Granier**, A. Guenther, D. Kinnison, T. Laepple, J. Orlando, X. Tie, G. Tyndall, C. Wiedinmyer, S. L. Baughcum, and S. Kloster, *Geoscientific Model Development*, 3, 1, 43-67, 2010.

Editor's Highlight*, Atmospheric Chemistry and Physics*: Historical (1850-2000) Gridded Anthropogenic and Biomass Burning Emissions of Reactive Gases and Aerosols: Methodology and Application, J.-F. Lamarque, T. C. Bond, V. Eyring, **C. Granier**, A. Heil, Z. Klimont, D. Lee, C. Liousse, A. Mieville, B. Owen, M. G. Schultz, D. Shindell, S. J. Smith, E. Stehfest, J. Van Aardenne, **O. R. Cooper**, M. Kainuma, N. Mahowald, J. R. McConnell, V. Naik, K. Riahi, and D. P. van Vuuren, *Atmospheric Chemistry and Physics*, Volume: 10, Issue: 15, Pages: 7017-7039, 2010.

Editor's Highlight, *Science*: Contributions of Stratospheric Water Vapor to Decadal Changes in the Rate of Global Warming, **S. Solomon**, **K.H. Rosenlof**, **R.W. Portmann**, **J.S. Daniel**, **S.M. Davis**, **T.J. Sanford**, and G.-K. Plattner, *Science,* 327, 5970, 1219-1223, doi: 10.1126/science.1182488, 2010.

Editor's Highlight*, Science*: Nitrous Oxide (N_2O): The Dominant Ozone-Depleting Substance Emitted in the 21st Century, **A.R. Ravishankara**, **J.S. Daniel**, and **R.W. Portmann**, *Science*, 326, 5949, 123-125, 2009.

Editor's Highlight, *Proceedings of The National Academy of Sciences*: Irreversible Climate Change Due to Carbon Dioxide Emissions, **S. Solomon**, G.-K. Plattner, R. Knutti, and P. Friedlingstein, *Proceedings of The National Academy of Sciences of The United States of America*, 106, 6, 1704-1709, 2009.

Editor's Highlight*, Atmospheric Environment*: Atmospheric Composition Change: Ecosystems-Atmosphere interactions, D. Fowler, K. Pilegaard, M.A. Sutton, P. Ambus, M. Raivonenc, J. Duyzerd, Simpson, H. Fagerli, S. Fuzzi, J.K. Schjoerring, **C. Granier**, A. Neftel, I.S.A. Isaksen, P. Laj, M. Maione, P.S. Monks, J. Burkhardt, U. Daemmgen, J. Neirynck, E. Personne, R. Wichink-Kruit, K. Butterbach-Bahl, C. Flechard, J.P. Tuovinen, M. Coyle, G. Gerosa, B. Loubet, N. Altimir, L. Gruenhage, C. Ammann, S. Cieslik, E. Paoletti, T.N. Mikkelsen, H. Ro-Poulsen, P. Cellier, J.N. Cape, L. Horváth, F. Loreto, Ü. Niinemets, P.I. Palmer, J. Rinne, P. Misztal, E. Nemitz, D. Nilsson, S. Pryor, M.W. Gallagher, T. Vesala, U. Skiba, N. Brüggemann, S. Zechmeister-Boltenstern, J. Williams, C. O'Dowd, M.C. Facchini, G. de Leeuw, A. Flossman, N. Chaumerliac, J.W. Erisman, *Atmospheric Environment*, 43, 33, Special Issue: SI, 5193-5267, 2009.

Editor's Highlight, *Atmospheric Environment*: Atmospheric Composition Change - Global and Regional Air Quality, P.S. Monks, **C. Granier**, S. Fuzzi, A. Stohl, M.L. Williams, H. Akimoto, M. Amann, A. Baklanov, U. Baltensperger, I. Bey, N. Blake, R.S. Blake, K. Carslaw, **O.R. Cooper**, F. Dentener, D. Fowler, E. Fragkou, **G.J. Frost**, S. Generoso, P. Ginoux, V. Grewe, A. Guenther, H.C. Hansson, S. Henne, J. Hjorth, A. Hofzumahaus, H. Huntrieser, I.S.A. Isaksen, M.E. Jenkin, J. Kaiser, M. Kanakidou, Z. Klimont, M. Kulmala, P. Laj, M.G. Lawrence, J.D. Lee, C. Liousse, M. Maione, G. McFiggans, A. Metzger, A. Mieville, N. Moussiopoulos, J.J. Orlando, C.D. O'Dowd, P.I. Palmer, **D.D. Parrish**, A. Petzold, U. Platt, U. Pöschl, A.S.H. Prévôt, C.E. Reeves, S. Reimann, Y. Rudich, K. Sellegri, R. Steinbrecher, D. Simpson, H. ten Brink, J. Theloke, G.R. van der Werf,

R. Vautard, V. Vestreng, Ch. Vlachokostas, and R. von Glasow, *Atmospheric Environment*, 43, 33, Special Issue: SI, 5268-5350, 2009.

AGU Editor's Highlight, *Geophysical Research Letters,* Secondary organic aerosol yields from cloud-processing of isoprene oxidation products, **B. Ervens**, A.G. Carlton, B.J. Turpin, K.E. Altieri, S.M. Kreidenweis, and **G. Feingold**, *Geophysical Research Letters*, 35, L02816, doi: 2007GL031828, 2008.

Recognition of Posters/Presentations

Abigail Koss, American Geophysical Union Outstanding Student Paper Award (Atmospheric Sciences category), for "Derived Emission Rates and Photochemical Production Rates of Volatile Organic Compounds (VOCs) Associated with Oil and Natural Gas Operations in the Uintah Basin, UT During a Wintertime Ozone Formation Event," AGU Fall Meeting, 2014.

Alexis Attwood, Outstanding Poster Award, DOC Boulder Laboratories Postdoctoral Poster Symposium, 2014.

Shona Smith, Outstanding Poster Award, DOC Boulder Laboratories Postdoctoral Poster Symposium, 2012.

Tara Kahan, Outstanding Poster Award, DOC Boulder Laboratories Postdoctoral Poster Symposium, 2011.

Ryan Neely, American Geophysical Union, Outstanding Student Paper Award, for "Initial Results of the Cloud, Aerosol Polarization and Backscatter Lidar at Summit, Greenland," AGU Fall Meeting, 2011.

Awards for outstanding oral and poster presentations by students and early-career scientists at the October 2011 World Climate Research Program (WCRP) Climate Conference in Denver, Colorado:

- **Ryan Neely**, a University of Colorado student and CIRES scientist in CSD's Chemistry and Climate Processes Program, received an award for his oral presentation, "Trends and Annual Cycles in the Background Stratospheric Aerosol Layer" [coauthored with **Susan Solomon**, John Barnes, and Ellsworth Dutton]
- **Irina Mahlstein**, a CIRES scientist in CSD's Chemistry and Climate Processes Program, for "September Arctic sea ice predicted to disappear for 2°C global warming above present" [poster coauthored with Reto Knutti]
- **Andrew Rollins**, a CIRES scientist in CSD's Atmospheric Composition and Chemical Processes Program, for "SPARC Water Vapor Assessment: Measurements of water vapor in the upper troposphere and lower stratosphere with CIMS during the 2011 MACPEX mission" [poster coauthored with **Troy D. Thornberry**, **Ru-Shan Gao**, **David W. Fahey**, Emrys G. Hall, Allen F. Jordan, Dale F. Hurst, Cornelius Schiller, Nicole Spelten, Martina Kraemer, Jessica B. Smith, Maryann R. Sargent, and David S. Sayres]
- **Paul J. Young**, a CIRES scientist in CSD's Chemistry and Climate Processes Program, for "Modeling the impact of late 20th century stratospheric ozone changes: Sensitivity to different ozone forcing data sets" [poster coauthored with **Susan Solomon**, **Birgit Hassler**, Greg Bodeker, **Robert W. Portmann**, and Jean- Francois Lamarque]
- **Birgit Hassler**, a CIRES scientist in CSD's Chemistry and Climate Processes Program, for "Twenty-five years of ozonesonde measurements at South Pole: An assessment of changing loss rates" [poster coauthored with **Susan Solomon**, **John S. Daniel**, Samuel J. Oltmans, and Bryan Johnson]

Alexis Attwood, American Geophysical Union Outstanding Student Paper Award, "The Effects of Mineral Dust on the Hygroscopic and Optical Properties of Inorganic Salt Aerosols," AGU Fall Meeting, 2011.

Rebecca Washenfelder, Outstanding Poster Award, DOC Boulder Laboratories Postdoctoral Poster Symposium, 2009.

Armin Sorooshian, Outstanding Poster Award, DOC Boulder Laboratories Postdoctoral Poster Symposium, 2009.

Patrick Veres, American Geophysical Union Outstanding Student Paper Award, AGU Fall Meeting, 2009.

Rebecca Washenfelder, Outstanding Poster Award, DOC Boulder Laboratories Postdoctoral Poster Symposium, 2008.

Hailong Wang, Outstanding Poster Award, DOC Boulder Laboratories Postdoctoral Poster Symposium, 2008.

Jeff Peischl, Outstanding Poster Award, DOC Boulder Laboratories Postdoctoral Poster Symposium, 2008.

Recognition of Outreach/Education/EEO/Diversity Efforts

Debra Dailey-Fisher, for helping to lead NOAA's efforts in providing opportunities to high school and college students, State of Colorado, "Governor's Summer Job Hunt 2012," awarded 2012.

MacKenzie Metcalfe, high school student intern at CSD, for her initiative and contributions as a summer intern working for NOAA, State of Colorado, "Governor's Summer Job Hunt 2012," awarded 2012.

MacKenzie Metcalfe, high school student intern at CSD, Greenhouse Scholar, program to support high-performing, under-resourced college students, 2012.

Leadership Roles

NOAA Roles

Stu McKeen, Member, design review committee for updates to the National Centers for Environmental Prediction (NCEP) air quality forecast program (2005-present).

Robert Banta, Coordinator, for CSD's activities in ESRL's new multi-laboratory, multi-agency Renewable Energy Program (2008-present).

Yelena Pichugina, Member, NOAA Renewable Energy Team, (2009-Present).

Members, NOAA Strategy, Execution, and Evaluation Council: **A.R. Ravishankara** (2010-2013) and **Eric Williams** (2010–present).

Karen Rosenlof, Author, NOAA State of the Climate Report (2010-present).

Sean Davis, Author, NOAA State of the Climate Report (2011-present).

David Fahey, Member, NOAA OAR Geoengineering Working Group (2012-present).

John S. Daniel, Chair of the NOAA Research Council's NOAA Libraries Advisory Committee (NLAC) (2014-present).

Jim Meagher NOAA Air Quality Program Manager, Weather and Water Goal (2004-2010).

A.R. Ravishankara, NOAA Lead, Understanding Climate Processes capability of the Climate Research and Modeling Program, NOAA Climate Goal (2007-2013).

A.R. Ravishankara, Lead, NOAA Health of the Atmosphere research program (2006-2013).

Co-lead, Atmospheric Composition, Carbon Cycle, and Climate Program of the NOAA Climate Program Office: **A.R. Ravishankara** (2011-2013) and **David Fahey** (2014-present).

Graham Feingold, NOAA representative to European Space Agency/Japan Aerospace Exploration Agency (ESA/JAXA) EarthCARE Mission (Earth Clouds, Aerosols, and Radiation Explorer) (2007-2012).

David Fahey, Member, NOAA Unmanned Aircraft System (UAS) Team and High-Altitude Long-Endurance (HALE) Working Group (2008-2010).

CIRES Roles

Joost de Gouw, CIRES Co-Associate Director for Environmental Chemistry, (2013-present).

Fred Fehsenfeld, CIRES Associate Director for Environmental Chemistry, (1998-2013).

R. Michael Hardesty, CIRES Associate Director for Environmental Observations, Modeling and Forecasting, (1998-present).

Allison McComiskey (Chair), **Jessica Gilman** (Vice-Chair), **Rick Tisinai** (Vice-Chair), **Brandi McCarty** (Member), **Anne Perring** (Member), **Ken Aikin** (Member), CIRES Members Council, various terms, (2008-2015).

Other Federal Roles

Jim Churnside, Member, U.S. Department of Defense Advanced Sensors Application Program Scientific Steering Group, (2005-present).

James B. Burkholder, Panel Member, NASA/JPL Chemical Kinetics and Photochemical Data Evaluation Panel, 2008-Present.

Allison McComiskey, Member, Science and Infrastructure Steering Committee, Department of Energy Atmospheric Radiation Measurement (ARM) and Atmospheric System Research (ASR), (2009-present).

Allison McComiskey, Cochair of the Aerosol Working Group, Department of Energy, Atmospheric System Research (ASR), (2009-present).

Andrew Langford, Member, U.S. EPA Stratospheric Intrusion Working Group, (2011-present).

Andrew Langford, Principal Investigator, NASA Tropospheric Ozone Lidar Network (TOLNet), (2011-present).

James Meagher (2006-2012), **A.R. Ravishankara** (2012-2013), and **John Daniel** (2014-present), Cochair, Air Quality Research Subcommittee of the Committee on Environment, Natural Resources, and Sustainability.

Greg Frost, Cochair, Emissions Working Group, NASA GEOstationary Coastal and Air Pollution Events (GEO-CAPE) Mission Science Team, (2013-present).

Si-Wan Kim, Member, NASA GEO-CAPE Satellite Science Working Group, (2013-present).

Graham Feingold, Member, Cloud-Aerosol-Precipitation-Interaction Working Group of the Department of Energy ASR, (2013-present).

R. Michael Hardesty, Cochair, NOAA-NASA Working Group on Space-Based Lidar Winds, (2010-2013).

Tom Ryerson, Member, NASA Tropospheric Airborne Measurement Evaluation Panel, (2007-2012).

A.R. Ravishankara, Cochair, Interagency Working Group on Atmospheric Composition, U.S. Climate Change Science Program (CCSP), (2005-2011).

A.R. Ravishankara, Co-Lead, U.S. CCSP Synthesis and Assessment Product 2.4 ("Trends in Emissions of Ozone-Depleting Substances, Ozone Layer Recovery, and Implications for Ultraviolet Radiation Exposure"), (2005-2008).

U.S. Non-Federal Roles

J. Andrew Neuman, Member, Scientific Advisory Board, Texas Air Research Center (2009-present).

David Parrish and **Fred Fehsenfeld**, Members, Independent Technical Advisory Committee (ITAC), Texas Air Quality Research Program (2010-present).

Allison McComiskey, Member, American Meteorological Society (AMS) Committee on Radiation (2012-present).

Yelena Pichugina, Member, American Meteorological Society (AMS) Renewable Energy Committee (2012-present).

Chuck Brock, member, ACCORD Aircraft Inlet Committee, National Science Foundation, (2015-present).

Greg Frost, Panelist, National Academy of Sciences Workshop on the Development of Unconventional Hydrocarbon Resources in the Appalachian Basin, Morgantown, West Virginia (2013).

Wayne Angevine, Chair, American Meteorological Society Committee on Boundary Layers and Turbulence (2009-2012).

R. Michael Hardesty, Councilor (2010-2012) and Member of the Executive Committee (2011-2012) of the American Meteorological Society.

Yelena Pichugina, Member, Colorado Research and Education in Wind (CREW), (2009-2011).

A.R. Ravishankara, Member, National Academy of Sciences Committee on America's Climate Choices, Panel on Advancing the Science of Climate Change, (2008-2010).

R. Michael Hardesty, Member, NASA Earth Systems Science and Applications Technology Subcommittee, (2002-2008).

International Roles

Jim Churnside, Delegate, International Council for the Exploration of the Seas, Working Group on Fisheries Acoustics Science and Technology (2003-present).

Owen Cooper, Member and sub-project leader, United Nations Task Force on Hemispheric Transport of Air Pollution (TF HTAP), established by the Executive Body of the UNECE (United Nations Economic Commission for Europe) (2006-present).

A.R. Ravishankara, Cochair, Montreal Protocol Scientific Assessment Panel (2007-present).

David Fahey, Steering Committee, Stratospheric Processes and their Role in Climate program (SPARC) (2007-present).

Graham Feingold, Cochair, Aerosols, Clouds, Precipitation, and Climate (ACPC), Project of the International Global Atmospheric Chemistry Project of IGBP, and Scientific Steering Committee member (2008-present).

Karen Rosenlof, Co-Lead, SPARC Water Vapour Assessment-2 (WAVAS-II; 2008-present).

Christoph Senff, Member, International Coordination Group on Laser Atmospheric Studies (2008-present).

James B. Burkholder, Member of WMO Absorption Cross Sections of Ozone (ASCO) Experts Committee, 2009-Present.

Amy Butler, Committee Member, SPARC Dynamics and Variability (DynVar) working group (2010-present).

A.R. Ravishankara, Member, Board of the International Atmospheric Chemistry Society (2010-present).

Claire Granier, Member, Steering Committee of the International Global Atmospheric Chemistry Project (IGAC) of the International Geosphere-Biosphere Programme (2011-present).

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

Greg Frost, Cochair, GEIA (Global Emissions InitiAtive) of the International Geosphere-Biosphere Programme (IGBP) (2012-present).

Claire Granier, Databases Director, GEIA (Global Emissions InitiAtive) of the International Geosphere-Biosphere Programme (IGBP) (2012-present).

Si-Wan Kim, Member, Task Force on Hemispheric Transport of Air Pollutants (HTAP), established by the Executive Body of the UNECE (United Nations Economic Commission for Europe) (2012–present).

Tom Ryerson (Lead); **David Fahey** and **Ken Aikin** (Members), IGAC/SPARC Chemistry-Climate Model Initiative (CCMI) working group on improved evaluation of chemistry-climate models using in-situ research aircraft data (2012-present).

Tom Ryerson, Scientific Steering Committee Member, IGAC/SPARC Chemistry-Climate Model Initiative, (2013-present).

Si-Wan Kim, Science Team Member, Korean Geostationary Environmental Monitoring Spectrometer (GEMS) (2013-present).

Tom Ryerson, Member, EU Monitoring Atmospheric Composition and Climate – Interim Implementation (MACC-II) User Advisory Board (2014-present).

David Fahey, Member, International Commission on Atmospheric Chemistry and Global Pollution (ICACGP) of International Association of Meteorology and Atmospheric Science (IAMAS) (2014-present).

Owen Cooper, Chair, Tropospheric Ozone Assessment Report (TOAR), an official Activity of the International Global Atmospheric Chemistry Project (IGAC) (2014-present).

Claire Granier, Member, Global Atmosphere Watch/World Meteorological Organization Task Team on "Observation Requirements and Satellite Needs" (2014-present).

Tom Ryerson, Member, WMO Global Atmosphere Watch Scientific Advisory Group on Reactive Gases (2009-2015).

Birgit Hassler, Invited Expert, 9th meeting of the Ozone Research Managers of the Parties to the Vienna Convention, Geneva (May, 14-16, 2014).

David Fahey and **Claire Granier**, Members, International Ozone Commission (IO3C) (2008 – present and 2004-2012, respectively).

David Fahey, Member, Steering Committee, Chemistry Climate Model Validation program, Stratospheric Processes and their Role in Climate (2003-2008).

Karen Rosenlof, Member, Advisory Board of the European Space Agency SPARC Initiative (SPIN) (2013).

R. Michael Hardesty, Member, Atmospheric Dynamics Mission/Aeolus Mission Advisory Group of the European Space Agency (2006-2013).

Graham Feingold, Member, Scientific Steering Committee of the International Global Atmospheric Chemistry project (IGAC) of IGBP (2008-2013).

Greg Frost, Lead, Community Initiative for Emissions Research and Applications (CIERA), a demonstration project now incorporated into the Global Emissions InitiAtive (GEIA) (2010-2013).

David Fahey and **Ru-Shan Gao**, Lead Organizers, **Karen Rosenlof**, referee, AquaVIT water vapor international intercomparisons, Karlsruhe, Germany (2008 and 2013).

Graham Feingold, Member, Executive Committee of the International Commission on Clouds and Precipitation (ICCP) (of the International Association of Meteorology and Atmospheric Sciences, International Union of Geodesy and Geophysics) (2004-2012).

Jim Meagher, Member and Cochair, Executive Committee of NARSTO (international U.S.-Canada-Mexico research coordinating organization for air quality) (2008-2012).

Jim Churnside, Cochair, International Council for the Exploration of the Seas, Study Group on Fisheries Optical Technologies (2007-2012).

Claire Granier, Cochair, GEIA (Global Emissions InitiAtive) of the International Geosphere-Biosphere Programme (IGBP) (2005-2011).

David Parrish, Member, Task Force on Hemispheric Transport of Air Pollutants (HTAP), established by the Executive Body of the UNECE (United Nations Economic Commission for Europe) (2006–2011).

Claire Granier, Member, Scientific Steering Committee, Analysis, Integration, and Modeling of the Earth System (AIMES) project of the International Geosphere-Biosphere Programme (IGBP) (2005-2010).

A.R. Ravishankara, Cochair (founding), Atmospheric Chemistry and Climate (ACC) joint project between WCRP/SPARC and IGBP/IGAC (2007-2009).

Graham Feingold, Member, WMO/IUGG International Aerosol-Precipitation Scientific Assessment Group (IAPSAG) (2004-2008).

A.R. Ravishankara, Cochair, SPARC/WCRP Group on Upper Troposphere/Lower Stratosphere Chemistry (1995-2009).

Susan Solomon, Cochair, Working Group 1, Intergovernmental Panel on Climate Change (IPCC) (2002–2008).

A.R. Ravishankara, Cochair, SPARC/IGAC Initiative on Laboratory Atmospheric Chemistry, joint with IGAC/IGBP (1998-2008).

Greg Frost, Panelist, Future Scientific and Policy Challenges in Tropospheric Composition, 5th ACCENT Barnsdale Expert Workshop, Barnsdale, United Kingdom, 2008.

Fred Fehsenfeld, Co-founding group of NARSTO (international U.S.-Canada-Mexico research coordinating organization for air quality) and past Steering Committee member.

Field Mission Leadership Roles

Joost de Gouw (Principal Investigator), Shale Oil and Natural Gas Nexus (SONGNEX), 2015.

Jim Roberts and **Carsten Warneke** (Co-Lead Scientists), Fire Influence on Regional and Global Environments Experiment (FIREX), (2015-2019).

Steve Brown (Co-Principal Investigator), Wintertime Investigation of Transport, Emissions, and Reactivity-2015 (WINTER-2015), 2015.

David Fahey (Co-Platform Scientist), the NASA Global Hawk Unmanned Aircraft System (UAS) in the NASA Airborne Tropical TRopopause Experiment (ATTREX), (2010-2015).

Tom Ryerson (Co-Principal Investigator), Twin Otter Projects Defining Oil/gas Well emissioNs (TOPDOWN), (2014-2015).

Tom Ryerson (Science Team Leader) and **David Fahey** (Science Team Member), Atmospheric Tomography Mission (ATom), (2015-2019).

Yelena Pichugina, **Robert Banta**, and **Alan Brewer** (Co-Principal Investigators), Wind Forecast Improvement Project in Complex Terrain (WFIP II), U.S. Department of Energy, (2014-2016).

Jim Roberts (Lead), Energy and Environment: Uintah Basin Winter Ozone Study (UBWOS), (2012-2014).

Joost de Gouw (Mission Lead), Southeast Nexus: Studying the Interactions Between Natural and Anthropogenic Emissions at the Nexus of Climate Change and Air Quality (SENEX) field mission, 2013.

Andrew Langford (Principal Investigator), Las Vegas Ozone Study (LVOS), 2013.

Karen Rosenlof (Member, leadership team), Studies of Emissions and Atmospheric Composition, Clouds and Climate Coupling by Regional Surveys (SEAC4RS) field mission, 2013.

Yelena Pichugina and **Robert Banta**, (Co-Principal Investigators), NOAA Study to Inform Meteorological Observation for Offshore Wind Positioning of Offshore Wind Energy Resources (POWER), U.S. Department of Energy, 2013.

Julie Lundquist, **Robert Banta**, **Yelena Pichugina**, and **Alan Brewer** (Co-Principal Investigators), The Turbine Wake and Inflow Characterization Study (TWICS), U.S. Department of Energy, (2010-2012).

Jessica Gilman, (Lead Organizer), Summer Ozone Near Natural gas Emissions (SONNE) field experiment, Boulder Atmospheric Observatory, summer 2012.

Owen Cooper (Steering Committee member), NCAR's Deep Convective Clouds and Chemistry (DC3) experiment, (2005-2012).

Tom Ryerson (Principal Investigator), NOAA NOy-O_3 instrument on the NASA DC-8, SEAC4RS, (2012-2013).

Bob Banta, **Alan Brewer**, and **Yelena Pichugina** (Co-Leads), Turbine Wake and Inflow Characterization Study (TWICS), 2011.

Steve Brown (Co-Principal Investigator), Nitrogen Aerosol Composition and Halogens on a Tall Tower (NACHTT), 2011.

David Fahey (Co-Project Scientist), the NASA Global Hawk Pacific (GloPac) Mission using the NASA Global Hawk Unmanned Aircraft System (UAS), 2010.

Tom Ryerson, **Dan Murphy**, **David Parrish**, **Eric Williams**, **Joost de Gouw** (Co-Leads), CalNex field mission, California, 2010.

Owen Cooper, Principal Investigator, IONS 2010 Ozonesonde Experiment during CALNEX, California, 2010.

Jim Churnside (Co-lead), Thin Layer Dynamics in East Sound, (2009-2011).

Dan Murphy, **Tom Ryerson**, and **Chuck Brock** (Co-Leads), the Aerosol, Radiation, and Cloud Processes affecting Arctic Climate (ARCPAC) Mission, 2008.

Conferences (Chair, Convener, Session Organizer, etc.)

Claire Granier (Cochair), 2016 International Global Atmospheric Chemistry (IGAC) Conference Scientific Program Committee, 2014-present.

Owen Cooper (Planning Committee), Transboundary Ozone Pollution Conference, Yosemite, California, 2015.

Sean Davis (Lead Convener), AGU Chapman conference, The Width of the Tropics: Climate Variations and Their Impacts, Santa Fe, NM, July 26-31, 2015.

Steve Brown (Chair) and **Rebecca Washenfelder** (Organizing Committee), 11th International User Meeting and Summer School on Cavity Enhanced Spectroscopy, Boulder, Colorado, summer 2015.

Sean Davis, (Session Chair), "Middle Atmosphere Dynamics, Reanalysis Systems, Data Assimilation," 18th Conference on the Middle Atmosphere, American Meteorological Society Annual Meeting, 2015.

Yelena Pichugina, (Session Chair), "Short-Range Forecast Modeling for Solar Electric Generation II," American Meteorological Society Annual Meeting, Sixth Conference on Weather, Climate, and the New Energy Economy, 2015.

Mike Hardesty (Session Chair), American Meteorological Society Annual Meeting, 2013 and 2015.

Owen Cooper (Organizer), First Workshop of IGAC's Tropospheric Ozone Assessment Report, Boulder, Colorado, 2014.

David Fahey (Session Co-convener), "Radiative Effects of Atmospheric Aerosols," European Geophysical Union General Assembly, Vienna, 2014.

Andrew Langford, (Session Cochair), "Air Quality and Atmospheric Measurements II," 16th Conference on Atmospheric Chemistry at the 2014 Annual Meeting of the American Meteorological Society, Atlanta, 2014.

Stu McKeen (Organizing Committee), U.S. Weather Research Program (USWRP) Air Quality Program Workshop sponsored by NOAA's Office of Weather and Air Quality, Greenbelt, Maryland, 2014.

Anne Perring (Session Cochair), "Bioaerosols and Homeland Security," American Association of Aerosol Research 33rd Annual Conference, 2014.

Yelena Pichugina (Session Chair and Judge for student presentations), "Renewable Energy Applications: Observations and Simulations of Wind Farms," AMS 21st Symposium on Boundary Layers and Turbulence, Leeds, U.K., 2014.

Steve Brown (Session Convener), "Chemistry of Atmospheric Nitrogen Containing Compounds," American Chemical Society National Meeting, 2014.

Carsten Warneke (Session Convener), "Atmospheric Impacts of Oil and Gas Development," Fall Meeting of the American Geophysical Union, 2014.

Sean Davis (Session Convener and Chair), "Reanalysis: Evaluation and Intercomparison," Fall Meeting of the American Geophysical Union, 2014.

Steve Brown (Convener) and **David Parrish** (Chair), "Air Quality in Asia," Fall Meeting of the American Geophysical Union, 2014.

Jan Kazil (Chair and Primary Convener), "Warm Boundary Layer Clouds and Climate Change from the Cloud- to the Global Scale," Fall Meeting of the American Geophysical Union, 2014.

Troy Thornberry (Chair, Convener), "Processes Controlling Upper Troposphere/Lower Stratosphere Composition and Structure," Fall Meeting of the American Geophysical Union, 2014.

Joost de Gouw (Chair, Convener), "Atmospheric Gas-Phase and Aerosol Chemistry over the Southeastern United States," Fall Meeting of the American Geophysical Union, 2014.

Barbara Ervens (Convener), "Atmospheric Ice Nucleii and Ice Cloud Formation: Field, Laboratory, and Modeling Studies," Fall Meeting of the American Geophysical Union, 2014.

Greg Frost (Cochair and Primary Convener), "Improving Emissions through Observations," Fall Meeting of the American Geophysical Union, 2014.

Barbara Ervens (Workshop Organizer), Aerosols and Clouds: Connections from the Laboratory to the Field to the Globe, Telluride Science Research Center, Telluride, Colorado, 2014.

Owen Cooper (Scientific Steering Committee), MOZAIC–IAGOS Scientific Symposium on Atmospheric Composition Observations by Commercial Aircraft: 20th Anniversary, 12 – 15 May 2014, Toulouse, France.

Greg Frost (Organizer), 16th Global Emissions InitiAtive (GEIA) Conference, Boulder, Colorado, 2014.

Steve Brown (Chair), Gordon Research Conference on Atmospheric Chemistry, Vermont, 2013.

Greg Frost (Organizer), 15th Global Emissions InitiAtive (GEIA) Conference, Toulouse, France, 2013.

Christoph Senff (Session Chair), Annual Meeting of the American Meteorological Society, Austin, Texas, 2013.

Mike Hardesty (Scientific Steering Committee), Coherent Laser Radar Conference, (2009, 2011, 2013).

Jan Kazil (Chair and Session Convener), "Wet Scavenging and Deposition: Quantification, Mechanistic Understanding, and Impacts," Fall Meeting of the American Geophysical Union, 2013.

Greg Frost (Cochair and Primary Convener), "Measurements, Modeling, and Evaluation of Emissions," Fall Meeting of the American Geophysical Union, 2013.

Joost de Gouw (Session Convener), "SENEX," Fall Meeting of the American Geophysical Union, 2013.

James Roberts (Session Co-Convener), "Atmospheric Impacts of Oil and Gas Development," Fall Meeting of the American Geophysical Union, 2013.

Jim Churnside (Program Committee Member and Session Chair), SPIE Conference on Ocean Sensing and Monitoring III and IV, 2012 and 2013.

Greg Frost (Session Convener), "Emissions Understanding, Constraints, and Changes," Fall Meeting of the American Geophysical Union, 2012.

Barbara Ervens (Session Convener), "Ice Nucleation and Properties of Cold Clouds," Fall Meeting of the American Geophysical Union, 2012.

Mike Hardesty (Session Chair) International Symposium on Tropospheric Profiling, 2012.

Joshua Schwarz (Session Convener), "Black Carbon Aerosol: Measurements, Mechanisms, and Climate Forcing," Fall Meeting of the American Geophysical Union, 2012.

Christoph Senff (Session Chair), 26th International Laser Radar Conference, Porto Heli, Greece, 2012.

Robert Banta (Facilitator and Discussion Group Leader), Department of Energy Complex Flow Workshop (became the template for DOE's second Wind Forecast Improvement Program, currently in the planning stages), 2012.

Wayne Angevine (Cochair), American Meteorological Society 20th Symposium on Boundary Layers and Turbulence, Boston, Massachusetts, 2012.

Andrew Rollins and **Troy Thornberry** (Session Cochairs), "Water vapor in the upper troposphere and lower stratosphere," Fall Meeting of the American Geophysical Union, 2012.

Jan Kazil (Chair and Session Convener), "Nanoparticles in the Earth's Atmosphere," Fall Meeting of the American Geophysical Union, 2012.

Mike Hardesty (Symposium Cochair and Session Chair), 16th International Symposium for the Advancement of Boundary-Layer Remote Sensing, Colorado, 2012.

Barbara Ervens (Session Chair), "The Chemical Processing of Atmospheric Organic Aerosol," Fall Meeting of the American Geophysical Union, 2012.

Mike Hardesty (Session Chair), International Laser Radar Conference, 2010 and 2012.

James B. Burkholder, Chair, 22nd International Symposium on Gas Kinetics, Boulder, Colorado, 2012.

Steve Brown (Vice-Chair), Gordon Research Conference on Atmospheric Chemistry, Vermont, 2011.

Graham Feingold (Session Convener), "Aerosol-Cloud-Precipitation-Radiation-Interactions," International Union of Geodesy and Geophysics (IUGG), Melbourne, Australia, 2011.

Mike Hardesty (Organizer), NOAA/NSF Workshop on Tropospheric Profiling Technologies, 2011.

David Parrish (Session Convener), "Current Air Quality Issues in California," Fall Meeting of the American Geophysical Union, 2011.

Jan Kazil (Chair and Session Convener), "Coupled Ocean Atmosphere Land Processes in Tropical Eastern Oceans," Fall Meeting of the American Geophysical Union, 2011.

Si-Wan Kim (Session Convener), "Remote Sensing of Trace Gases and Aerosols: Air Quality Applications," Fall Meeting of the American Geophysical Union, 2011.

Steve Brown (Session Convener), "Tropospheric Halogens: Sources, Multiphase Chemistry, and Impacts," Fall Meeting of the American Geophysical Union, 2011.

Ru-Shan Gao (Session Chair), "Aerosol Modeling I," 7th Asian Aerosol Conference, Xi'an, China, 2011.

David Fahey (Member, Organizing Committee), NOAA Climate Variability and Change Science Challenge Workshop, Boulder, Colorado, 2011.

Greg Frost (Session Convener), "Evaluating Emissions Across Spatial and Temporal Scales," Fall Meeting of the American Geophysical Union, 2011.

Karen Rosenlof (Session Co-organizer), "Changes in Variability Associated with Climate Change," and session Co-organizer for water vapor poster cluster, World Climate Research Program meeting, 2011.

Yelena Pichugina (Session Organizer, Chair, and Judge of student presentations), "Weather-driven Renewable Energy session," Fall Meeting of the American Geophysical Union, 2011.

Barbara Ervens (Session Convener), "Multiphase Chemistry: Aerosol Formation and Modification by Aqueous Phase Processes," Fall Meeting of the American Geophysical Union, 2010, 2011, 2013.

Graham Feingold (Session Convener), Fall Meeting of the American Geophysical Union, 2010 and 2011.

Tom Ryerson (Convener), Boulder *Deepwater Horizon* Joint Chemical Analysis meeting, 2011.

Owen Cooper (Session Convener), "Impact of Baseline Ozone and Particulate Matter on Surface Air Quality," Fall Meeting of the American Geophysical Union, 2011.

David Parrish (Session Convener), "Climate Change, Air Quality and Their Interrelations at the North American West Coast," Fall Meeting of the American Geophysical Union, 2010.

Joost de Gouw (Session Convener), "Formation and properties of organic aerosols: Observations, laboratory studies, and models," Fall Meeting of the American Geophysical Union, 2011.

Chuck Brock (Session Convener), "Aerosols in Urban and Rural Environments: Sources, Transformations, Properties, and Atmospheric Effects," Fall Meeting of the American Geophysical Union, 2011.

Joost de Gouw (Session Convener), "CalNex," Fall Meeting of the American Geophysical Union, 2010.

Karen Rosenlof and **Sean Davis** (Conveners), special session on tropical extent, Fall Meeting of the American Geophysical Union, 2010.

Greg Frost (Session Convener), "Quantification of Emissions: Addressing Current and Future Challenges," Fall Meeting of the American Geophysical Union, 2010.

Greg Frost (Chair), Global/International Issues Session, EPA 19th Annual Emission Inventory Conference, San Antonio, Texas, 2010.

Yelena Pichugina (Organizing Committee), International Laser Radar Conference, 2010.

Wayne Angevine (Cochair), American Meteorological Society 19th Symposium on Boundary Layers and Turbulence, Keystone, CO, 2010.

Steve Brown (Session Convener), "Atmospheric Chemistry and Climate," American Chemical Society National Meeting, 2010.

Chuck Brock (Session Convener), "Composition of the Arctic Atmosphere: Sources, Transport, Chemistry, and Impacts on Clouds and Climate," Fall Meeting of the American Geophysical Union, 2009.

Chuck Brock (Workshop Convener), ARCPAC Data Workshop, 2009.

Greg Frost (Organizer), Workshop on a Coordinated U.S. Initiative on Emissions Research, Boulder, Colorado, 2009.

Owen Cooper (Session Convener), "Vertical and Long-Range Transport of Trace Gases and Aerosols," European Geophysical Union General Assembly, 2009.

Greg Frost (Coordinator), International Workshop on Air Quality Forecasting Research, Boulder, Colorado, 2009.

Barbara Ervens (Session Chair), "Chemical Transformations of Organic Compounds in Aerosol and Clouds," Joint Assembly Meeting AGU, Toronto, 2009.

Greg Frost (Session Chair), "Anthropogenic Emissions at Different Scales," GEIA-ACCENT Open Conference, Oslo, Norway, 2009.

Greg Frost (Organizer), Workshop on Surface Emission of Atmospheric Compounds, Boulder, Colorado, 2009.

Barbara Ervens (Session Chair), "Aerosol, Clouds, and Climate" 27th American Association for Aerosol Research, Annual Conference, Orlando, 2008.

Claire Granier (Cochair), organization committee of the 10th International Global Atmospheric Chemistry (IGAC) Conference, International Geosphere-Biosphere Programme, 2008.

Christoph Senff (Steering Committee Member and Cochair of the Program Committee), 24th International Laser Radar Conference (under the auspices of the International Radiation Commission, International Association of Meteorology and Atmospheric Physics), 2008.

Karen Rosenlof (Member, Organizing Committee), Chapman Water Vapor Conference, 2008.

Joost de Gouw (Session Convener), "Sources, Evolution, and Sinks of Organics in the Troposphere," Fall Meeting of the American Geophysical Union, 2008.

R. Michael Hardesty (General Cochair), 24th International Laser Radar Conference (under the auspices of the International Radiation Commission, International Association of Meteorology and Atmospheric Physics), 2008.

Robert Banta, (Group Leader and Facilitator), Department of Energy-sponsored wind-energy planning workshop, Wind Resource Characterization, 2008.

R. Michael Hardesty (Session Convener), "The Role of Atmospheric Wind Measurements in Weather and Climate Forecasting," Fall Meeting of the American Geophysical Union, 2008.

Robert Banta (Session Chair), AMS Boundary Layers and Turbulence, Stockholm, Sweden, 2008.

Service to the Scientific Community

Editorships

Graham Feingold, Editor, *Atmospheric Chemistry and Physics* (2003-present).

A.R. Ravishankara, Member, Advisory Editorial Board, *Physical Chemistry Chemical Physics* (2003-present).

Greg Frost, Associate Editor, *Journal of Geophysical Research-Atmospheres*, American Geophysical Union (2007-present).

James B. Burkholder, Co-Editor*, Atmospheric Chemistry and Physics*, (2008-Present).

David Parrish, Editorial Advisory Board, *Atmospheric Environment* (2009–present).

David Parrish, Editorial Board, *Journal of Atmospheric Chemistry* (2009–present).

Jim Churnside, Associate Editor, *Optics Express* (2011-present).

Allison McComiskey, Assistant Editor, AMS *Journal of Applied Meteorology and Climatology* (2013-present).

Greg Frost, Guest Editor, *Atmospheric Chemistry and Physics* (2013-present)

Wayne Angevine, Associate Editor, *Monthly Weather Review* (2013-present).

James M. Roberts, **Steven S. Brown**, **James B. Burkholder**, **Barbara Ervens**, Co-Editors, *Atmospheric Chemistry and Physics* (2014).

Owen Cooper, Associate Editor, *Elementa* (2013-present).

Joshua Schwarz, Associate Editor, *Geophysical Research Letters*, American Geophysical Union (2013-present).

Barbara Ervens, Member of the Editorial Advisory Board, *Environmental Science and Technology Letters* (2014-present).

Chuck Brock, Panel Member, National Center for Atmospheric Research (NCAR) Observing Facilities Assessment Panel (OFAP), 2015-2018.

Barbara Ervens, Editor, Inter-Journal Special Issue: *Atmospheric Chemistry and Physics*/*Atmospheric Measurement Techniques*, Results from the Ice Nucleation Research Unit (INUIT) (2014).

Joost de Gouw, Editor, *Journal of Geophysical Research-Atmospheres* (2009-2013).

Barbara Ervens, Member, Editorial Board, *Atmospheric and Climate Sciences* (2011-2012).

James B. Burkholder, guest-Editor, Ravishankara Festschrift, J. Phys. Chem. A (2012).

Christoph Senff, Associate Editor, *Journal of Atmospheric and Oceanic Technology* (2008-2011).

Claire Granier, Co-Editor in Chief, *Journal of Atmospheric Chemistry*, Kluwer Academic Publishers, Dordrecht, The Netherlands (2006-2010).

R. Michael Hardesty, Chief Editor, Atmospheres, AMS *Journal of Atmospheric and Oceanic Technology* (2006-2010).

Owen Cooper, Co-Editor, *Atmospheric Chemistry and Physics* (2007-2010).

Dan Murphy, Editor, *Aerosol Science and Technology* (2004-2008).

David Fahey, Editorial Board, *Journal of Atmospheric Chemistry*, Kluwer Academic Publishers, Dordrecht, The Netherlands (1994–2008).

Reviewer for Programs/Organizations

Barbara Ervens, Reviewer, INUIT program (Ice Nucleation Research Unit), German Research Foundation, 2014.

Birgit Hassler, Reviewer, NASA, focused on Suomi National Polar-Orbiting Partnership (Suomi NPP) Science Team (ST) research, 2014.

Aditya Choukulkar, Reviewer, NSF, Physical and Dynamic Meteorology program, 2014.

Karl Froyd, Panelist, NASA Atmospheric Composition Laboratory Research Program, Washington D.C., 2014.

Si-Wan Kim, Reviewer, NASA Research Opportunity in Space and Earth Sciences (ROSES) Atmospheric Composition: Modeling and Analysis Program, 2014.

Joshua Schwarz, Reviewer, NASA AC4 Program, Bethesda, 2014.

Barbara Ervens, Reviewer, NASA Postdoctoral Program, 2013, 2014.

Allison McComiskey, Reviewer, Argonne National Laboratory, 2013.

Barbara Ervens, Reviewer, European Research Area (ERA) "Chemistry" (European Commission), 2013.

Yelena Pichugina, Reviewer, Department of Energy, Small Business Innovation Research proposals, 2013.

Joost de Gouw, Panel Reviewer, Department of Energy, Brookhaven National Laboratory Science Focus Area Review, Influences of Aerosols and Clouds on Climate and Climate Forcing, 2013.

Greg Frost, Panel Reviewer, NOAA Climate Program Office AC4 Review Panel, Boston, 2013.

Joshua Schwarz, Reviewer, Dept. of Energy, Atmospheric Science Program, Greenbelt, 2013.

A.R. Ravishankara, Chair, panel on "Atmosphere and Climate," reviewing research of Germany's Helmholtz Association, 2012-2013.

Barbara Ervens, Reviewer, Research Corporation for Science Advancement, 2012-2013.

R. Michael Hardesty, Technical Reviewer, Howard University/NASA University Research Center, 2009-2013.

J. Andrew Neuman, Reviewer, National Science Foundation (NSF) Office of Polar Programs Arctic Natural Sciences Program (2009-2013).

Karen Rosenlof, Reviewer, SHARP Program (German stratospheric research program), Berlin, 2012.

Anne Perring, Reviewer, NOAA Climate Program's Earth System Science AC4 proposals, 2012.

Joost de Gouw, Panel Reviewer, EPA Star Grant Program, Dynamic air quality management, 2012.

J. Andrew Neuman, Reviewer, National Science Foundation (NSF) Directorate for Geosciences Atmospheric Chemistry Program, 2012.

Joost de Gouw, Panel Reviewer, EPA Star Grant Program, Anthropogenic influence on organic aerosol formation, 2012.

R. Michael Hardesty, Member, NCAR Earth Observing Laboratory External Advisory Committee, 2010-2014; Chair, 2013-2014.

Barbara Ervens, Reviewer, France's National Research Agency (Agence Nationale de la Recherche), 2011-2013.

David Fahey, Reviewer, Cooperative Institute for Climate Science (CICS) at Princeton University and the NOAA Geophysical Fluid Dynamics Laboratory at the invitation of the NOAA/OAR Cooperative Institutes Program, 2012.

R. Michael Hardesty, Reviewer, NASA Goddard Space Flight Center Earth and Space Science Directorate, 2011.

Robert Banta, Team Leader, two Department of Energy proposal evaluation sessions, 2011.

Joost de Gouw, Panel Reviewer, EPA Star Grant Program, Graduate Student Fellowships, 2011.

R. Michael Hardesty, Reviewer, NASA Langley Research Center Science Directorate Review Panel, 2011.

Barbara Ervens, Reviewer, National Science Foundation (NSF) Atmospheric Chemistry Program, 2009-2012.

David Fahey, Member, Observing Facilities Assessment Panel (OFAP), National Center for Atmospheric Research, Boulder, Colorado, 2007-2011.

Karl Froyd, Panelist, NASA Atmospheric Composition Laboratory Research Program, Washington D.C., 2011.

Karen Rosenlof, Review Panel for NASA MACPEX participants, Washington D.C., 2011.

Graham Feingold, Review Committee Chair, Department of Energy, Pacific Northwest National Laboratory, 2006-2011.

Karen Rosenlof, Reviewer, SPARC Data Initiative, 2011.

Karl Froyd, Panelist, NOAA Atmospheric Composition and Climate Program, Washington D.C., 2010.

Greg Frost, Panel Reviewer, NASA Review Panel for the Air Quality Applied Science Team, Alexandria, Virginia, 2010.

Barbara Ervens, Reviewer, Netherlands' Organisation for Scientific Research (Council Earth and Life Sciences), 2009.

R. Michael Hardesty, Reviewer, NASA Goddard Space Flight Center Earth and Space Science Directorate, 2009.

Karen Rosenlof, Review Panelist, for selection of NASA SEAC4RS forecasting and modeling teams, Washington D.C., 2009.

Karen Rosenlof, Review Panelist, for the NOAA Atmospheric Composition & Climate Program external proposals, Silver Spring, Mardland, 2009.

Education and Mentorship

Mentors for Graduate, Undergraduate, or High School Students

Greg Frost, Mentor, high school student, So-Yun Kim (Fairview High School, Boulder), 2014.

Henry LeRoy Miller, Jr., Mentor, high school graduate and incoming freshman Annie Davis (Miami University of Ohio), 2014.

Chuck Brock, Mentor, Frank Erdesz, undergraduate research assistant in electrical engineering, 2014-2015.

Debra Dailey-Fisher, Mentor, Jessica Lucas (Pima Medical School, Denver), Adrienne Bauduit (Spelman College), Zita Toth (Colorado College, Colorado Springs), Mackenzie Metcalfe (University of Northern Colorado, Greeley), Annie Davis (Boulder High School, Boulder), Libby Samuelson and Scout Ennis (University of Colorado, Boulder), Eli Lane (Regis University), various terms, 2008-present.

Anne Perring, Scientist Mentor, Earth Explorers program in Longmont, Colorado, middle schools, 2014.

Birgit Hassler, Scientist Mentor, Earth Explorers program in Longmont, Colorado, middle schools, 2014.

Robert Banta, Mentor/Sponsor, Thomas Damian (Karlsruhe Institute of Technology) for three months of "study abroad" at ESRL, 2014.

Raul Alvarez, Mentor, Niwot High School (St. Vrain Valley School District) FIRST Robotics (www.usfirst.org) team, 2007-2009.

Raul Alvarez, Mentor, two Nederland High School (Boulder Valley School District) students for Boulder Valley School District Science Fair, 2010.

Andrew Langford and **David Parrish**, Mentors, high school student Melody Dong (Poudre High School), High School Internship and Research Opportunities (HIRO) program of the National Center for Atmospheric Research, 2011.

Andrew Langford, Mentor, Hollings Undergraduate Scholar, Shaena Berlin, MIT, 2012.

Joost de Gouw, Mentor, Hollings Undergraduate Scholars (Abigail Koss, Massachusetts Institute of Technology, 2011; Rosemary Kanters, Ohio University, 2012; Megan Dumas, Stonehill College, 2013; Luis Martinez, University of Texas Brownsville, 2014).

David Parrish, Mentor, Hollings Undergraduate Scholar, Shaena Berlin, MIT, 2012.

Steve Brown, Mentor, Hollings Undergraduate Scholars (Reed Womack, Dartmouth University, 2013; Thomas Langel, University of Wisconsin, 2010).

Rebecca Washenfelder, Mentor, Hollings Undergraduate Scholar (Taylor Brownlee, Arizona State University, 2011).

Ru-Shan Gao, Mentor, graduate school student Alexander Ting (Georgia Tech), 2014.

Rebecca Washenfelder, Mentor, graduate students Jessica Axson (University of Colorado, 2010-2011) and Ryan Thalman (University of Colorado, 2008).

Jim Churnside and **Brandi McCarty**, Mentors, Hollings Undergraduate Scholar (Emmitt Perl, University of San Diego, 2011).

Chuck Brock, Mentor, John Trytko, undergraduate research assistant in electrical engineering, 2010-2013.

Jessica Gilman, Mentor, 3 undergraduate students, 2013 SENEX field mission.

Joost de Gouw and **Carsten Warneke**, Mentor of Visiting Graduate Students (Kanako Sekimoto, Yokohama City University, Japan, 2009; Yuan Bin, Peking University, China, 2010; Trevor Vandenboer,

Toronto University, Canada, 2010; Warda Ait-Helal, University of Lille, France, 2011; Felix Geiger, Karlsruhe Institute of Technology, Germany, 2011).

Christoph Senff and **Brandi McCarty**, Mentors, high school student Kevin Marrero (Colegio San Benito, Puerto Rico), High School Internship and Research Opportunities (HIRO) program of the National Center for Atmospheric Research, 2011.

Chuck Brock, Mentor, Kelvin Bates, NOAA Hollings Scholarship program, 2011.

Christine Ennis, Mentor, high school student, High School Internship and Research Opportunities (HIRO) program of the National Center for Atmospheric Research, 2010.

Jim Roberts, NOAA advisor for a graduate student at North Carolina A&T, 2010.

Laurel Watts, Mentor for Junior First Robotics group, Casa de la Esperanza (House of Hope), Longmont, Colorado, after school program to low income Hispanic children, (2008-2009).

Advisor or Defense Committee for Ph.D. Candidates

Joost de Gouw, advisor for Ph.D. candidates at the University of Colorado (Dan Bon, 2004-2011; Patrick Veres, 2005-2011; Rui Li, 2011-present; and Abigail Koss, 2013-present).

A.R. Ravishankara, External Examiner on the Ph.D. thesis committee for Cora Young, University of Toronto, 2009.

Greg Frost, Member of Ph.D. comprehensive exam committee, Kristen Brown, University of Colorado, Boulder, 2014.

Robert Banta, Committee member, Matthew Aitken, University of Colorado, 2014.

Greg Frost, Advisor, University of Colorado Ph.D. student Ingrid Mielke-Maday, 2014-present.

Karen Rosenlof, member of Ph.D. thesis committees of Adriana Bailey (University of Colorado, 2013), Wei Yuan (SUNY Stony Brook, 2013), and Ryan Neely (University of Colorado, 2012).

Si-Wan Kim, Mentor and Ph.D. thesis committee member, Hyo-Jung Lee, Pusan National University, Korea, 2012-2014,

Joost de Gouw, member of Ph.D. thesis committees of University of Colorado students Allison Aiken (2008), Katja Dzepina (2009), Chris Gray (2014), Amber Ortega (2015); of North Carolina A&T student Darkus Jennings (2012), and University of Paris student Joelle Bechara (2010).

Graham Feingold, member of Ph.D. thesis committees of three students at the University of Colorado, and external examiner for one student at the University of Warsaw, Poland, 2013.

Carsten Warneke, member of Ph.D. thesis committee of Elena Crespo, University of Nijmegen, the Netherlands (2012).

Ranajit Talukdar, external expert at Ph.D. defense of Bartlomiej Witkowski, University of Warsaw, 2013.

Greg Frost, member of Ph.D. thesis committee of Lin Su, University of Colorado (2008-2012).

Barbara Ervens, member of Ph.D. thesis committee of Jessica Axson, University of Colorado (2012) and Marta Kapala, University of Colorado, 2011.

James B. Burkholder, Member of Ph.D. thesis committee, Katy Plath, University of Colorado, Boulder (2010).

J. Andrew Neuman, member of Ph.D. thesis committee of Jin Liao, Georgia Institute of Technology, 2011.

Karl Froyd, member of Ph.D. thesis committee of Kelly Baustian, University of Colorado, 2011.

Robert Banta, external dissertation examiner, Susanne Drechsel, University of Innsbruck, 2011.

R. Michael Hardesty, member of Ph.D. thesis committee of Ryan Neely (University of Colorado, 2012) and John Smith (University of Colorado, 2013).

Barbara Ervens, member of Ph.D. thesis committee of Daya Shankar Kaul, Indian Institute of Technology, Kanpur (India), 2014.

Barbara Ervens, member of Ph.D. thesis committee of Gregory Schill, University of Colorado, 2014.

Graham Feingold, member of Ph.D. thesis committees of three students at the University of Colorado, and external examiner for student at the University of Warsaw, Poland (2013), University of Oslo (2014) and Wageningen University (2014).

Other Education Contributions

Greg Frost, Mentor, Kelsey Tayne, K-12 Education Coordinator for ESRL's Global Monitoring Division (2014-present).

John S. Daniel, invited presentation for physics course at Carleton College, "From Ozone Depletion to Climate Change: Scientifically Rewarding, Politically Charged" (2014).

Anne Perring, Presenter, NOAA 8th Grade Science Days at the NOAA Earth System Research Laboratory, Boulder, Colorado (2011-2014).

Jan Kazil, Instructor, annual NCAR WRF-Chem Workshop, Boulder, Colorado (2009-2010, 2012-2014).

Raul Alvarez, Presenter (Lab demonstration/tour: Using Lasers to Probe the Atmosphere), NOAA 8th Grade Science Days at the NOAA Earth System Research Laboratory, Boulder, Colorado, (2004-2014).

Raul Alvarez, NOAA Outreach Presenter, Denver Public Schools Career Fair, (2012-2014).

Anne Perring, Scientific Reviewer of various resources of CLEAN (Climate Literacy & Energy Awareness Network), CIRES Education and Outreach (2012-2014).

Scott Sandberg, Presenter, ozone lidar, for tour of 400 7th graders during DISCOVER-AQ mission, Houston, Texas (July 2014).

David Parrish, Mentor, high school science teacher, STEM Teacher and Researcher (STAR) Program (2013).

Robert Banta, Lecturer, MICMoR (Mechanisms and Interactions of Climate Change in Mountain Regions) program summer school on Observations and Experimental Methods in an Inhomogeneous Atmosphere: How to Make Sense of the Atmosphere in Mountain Regions, Karlsruhe Institute of Technology/IMK-IFU, Garmisch-Partenkirchen, Germany (2013).

Anne Perring, Reviewer, NOAA Hollings Scholarship applications (2012-2013).

Jessica Gilman, Demonstration Leader, NASA Women in Science Symposium, Laramie, Wyoming (May 2012).

Jessica Gilman, Contributor, Earth Explorers middle school science project (April 2012).

R. Michael Hardesty and **David Fahey**, Scientific Advisory Panel, NOAA Cooperative Remote Sensing Science and Technology (CREST) Center, at City College of the City University of New York [NOAA Educational Partnership Program with Minority Serving Institutions] (2002-2013 and 2002-2011, respectively).

Raul Alvarez, Scientist Participant, Earth Explorers program (STEM outreach to minority/underrepresented students in Colorado, www.earthexplorers.org) (2012).

Yelena Pichugina, **Robert Banta**, and **Alan Brewer**, Mentors and Lecturers, Ph.D. Summer School on Remote Sensing for Wind Energy, "Offshore Measurements of Wind Flow Properties Using Ship-borne High-Resolution Doppler Lidar," University of Colorado-Boulder and Technical University of Denmark, Boulder, Colorado (2012).

Barbara Ervens, Scientific Reviewer, various resources of CLEAN (Climate Literacy & Energy Awareness Network), CIRES Education and Outreach (2012).

Robert Banta, Invited Lecturer, academic Mountain Meteorology class lecture on "Measurement Techniques: Sampling the Mountain Atmosphere," University of Utah, Salt Lake City (2012).

Raul Alvarez, Scientist Participant/Contributor, NOAA Teacher at Sea program during the DYNAMO Experiment aboard the NOAA Ship R/V *Ronald H. Brown* (2011.)

John S. Daniel, General public talk on climate change to Westminster 7:10 Rotary Club (September, 2011).

Robert Banta, **Yelena Pichugina**, **Robert Hardesty**, and **Alan Brewer**, Mentors, AMS Short Course on Wind Energy Applications, "Innovative Measurement Techniques for Wind-Energy Applications Including Remote-Sensing Techniques," Keystone, Colorado (August 2010).

Robert Banta, Distinguished Lecturer, AMS Short Course on Mountain Meteorology, Mountain Weather Workshop (2008).

James B. Burkholder, ISET Summer Students Mentor, PI Alam Hasson, U. of California at Fresno (2011).

Robert Banta, **Yelena Pichugina**, **Robert Hardesty**, and **Alan Brewer**, Mentors, AMS Short Course on Wind Energy Applications, "Innovative Measurement Techniques for Wind-Energy Applications Including Remote-Sensing Techniques," Keystone, Colorado (August 2010).

Robert Banta, Distinguished Lecturer, AMS Short Course on Mountain Meteorology, Mountain Weather Workshop, (2008).

James B. Burkholder, ISET Summer Student Mentor, Chris Ware, PI S. Bililign, U. of North Carolina A&T.

Collaborations

As noted in the Publications Metrics section of this document (see page 53), CSD's research is highly collaborative. In the January 2008-February 2015 time period, a large fraction (86%) of CSD's journal publications involved external coauthors, and CSD collaborations cross national boundaries to involve international researchers 44% of the time. In addition to these scientist-to-scientist collaborations, CSD partners with many national and international organizations on research projects, field missions, scientific assessments, and other endeavors.

This section lists some of our major collaborations and partnerships.

Major Research Collaborations

NOAA and Cooperative Institutes

CSD's peer- reviewed journal articles involve coauthors from CIRES 79% of the time, and coauthors from other NOAA Laboratories and Programs 20% of the time.

Cooperative Institute for Research in Environmental Sciences (CIRES)

Office of Oceanic and Atmospheric Research Laboratories:

- Air Resources Laboratory
- Atlantic Oceanographic and Meteorological Laboratory
- Earth System Research Laboratory (Global Monitoring Division, Physical Sciences Division, and Global Systems Division)
- Geophysical Fluid Dynamics Laboratory
- Great Lakes Environmental Research Laboratory
- National Severe Storms Laboratory
- Pacific Marine Environmental Laboratory

NOAA Programs:

- Climate Program Office
- Office of Weather and Air Quality

Other NOAA relationships:

- Office of Marine and Aviation Operations (including the Aircraft Operations Center)
- National Environmental Satellite, Data, and Information Service
- National Marine Fisheries Service
- National Weather Service

U.S. Federal

CSD's peer-reviewed journal articles involve coauthors from other Federal agencies 28% of the time.

Air Force Weather Research Agency

Department of Agriculture (National Forest Service (Fire Science Laboratory))

Department of Commerce (National Institute of Standards and Technology)

Department of Energy (including Pacific Northwest National Laboratory; Lawrence Livermore National Laboratory; Argonne National Laboratory; Brookhaven National Laboratory; Atmospheric Radiation Measurement Program, National Renewable Energy Laboratory)

Department of Interior (including Bureau of Land Management; Bureau of Ocean Energy Management (Louisiana); National Park Service (IMPROVE network))

Department of Labor (Occupational Health and Safety Administration)

Department of State

Environmental Protection Agency

National Aeronautics and Space Administration (including Ames Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Langley Research Center)

National Science Foundation

U.S. Navy

U.S. State or Municipal Agencies

California Air Resources Board

California Energy Commission

Clark County (NV) Department of Air Quality

Colorado Department of Public Health and Environment

Denver Regional Air Quality Council

Texas Commission on Environmental Quality

Utah Department of Environmental Quality

U.S. Research Organizations

National Center for Atmospheric Research

Scripps Institution of Oceanography

International Research Organizations

Multi-National

European Space Agency

International Geosphere-Biosphere Programme (IGBP) – International Global Atmospheric Chemistry Project (IGAC)

World Climate Research Programme (WCRP) – Stratosphere-troposphere Processes and their Role in Climate (SPARC)

World Meteorological Organization

National

Alfred Wegener Institute of Polar and Marine Research (Germany)

Centre National de la Recherche Scientifique (France)

Chinese Academy of Sciences (China)

Deutsches Zentrum fuer Luft- und Raumfahrt (DLR) (Germany)

Environment Canada (Canada)

Forschungszentrum Jülich (Germany)

Karlsruhe Institute of Technology (Germany)

Royal Netherlands Meteorological Institute (KNMI) (The Netherlands)

Laboratorie d'Aerologie (France)

Laboratoire de l'Atmosphère et des Cyclones/Maido Observatory at La Réunion (France)

Max Planck Institute for Biochemistry (Germany)

Max Planck Institute for Chemistry (Germany)

Max Planck Institute for Meteorology (Germany)

Meteorological Research Institute (Japan)

Norwegian Institute for Air Research (NILU) (Norway)

National Institute for Public Health and the Environment (RIVM) (The Netherlands)

Swiss Federal Institute of Technology (ETH) (Switzerland)

UK Facility for Airborne Atmospheric Measurements (UK)

Academia

CSD's peer-reviewed journal articles involve coauthors from academia 72% of the time.

California Institute of Technology (U.S.)

Cambridge University (U.K.)

Carnege Mellon University (U.S.)

Colorado State University (U.S.)

Columbia University (U.S.)

Dalhousie University (Canada)

Danish Technical University (Denmark)

Georgia Institute of Technology (U.S.)

Harvard University (U.S.)

Hebrew University (Israel)

Hendrix College (U.S.)

Hiram College (U.S.)

Hokkaido University (Japan)

Johns Hopkins University (U.S.)

Kyoto University (Japan)

Leipzig University (Germany)

Massachusetts Institute of Technology (U.S.)

Memorial University (Canada)

Montana State University (U.S.)

Oregon State University (U.S.)

Oxford University (U.K.)

Peking University (China)

Pennsylvania State University (U.S.)

Reading University (U.K.)

Rutgers University (U.S.)

Saint Louis University (U.S.)

State University of New York-Stony Brook (U.S.)

Texas A&M University (U.S.)

Texas Technical University (U.S.)

University of Alabama in Huntsville (U.S.)

University of Arizona (U.S.)

University of Bern (Switzerland)

University of Calgary (Canada)

University of California (Berkeley, Davis, Irvine, Los Angeles, San Diego, Santa Cruz) (U.S.)

University of Colorado-Boulder (U.S.)

University of Hohenheim (Germany)

University of Houston (U.S.)

University of Lancaster (U.K.)

University of Leeds (U.K.)

University of Maryland (U.S.)

University of Miami (U.S.)

University of Minnesota (U.S.)

University of Montana (U.S.)

University of New South Wales (Australia)

University of North Carolina (U.S.)

University Pierre and Marie Curie (France)

Universitat Politecnica de Catalunya (Spain)

University of Rhode Island (U.S.)

University of Southern Mississippi (U.S.)

University of Texas (U.S.)

University of Toronto (Canada)

University of Utah (U.S.)

University of Warsaw (Poland)

University of Washington (U.S.)

University of Wisconsin (U.S.)

University of Wyoming (U.S.)

Utah State University (U.S.)

Weizmann Institute of Science (Israel)

Yale University (U.S.)

York University (Canada)

Private Sector, Industry, and Industry Groups

CSD's peer-reviewed journal articles involve coauthors from the private sector 11% of the time.

Aerodyne Research, Inc.(U.S.)

Airborne Technologies, Inc. (U.S.)

Aerosol Dynamics Inc. (U.S.)

Alion Science and Technology (U.S.)

Atmospheric and Environmental Research, Inc. (U.S.)

AURAIA, LLC. (U.S.)

Ball Aerospace (U.S.)

Baron Advanced Meteorological Systems, LLC. (U.S.)

Bodeker Scientific (New Zealand)

Colorado Oil and Gas Conservation Commission (U.S.)

Droplet Measurement Technologies (U.S.)

DuPont Chemicals & Fluoroproducts (U.S.)

Electric Power Research Institute (U.S.)

HNO Green Fuels, Inc. (U.S.)

Honeywell (U.S.)

Iberdrola (U.S.)

International Civil Aviation Organization (ICAO)

International Maritime Organization (IMO)

Lockheed Martin (U.S.)

Maersk Line (international)

NorthWest Research Associates (U.S.)

Questar Energy Products (U.S.)

RTI International (U.S. Headquarters; international)

Science and Technology Corporation (U.S.)

Sharply Focused (U.S.)

Siemens (U.S. and global)

Southern Company (U.S.)

Western Energy Alliance (U.S.)

Western Regional Air Partnership (U.S.)

Wet Labs (U.S.)

Collaboration on National and International Assessments

The Chemical Sciences Division works with several national and international organizations on Assessments of climate, the stratospheric ozone layer, air quality, and focused topics in atmospheric science:

United Nations Environment Programme

World Meteorological Organization

Intergovernmental Panel on Climate Change

European Commission

United Nations Economic Commission for Europe (UNECE), Hemispheric Transport of Air Pollutants (HTAP)

Stratosphere-troposphere Processes And their Role in Climate (SPARC) Programme (WCRP)

International Global Atmospheric Chemistry (IGAC) Project (IGBP)

National Aeronautics and Space Administration

U.S. National Academy of Sciences

U.S. Global Change Research Program (formerly U.S. Climate Change Science Program)

Patents and Technology Transfer Activities

Patents

Existing

J. H. Churnside, S. F. Clifford, and S. G. Hanson, "Single-Ended Dual Spatial Filter Detector for the Passive Measurement of Winds and Turbulence Aloft," U.S. Patent 5159407 (1992).
This device uses a pair of single-wavenumber spatial filters to profile wind and turbulence from the ground using a star as the source of light. Measurement heights are selected by adjusting the positions of the filters relative to the focus of the collecting telescope.

A. J. Bedard, Jr., J. H. Churnside, and R. T. Nishiyama, "Apparatus and Method for Reducing Acoustic or Electromagnetic Energy in the Vicinity of a Source," U.S. Patent 5393940 (1995).
This patent describes a design for a fence to reduce the level of acoustic or radio energy on the ground near an acoustic sounding system or radar. The top of the fence is shaped such that diffraction directs energy horizontally instead of toward the ground.

J. H. Churnside, E. P. Gordov, and V. M. Orlovskii, "Autodyne Lidar System Utilizing a Hybrid Laser," U.S. Patent 5778019 (1998).
This patent describes a three-mirror laser system with the third mirror at some distance in the atmosphere. Operated near threshold, it is very sensitive to absorbing gasses within the extended laser cavity.

J. R. Jordan, J. H. Churnside, and P. E. Johnston, “Detection of transient signals in Doppler spectra,” U.S. Patent 8022864 (2011).
This patent describes a novel signal processing scheme to detect brief bursts of signal buried in noise in the Doppler spectra of a Doppler radar or lidar.

In Development or Under Consideration

Steven S. Brown, William P. Dubé, and Robert Wild, *A Cavity Ring Down Instrument for Ambient Measurements of Total Reactive Nitrogen (NO_y) Together with Nitrogen Oxides (NO, NO_2) and Ozone (O_3):* a sensitive, compact detector that measures total reactive nitrogen (NO_y), as well as NO_2, NO, and O_3. Declaration submitted April 2014.

Ru-Shan Gao, *Printed Optical Particle Spectrometer (POPS):* A novel, low-cost lightweight scientific instrument suitable for aerosol measurements both at ground sites and on balloons. The NOAA Technology Partnership Office is currently choosing the best way of the transfer of technology.

Daniel M. Murphy, *Open Path Optical Cell with Zero and Calibration Purge for Cavity Ring-Down and Other Techniques:* A technique to achieve the need to calibrate and zero an optical path that is widely open to air for sampling. Declaration submitted in 2013, however it is unlikely to be pursued as a patent.

Technology Transfer

Daniel M. Murphy, *Pumped Counterflow Impactor and design for a Differential Mobility Analyzer Column:* Technology transfer to Brechtel Manufacturing in ~2008; both products remain in production.

Assessment Contributions

Scientific Assessment of Ozone Depletion: 2014. World Meteorological Organization and United Nations Environment Programme, 2014.

A.R. Ravishankara	Cochair, Scientific Assessment Panel; Scientific Steering Committee
Christine A. Ennis	Coordinating Editor; Reviewer
James B. Burkholder	Coauthor, Chapter 1 (Ozone-Depleting Substances and Other Gases of Interest to the Montreal Protocol); Contributor, Chapter 5 (Scenarios and Information for Decision-Makers)
John S. Daniel	Coauthor, Chapter 5 (Scenarios and Information for Decision-Makers); Reviewer
David W. Fahey	Coauthor, *Twenty Questions and Answers About the Ozone Layer: 2014 Update;* Reviewer
Birgit Hassler	Contributor, Chapter 2 (Update on Global Ozone: Past, Present, and Future); Contributor, Chapter 3 (Update on Polar Ozone: Past, Present, and Future); Reviewer
Robert W. Portmann	Contributor, Chapter 4 (Stratospheric Ozone Changes and Climate)
Amy Butler	Reviewer

Assessment for Decision-Makers. Scientific Assessment of Ozone Depletion: 2014. World Meteorological Organization and United Nations Environment Programme, 2014.

A.R. Ravishankara	Cochair, Scientific Assessment Panel; Author
Christine A. Ennis	Coordinating Editor; Reviewer
John S. Daniel	Contributor; Reviewer
David W. Fahey	Reviewer

Scientific Assessment of Ozone Depletion: 2010. World Meteorological Organization and United Nations Environment Programme, 2011.

A.R. Ravishankara	Cochair, Scientific Assessment Panel
Christine A. Ennis	Coordinating Editor; Reviewer
John S. Daniel	Coordinating Lead Author, Chapter 5 (A Focus on Information and Options for Policymakers); Reviewer
David W. Fahey	Coordinating Lead Author, *Twenty Questions and Answers About the Ozone Layer: 2010 Update;* Lead Author, Chapter 3 (Future Ozone and Its Impact on Surface UV); Reviewer
Susan Solomon	Lead Author, Chapter 4 (Stratospheric Changes and Climate); Reviewer
Robert W. Portmann	Lead Author, Chapter 3 (Future Ozone and Its Impact on Surface UV); Reviewer
Karen Rosenlof	Lead Author, Chapter 4 (Stratospheric Changes and Climate)
James B. Burkholder	Coauthor, Chapter 2 (Stratospheric Ozone and Surface Ultraviolet Radiation)
Dimitrios Papanastasiou	Contributor, Chapter 2 (Stratospheric Ozone and Surface Ultraviolet Radiation)
Daniel L. Albritton	Reviewer
Birgit Hassler	Reviewer

Climate Change 2013: The Physical Science Basis. Intergovernmental Panel on Climate Change, 2013.

A.R. Ravishankara	Review Editor, Chapter 8 (Anthropogenic and Natural Radiative Forcing); Reviewer
Graham Feingold	Lead Author, Chapter 7 (Clouds and Aerosols); Contributing Author, Chapter 10 (Detection and Attribution of Climate Change: from Global to Regional); Reviewer

Owen Cooper	Contributing Author, Chapter 2 (Observations: Atmosphere and Surface); Reviewer
John Daniel	Contributing Author, Chapter 8 (Anthropogenic and Natural Radiative Forcing); Reviewer
Sean Davis	Contributing Author, Chapter 2 (Observations: Atmosphere and Surface)
Claire Granier	Contributing Author, Chapter 7 (Clouds and Aerosols)
Daniel M. Murphy	Contributing Author, Chapter 11 (Near-term Climate Change: Projections and Predictability); Reviewer
David W. Fahey	Reviewer
Birgit Hassler	Reviewer
David Parrish	Reviewer
Robert Portmann	Reviewer
Karen Rosenlof	Reviewer
Michael Trainer	Reviewer

Drawing Down N_2O to Protect Climate and the Ozone Layer, United Nations Environment Programme (UNEP) Synthesis Report, 2013.

A.R. Ravishankara	Steering Committee; Co-Coordinator; Lead Author, Chapter 1 (Introduction); Lead Author, Chapter 2 (N_2O: Its Role in Climate Change and Ozone Layer Depletion); Editor
John S. Daniel	Lead Author, Chapter 1 (Introduction); Lead Author, Chapter 2 (N_2O: Its Role in Climate Change and Ozone Layer Depletion)

HFCs: A Critical Link in Protecting Climate and the Ozone Layer, United Nations Environment Programme (UNEP) Synthesis Report, 2011.

A.R. Ravishankara	Lead Author
John S. Daniel	Contributor of Information/Data; Reviewer
David W. Fahey	Contributor of Information/Data; Reviewer

Atmospheric Aerosol Properties and Climate Impacts, Synthesis and Assessment Product 2.4, U.S. Climate Change Science Program and the Subcommitte on Global Change Research, 2009.

Graham Feingold	Editor, whole report; Author, Executive Summary; Lead Author, Chapter 2 (Remote Sensing and *In Situ* Measurements of Aerosol Properties, Burdens, and Radiative Forcing); Lead Author, Chapter 3 (Modeling the Effects of Aerosols in Climate); Author, Chapter 4 (The Way Forward); Contributing Author, Chapter 1 (Introduction)
Susan Solomon	Reviewer

Trends in Emissions of Ozone-Depleting Substances, Ozone Layer Recovery, and Implications for Ultraviolet Radiation, Synthesis and Assessment Product 2.3, U.S. Climate Change Science Program and the Subcommittee on Global Change Research, 2008.

A.R. Ravishankara	Agency Lead; Report Editor; Convening Lead Author, Executive Summary; Convening Lead Author, Chapter 1 (Introduction); Convening Lead Author, Chapter 6 (Implications for the United States)
David W. Fahey	Convening Lead Author, Chapter 4 (How Do Climate Change and Stratospheric Ozone Loss Interact?); Lead Author, Executive Summary; Lead Author, Chapter 6 (Implications for the United States)
John S. Daniel	Lead Author, Executive Summary; Lead Author, Chapter 2 (Current Trends, Mixing Ratios, and Emissions of Ozone-Depleting Substance and Their Substitutes); Lead Author, Chapter 5 (The Future and Recovery); Lead Author, Chapter 6 (Implications for the United States)
Robert Portmann	Reviewer
Susan Solomon	Reviewer

Advancing the Science of Climate Change, U.S. National Research Council Report on America's Climate Choices, 2010.

A.R. Ravishankara	Author Panel
[Susan Solomon	Overall Committee Member, America's Climate Choices]

Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia, U.S. National Research Council Report, 2011.

Susan Solomon	Committee Chair; Lead Author

Hemispheric Transport of Air Pollution 2010, Part A – Ozone and Particulate Matter, United Nations Economic Commission for Europe, 2011.

Owen Cooper	Lead Author, Chapter 1 (Conceptual Overview of Hemispheric or Intercontinental Transport of Ozone and Particulate Matter)
David Parrish	Lead Author, Chapter 2 (Observational Evidence and Capabilities Related to Intercontinental Transport of Ozone and Particulate Matter)

Hemispheric Transport of Air Pollution 2010, Part D – Answers to Policy Relevant Science Questions, United Nations Economic Commission for Europe, 2010.

David Parrish	Contributing Author

Impacts of Megacities on Air Pollution and Climate, World Meteorological Organization Global Atmosphere Watch, and International Global Atmospheric Chemistry Project, 2012.

David Parrish	Lead Author, whole report; Coordinating Lead Author, Chapter 5 (North America); Lead Author, Chapter 8 (Key Issues and Outlook), Contributing Author, Chapter 1 (Introduction); Contributing Author, Chapter 7 (Overview of International Collarorative Research Activities)

Bounding the Role of Black Carbon in the Climate System: A Scientific Assessment, published in the *Journal of Geophysical Research*, 2013.

David W. Fahey	Coordinating Lead Author (full report); Lead Author, Section 10 (Synthesis)
Joshua Schwarz	Contributing Author, Section 3 (Measurements and Microphysical Properties)

Lifetimes of Stratospheric Ozone-Depleting Substances, their Replacements, and Related Species, Stratosphere-troposphere Processes And their Role in Climate, World Climate Research Programme, 2013.

James B. Burkholder	Lead Author, Chapter 3 (Evaluation of Atmospheric Loss Processes); Coauthor, Chapter 6 (Recommended Values for Steady-State Lifetimes); Mail and Meeting Reviewer
John S. Daniel	Principal Reviewer, Chapter 2 (The Theory of Estimating Lifetimes Using Models and Observations); Mail and Meeting Reviewer
David W. Fahey	Mail and Meeting Reviewer
A.R. Ravishankara	Mail and Meeting Reviewer

Chemical Kinetics and Photochemical Data for Use in Atmospheric Studies, Evaluation No. 17, NASA Panel for Data Evaluation, 2011.

James B. Burkholder	Author

The Role of Halogen Chemistry in Polar Stratospheric Ozone Depletion, Stratosphere-troposphere Processes And their Role in Climate (SPARC) report, 2009.

David W. Fahey	Steering Group, Atmospheric Measurements
Ru-Shan Gao	Steering Group, Atmospheric Measurements; Reviewer
James B. Burkholder	Reviewer
Robert W. Portmann	Reviewer

The AquaVIT-1 Intercomparison of Atmospheric Water Vapor Measurement Techniques, published in the journal *Atmospheric Measurement Techniques*, 2014.

David W. Fahey	Lead Author
Ru-Shan Gao	Coauthor
Sean M. Davis	Coauthor

Regional Assessments from CSD Field Studies:

Las Vegas Ozone Study Final Report, NOAA ESRL CSD report to Clark County, Nevada, 2014.

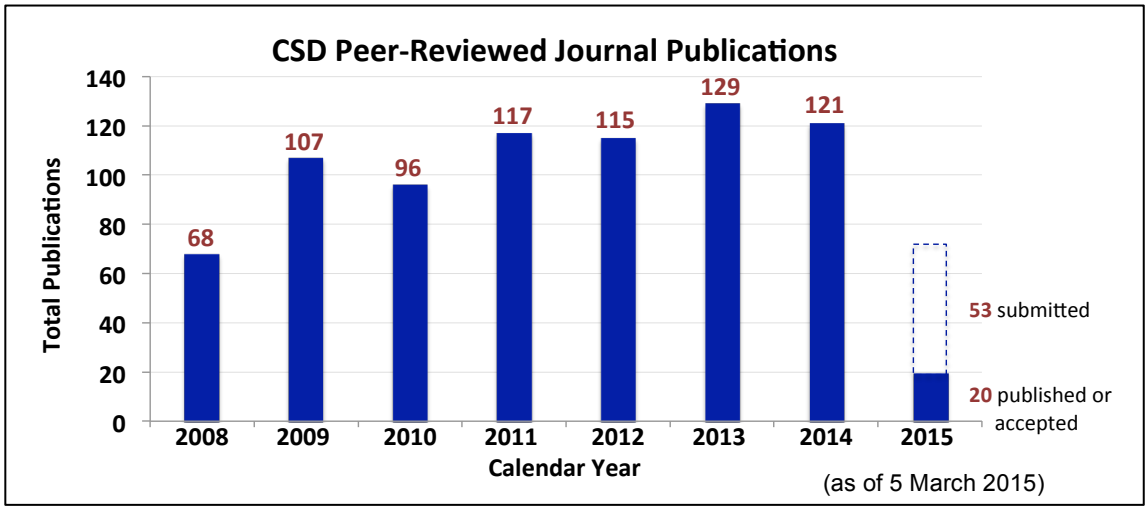
Synthesis of Policy Relevant Findings from the CalNex 2010 Field Study (California research at the Nexus of Air Quality and Climate Change), NOAA ESRL CSD report to the California Air Resources Board, 2014.

Air Chemistry in the Gulf of Mexico Oil Spill Area NOAA WP-3D Airborne Chemical Laboratory Flights of 8 and 10 June 2010, CSD report to OSHA, EPA, and other stakeholders during 2010 Deepwater Horizon oil spill, 2010.

Publication Metrics

Overview

CSD has published 773 peer-reviewed journal articles since the January 2008 CSD Review; an additional 53 are in submitted or "discussion" status. A list of these publications begins on page 57.



Additional publications during this time period include 2 reports, 15 book chapters or sections, and 43 contributions to Assessment reports. Lists of these publications are found on pages 115-120. Further information on Assessment contributions is given on pages 49-52.

Measures of Collaboration

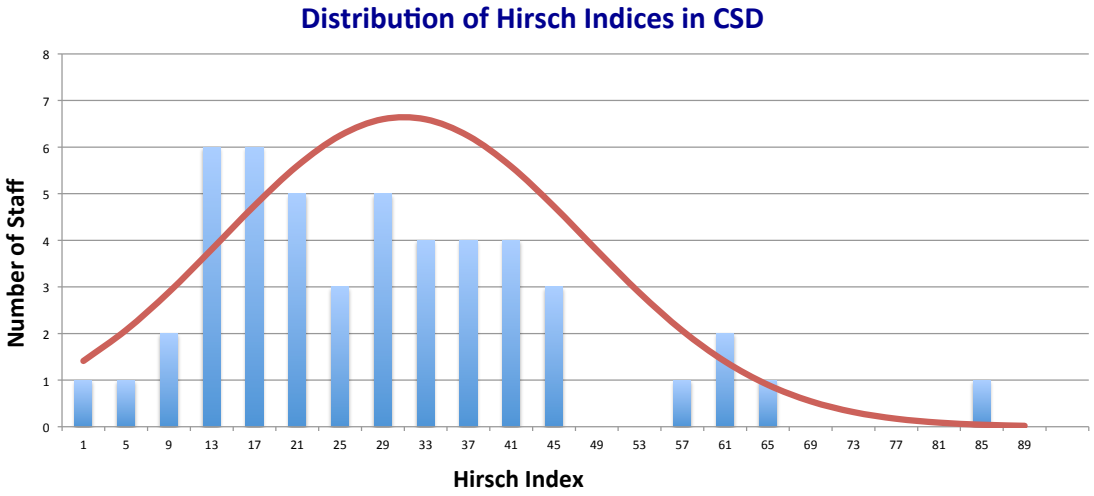
The affiliations of the coauthors of CSD publications give a good measure of CSD's highly collaborative research endeavor. As a percentage of peer-reviewed journal articles published since January 2008:

- Internal collaboration (more than 1 CSD Program Area): 196/773 = 25%
- External collaboration: 662/773 = 86%
- Collaboration with other NOAA labs: 156/773 = 20%
- Collaboration with Universities: 555/773 = 72%
- Collaboration with NASA: 125/773 = 16%
- Collaboration with NCAR: 137/773 = 18%
- Collaboration with the private sector: 87/773 = 11%
- International collaboration: 338/773 = 44%

The Hirsch Index: A Measure of Impact

Individual Staff: Career Hirsch Indices

The Hirsch Index gives a measure of the impact of publications and is computed using citation data. For this Review, current CSD researchers who have had their Ph.D. for at least 10 years computed their career Hirsch Indices. The graph below shows the results as of February 2015.



CSD Results

Median = 29
Geometric Mean = 26
Range = 3 to 85
No. of Scientists Considered = 49

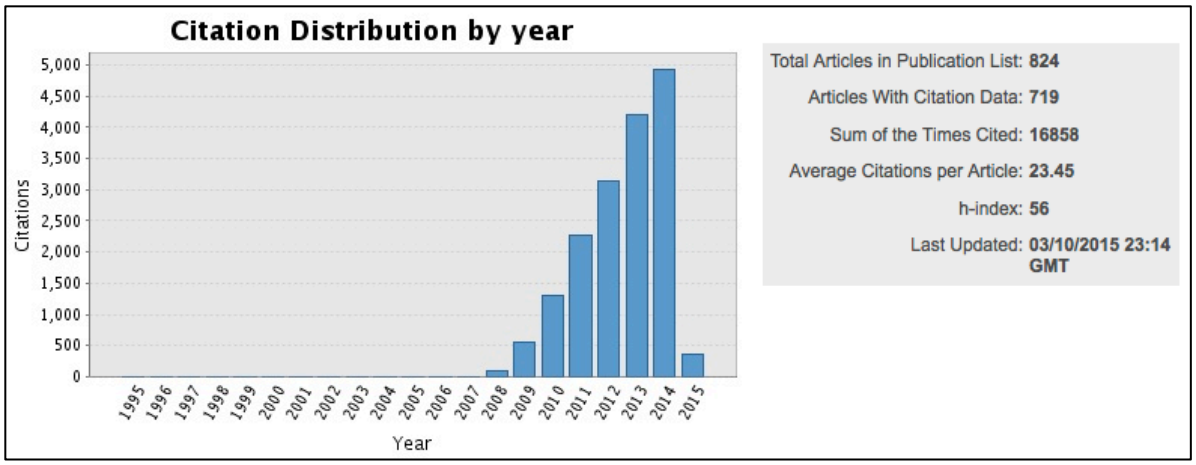
Definition: *A scientist has index h if h of his or her Np papers have at least h citations each and the other (Np – h) papers have ≤h citations each.*

"Typical" values of Hirsch Index, h:
~12 = Faculty at major research universities
~18 = Advancement to full professor
~15–20 = Considered for fellowship in APS
~35 = Nobel Prize winners
~46 = Membership in NAS

The Aggregate "CSD" Hirsch Index: 2008 to Present

In addition, the Hirsch Index was calculated using Web of Science for 719 CSD journal articles, books, reports, and book sections published since the last CSD review (2008 to present) *and* that have citation data available. This is equivalent to calculating a "career" Hirsch Index as above, considering "CSD" to be a single researcher who began publishing in 2008.

The results for the aggregate CSD Hirsch Index since the last CSD Review are shown below. CSD's work published since 2008 has been cited 16,858 times to date, giving a "CSD" Hirsch Index of 56.


Citation Distribution by year
Citations
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year
Total Articles in Publication List: 824
Articles With Citation Data: 719
Sum of the Times Cited: 16858
Average Citations per Article: 23.45
h-index: 56
Last Updated: 03/10/2015 23:14 GMT

List of Publications

(as of 5 March 2015)

Peer Reviewed Journal Articles:	773 published or accepted
	53 submitted or in discussion
Reports	2
Book Chapters or Sections	15
Assessments or Assessment Chapters	43

Journal Articles: Submitted or In Discussion (53 total)

2015

Baker, K.R., A.G. Carlton, T.E. Kleindienst, J.H. Offenberg, M.R. Beaver, D.R. Gentner, A.H. Goldstein, P.L. Hayes, J.L. Jimenez, J.B. Gilman, J.A. de Gouw, M.C. Woody, H.O.T. Pye, J.T. Kelly, M. Lewandowski, M. Jaoui, P.S. Stevens, W.H. Brune, Y.-H. Lin, C.L. Rubitschun, and J.D. Surratt, Gas and aerosol carbon in California: Comparison of measurements and model predictions in Pasadena and Bakersfield, *Atmospheric Chemistry and Physics*, *Discussions 15*, 157-198, doi:10.5194/acpd-15-157-2015, 2015.

Bernard, F., M.R. McGillen, E.L. Fleming, C.H. Jackman, and J.B. Burkholder, CBrF3 (Halon-1301): UV absorption spectrum between 210 and 320 K, atmospheric lifetime, and ozone depletion potential, *Journal of Photochemistry and Photobiology A: Chemistry*, *submitted*, 2015.

Churnside, J.H., K. Naugolnykh, and R.D. Marchbanks, Optical remote sensing of sound in the ocean, *Journal of Applied Remote Sensing*, *submitted*, 2015.

de Gouw, J.A., S.A. McKeen, K.C. Aikin, C.A. Brock, S.S. Brown, J.B. Gilman, M. Graus, T. Hanisco, J.S. Holloway, J. Kaiser, F.N. Keutsch, B.M. Lerner, J. Liao, M.Z. Markovic, A.M. Middlebrook, K.-E. Min, J.A. Neuman, J.B. Nowak, J. Peischl, I.B. Pollack, J.M. Roberts, T.B. Ryerson, M. Trainer, P.R. Veres, C. Warneke, A. Welti, and G.M. Wolfe, Airborne measurements of the atmospheric emissions from a fuel ethanol refinery, *Journal of Geophysical Research*, *submitted*, 2015.

Feingold, G., I. Koren, T. Yamaguchi, and J. Kazil, On the reversibility of transitions between closed and open cellular convection, *Atmospheric Chemistry and Physics*, *Discussions 15*, 5553-5588, doi:10.5194/acpd-15-5553-2015, 2015.

Fielding, M.D., J.C. Chiu, R.J. Hogan, G. Feingold, E. Eloranta, E.J. O'Connor, and M.P. Cadeddu, Joint retrievals of cloud and drizzle in marine boundary layer clouds using ground-based radar, lidar and zenith radiances, *Atmospheric Measurement Techniques*, *Discussions 8*, 1833-1889, doi:10.5194/amtd-8-1833-2015, 2015.

Forrister, H., J. Liu, E. Scheuer, J. Dibb, L. Ziemba, K.L. Thornhill, B. Anderson, G. Diskin, A.E. Perring, J.P. Schwarz, P. Campuzano-Jost, J.-L. Jimenez, A. Nenes, and R.J. Weber, Evolution of brown carbon in wildfire plumes, *Geophysical Research Letters*, *submitted*, 2015.

Harris, N.R.P., B. Hassler, F. Tummon, G.E. Bodeker, D. Hubert, I. Petropavlovsikh, W. Steinbrecht, J. Anderson, P.K. Bhartia, C.D. Boone, A. Bourassa, S.M. Davis, D. Degenstein, A. Delcloo, S.M. Frith, L. Froidevaux, S. Godin-Beekmann, N. Jones, M.J. Kurylo, E. Kyrola, M. Laine, S.T. Leblanc, J.C. Lambert, E. Mahieu, A. Maycock, M.d. Maziere, A. Parrish, R. Querel, K.H. Rosenlof, C. Roth, C. Sioris, B. Liley, J. Staehelin, R.S. Stolarski, R. Stubi, J. Tamminen, C. Vigouroux, K. Walker, H.J. Wang, J. Wild, and J.M. Zawodny, Past changes in the vertical distribution ofozone, Part III: Analysis and interpretation of trends, *Atmospheric Chemistry and Physics*, *submitted*, 2015.

Huang, C., L. Li, H.L. Wang, Q. Wang, Q. Lu, J.A. de Gouw, M. Zhou, S.A. Jing, J. Lu, and C.H. Chen, VOC species and emission inventory from vehicles and their SOA formation potentials estimation in Shanghai, China, *Atmospheric Chemistry and Physics*, *submitted*, 2015.

Kaiser, J., G.M. Wolfe, K.E. Min, S.S. Brown, C.C. Miller, D.J. Jacob, J.A. de Gouw, M. Graus, T.F. Hanisco, J.S. Holloway, J. Peischl, I.B. Pollack, T.B. Ryerson, C. Warneke, and F.N. Keutsch, Reassessing the ratio of glyoxal to

formaldehyde as an indicator of hydrocarbon precursor speciation, *Atmospheric Chemistry and Physics*, *submitted*, 2015.

Koss, A., J. de Gouw, C. Warneke, J. Gilman, B. Lerner, M. Graus, B. Yuan, P. Edwards, S. Brown, R. Wild, J.M. Roberts, T. Bates, and P. Quinn, Photochemical aging of volatile organic compounds associated with oil and natural gas extraction in the Uintah Basin, UT, during a wintertime ozone formation event, *Atmospheric Chemistry and Physics*, *submitted*, 2015.

Lefohn, A.S., and O.R. Cooper, Introduction to the special issue on observations and source attribution of ozone in rural regions of the Western United States, *Atmospheric Environment*, *submitted*, 2015.

Millet, D.B., M. Baasandorj, D.K. Farmer, J.A. Thornton, K. Baumann, P. Brophy, S. Chaliyakunnel, J.A. de Gouw, M. Graus, L. Hu, A.R. Koss, B.H. Lee, F. Lopez-Hilfiker, J.A. Neuman, F. Paulot, J. Peischl, I.B. Pollack, T.B. Ryerson, C. Warneke, B.J. Williams, and J. Xu, A large and ubiquitous source of atmospheric formic acid, *Atmospheric Chemistry and Physics*, *Discussions 15*, 4537-4599, doi:10.5194/acpd-15-4537-2015, 2015.

Papadimitriou, V.C., E.S. Karafas, T. Gierczak, and J.B. Burkholder, CH3CO + O2 + M (M = He, N2) Reaction rate coefficient measurements and implications toward the OH radical product yield, *Journal of Physical Chemistry*, *submitted*, 2015.

Solomon, A., G. Feingold, and M. Shupe, The role of ice nuclei recycling in the maintenance of cloud ice in arctic mixed-phase stratocumulus, *Journal of Geophysical Research*, *submitted*, 2015.

Veres, P.R., and J.M. Roberts, Development of a photochemical source for the production and calibration of acyl peroxynitrate compounds, *Atmospheric Measurement Techniques*, *submitted*, 2015.

Veres, P.R., J.M. Roberts, R. Wild, P.M. Edwards, S.S. Brown, T.S. Bates, P.K. Quinn, J.E. Johnson, R. Zamora, and J. de Gouw, Peroxynitric acid (HO2NO2) measurements during the UBWOS 2013 and 2014 studies using iodide ion chemical ionization mass spectrometry, *Atmospheric Chemistry and Physics*, *submitted*, 2015.

Wagner, N.L., C.A. Brock, W.M. Angevine, A. Beyersdorf, P. Campuzano-Jost, D. Day, J.A. de Gouw, G.S. Diskin, T.D. Gordon, M.G. Graus, G. Huey, J.L. Jimenez, D.A. Lack, J. Liao, X. Liu, M.Z. Markovic, A.M. Middlebrook, T. Mikoviny, J. Peischl, A.E. Perring, M.S. Richardson, T.B. Ryerson, J.P. Schwarz, C. Warneke, A. Welti, A. Wisthaler, L.D. Ziemba, and D.M. Murphy, In situ vertical profiles of aerosol extinction, mass, and composition over the southeast United States during SENEX and SEAC4RS: observations of a modest aerosol enhancement aloft, *Atmospheric Chemistry and Physics*, *Discussions 15*, 3127-3172, doi:10.5194/acpd-15-3127-2015, 2015.

Ye, C., X. Zhou, D. Pu, J. Stutz, J. Festa, M. Spolaor, C. Tsai, C. Cantrell, R.L.M. III, T. Campos, A. Weinheimer, R.S. Hornbrook, E.C. Apel, A. Guenther, L. Kaser, B. Yuan, J. Haggerty, S. Hall, K. Ullmann, J. Smith, J. Ortega, and C. Knote, Rapid recycling of reactive nitrogen in the marine boundary layer, *Science*, *submitted*, 2015.

Yuan, B., L. Kaser, T. Karl, M. Graus, J. Peischl, T.L. Campos, S. Shertz, E.C. Apel, R.S. Hornbrook, A. Hills, J.B. Gilman, B.M. Lerner, C. Warneke, F.M. Flocke, T.B. Ryerson, A.B. Guenther, and J.A. de Gouw, Airborne flux measurements of methane and volatile organic compounds (VOCs) over the Haynesville and Marcellus shale gas production regions, *Journal of Geophysical Research*, *submitted*, 2015.

2014

Burkholder, J.B., R.A. Cox, and A.R. Ravishankara, Atmospheric degradation of ozone depleting substances, their substitutes, and related species, *Chemical Reviews*, *submitted*, 2014.

Churnside, J.H., R.D. Marchbanks, P.L. Donaghay, J.M. Sullivan, and W.M. Graham, Hollow aggregations of moon jellyfish (Aurelia spp.), *Marine Ecological Progress Series*, *submitted*, 2014.

Cleary, P.A., N. Fuhrman, L. Schulz, J. Schafer, J. Fillingham, H. Bootsma, T. Langel, E.J. Williams, and S.S. Brown, Ozone distributions over southern Lake Michigan: Comparisons between ferry-based observations, shoreline-based DOAS observations and air quality forecast models, *Atmospheric Chemistry and Physics*, *Discussions 14*, 23201-23236, doi:10.5194/acpd-14-23201-2014, 2014.

Cui, Y.Y., J. Brioude, S. McKeen, W. Angevine, S.-W. Kim, G. Frost, R. Ahmadov, J. Peischl, N. Bousserez, Z. Liu, T. Ryerson, S.C. Wofsy, G. Santoni, E. Kort, M. Fischer, and M. Trainer, Top-down estimate of methane emissions in California using a mesoscale inverse modeling technique: 1. The South Coast Air Basin, *Journal of Geophysical Research*, *submitted*, 2014.

Damme, M.V., L. Clarisse, E. Dammers, X. Liu, J.B. Nowak, C. Clerbaux, C.R. Flechard, C. Galy-Lacaux, W. Xu, J.A. Neuman, Y.S. Tang, M.A. Sutton, J.W. Erisman, and P.F. Coheur, Towards validation of ammonia (NH3)

measurements from the IASI satellite, *Atmospheric Measurement Techniques*, *Discussions 7*, 12125-12172, doi:10.5194/amtd-7-12125-2014, 2014.

de Foy, B., Y.Y. Cui, J.J. Schauer, M. Janssen, J.R. Turner, and C. Wiedinmyer, Estimating sources of elemental and organic carbon and their temporal emission patterns using a least squares inverse model and hourly measurements from the St. Louis-Midwest supersite, *Atmospheric Chemistry and Physics*, *Discussions 14*, 12019-12070, doi:10.5194/acpd-14-12019-2014, 2014.

Emmons, L.K., S.R. Arnold, S.A. Monks, V. Huijnen, S. Tilmes, K.S. Law, J.L. Thomas, J.-C. Raut, I. Bouarar, S. Turquety, Y. Long, B. Duncan, S. Steenrod, S. Strode, J. Flemming, J. Mao, J. Langner, A.M. Thompson, D. Tarasick, E.C. Apel, D.R. Blake, R.C. Cohen, J. Dibb, G.S. Diskin, A. Fried, S.R. Hall, L.G. Huey, A.J. Weinheimer, A. Wisthaler, T. Mikoviny, J. Nowak, J. Peischl, J.M. Roberts, T. Ryerson, C. Warneke, and D. Helmig, The POLARCAT Model Intercomparison Project (POLMIP): Overview and evaluation with observations, *Atmospheric Chemistry and Physics*, *Discussions 14*, 29331-29393, doi:10.5194/acpd-14-29331-2014, 2014.

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Invited Talks

Listing is for 2013-present, for current staff only

Ravan Ahmadov, Invited Presentation, "Understanding High Wintertime Ozone Events over an Oil and Natural Gas Production Region from Air Quality Model Perspective," Fall Meeting of the American Geophysical Union, 2014.

Ken Aikin, Invited Talk, "User-Friendly Website for Accessing NOAA/ESRL Chemical Sciences Division (CSD) Tropospheric Airborne Data Archive," Earth Science Information Partners (ESIP) Meeting, Copper Mountain, Colorado, July 2014.

Robert Banta, Invited Lecturer, 3rd Weather Information Service Engine (WISE) International Workshop, Seoul, South Korea, November 2014.

Robert Banta, Invited Seminar, "Generalized Relationships in the SBL Derived from High-Resolution Doppler Lidar and Instrumented Tower Data," University of Oklahoma, December 2013.

Robert Banta, Invited Seminar, "Lidar and Meteorology – Airborne Ozone DIAL and Doppler Lidar Studies of Atmospheric Processes at NOAA/ESRL," University of Oklahoma, December 2013.

Chuck Brock, Invited Speaker, "Relating Aerosol Mass and Optical Depth in the Summertime Continental Boundary Layer," Fall Meeting of the American Geophysical Union, 2014.

Chuck Brock, Invited Speaker, "Arctic Haze: Results from Airborne Field Projects During the International Polar Year 2008," Toronto NetCare Workshop, 2014.

Chuck Brock, Invited Tutorial Speaker, "Field and Mobile Atmospheric Aerosol Measurement: Principle and Practice," American Association for Aerosol Research Annual Conference, 2014.

Steve Brown, Invited Talk, "Heterogeneous Atmospheric Chemistry of N_2O_5: Results from Recent Field Campaigns," American Chemical Society National Meeting, Denver, Colorado, March 2015.

Steve Brown, Invited Talk, "Nocturnal Oxidation of Biogenic VOCs in the Residual Layer," IGAC conference on Atmospheric Chemistry, Natal, Brazil, September 2014.

Steve Brown, Invited Talk, "Organic Aerosol from Nocturnal Oxidation of Biogenic VOCs: Results from Night Flights in the Southeast U.S. during SENEX 2013," AAAR National Meeting, Orlando, Florida, October 2014.

Steve Brown, Invited Talk, "Winter Ozone Photochemistry in an Oil and Gas Producing Mountain Basin," American Chemical Society National Meeting, San Francisco, California, July 2014.

Steve Brown, Invited Talk, "Emerging Issues in U.S. Air Quality," Hong Kong Polytechnic University, Hong Kong, China, November 2013.

Steve Brown, Invited Talk, "The Changing Face of U.S. Air Quality," McElvain Lecture in Physical Chemistry, University of Wisconsin-Madison, October 2013.

Steven Brown, Invited Talk, "Radicals, Strange Radicals and the Radical Mechanisms that Make Them," SEAS Seminar, Harvard University, March 2013.

Steve Brown, Invited Talk, "Heterogeneous Chemistry vs Photochemistry: What Really Controls Atmospheric Oxidation," Weizmann Institute of Science, Rehovot, Israel, January 2013.

Amy H. Butler, Invited Speaker, "Separating the Stratospheric and Tropospheric Pathways of ENSO Teleconnections," NCAR Climate Variability and Change Working Group meeting, 2014.

Amy H. Butler, Invited Speaker, "Do Stratosphere-Resolving Models Make Improved Seasonal Climate Predictions?," NCAR Atmospheric Modeling and Predictability seminar, 2014.

Amy H. Butler, Invited Speaker, "Toward a Consistent Definition of Sudden Stratospheric Warmings," Colorado State University Department of Atmospheric Sciences, 2013.

Aditya Choukulkar, Invited Seminar, "Coherent Doppler Lidar for Wind Energy – Retrieval Algorithms and

Uncertainty," ATOC Seminar, University of Colorado Boulder, February 2014.

Jim Churnside, Invited Speaker, "Ecosystem Studies Using Profiling Polarization Lidar,"International Geoscience and Remote Sensing Symposium, Quebec City, Quebec, July 2014.

Owen Cooper, Invited Speaker, "Trends in Global Ozone and its Precursors since 1970," Transboundary Ozone Pollution Conference, Tenaya Lodge, Yosemite National Park, March 2015.

Owen Cooper, Invited Seminar, "Global Distribution and Trends of Tropospheric Ozone: An Observation-Based Review," University of Virginia, Department of Environmental Sciences, February 2015.

Owen Cooper, Invited Presentation, "Inflow Processes over Western North America," Joint Workshop of AQMEII3 and TF HTAP, U.S. EPA, Research Triangle Park, North Carolina, October 2014.

Owen Cooper, Invited Lecture, "IPCC AR5 Chapter 2. Observations: Atmosphere & Surface," CIRES/ATOC Seminar Series: Reading the IPCC Report, CIRES, University of Colorado, Boulder, September 2014.

Owen Cooper, Invited Presentation, "Global Distribution and Trends of Tropospheric Ozone: An Observation-Based Review," MOZAIC-IAGOS Scientific Symposium on Atmospheric Composition Observation by Commercial Aircraft, Toulouse, France, May 2014.

Owen Cooper, Invited Presentation, "Global Distribution and Trends of Tropospheric Ozone: An Observation-Based Review," Global Change Seminar Series, School of GeoSciences, University of Edinburgh, Scotland, April 2014.

Owen Cooper, Invited Presentation, "Global Distribution and Trends of Tropospheric Ozone: An Observation-Based Review," NCAR Advanced Study Program Seminar Series, Boulder, March 2014.

Owen Cooper, Invited Presentation, "Status of IAGOS in the USA Working Group," IAGOS Annual Meeting, San Lorenzo del Escorial, Spain, June 2013.

Owen Cooper, Invited Presentation, "Inflow Processes Influencing Air Quality over Western North America," Meeting of the Task Force on Hemispheric Transport of Air Pollution, Geneva, Switzerland, March 2013.

Owen Cooper, Invited Presentation, "Long-Term Ozone Trends at Rural Ozone Monitoring Sites across the United States, 1990-2010," Harvard School of Engineering and Applied Sciences Environmental Science and Engineering Seminar, Harvard University, Cambridge, March 2013.

Joost de Gouw, Invited Talk, "Overview of the NOAA SENEX Field Mission," Annual Meeting of the American Association for Aerosol Research, October 2014.

Joost de Gouw, Invited Talk, "Formation of Organic Aerosol in the Outflow from Urban Areas in the Southeastern United States," Goldschmidt Conference, June 2014.

Joost de Gouw, Lecture series, "Volatile Organic Compounds in the Atmosphere," Shanghai Academy of Environmental Sciences, China, March 2014.

Joost de Gouw, Seminar, "Volatile Organic Compounds in a Changing Atmosphere: How our Energy Choices Affect Air Quality and Climate Change," Peking University, China, March 2014.

Joost de Gouw, Invited Talk, "Emissions and Chemistry of Volatile Organic Compounds (VOCs) from Oil and Gas Production in Colorado and Utah," Air Water Gas Workshop, October 2013.

Joost de Gouw, Seminar, "Organic Carbon in a Changing Atmosphere: How our Energy Choices Affect Air Quality and Climate Change," Department of Chemistry and Biochemistry, University of Colorado, October 2013.

Barbara Ervens, Invited Talk, "Ice Nucleation in Clouds: Sensitivities to Physicochemical IN Properties and Cloud Microphysics," Spring Meeting of the American Chemical Society, Denver, Colorado, 2015.

Barbara Ervens, Invited Talk, "Secondary Organic Aerosol Formation: The Role of Chemical Processes in the Aqueous Phase of Clouds and Aerosol Particles," Atmospheric Science Department, Colorado State University, Fort Collins, Colorado, 2015.

Barbara Ervens, Invited Talk, "The Role of Clouds in Impacting the Chemical Composition of the Troposphere - A Review," Workshop: 'Aerosols and Clouds: Connections from the Laboratory to the Field to the Globe', Telluride, Colorado, 2014.

Barbara Ervens and **Graham Feingold**, Invited Talk, "Ice Nucleation Modeling," International Aerosol Modeling Algorithms (IAMA) Conference, Davis, California, 2013.

David Fahey, Invited Talk, "Pursuing Climate Science: From Small Particles to Large Airplanes," Advanced Studies, Program, National Center for Atmospheric Research, Boulder, Colorado, September 2014.

David Fahey, Keynote Address, "Reflections on Aerosols and Climate and the Future," AeroCom Workshop, Steamboat Springs, Colorado, September 2014.

David Fahey, Invited Talk, "Bioaerosol Research at CSD: One Year of Laboratory and Field Measurements," Max Planck Institute for Chemistry - Mainz, Mainz, Germany, July 2014.

David Fahey, Invited Talk, "The NASA ATTREX Mission: Demonstrating the Global Hawk Unmanned Aircraft System (UAS) for Earth Science Research," Forschungszentrum Jülich GmbH, Jülich, Germany, June 2014.

David Fahey, Invited Talk, "Contributing to the Climate Change Building: A Scientist-to-Scientist Perspective," National Institute for Standards and Technology, Boulder, Colorado, June 2014.

David Fahey, Invited Talk, "A Climate Science Perspective, Science and Public Policy Class," CU Physics Department, Boulder, Colorado, October 2013.

David Fahey, Invited Talk, **"**The Role of the Montreal Protocol in Protecting Present and Future Climate: A Scientific Perspective," Delft University of Technology, Climate Institute and Department of Philosophy, The Netherlands, September 2013.

David Fahey, Invited Talk, "Pursuing Climate Science: From Small Particles to Large Airplanes," School of Earth, Atmospheric and Environmental Sciences, University of Manchester, Manchester, U.K., September 2013.

David Fahey, Invited Talk, "Assessing the Role of Black Carbon in the Climate System: An Important Challenge and Template for the Future," ACCENT-Plus Symposium, Atmospheric Composition Change: the European Network – Policy Support and Science, Urbino, Italy, September 2013.

David Fahey, Invited Talk, "Assessing the Role of Black Carbon in the Climate System: An Important Challenge and Template for the Future," Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands, September 2013.

David Fahey, Invited Talk, "The NASA ATTREX Mission: Demonstrating the Global Hawk Unmanned Aircraft System (UAS) for Earth Science Research," Kirchhoff Institute for Physics, University of Heidelberg, Heidelberg, Germany, April 2013.

Karl Froyd, Invited Speaker, "Mineral Dust as Ice Nuclei in the Upper Troposphere," Fall Meeting of the American Geophysical Union, 2013.

Graham Feingold, Invited Speaker, "From Droplet Nucleation to Precipitation: Following in Sean Twomey's Giant Footsteps". AMS Cloud Physics Conference, July 2014.

Graham Feingold, Invited Panelist, "What are the Biggest Weaknesses in Model Predictions of Water?" GEWEX Conference, Den Haag, Netherlands, 2014.

Graham Feingold, Invited Speaker, "Aerosol Influences on Warm Cloud Precipitation and Why it is so Difficult to Provide Observational Constraints," Telluride Science Research Center workshop, 2014.

Graham Feingold, Invited Speaker, "How Resilient are Cloud Systems to Aerosol Perturbations?" 19th International Conference on Nucleation and Atmospheric Aerosols, 24-28 June 2013, Fort Collins, Colorado, 2013.

Graham Feingold, Keynote Speaker, "Low-Dimensional Models of Complex Aerosol-Cloud Interactions". Goldschmidt Conference, Florence, Italy, 2013.

Jessica Gilman, Invited Speaker, "Characterizing the Emissions of Volatile Organic Compounds (VOCs) from Oil and Natural Gas Operations in Several U.S. Shale Basins," Colorado State University in Fort Collins, Colorado, November 2013.

Jessica Gilman, Invited Speaker, "Regional Characteristics and Potential Atmospheric Impacts of Volatile Organic Compounds (VOCs) Emitted from Oil and Natural Gas Operations in Several Major Shale Plays across the United States," 125th Annual Geological Society of America Meeting in Denver, Colorado, October 2013.

Jessica Gilman, Invited Speaker, "Characterizing Emissions and Assessing Air Quality Impacts from Oil and Natural Gas Operations in Colorado and Utah," 246th American Chemical Society National meeting in Indianapolis, Indiana, September 2013.

Birgit Hassler, Invited Speaker, **"**Ozone Dataset in Support of CMIP6 Simulations," CCMI Workshop, Lancaster, U.K., 2014.

Si-Wan Kim, Invited Talk, "Evaluation of NO_x Emission Inventory Over East Asia using OMI, MAX-DOAS, and Surface Observations and Regional Model Simulations," the 5th GEMS Science Team Meeting, October 2014.

Si-Wan Kim, Invited Talk, "Impact of a Priori Information on Satellite NO_2 and HCHO Retrievals Over the Los Angeles Basin," the 5th GEMS Science Team Meeting in October 2014.

Si-Wan Kim, Invited Talk, "Trend, Seasonality, and Diurnal Variation of Tropospheric NO_2 Columns in Seoul and Los Angeles," the 4th GEMS Science Team Meeting, October 2013.

Jin Liao, Invited Speaker, "High Levels of Molecular Chlorine Found in the Arctic Atmosphere," AGU fall meeting, 2014.

David D. Parrish, Invited Talk, "How Complete Is Our Knowledge of Tropospheric Ozone? (at Least as it is Currently Incorporated into Chemistry-Climate Models)," American Geophysical Union Fall Meeting, December 2014.

David D. Parrish, Chair's Lecture Series, "Air Pollution in Developing Mega-Cities - Something Old, Something New - Lessons from Los Angeles," California Air Resources Board, August 2014.

David D. Parrish, Invited Talk, "Systematic Comparison Of Long-Term Tropospheric Ozone Changes Between Observations And Models," IGAC/SPARC Chemistry-Climate Model Initiative (CCMI) Workshop, May 2014.

David D. Parrish, Invited Talk, "Air Pollution in Developing Mega-cities: Something Old, Something New," College of Environmental Sciences and Engineering, Peking University Seminar, April 2014.

David D. Parrish, Invited Talk, "Air Pollution in Developing Mega-cities: Something Old, Something New," Monsoon Asia Integrated Regional Study (MAIRS) Open Science Conference, April 2014.

David D. Parrish, Invited Talk, "Long-Term Baseline Ozone Changes: Disagreement between 3 ACCMIP/CMIP5 Models and Observations," American Geophysical Union Fall Meeting, December 2013.

David D. Parrish, Invited Talk, "Long-Term Changes in Lower Tropospheric Baseline Ozone Concentrations: Comparing Chemistry-Climate Models and Observations at Northern Mid-Latitudes," ESRL/CSD Seminar, October 2013.

David D. Parrish, Invited Talk, "Urban Air Quality Trends in a Global Context," RISUD International Workshop on Regional Air Quality - Linking Science to Policy, June 2013.

David D. Parrish, Invited Talk, "Decadal Trends of VOC Toxics in the Los Angeles Urban Area," CRC Mobile Source Air Toxics Workshop, February 2013.

Anne Perring, Invited Speaker, "Bioaerosol: One Year of Laboratory and Field Observations," CU Boulder Environmental Engineering Seminar, 2014.

Anne Perring, Invited Speaker, "From Urban Centers to the Remote Atmosphere: Airborne Observations of Black Carbon (BC) Aerosol," Physical Research Laboratory Seminar, Ahmedabad India, 2013.

James Roberts, Invited Talk, "An Overview of the Uintah Basin Winter Ozone Study Intensives: 2012, 2013, and 2014," Fall Meeting of the AGU, December 2014.

James Roberts, Invited Talk, "The Atmospheric Chemistry of HNCO and $ClNO_2$ in Relation to Potential Health Impacts," Department of Chemistry, University of Colorado, Denver, October 2014.

James Roberts, Invited Talk, "The Atmospheric Chemistry of Small Molecules and their Potential Health Effects," Berkeley Atmospheric Science Center, University of California, Berkeley, March 2014.

Karen H. Rosenlof, Invited SPARC Lecture for Theme 4: Stratospheric Constituents and Circulation, "Observational Datasets, Reanalysis and Attribution studies," SPARC 2014 General Assembly, Queenstown, New Zealand, January 2014.

Karen H. Rosenlof, Invited Lecture, "Stratospheric Water Vapor: Trends and Climate Impacts," 535st International Wilhelm and Else Heraeus Seminar: Water Vapor and Ice in the Atmosphere, Bad Honnef/Bonn, Germany, June 2013.

Karen H. Rosenlof, Invited Lecture, "Links Between the Stratospheric Mean Meridional Circulation, Water, Ozone and Climate," WCRP Regional Workshop on Stratosphere-Troposphere Processes and their Role in Climate, Kyoto University, Kyoto, Japan, April 2013.

Tom Ryerson, Invited Briefing to the Interagency Coordinating Committee on Oil Pollution Research, "Rapid Airborne Assessment of Offshore Blowouts: A Gap in National Oil Spill Response Capabilities," Washington Navy Yard, September 2014.

Tom Ryerson, Invited Briefing to U.S. Coast Guard Admirals and Staff, "Rapid Airborne Assessment of Offshore Blowouts: A gap in National Oil Spill Response Capabilities," USCG HQ, Washington, D.C., June 2014.

Tom Ryerson, Keynote Talk at the Twelfth Annual Atmospheric Science Symposium, "Airborne Measurements Addressing Climate and Air Quality Issues: Connecting Local Emissions to Global Impacts," UC Berkeley Atmospheric Sciences Center, February 2014.

Tom Ryerson, Invited Talk at American Chemical Society National Meeting, "Airborne Chemical Measurements Provide Time-Critical Decision Support During Offshore Blowouts," New Orleans, Louisiana, April 2013.

Joshua Schwarz, Invited Speaker, "Non-Pulsed LII Applied to Atmospheric Black Carbon Characterization in the Service of Climate Science," GRC on Laser Diagnostics in Combustion, Waterville Valley, New Hampshire, 2015.

Joshua Schwarz, Invited Speaker, "BC in Ice, Rain, Snow, and Air," Workshop on BC in the Andes, San Jose, Chile, 2013.

Christoph Senff, Invited Speaker, "Ozone Transport and Mixing Processes in the Boundary Layer Observed with Lidar during Discover-AQ," Fall Meeting of the American Geophysical Union, 2014.

Ranajit Talukdar, Invited Speaker, "Henry's Law Solubility Coefficients and Hydrolysis Rate Coefficients of Some Atmospheric Trace Gases Using a Newly Developed Method," Department of Chemistry, University of Warsaw, Poland, November 2013.

Troy Thornberry, Invited Presentation, "Water Vapor and Cirrus Clouds in the Pacific TTL during ATTREX 2013," Fall Meeting of the American Geophysical Union, 2013.

Troy Thornberry, Invited Presentation, "Dehydration in the Pacific TTL Inferred from Water Vapor Measurements during ATTREX 2013," 535th International Wilhelm and Else Heraeus Seminar: Water Vapor and Ice in the Atmosphere, Bad Honnef, Germany, June 2013.

Rebecca Washenfelder, Invited Seminar, "Optical Properties of Organic Aerosol," Sigma Xi Honor Society, University of Colorado, Boulder, Colorado, 2013.

Rebecca Washenfelder, Invited Seminar, "Broadband Cavity Enhanced Spectroscopy," Department of Civil and Environmental Engineering, Israel Institute of Technology, Haifa, Israel, 2013**.**

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