

Gregory R. Carmichael

December 2019

EDUCATION

Ph.D, 1979 Chemical Engineering, U of Kentucky
M.S., 1975 Chemical Engineering, U of Kentucky
B.S., 1974 Chemical Engineering, Iowa State University

APPOINTMENTS

2014 – Director, University of Iowa Informatics Initiative
2002-2014, Associate Dean for Graduate Studies and Research, College of Engineering
1991-Present, Co-Director, Center for Global & Regional Environmental Research
1981-1995, and 1998-2000, Chairman, Dept. of Chemical and Biochemical Engineering
1985-Present, Professor of Chemical and Biochemical Engineering, University of Iowa
1981-1985, Associate Professor of Chemical Engineering, University of Iowa
1978-1981, Assistant Professor of Chemical Engineering, University of Iowa

AWARDS

Fellow American Geophysical Union, December 2018
University of Iowa Presidential Lecture, Feb 2017
University of Iowa Graduate College, Outstanding Mentor Award, May, 2017
Hall of Distinction, University of Kentucky, College of Engineering Alumni Award, April 2016
Fellow, American Institute of Chemical Engineering (AIChE), 2013
AIChE Lawrence K. Cecil Award for outstanding chemical engineering contribution and achievement in the preservation or improvement of the environment (2012)
NASA Group Achievement Awards (INTEX-A Experiment, 2005 & ARCTAS Experiment 2009)
Priestley Lecture, CSIRO, Melbourne, Australia, 2003
Kammermeyer Chair of Chemical & Biochemical Engineering, 2001-Present
Japan Ministry of Education and Culture, Distinguished Visiting Professorship Award, Disaster Prevention Res Inst, Kyoto Univ, May-Aug, 2000
College of Engineering Outstanding Research Award, 1999
Iowa Board of Regents Faculty Recognition Award, 1998
Intl Atmospheric Science and Application to Air Quality, Research Recognition Award, 1998
Professional Progress Award, Iowa State Univ, 1989
Outstanding Young Alumni Award, Iowa State Univ, 1986
ASEE Dow Young Faculty Award for the North Midwest Section, 1986
University of Iowa Faculty Scholar, 1982-1985

PROFESSIONAL AND SERVICE ACTIVITIES (*illustrative*)

Department

Chairman, Chemical and Materials Engineering Program, 1982-1984
Chairman, Dept. of Chemical & Materials Engineering, 1984-1989
Chairman, Dept. of Chemical & Biochemical Engineering, 1989-1995
Interim Chair, Dept. of Chemical & Biochemical Engineering, 1998-2000

College

Associate Dean for Research and Graduate Studies, 2002-2014
Graduate College Self Study, 2002
Core Curriculum Committee, 1999-2001
Ad Hoc Core Curriculum Committee, 1997-1999
Member of Administrative Council, 1983-1995, 1998-2000
Mathematics Stem Committee, 1979-1980
College Self Study Committee, 1984
International Study Committee, 1984
Chair, Ad Hoc Committee on Foreign Language, 1986
Ad Hoc Committee on Engineering I & II, 1987
Engineering College Mathematics Liaison, 1998-2000

University

Director Iowa Informatics Initiative, 2014 – present
University of Iowa Research Foundation, Board of Directors, 2011 -
Export Controls Advisory Board, 2010-
Ad Hoc Task Force on Research, 2009-2011
Ad Hoc Committee on Postdoctoral fellows, 2007- 2011
Ad Hoc Committee on International Student Recruitment, 2007- 2010
Intercollegiate Task Force on the Organization of Regional Education in the Life
Sciences, 2007- 2009
Search Committee for the Vice President for Research, Chair 2004
University Task Force on Energy Conservation, 2004-2010
General Education Fund Task Force, Jan-Aug 2004
Ad-hoc Economic Development Committee for the VP of Research, Nov 2003-2008
Self-Study, Graduate College, 2003
Center for Bioinformatics and Computational Biology, Advisory Board, October,
2002-
Advanced Research Computing Advisory Group, 1985-present
UI-Representative to University Consortium for Atmospheric Research (UCAR) 1994-
present
MUCIA Executive Committee, 1998-2002
Advisory Committee for International Programmes, 1997-1999
Chair, College of Liberal Arts Review, 1994-1995
UI- Representative on Steering Committee of San Diego Super-computing Center,
1994-1997
Chair, Research Council 1991-1993
Chair, Advanced Computing Advisory Committee, 1992-1993
Chair, Ad Hoc Review Committee of Central Research Facilities, 1991-1992
Board of Directors, Iowa Research Foundation, 1992-1998
Co-Director, Center for Global & Regional Environmental Research, 1995-present
Search Committee for V.P. of Research & Development & Dean of Graduate College,
1986-1988
Search Committee for Biocatalysis Chair, 1986
University Self Study, Chair of Subcommittee on Service, 1986-1987
Treasurer and Secretary of University of Iowa Faculty Club (Triangle Club) 1979-1982
High Speed Computer Facility - Advisory Board Member, 1987- 1995
Foreign Language Council, 1987-1992

Foreign Language Fellowship Committee, 1987-1988, Chairman, 1989-1990
Biotechnology Advisory Board, 1988-1995
Faculty Scholars Committee, 1988
Co-organizer, University of Iowa Global Group
Research Council, 1990-1993
Chair, Research Council, 1991-1992
Electron microscopy Advisory Board, 1990-2000

National and International

AIChE

- Active member of American Institute of Chemical Engineers **since** 1974
- Leadership roles include:
- Member PAIC PUBLIC AFFAIRS AND INFORMATION COMMITTEE, 2020 –
- Member Government Relations Committee 2009-2016
- Environmental Division Past chair, Chair, 1st Vice Chair, 2nd Vice Chair, Environmental Division, 2006-2010
- Member, AIChE Acid Rain Task Force, 1981-1990
- President, AIChE, Iowa Chapter, 1987-1988

Co-Chair Scientific Community Committee, NASA Aerosol and Convective Clouds and Precipitation Decadal Survey Study (A-CCP), 2018 - present

Chair of the Science Advisory Board for Environmental Research Programs, World Meteorological Organization, 2014 –

NASA Earth Science Subcommittee, 2014 -

MACC Advisory Board, EU, European Center for Medium Range Weather Forecasting, 2010- 2014

Advisory Board Member, College of Environmental Science, Peking University, 2008-2011

Chair, Scientific Advisory Group, Shanghai Pilot Project, Shanghai Meteorological Bureau, 2007-2015

UCAR, Nominations Committee, 2008-2010

National Research Council, Committee on Mesoscale Observations to meet National Needs, 2007-2009

NOAA, Climate Change Science Research Program, Committee on Direct Radiative Effect of Aerosols, 2004-2005

Texas Environmental Research Council (TERC), Scientific Advisory Board, 2004-2010

NSF, Ad hoc Committee on Cyberinfrastructure in the Atmospheric Sciences (Crydas), June 2003-2004

IGAC (International Global Atmospheric Chemistry), DEBITS (Deposition of Biogeochemically Important Trace Species), coordinating committee, 2004-2007

Anthropogenic Brown Cloud, Scientific Advisory Board, UNEP, 2002-

International Advisory Committee, Urbanization, Emissions and Global Carbon Cycle Institute; Intensive Global Change Institutes, IGPB/START, 2002-

Advisory Board, NASA Langley Research Center, Data Archive and Analysis Center (DAAC), 2001- 2003

Chair, Scientific Advisory Group, Urban Research Program, The World Meteorological Organization, 1999-2014

International Global Atmospheric Chemistry DEBITS, Steering Committee, 1998
Commission on Atmospheric Chemistry and Global Pollution (CACGP) Elected to
Steering Committee, 1998-2004
Stanford University, Dept. of Civil & Environ. Engineering, Advisory Board, 1998.
World Meteorological Organization, Global Atmospheric Watch, Observations Group,
1998-2000
Governors Science Council, 1991-2000
EPA/AMS Advisory Committee, 1991-1994
American Meteorological Society – member
Board on Urban Environment, member, 2007-2010
Chair, Atmospheric Chemistry Committee, American Meteorological Society,
1994-96
2020 – International Volunteer Committee
American Chemical Society - member
Iowa Academy of Science - member
Co-Chairman, Engineering Session Iowa Academy of Science, 1980-1981
Chairman, Engineering Session, Iowa Academy of Science, 1981-1982
Sigma Xi – member
American Geophysical Union - member
American Society of Engineering Education - member
Omega Chi Epsilon - Associate Member
American Association for the Advancement of Science - member
Tau Beta Pi - member

Editorial Boards:

Environmental Chemistry, 2004-
Environmental Fluid Dynamics, 2000-
Environmental Software, 1990-
Atmospheric Environment 1995-
Numerical Insight Series, Gordon and Breach Publishing Group, 1997-
Environmental Series, Applied Mechanics Publications, 1997-

PhD Dissertation Supervision

| Date | Student | Topic | Permanent Position |
|------|---------------------|--|--|
| 1981 | Reda, Mohammad | Multicomponent Diffusion Analysis of SO ₂ and Sulfate Production in Clouds Using a Detailed Cloud Scavenging Model | Professor, Dept of Chemical Engineering, Kuwait University |
| 1985 | Yoshisato, R.A. | Stimulation and Optimization of the Total Continuous Membrane Column by a Two | Dow Chemical, Corporate Research |
| 1985 | Adewuyi, Yusuf | Reaction Kinetics of Hydrogen Peroxide with Reduced Sulfur Compounds in Aqueous Medium Investigation of Sulfate | Assoc Professor, Dept of Chemical Engineering, North Carolina A & M |
| 1985 | Hong, Min Sun | An Investigation of Sulfate Production in Clouds using a Detailed Transport/ Chemistry Model (STEM-II) Coupled with Detailed Cloud Scavenging Models | Professor, Environmental Engineering, Ajou University, Korea |
| 1986 | Cho, Seog-Yeon | Mathematical Modeling and Sensitivity Analysis of Acid Deposition | Professor, Environ. Engineering, Inha University, Korea |
| 1987 | Shim, Shang-Gyoo | Application of Detailed Combined Transport/Transformation/Removal Model to Mesoscale Acid Deposition | Senior Researcher, Korean Institute for Science & Technology |
| 1987 | Chang, Young Soo | Behaviors of the Polluted Air Mass Under Long Range Transport mechanism Induced by Local Flows | Research Scientist, Argonne National Lab |
| 1988 | Habib, Khaled | Anodic Behavior of Metallic Electrode During Cyclic Deformation in Aqueous Solutions by Holographic Interferometry Holometry | Senior Researcher, Materials Applic. Dept., Kuwait Institute for Scientific Research |
| 1989 | Lu, Maiying | The Effects of Pollutants on Atmospheric Corrosion of Steels: A Modeling and Kinetics Study | Post Doctoral Fellow, Dept of Chemical Engineering, Texas Tech University |
| 1989 | Ye, Steve Shao-Jian | Sensitivity Analysis of a Structured Metabolic Model for Glucose-Limited Aerobic Growth of <i>Saccharomyces Cerevisiae</i> in Vegetative Cell Cycle | Searle, NutriSweet Division |
| 1990 | Shin-Woo Chul | Comprehensive Air Pollution Modeling on Multiprocessing Environments: Application to Regional Scale Problems | Senior Researcher, Korea Dept of Defense |

| | | | |
|------|--|--|--|
| 1991 | Kothamarthi, V. Rao | Studies of the Long Range Transport of Trace Gases and Aerosols in the Western Pacific Rim | Research Scientist, Univ of Illinois & Argonne National Lab |
| 1994 | Sunwoo, Young | Ozone in East Asia | Professor, Environmental Engineering, Kyonggyo University |
| 1994 | Crist, Kevin | UVB and Tropospheric Trace Gas Interactions | Professor, Environmental Health Sciences, University of Ohio |
| 1994 | Zhang, Yang | Dust-Tropospheric Trace Gas Interactions | Assoc Professor, Atmospheric Sciences, North Carolina State |
| 1995 | John, Kuruvilla | Sensitivity of Regional Photochemical Oxidant Cycle to Climate Change | Professor, Environmental Engineering, Texas Tech, Kingsville, TX |
| 1997 | Beardsley, R.A. | Electrophoresis in Bioseparations | Venture Capital Group |
| 1997 | Arndt, Richard | Long Range Transport of Sulfur | Asst Professor, Windsor University, Windsor, Canada |
| 1997 | Sandu, Adrian (w/ Prof. Florian Potra) | Implicit Solvers for use in Integrating Stiff ODEs | Assoc Professor, Computer Science Dept, Virginia Tech |
| 1998 | Xu, Wie | Acid Deposition in China | Research Scientist, Max Planck Institute for Climatology, Germany |
| 1998 | Damian, Valeiru (w/ Prof. Florian Potra) | STEM-III Development, Computer Science | Smiths, Klein, Beacham Research Division, Philadelphia, PA |
| 1999 | Song, Chul Han | Aerosol Modeling | Dean & Professor, Gwangju Inst of Science & Tech. (GIST), Dept of Env Sci and Engineering, South Korea |
| 1999 | Phadnis, Mahesh | Heterogeneous Reactions in the Troposphere | Research Scientist, Earthtech, Boston, MA |
| 2000 | He, Shan | Aerosol Radiative Forcing (CEE) | NESCAUM, Boston, MA |
| 2001 | Daescu, Dacian | Adjoint Model for Atmospheric Chemistry | Assoc. Professor, Portland University |
| 2002 | Guttikunda, Sarath | Impact of Asian Megacities | Research Scientist, World Bank, Washington, D.C. |
| 2005 | Thongboonchoo, Narisara | Air Quality in Thailand | Assoc. Prof, Chem Engrg, King Mongkut's |

| | | | |
|------|----------------------|--|--|
| | | | Institute of Technology, Thailand |
| 2006 | Pan, Li | Global Mercury | NOAA Air Resources Lab |
| 2007 | Mena, Marcelo | Air Quality in Santiago | Undersecretary of the Environment Chile |
| 2008 | Adhikary, Bhupesh | Aerosol/Climate Forcing in South Asia | Asst Prof. University of Kathmandu |
| 2009 | Kulkarni, Sarika | Aerosol Distributions in East Asia | California Air Resources Board |
| 2010 | Wei, Chao | Heterogeneous Chemistry | Max Planck Institute for Atmospheric Chemistry |
| 2012 | Marrapu, Pallavi | Aerosol Climate Feedbacks | Post Doc NOAA Boulder |
| 2012 | Jamroensan, Aditsuda | Modeling aerosol climate interactions in SE Asia | Thailand Atomic Energy Commission |
| 2012 | Huang, Min | Heterogeneous Chemistry | University of Maryland, Research Assist. Prof |
| 2014 | Yu, Man | Air Quality and Climate in the Pearl River Delta | Post doc Argonne |
| 2014 | Saide, Pablo | Air Quality forecasting and assimilation | Faculty UCLA dept atmos. Sci. |
| 2017 | Sabhani, Negin | Long range Transport of Pollutants to the Arctic | Post Doc NCAR |
| 2015 | Gao, Meng | Reducing uncertainties in climate forcing and health estimates through data assimilation | Post Doc Harvard University & IAP China |
| 2017 | Abdioskouei Maryam | Novel techniques to estimate emissions | NCAR Staff scientist |
| 2016 | Du, Lingyun | Brown carbon role in atmospheric absorption | |

MS Thesis Supervision

| Date | Student | Topic |
|------|-------------------|---|
| 1979 | Yang, Dyi-Kang | A Numerical Investigation the Transport and Deposition of Reactive Pollutants |
| 1979 | Chang, Shuh-Chih | Mass Transfer Accompanied by Complex Chemical Reaction |
| 1980 | Lin, Chiao | Regional Scale Pollutant Modeling |
| 1980 | Adewuyi, Yusuf | Gaseous Absorption of Air Pollutants |
| 1981 | Mavedatt, Mehrnaz | A Methodology for Liquid Organic Waste Identification and Processing |
| 1982 | Hong, Min-Sun | An Investigation of Sulfate Production in Clouds Using a Flow-Through Chemical Reactor Model Approach |

| | | |
|------|--------------------|---|
| 1982 | Yuk, Kam | An Extrapolation Technique for the Numerical Solution of Atmospheric Transport Problems |
| 1982 | Leung, Solomon | Solute Redistribution During Normal Freezing Operations |
| 1983 | Kim, W-J | Transport of Reduced Sulfur Compounds in the Troposphere |
| 1983 | Tsay, R-P | The Importance of Free Radical Chemistry on the Production of Sulfate in Cloud Droplet |
| 1983 | Shieh, D. | Comparision of Solution Techniques for the Integration of Stiff ODE's Arising from Atmospheric Transport Problems |
| 1984 | Korndorf, Lisa | Mathematicsl Analysis of Continuous Rotating Annular Electrophoresis |
| 1984 | Shan, T-C | Application of Finite Analytic Method to the Atmospheric Transport Equation |
| 1984 | Chang, Y-S | A Numerical Investigation of the Formation of Ambient NH_4NO_3 Aerosol |
| 1985 | Zingher, Harry | Numerical Analysis of Buoyancy Effects in the CRAE Column |
| 1986 | Gorowitz, J. | Study of Electrokinetic Phenomena |
| 1987 | Hash, Linda | The Fate of Toxic Chemistry in the Atmosphere |
| 1987 | Bream, Allen | An Immobilized Enzyme Reactor/Separator for the Hydrolysis of Casein by Subtilisin Carlsberg |
| 1989 | Ravishanker, B.S. | Important Acid Production Pathways and Effect of Source Emission Reductions on Acid Deposition |
| 1989 | John, Kuruvilla | Numerical Evaluation of the Impaac of Urban and Industrial Emissions on Mesoscale Acidic Deposition |
| 1995 | Chen, Li Ling | Analysis of Aerosol and Non Methane Hydrocarbon Data from Cheju Island, Korea |
| 1995 | Phadnis, Mahesh | Evaluation of Various Modeling Methodologies for Calculation of Acid Deposition |
| 1995 | Arndt, Richard | The Distribution and Deposition of Sulfur Oxides in Asia |
| 1996 | Hotchkiss, Brian | Sensitivity Analysis of Ozone and UVB Flux via Automatic Differentiation |
| 1996 | Durchenwald, James | Visualization of Large Atmospheric Data Sets |
| 1998 | Suib, Fachrizal | Acid Deposition in Indonesia |

| | | |
|------|-------------------------|--|
| 1999 | Yienger, James (CEE) | Global Distribution of Tropospheric Ozone |
| 1999 | Wang, Jing | Dust Emissions in Asia |
| 1999 | Dwivedi, Pramod | Biofuels and Health in Rural India |
| 2001 | Dorwart, James | Particulates and Human Health |
| 2004 | Kulkarni, Sarika | Aerosol Distributions in East Asia |
| 2007 | Adhikary, Bhupesh | Asian Aerosols |
| 2008 | Huang, Hao | Secondary Aerosols |
| | | |

SEMINARS AND INVITED LECTURES

Seminars and Invited Lectures

1980 - 1994

Seminar: Radiological and Environmental Research Division of Argonne National Laboratory, Aug., 1980.

Seminar: Environmental Engineering Program at the University of Iowa, Spring, 1980.

Seminar: Dept. of Chemical Engineering, Seoul National Univ., June, 1983.

Seminar: Dept. of Chem. Eng., Korea Adv. Inst. of Science and Technology, June, 1983.

Seminar: Kentucky Center for Energy, February, 1983.

Seminar: OECD Workshop on Long Range Transport Models, April, 1983.

Seminar: Theoretical Research Group on Regional Planning, Toyohashi University of Technology, Japan, July, 1983.

Invited lecture 5th Symposium of the Assoc. of Environmental and Sanitary Engineering ,

Invited lecture Kyoto University, Japan, July, 1983.

Seminar: National Inst. of Environmental Studies, Tsukuba, Japan, October, 1983.

Invited lecture 17th Autumn Meeting of Japan Society of Chemical Engineering, Tohoku University, Sendai, Japan, October, 1983.

Seminar: Dissolution of Multicomponent Drugs, College of Pharmacy, University of Iowa, 1982.

Seminar: Sanitary Eng. Dept., Kyoto University, Kyoto, Japan, November, 1983

Seminar: Dept. of Chemical Engineering, Osaka Univ., Osaka, Japan, Nov., 1983.

Seminar: Technology Development Center, Toyohashi Univ. of Tech., Nov., 1983.

Seminar: Water Research Inst., Nagoya Univ., Japan, November, 1983.

Invited lecture: Atmospheric Chemistry, Particulate Matter and air Quality Study Group, Joint Symposium, Air Pollution Study Association, Kanto Branch, Tokyo, Dec., 1983

Invited lecture: Acid Deposition Modeling National Institute of Environmental Studies and Meteorology Atmospheric Chemistry and Meteorology, Branches of Japan Society of Air Pollution, Tsukuba, Japan, June 1985.

Invited lecture: Study Association, Kanto Branch, Tokyo, Dec., 1983.

Seminar: Sensitivity Analysis, National Institute for Environmental Studies, Atmospheric Chemistry, Physics and Aerosol Groups, Tsukuba, Japan, June, 1985.

Invited lecture: Reducing Scientific Uncertainty in Atmospheric Processes Influencing Acid Rain, Argonne National Lab Symposium/Workshop, Acid Rain Control: Developing a Consensus for Action., August, 1985.

Seminar: Tropospheric Trace Gas Modeling, University of Iowa Academic Seminar for University Administration, November, 1985.

Seminar: Toyota Research Center, September, 1986.

Seminar: Seoul National University, October, 1986.

Seminar: Electric Power Research Institute, Palo Alto, March, 1987.

Seminar: Central College, "Biochemical Engineering", January, 1987.

Invited Distinguished Lecture: San Jose State University Dept. of Meteorology, March, 1987.

Invited Lecture: "Sensitivity Analysis", Task Force on Acid Rain Modeling, Warsaw, Poland, April, 1987.

Invited Lecturer: "Air Pollution Modeling", NEA, National Energy Corp., Rome, Italy, June, 1987.

University of Munich, Institute of Meteorology, "Tropospheric Trace Gas Modeling", June, 1987, Munich, West Germany.

Seminar: Central Electricity Board, "Air Pollution Modeling", Leatherhead, England, July, 1987.

Briefing to EPA Air Resources Laboratory, Acid Deposition Modeling, November, 1987.

Seminar: "Long Range Transport of Pollutants in Japan", seminar to Environmental Engineering Department, University of Iowa, November, 1987.

Invited lecture: "Long Range Transport of O₃ in Japan", International Meeting on Photochemical Oxidants in North America, Quebec, February, 1987.

Invited lecture: "Super-computing, How Does One Approach the Change" Engineering Foundation Meeting on Reaction Engineering, February, 1987, Santa Barbara.

Invited lecture: series, "Air Pollution Modeling, Chinese Research Academy for Environmental Studies, Beijing, China, April, 1988.

Special lecture: "Long Range Transport of Air Pollutants", National Institute for Environmental Studies, Korea, Seoul, April, 1988.

Seminar: "Air Pollution Modeling", Korean Institute for Energy Research, Daeduk, April, 1988.

Seminar: "Chemical Engineering Aspects of Air Pollution Modeling", Korean Institute for Science and Technology, Department of Chemical Engineering, April, 1988.

Seminar: "Modeling Trace Gases in the Lower Troposphere - A Chemical Engineering Analysis", Dept. of Chemical Engineering, University of Nebraska, Dec., 1988.

Seminar: "Modeling Trace Gases in the Lower Troposphere - A Chemical Engineering Analysis", Department of Chemical Engineering, Iowa State Univ., Feb., 1989.

Seminar: "Global Change", Seminar to University of Iowa President and Advisory Council, University of Iowa, Feb., 1989.

Seminar: "Modeling Trace Gases in the Lower Troposphere - A Chemical Engineering Analysis", Institute for Hydraulic Research, U. of Iowa, March, 1989.

Seminar: Honors Seminar, "Environmental Quality Concerns", College of Pharmacy, March, 1989.

Seminar: "Chemical Integration in the CALGRID Model", California Air Resources Board, Sacramento, CA, April, 1989.

Seminar: "Long Range Transport Modeling", Chinese Research Academy for Environmental Studies", May 13, 1989.

Invited Speaker: "Long Range Transport of Pollutants in the Pacific Rim", Hong Kong University, NASA/PEM Planning Meeting, May 10, 1989

Invited Speaker: "Modeling Regional Scale Photochemical Oxidants", Gordon Conference on Air Chemistry, June 1989.

Seminar: "Regional Trace Gas Cycles, Their Importance in Global Change", Kyoto University, Dept. of Chemical Engineering, July 1989

Seminar: "Regional Scale Trace Gas Cycles - A Chemical Engineering Analysis", Kyushu University, Dept. of Chemical Engineering, July 1989.

Seminar: "Regional Scale Trace Gas Cycles, Their Importance in Global Change", National Institute for Environmental Studies, Japan, July 1989.

Seminar: Understanding the Impact of Anthropogenic Emissions on the Atmospheric Environment through the use of Comprehensive Atmospheric Trace Gas Cycles, Department of Chemical Engineering, Louisiana State University, October 1990.

Global Change: - *invited lecture* - Iowa Association for Energy Efficiency Iowa's Pursuit of Energy Efficiency", Des Moines, October 1990

Seminar: The Long-Range Transport of Pollutants in and around Japan, California Institute of Tech., Environment Engineering, April 1990.

Seminar: Overview of Episodic Tropospheric Trace Gas Models, invited presentation at the Workshop on S and N fluxes to the North Atlantic Ocean, Bermuda, April 1990

Invited lecturer: IBM Summer Institute on Environmental Modeling, July 1990 Austria, 2 talks: "Acid Deposition Modeling" and "Photochemical Oxidants in East Asia."

Invited Paper: "Understanding Trace Gas Cycles Through the use of Comprehensive Atmospheric Chemistry Models", 1st PRC-US Workshop on Atmospheric chemistry Modeling, Shanghai, China, August 1-8, 1990.

Invited Critical Review: National Acid Precipitation Assessment Program (NAPAP) State of the Science and Technology Conference, Hilton Head, SC, Feb, 1990.

Seminar: "Air Pollution Modeling", Louisiana State University, Dept of Chemical Engineering, October 1990.

Invited lecture: "Acid Deposition Modeling, Workshop on Acid Rain in Asia, Bangkok Thailand, Nov 18-23, 1990.

Invited lecture: "Advances in Air Pollution Modeling", NSF-University of Kentucky, Workshop on Computational Advances in Transport Phenomena, Lexington, KY, Jan 7-9, 1991.

Seminar: "The STEM-II Regional Scale Atmospheric Chemistry Model. Description of the model and current applications." Max Planck Institute for Chemistry, Air Chemistry, Feb. 28, 1991.

Seminar: "Regional Scale Trace Gas Modeling - Current Status and Future Directions," Inst for Geophysics and Meteorology, University of Koln, Germany, March 4, 1991.

Seminar: "Atmospheric Chemistry of Oxidant and Acid Formation: Key Aspects for Long Range Transport Modeling" Invited lecture - EMEP Workshop on Photochemical Modeling for Long Range Transport in Relation to Abatement Strategies." Berlin, Germany, April 16-19, 1991.

Seminar: "Eulerian Modeling of the Long-Range Transport of Photochemical Oxidants." EMEP Workshop, Berlin, Germany, April 16-19, 1991.

Seminar: "Regional Scale Trace Gas Modeling: Current status and future directions." European Geophysics Society, Wiesbaden, April 25, 1991.

Seminar: "Regional distribution of tropospheric ozone in East Asia." European Geophysics Society

Seminar: "Photochemical Oxidant and Acid Formation Key Aspects for Long Range Transport Modeling." Univ Blaise Pascal, CNRS, Lab for Meteorologic Physics, May 1991.

Seminar: "Photochemical Oxidants in East Asia" Fraunhofer-Isntitut fur Atmospharische Umweltforschung Garmesh, Germany, May 23, 1991.

Seminar: "Long Range Transport of Transport of Trace Gases in East Asia, Stockholm University, Dept of Meteorology, May 30, 1991, Stockholm, Sweden.

Seminar: "Regional Scale Trace Gas Modeling", Norway Meteorological Inst. June 3, 1991, Oslo, Norway.

Seminar: "Modeling Photochemical Oxidants in East Asia", IBM, Bergen Scientific Center, Bergen, Norway, June 6, 1991.

Seminar: "Global Warming", The International Summer Institute, Des Moines, IA, July 1991.

Seminar: "Ozone in Asia", University of Chicago, Dept of Geophysical Sciences, Oct ,1991.

Guest lectures: Acid Deposition Modeling, three lectures as guest of Polish Academy of Sciences at the Institute for Meteorology and Water Resources, Warsaw, Krakow and Katowiec, May 1992.

Seminar: "Tropospheric Air Quality in the Western Pacific Rim Region" Kyushu University Institute for Applied Mechanics, August 1992.

Invited Lecture: "Acid Rain Modeling in Asia" 4th Workshop on Acid Rain in Asia, Bangkok, Thailand, Nov 1992.

Invited lecture: "Modeling Acid Rain in Asia" International Symposium on Sustainable Development, New Delhi, India, Jan., 1993

Invited Lecture: "Long Range Transport in Asia" Air Pollution '93, International Symposium, Monteray, Mexico,

Seminar: "Trace Gases in East Asia", seminar, University of Rhode Island, School of Oceanography, April 16, 1993

Seminar: "Acid Deposition: A Progress Report. Invited presentation in Commission on Atmospheric Chemistry and Global Pollution, International Association of Meteorology and Applied Physics International Meeting, Symposium titled" Major Advances in Atmospheric Chemistry Over the Past Decade and Their Impact on Public Welfare", July 17, 1993, Yokohama, Japan.

Seminar: "Long Range Transport of Pollutants in East Asia" Seminar, Department of Atmospheric Sciences, Seoul National University, July 2, 1993.

Seminar: "Air Pollutants in Asia", invited lecture Argonne National Laboratory, Oct 5, 1993

Seminar: "Analysis of Residual Ozone", TNO Environmental Division, Delft, Netherlands, June, 1994.

Seminar: "Aerosol Composition at Cheju Island, Korea", 4th International Conference on Atmospheric Sciences and Air Quality, Invited Lecture, June 1, 1994

Invited Lecture: "Acid Rain in Asia", Workshop on Acid rain Network in South, East, and Southeast Asia, KL, Malaysia, May 1994.

Seminar: "Modeling the Long-Range Transport and Acid Deposition of Sulfur Compounds in Asia", ADB Workshop on Acid Deposition in Asia (RAINS-ASIA), Bangkok, Nov 1994.

Seminar: "Energy and the Environment: Acid Deposition in Asia Today and Tomorrow", Department of Biology, Iowa State University, 1995.

- Seminar:* "Acid Deposition in Asia", Department of Geography Graduate Seminar, University of Iowa, February 1995.
- Seminar:* "Recent Advances in Air Quality Modeling", Keynote lecture, Canadian Meteorological and Oceanographic Society, Kalona, British Columbia, May 1995.
- Seminar:* "Distribution of ozone and aerosols in East Asia", seminar Center of Atmospheric Sciences, Wageningen University, Netherlands, July 1995.
- Invited talk:* "Present State and Future Directions of Air Quality Modeling", Dagstuhl Conference on Systems Analysis Modeling and Simulation for Environmental Applications, Dagstuhl Germany, October 1995.
- Plenary lecture:* "The Impact of Expanding Energy Use on the Asian Environment" 21st International Technical Meeting on Air Pollution Modeling and Its Application, Baltimore, November 1995.
- Invited talk:* "An Integrated Analysis of the Impact of Expanding Energy use on the Asian Environment", Aspen Global Change Institute, Summer Workshop on the Environmental Future of China, Aug 1995.
- Keynote address:* "Integrated Analysis of energy growth and acid deposition in Northeast Asia", International Symposium on Acid Deposition and Its Impacts, Tsukuba, Japan, Dec., 1996
- Seminar:* "Air Quality Issues in Megacities", invited lecture, Coastal '96, Rio de Janeiro, Brazil, August, 1996.
- Invited lecture:* "Sensitivity Analysis of Atmospheric Chemistry Models using Automatic Differentiation", Air Pollution '96, Toulouse, France, September, 1996

1997

- Seminar:* "The role of heterogeneous chemistry involving mineral aerosol, Department of Chemistry, ETH, Lousanne, April, 1997.
- Seminar:* "Trace gas and aerosol cycles in Asia", Center for Atmospheric Sciences, Utrecht University, Utrecht, Netherlands, April, 1997.
- Seminar:* "New techniques for solving atmospheric chemistry problems", Computational Science Institute, Amsterdam, April, 1997.
- Seminar:* "Future directions in air quality modeling", CISE, Electricity Board, Milan Italy, July, 1997.
- Seminar:* "Sensitivity analysis using automatic differentiation" GMD-First, Berlin, August, 1997.
- Invited lecture:* "Acid Rain modeling and Monitoring", Workshop on Acid Deposition in Africa, Toulouse France, Oct., 1997.
- Invited Lecture:* Tropospheric ozone in east Asia, 3rd International Joint Seminar on Regional Deposition Processes in the Atmosphere, Nara, Japan, Nov, 1997.
- Special lecture:* "Tropospheric Ozone production in East Asia", Toyohashi Institute of technology, Nov., 1997 Acid Deposition in NE Asia,
- Special lecture:* to the Graduate College, Niigata University, Oct., 1997
- Plenary lecture:* "Trace gas and Aerosol Emission in Asia," Synthesis Workshop on Greenhouse Gas Emissions, Aerosols, and Land Use and Cover Change in Southeast Asia, Taiwan, Nov., 1997
- Invited paper:* Sensitivity Analysis using Automatic Differentiation, AGU Fall Meeting, San Francisco, Dec, 1997

1998

- Seminar:* Asia Energy Growth and the impacts on the atmospheric environment , seminar, IPERTS, Iowa State University, Jan., 9, 1998.

Keynote Lecture: “Atmospheric Chemistry from the Micro Scale, Meso Scale and Global Scale and Back”, World Meteorological Organization, Committee of Atmospheric Sciences, Skopje, Macedonia, Feb., 1998

Invited Lecture: “Modeling Aerosol Processes in Asia”, Asia Pacific Network, Scoping Meeting on Aerosols, New Delhi, India, April, 1998.

Seminar: “Modeling Aerosols at Regional Scales”, NASA Workshop on Aerosols, New York, May, 1998.

Special Lecture: “The Role of Mega Cities on the Asian Environment”, Global Change Program Capitol Hill Seminar, Washington, D.C., June, 1998.

Invited Lecture: “Regional Modeling of the Indonesia Fires”, WMO Special Meeting on Fires in SE Asia, Singapore, June, 1998.

Seminar: “Air Pollution in Shanghai”, The World Bank, Washington, D.C., June, 1998.

Invited Lecture: “Future Challenges in Air Pollution Modeling”, NATO Advance Research Simenal, Bulgaria, July, 1998.

Invited Lecture: “Long Range Transport of Pollutants in Asia”, Workshop on Modeling Pollutant Transport in Asia, IIASA, Vienna, Austria, July, 1998.

Seminar: “The Role of Heterogeneous Processes in the Troposphere”, NCAR Seminar Series, Sept., 1998.

Invited Lecture: “Challenges in Modeling Aerosols at Regional Scales”, Special workshop on Aerosol State of the Science, Pacific Northwest Lab, Sept., 1998.

Keynote Lecture: “Urban Environments a Re-Emerging Focus”, Intl., Air Pollution Modeling Symposium, Paris, Oct., 1998.

Lecture: “Environmental Programs in the UN”, Rotary, Iowa City, Oct., 1998.

Seminar: “Aerosol Processes in Asian Environments”, Institute of Atmospheric Physics, Beijing, China, Nov., 1998.

Keynote Address: “Long Range Transport of Aerosols”, 6th ASAAQ International Conference, Nov., 1998.

Invited Lecture: “The RAINS-ASIA Program”, IGAC DEBITS Workshop, Bangkok, Nov., 1998.

Keynote Address: “Asian Development and the Environment”, International Conference Mission Earth, San Francisco, Dec., 1998.

1999

Invited Lecture: “Integrated Assessment of the Impacts of Energy Use and the Environment of China”, American Association for the Advancement of science, Anaheim, Jan., 1999.

Seminar: “Asian Development and Environmental Consequences”, University of California, Irvine, Feb., 1999.

Seminar: “Modeling Air Quality in Chinese Cities”, World Resources Institute, Feb., 1999.

Invited Lecture: “Advances in aerosol modeling”, Air Pollution 99, Stanford Univ., June, 1999

Plenary Lecture: “ Tropospheric chemistry impacts of emissions from the transportation sector”, International Colloquium and Exhibit on Environmentally Preferred Advanced Energy Generation, Irvine, CA April, 1999.

Seminar: “The importance of chemistry on aerosol surfaces”, Goddard Institute for Space Science (GISS), New York, NY Dec., 1999

Seminar: “Modeling air pollution in Asian Megacities”, The World Bank, Oct., 1999

Invited Talk: “Mineral aerosol as reactive surfaces in the atmosphere”, Special Session on heterogeneous chemistry, American Geophysical Union, Dec., 1999

Seminar: “Modeling dust processes in East Asia”, Institute for Atmos. Physics, Beijing, Nov., 1999.

Plenary Lecture: “Urban Environments: challenges and future research directions”, Workshop on the WMO Program on Urban Environments, Beijing, 1999

Invited Lecture: “Intercomparison of long range transport models for sulfur deposition in East Asia”, Workshop on Long Range Transport Models, International Institute for Applied Systems Analysis, Vienna, Austria, July, 1999

Invited Talk: “Modeling aerosol processes in East Asia”, NSF-Sponsored, ACE-Asia Planning Meeting, Kunming China, Nov., 1999

Invited Talk: “Modeling dust chemistry interactions on regional scales”, Workshop on Mineral Dust, Boulder CO, Oct., 1999.

Invited Talk: “Acid Deposition Modeling in Asia”, Asian Development Bank, Workshop on Acid Rain in Asia, Asian Institute of Technology, May, 1999.

2000

Seminar: “Long Term Trends in Sulfur Deposition in Asia”, The World Bank, Feb., 17,2000.

Plenary Lecture: “Challenges in Atmospheric Chemistry Modeling”, Institute for Mathematics and Its Applications, Univ. of Minn., March 23, 2000

Seminar: “The Changing Trend of Sulfur Deposition in East Asia”, Woodrow Wilson School, Princeton University, April, 15, 2000.

Plenary Lecture: “The Changing Trend of Sulfur Deposition in East Asia”, ICEPAC Conference, Irvine, CA, April, 2000.

Invited Talk: “Modeling Aerosol Processes”, Energy Research Center, Netherlands, April, 2000.

Seminar: “The Influence of Aerosol Processes on Atmospheric Chemistry”, Kyoto University, Japan, June, 2000.

Seminar: “The Influence of Aerosol Processes on Atmospheric Chemistry”, Frontier Research Institute, Tokyo, Japan, August, 2000.

Seminar: “The Influence of Aerosol Processes on Atmospheric Chemistry”, Tohoku University, Sedai, Japan, July, 2000.

Plenary Lecture: “Inter-comparison of Long Range Transport Models”, Workshop on Long Range Transport, IIASA, Vienna, Austria, Sept., 2000.

Plenary Lecture: “Inter-comparison of Long Range Transport Models Applied to Asia, Acid Rain 2000 International Conference, Tsukuba, Japan, Dec., 2000.

Plenary Lecture: “The Influence of Aerosol Processes on Atmospheric Chemistry”, International Conference on the Atmospheric Science and Its Application to Air Quality, Taipei, ROC, Nov., 2000.

All College Seminar: Air Quality Engineering, Iowa State University, Nov., 2000.

Invited Talk: The Role of Heterogeneous Reaction in Tropospheric Chemistry, AIChE Annual Meeting, LA, Nov. 2000

2001

Seminar: The Impact of Asian Emissions on Local/Regional and Global Air Quality, Cal Tech, Environmental Engineering Seminar Series, Jan. 2001

Seminar: The Impact of Asian Emissions on Local/Regional and Global Air Quality, Washington State University, Feb. 2001

- Plenary Talk:* Changing Trends in Asia Emissions, ICEPAC Conference, Irvine, CA, Feb. 2001
- Plenary Talk:* Environmental Implications of the Long Range Transport of Pollutants for Asia, MIT/Endicott Symposium on Exporting and Importing Air Pollution, June, 2001
- Plenary Talk:* Perspectives in Transboundary Pollution Transport in Asia: Lessons and Remaining Challenges, 12th World Air and Environmental Congress, Seoul, Korea, Aug. 26-31, 2001
- Seminar:* The Impact of Asian Emissions on Local/Regional and Global Air Quality, Environmental Science Seminar Series, UI, Nov., 2001
- Seminar:* The Impact of Asian Emissions on Local/Regional and Global Air Quality, NASA Langley Research Center, Langley, VA, Nov. 2001
- Invited Talk:* Intercomparison of Long Range Transport Models in Asia, Workshop on Transboundary Air Pollution, IIASA, Vienna, Austria, Oct. 2001
- Invited Talk:* Interactions between Aerosols and Photochemistry in the East Asia Troposphere, Special Session on Heterogeneous Chemistry, AGU Annual Meeting, San Francisco, CA, Dec. 2001
- Invited Talk:* Climate Effects and Air Quality: Aerosol/Chemistry Interactions and the Role of Megacities, EPA Workshop on Climate Effects and Air Pollution, Research Triangle Park, NC, Dec 2001
- Invited Talk:* Chemical Weather Forecasting Challenges, Workshop on Air Quality Forecasting for the Weather Research Program, Palm Springs, CA, Nov. 2001

2002

- Invited Talk:* Measurement Needs for a Modeler's Perspective, Workshop on the Design of a Continental Measurement Network, San Luis Potosi, Mexico, Jan 2002
- Invited Talk:* Chemical Weather Forecasting, World Meteorological Organization, Experts Meeting on Air Quality Forecasting, Cuernavaca, Mexico, October, 2002
- Invited Talk:* Intercontinental Transport of Pollutants, Lessons Learned from Recent Field Experiments, US/Germany Joint Meeting on International Transport of Pollutants, Baden Baden, Germany, October 2002
- Invited Talk:* Modeling Analysis in Support of the Ace Asia Field Experiment, Annual AGU Meeting, San Francisco, December 2002
- Special Seminar:* Recent Advances in Air Quality Modeling, Malaysian Meteorological Agency, Kuala Lumpur, Malaysia, November 2002
- Invited Talk:* Chemical Weather Forecasting in Support of Field Experiments, Telluride Summer Institute on Atmospheric Chemistry, Telluride, CO, August 2002
- Public Lecture:* The Globalization of Air Pollution, Should We Care?, Telluride, CO, August 2002
- Invited Talk:* Recent Advances in Chemical Weather Forecasting in Support of Atmospheric Chemistry Studies, NCAR Summer School on Aerosols in Climate and Hydrology, Boulder, CO, July 2002
- Invited Talk:* Impacts of Aerosols on Tropospheric Chemistry, NCAR Summer School on Aerosols in Climate and Hydrology, Boulder, CO, July 2002
- Seminar:* Recent Advances in Chemical Weather Forecasting, Environmental Engineering Seminar, UI, November 2002
- Invited Talk:* Recent Advances in Chemical Weather Forecasting in Support of Field Experiments, Symposium on Recent Advances in Atmospheric Chemistry, Boston, August 2002

2003

Invited Talk: Recent Advances in Long Range Transport Modeling, 4th Model Intercomparison Workshop, IIASA, Vienna, Austria, Jan., 2003

Invited Talk: Long Range Transport of Pollutants in Asia, Acid Rain in Thailand, Symposium, JICA, Bangkok, Thailand, February, 2003

Seminar: The Impacts of Aerosols on Tropospheric Chemistry, Atmospheric Science Seminar, MIT, February, 2003.

Special Seminar: Air Quality and Climate change, Thailand Meteorological Agency, Bangkok, Thailand, February 2003

Invited Talk: Advances in Chemical Weather Forecasting: Results for Recent Field Experiments, International Meeting of Atmospheric Scientists in Support of Air Quality, Tsukuba, Japan, March 2003

2004

Invited Talk: Recent Advances in Long Range Transport Modeling, 5th Model Intercomparison Workshop, IIASA, Vienna, Austria, Jan., 2004

Seminar: Changing Trends of Asian Emissions and the Implications for the Quality of the Air We Breathe, Univ. Wisc., Env. Eng., Oct., 2004

Seminar: Improving Predictability of Air Quality, Tsinghua University, Dept. Env. Eng., Beijing, Sept. 2004

Keynote Address: Regional Emissions and Air Pollutant Transport in China, Beijing International Environment Forum 2004, Sept. 2004

Invited Talk: Chemical Data Assimilation in Support of Chemical Weather Forecasts, Annual meeting of the American Meteorological Society, Seattle, Jan., 2004

Invited Talk: How well can we characterize the sources (regions, sectors, etc.) contributing to an observable? Intercontinental Transport of Pollutants, USEPA Workshop, RTP, Oct., 2004

Special lecture: The Need for Closer Integration of Measurements and Models, Pacific Northwest national Laboratory Workshop on the Frontiers of Atmospheric Chemistry, Oct., 2004

Invited Talk: Improving Emission Estimates Through Regional Studies, Black Carbon and Climate Change Workshop, San Diego, Oct., 2004

Special lecture: Improving Emission Estimates Through Regional Studies, SARCS Regional Training workshop on "Biogenic and Anthropogenic Emissions from Southeast Asia", National Central University, Chung Li, Taiwan, Nov., 2004

Seminar: Recent Advances in Chemical Weather Forecasting, University of Alabama, Huntsville, May, 2004

Seminar: The Role of Heterogeneous Reactions in Atmospheric Chemistry, Carnegie Mellon University, Feb., 2004

Invited Talk: The Impact of Megacities on Air Pollution, Dubai Int'l. Conference on Atmospheric Pollution, Dubai, Feb, 2004

2005

Invited talk: The WMO GAW GURME program- an overview. GAW Symposium 2005, Geneva, Switzerland.

Invited Talk: Advances in chemical data assimilation in support of air quality forecasting. NOAA Workshop on Chemical Data Assimilation in Support of Chemical Weather Forecasting, Washington DC

Seminar: The Globalization of Air Pollution... Why should we care?, Arizona State University, department of mechanical Engineering. Tempe AZ

Invited Talk: How well can we assess source receptor relationships? EU Task Force Meeting on hemispheric Transport of Pollutants, Brussels, Belgium

Invited Talk: Modeling regional scale pollution in East Asia. Workshop on Regional Strategies for Air Quality Management

Invited talk: Regional-Scale Chemical Data Analysis & Assimilation for ICARTT: How does the integration of observations with predictions improve regional air quality models? Symposium on air quality forecasting, Fall AGU meeting, San Francisco.

Invited Talk: Regional-Scale Chemical Data Analysis & Assimilation for ICARTT: How does the integration of observations with predictions improve regional air quality models ?ICARTT Science Workshop, Durham New Hampshire

Invited Talk: The Globalization of Air Pollution, University of Iowa President's Club, Iowa City, IA

Seminar: The Globalization of Air Pollution...Why should we care? Center for Atmospheric Sciences, University of New Hampshire.

Invited talk: Linking emissions to air quality, modeling aerosols at regional scales. Joint US/India Workshop on Nanoscale Aerosol Science and Technology, Mumbai India.

Invited talk: How well can we model aerosol distributions in Asia? Annual Meeting of the Asian Aerosols Society, Mumbai

2006

Invite Talk: Recent Advances in Air Quality Forecasting, WMO GURME Workshop on Air Quality Forecasting in Latin America Cities, Sao Paula, Brazil

Invited Talk: Lessons Learned from Model Intercomparison Studies, Workshop on Model Intercomparison Studies in Support of EU Task Force on Hemispheric Transport of Pollutants, Washington, DC

Invited Talk: Chemical Data Assimilation, IGACO Workshop, WMO Geneva, April.

Invited Talk: Recent Advances in Air Quality Forecasting, GURME Air Quality Training Course, Lima Peru, July.

Seminar: Linking aerosols sources to climate change and air pollution impacts -- How good are our global and regional models? Department of Chemical Engineering, University of Kentucky, Sept.

Invited Talk: Passive Samplers and their use in atmospheric chemistry studies, DEBITS Workshop, South Africa, Sept.

Special lecture: Recent advances in air quality forecasting, Shanghai Meteorological Agency, Shanghai, Oct.

Seminar: Recent Advances in Chemical data Assimilation, Institute for Atmospheric Physics, Chinese Academy of Sciences, Beijing, Oct.

Special lecture: VERNON L. SNOEYINK DISTINGUISHED VISITING LECTURE SERIES IN ENVIRONMENTAL ENGINEERING, The Globalization of Air Pollution: Implications for the Quality of the Air We Breathe, University of Illinois, Department of Environmental Engineering, Nov.

2007

Invited Talk: Recent Advances in Air quality Forecasting, Workshop on regional Pollution, Ghangzhou, China, Jan.,

Invited Talk: Estimating Source/receptor Relationships, Workshop on Hemispheric Transport of Pollutants, Geneva, Jan.

Special Lecture: Improved Air Quality Forecasts Through Data Assimilation, Shanghai Meteorological Agency, Shanghai, Jan.

Seminar: Improving Air Quality Forecasting through Closer Integration of

Measurements and Models, University of Madrid, School of Informatics, Madrid, April

Seminar: Improving Air Quality Forecasting through Closer Integration of Measurements and Models, European Joint Research Center, Ispra, Italy, Feb.

Invited Talk: Dust and its Role in Tropospheric Chemistry , **The International Association of Meteorology and Atmospheric Sciences (IAMAS)** Joint Meeting, Perugia, Italy, July, 2007.

Invited Talk: Regional and Global Perspectives of Megacity Air Pollution, Joint Assembly of the American Geophysical Union, Alcapulco, Mexico, June, 2007.

Plenary Lecture: Predicting Air Quality: Current Status and Future Directions, 29th International Technical meeting on Air Pollution Modeling and Its Applications, Portugal, Sept., 2007.

Plenary Lecture: Improving Regional Predictions Of Air Quality Through The Closer Integration Of Observations And Models, International Conference on Atmospheric Science and Its Application to Air Quality, Hong Kong, China, May, 2007.

Seminar: Improving Regional Predictions Of Air Quality Through The Closer Integration Of Observations And Models, Gwangju Insitute for Science and Technology, Gwangju S. Korea, Aug., 2007.

Special Lecture: Future Directions For Improving Air Quality Predictions, Hankyong National University , Seoul Korea, Aug., 2007.

Invited Talk: Regional Scale Modeling in Support of PACDEX, Fall AGU Meeting, Dec., 2007.

2008

Invited Talk: ABCs of Climate Change: The Effect of Atmospheric Brown Clouds on Health and Climate Policie, Climate Change and Human Justice Symposium, University of Iowa, March, 2008

Seminar: Regional and Global Perspectives of Megacity Air Pollution, Department of Atmospheric Sciences, Sun-Yat Sen University, Guangzhou, China, Jan., 2008

Invited Talk: Regional and Global Perspectives of Megacity Air Pollution, Some perspectives from Project Atmospheric Brown Cloud (ABC), 2nd International Workshop on Mega-city and Regional Air Pollution, Guangzhou China, Jan., 2008

UNEP ABC Science team lecture: Use of Models in air quality and climate studies in Asia, Kathmandu, Nepal, December 2008.

WMO-GURME Workshop on Air Quality Modeling and Forecasting: Current Application and Future Challenges to air Quality Forecasting, Pune, India, December 2008.

Invited Talk: Chemical Weather – A New Challenge/Opportunity for Weather and Other Services Evolving Complexity of observing systems, models, and applications, Final Assembly of the U GEMS Project, Julich, Germany, April 2008.

Keynote Lecture: The Growing Reach of Air Pollution – Local, Regional, Global, and Back Again, International Conference on Air Quality 2008, Istanbul, Turkey, March 2008.

Keynote Lecture: The Globalization of Air Pollution, World Meteorological Day, Geneva, Switzerland, March 2008.

Distinguished Lecture: What Goes Around Comes Around, CIRES, University of Colorado, Boulder, February 2008.

Seminar: ABCs (Atmospheric Brown Clouds) and Their Impacts on Air Quality and Climate Change, Department of Energy, Environment and Chemical Engineering, Washington University, St. Louis, February 2008.

Invited Talk: Regional and Global Perspectives of Megacity Air Pollution, AIChE National Meeting, Philadelphia, November 2008.

Seminar: Improving Air Quality Predictions through closer integrations of models and measurements, UCLA Department of Atmospheric Science, May 2008.

Invited Talk: Regional and Global Perspectives of Megacity Air Pollution, IGAC Congress, Annecy, France, 2008.

Invited Talk: Regional and Global Perspectives of Megacity Air Pollution, Beijing Environmentla Forum, Beijing, October 2008.

Invited Talk: The ABC Project, UNEP Meeting of Environment Minister, Central Asia, Bishkek, Kyrgyzstan, April 2008.

Public Lecture: ABCs (Atmospheric Brown Clouds) and Their Impacts on Air Quality and Climate Change, Café Scientifica, Iowa City, November 2008.

Invited Talk: ABCs (Atmospheric Brown Clouds) and Their Impacts on Air Quality and Climate Change, Conference on Climate Change and Human Justice, College of Law, University of Iowa, February 2008.

2009

Invited Talk: Regional and Global Perspectives of Megacity Air Pollution, Annual Meeting of the America Meteorological Society, Phoenix, January 2009.

Special Seminar: Current State and Future Direction of Air Quality Forecasting, Milan Municipal Environmental Agency, Milan, Italy, June 2009.

Invited Lecture: Asian Aerosols: Current and Future Aerosol Distributions and Their Implications for Human Health and Regional Climate Change, Mountain and Glacier Symposium, Milan, Italy, June 2009.

Keynote Address: Megacities – Where Pollution Problems and Solutions Appear First, 11th International Conference on Atmospheric Science and Air Quality, Jena, China, April 2009.

Seminar: The Growing Reach of Air Pollution – Local, Regional, Global and Back Again!, Department of Environmental Engineering, Tsinghua University, Beijing China, 2009

Invited Lecture: Asian Aerosols: Current and Future Aerosol Distributions and Their Implications for Human Health and Regional Climate Change, Goldschmidt Meeting, Switzerland, July, 2009.

Seminar: Current State and Future Direction of Air Quality Prediction, Kyushu Univ., Japan, July 2009.

Keynote Address: Regional and Global Perspectives of Megacity Air Pollution, International Meeting of the International Conference on Urban Climate, Yokohama, Japan, July, 2009.

Invited Lecture: Current State and Future Direction of Air Quality Prediction, Frontiers Inst., Tokyo, Japan, July 2009.

Seminar: Asian Aerosols: Current and Future Aerosol Distributions and Their Implications for Human Health and Regional Climate Change, College of Environmental Studies, Peking University, Sept., 2009.

Seminar: Asian Aerosols: Current and Future Aerosol Distributions and Their Implications for Human Health and Regional Climate Change, Institute for Atmospheric Physics, Beijing, July, 2009.

Seminar: Asian Aerosols: Current and Future Aerosol Distributions and Their Implications for Human Health and Regional Climate Change, Shanghai Environmental Protection Bureau, Sept., 2009.

Invited Talk: Lessons learned from the Beijing Olympics, Gordon research Conference on Atmospheric Chemistry, New Hampshire, Aug., 2009

Invited Talk: *Chemical Weather – A New Challenge/Opportunity for Weather and Other Services*, Technical Conference of the Commission for Atmospheric Sciences, 15th Meeting, Seoul, KR, Nov. 2009.

2010

Invited Talk: Asian Aerosols: Current and Future Distributions and Implications to Air Quality and Regional Climate Change, Annual Meeting of the American Meteorological Society, Atlanta GA, Jan., 2010-04-30.

Invited Talk: Improving air quality analysis through a closer integration of observations and models. Future Research Directions in Megacities in China, Peking University, Feb., 2010

Invited Talk: Current State and Future Direction of Air Quality Prediction, EU Commission on Science and Technology (COST), Geneva, March, 2010.

Invited Talk: Aerosol Emissions and Their Implications for Human Health and Climate Change, Special Experts Meeting on BC Called by the Secretary General UNEP, NAS, DC, Oct., 2009.

Invited Talk: Atmospheric Chemistry & Transport: Estimating SLCF Distributions and Contributions, EPA Meeting on Short Lived Climate Forcing, NC, April, 2010.

Seminar: Asian Aerosols: Current and Future Distributions and Implications to Air Quality and Regional Climate Change, Iowa Superfund Project, April, 2010.

Plenary lecture: Current State and Future Direction of Air Quality Prediction International Conference on Air Quality and Atmospheric Science, Shandong, China June, 2010.

Seminar: Asian Aerosols: Current and Future Distributions and Implications to Air Quality and Regional Climate Change, Dept of Environ. Eng., Tsinghua Univ. Beijing, China, June 2010.

Seminar: Asian Aerosols: Current and Future Distributions and Implications to Air Quality and Regional Climate Change, Institute for Atmospheric Physics, Beijing, China June 2010.

Invited talk: *Chemical Weather – A New Challenge/Opportunity for Weather and Other Services*, World Meteorological Day at the Shanghai Expo, May 2010.

Invited talk: Current State and Future Direction of Air Quality Prediction, Special GURME Symposium on air quality forecasting, Santiago, Chile, July, 2010.

Seminar: Black carbon as a key climate forcing agent, Univ. Santiago, Chile, July 2010.

Seminar: Current State and Future Direction of Air Quality Prediction, Gwangju Institute for Science and Technology, Korea, Aug., 2010.

Seminar: Globalization of air pollution, Dept. of Chemical Eng., Columbia University, Sept., 2010.

Invited paper: Regional and Global Perspectives of Megacity Air Pollution, Beijing Forum, China, Nov. 2010.

Special lecture: Globalization of air pollution, International Workshop on long Range Transport of Pollution, Kyushu Japan, Nov. 2010.

Invited paper: Constraining aerosol distributions through data assimilation of satellite AOD, American geophysical union annual meeting, San Francisco, Dec. 2010.

2011

- Invited lecture:* Globalization of air pollution, Air Quality and Climate Conference 2011 Opportunities in Air Quality-Climate Research in Asian-Pacific Region, Hawaii, March 2011.
- Invited lecture:* Globalization of air pollution, UNEP ABC Training school on atmospheric science, Katmandu Nepal, March, 2011.
- Keynote Address:* The Globalization of Air Pollution, Acid Rain 2011, Beijing, June, 2011.
- Keynote Address:* The Globalization of Air Pollution, US/Korea Conference on Science, Utah, Aug., 2011
- Invited Talk:* Short Lived Climate Forcing Agents, Policy Opportunities, Technical Workshop on Science and Policy of Short-lived Climate Forcers, September 9-10, 2011, Mexico City.
- Invited Talk:* Multi-model studies of air quality in Asia, Project ABC Science Team Workshop, Seoul, Sept., 2011.
- Invited Talk:* Reducing Uncertainties in Aerosol Distributions, Health Effects and Air Pollution Workshop, HEI, Boston, Oct. 2011.
- Seminar:* Sensitivity analysis of aerosol feedbacks on chemistry and climate at urban and regional scales. UCLA Dept. of Atmos. Science, Oct., 2011
- Invited Talk:* Pollutant transport in and around China – implications for air quality planning. China-EPA Regional Air Quality management Workshop, Beijing, Oct., 2011
- Plenary Talk:* A closer integration of models and observations across air quality/weather/climate applications. 3rd International Air Quality Forecasting Workshop, Washington DC, Dec., 2011
- Invited Talk:* A closer integration of models and observations across air quality/weather/climate applications. GURME Workshop on the Design of the Shanghai Meso Scale Observing System, Shanghai, Dec., 2011
- Seminar:* A closer integration of models and observations across air quality/weather/climate applications. Department of Atmos. Science, Nanjing University, Dec. 2011.

2012

- Invited Talk:* Chemical Weather – A challenge and opportunity for societal service and risk reduction. Workshop on Megacities, Santiago Chile, Jan., 2012
- Invited Talk:* Applications of air quality models. Workshop on Air Quality Modeling, Asian Center for Air Pollution, Niigata, Japan, Jan. 2012
- Seminar:* Sensitivity analysis of aerosol feedbacks on chemistry and climate at urban and regional scales. NASA Goddard Space Flight center, Jan. 2012
- Invited Talk:* What is our understanding of Asian aerosols and their climate and air pollution impacts, AAAS Annual meeting, Vancouver, Feb. 2012.
- Invited talk:* Sensitivity Analysis of Aerosol Feedbacks on Chemistry and Climate at Urban and Regional Scales, Spring ACS meeting, Denver, April, 2012.
- Seminar:* Sensitivity analysis of aerosol feedbacks on chemistry and climate at urban and regional scales, Dept. of Atmos. Science, Wisconsin, Madison, June, 2012.
- Cecil Award Lecture:* What Goes Around Comes Around - *The globalization of air pollution and the implications for the quality of the air we breathe, the water we drink, and the food we eat*, Annual AIChE Meeting, Pittsburg, Oct., 2012

Invited Talk: Modeling the Transport and Fate of Black Carbon, US-Russia Bilateral Meeting on BC, Moscow, Oct. 2012.

Invited Talk: Sectoral Contributions to Black Carbon Concentrations and Radiative Forcing in Delhi, Fall AGU meeting, San Francisco, Dec. 2012.

Invited talk: Recent advances in chemical data assimilation, International Workshop on Air Quality Forecasting, Geneva, Switzerland, Dec., 2012.

2013

Stoute Lecture: What Goes Around Comes Around - The globalization of air pollution and the implications for the quality of the air we breathe, the water we drink, and the food we eat, Department of Earth and Atmospheric Sciences, University of Nebraska, Lincoln, April, 2013

Invited Lecture: Short-lived pollutants –opportunities to address air quality and climate together, University of Bogota, Columbia Jan2013

Seminar: Sensitivity analysis of aerosol feedbacks on chemistry and climate, Applied math Department, UIowa, Feb 2013

Invited Talk: Improving megacity air quality services through advancing research, India Institute for Tropical meteorology, Pune, India Apr 2013

Invited Talk: Improving aerosol distributions by assimilating cloud droplet number, Workshop on Monsoon Asia, Pune India, Apr 2013

Invited Talk: Regional and local interactions between air quality and climate in monsoon Asia, Workshop on Atmospheric Chemistry and Climate in Asia Monsoon, Kathmandu, Nepal, Jun 2013

Invited talk: MICS Asia III and other model intercomparison studies, Workshop on Asia Emissions, Beijing, China, Jun 2013.

Invited Talk: Emissions and modeling in support of air quality and climate impacts – a regional perspective, Workshop on Air Quality and Health, NCAR Boulder, Jul 2013

Invited Talk: Modeling aerosol feedbacks at local/regional scales, Geophysical Fluid-dynamics Research lab, Chip Levy retirement symposium, Aug 2013

Special Lecture: Future directions of air quality forecasts, Chilean Met. Agency, Santiago, Chile Oct 2013

Invited Talk: SLCP – A near term opportunity to deal with health and climate change BUT what are the knowledge gaps holding back action?, Workshop on SLCP in the Andes, Santiago, Chile, Oct 2013

Invited Talk: SLCP – A near term opportunity to deal with health and climate change, High Summit, Lecco, Italy Oct 2013

Invited Talk: Emissions and impacts of short-lived climate forcers, AGU, San Francisco, Dec 2013

2014

Seminar: Sensitivity analysis of aerosol feedbacks on chemistry and climate, Dept. Chem Eng, CMU, Jan 2014

Invited Talk: Advances in aerosol data assimilation, Workshop on AQ Forecasting in Support of the Youth Olympic Games, Nanjing, China, Feb 2014

Invited Talk: Globalization of air pollution: implications for the air we breath, the water we drink and the food we eat, Foreign Relation Council, Iowa City, Apr 2014

Plenary Lecture: Global Atmospheric Watch the first 25 years and what's next, International meeting of the International Global Atmospheric Chemistry Project, Brazil, Sept., 2014

Invited Talk: Improving Air Quality (*and Weather*) Predictions using Advanced Data Assimilation Techniques Applied to Coupled Models, International Open Science Conference on Atmospheric Science, Montreal, Aug. 2014

Invited Talk: Improving Air Quality (*and Weather*) Predictions in Asia using Advanced Data Assimilation Techniques Applied to Coupled Models, AGU Fall Meeting, Dec. 2014

2015

Keynote Address - Modeling Atmospheric Composition Matters: To Air Quality, Weather, Climate and More, International Meeting on Air Quality and Atmospheric Sciences, Kobe, Japan, Nov, 2015

Invited Talk - Improving Air Quality (and Weather) Predictions using Advanced Data Assimilation Techniques Applied to Coupled Models, AGU, Dec, 2015

Invited Talk - Modeling Atmospheric Composition Matters: To Air Quality, Weather, Climate and More, Seminar on Improving Air Quality in Chile, Santiago, Oct 2015

Invited Talk - Modeling Atmospheric Composition Matters: To Air Quality, Weather, Climate and More, International Acid Rain Conference, Rochester NY, Nov 2015

Invited Talk - Improving Air Quality (and Weather) Predictions using Advanced Data Assimilation Techniques Applied to Coupled Models, Korea Academy of Sciences Symposium on PM in Asia, Seoul, Korea, Sept, 2015

Invited Talk - Improving Air Quality (and Weather) Predictions using Advanced Data Assimilation Techniques Applied to Coupled Models, International Workshop on Air Quality Forecasting Research, College Park, Sept, 2015

Invited Talk - Emissions and Impacts of Short-Lived Climate Forcers, Asia Pacific Air Quality Consultation, Tokyo, March, 2015

2016

Plenary Talk - Atmospheric Composition Matters: To Air Quality, Weather, Climate and More, Science team meeting of the EU MARCO POLO Project, Guangzhou China, Feb, 2016

Invited Talk - Improving Air Quality (and Weather) Predictions Through Close Integration of Observations and Models, Center for Aerosol Research, University of British Columbia, Feb, 2016.

Invited Talk - Improving Air Quality (and Weather) Predictions Through Close Integration of Observations and Models, Blueprint Workshop on the Future of Data Assimilation, NCAR, Boulder, March 2016.

Invited Talk - Improving Air Quality (and Weather) Predictions Through Close Integration of Observations and Models, TEMPO Workshop on Applications, Univ. Of Alabama, Huntsville, June 2016.

Invited Talk – Recent advances in data assimilation, NCAR Summer School on data Assimilation, NCAR, Boulder, Aug., 2016.

Plenary Lecture – Recent Advances in Air Quality Modeling, IAUPA & BAQ Asia International Conference, Busan Korea, Aug. 2016.

Invited Talk - Advancing Environmental Predictions by Closer Integration of Air

Pollution and Meteorology Services, International Brainstorming Meeting on “Air Quality and Climate Impacts”, New Delhi, India, 5-7 October, 2016.

Invited Talk - Air Pollution and Climate Change Connections and Opportunities for Sustainable Development, Sustainable Infrastructure 2016, Shenzhen, China, Oct. 2016.

Invited Talk – Urban cross-cutting focus and elaboration of WMO guidelines for integrated urban services, UN Habitat III, Quito, Equator, Oct. 2016.

2017

Invited Talk - Improving Air Quality (*and Weather*) Predictions Through Close Integration of Observations and Models, International Workshop on Air Quality Forecasting, Toronto, Jan., 2017.

Invited Talk - Expanding the Role of Atmospheric Composition in Environmental Prediction and Services, American Meteorological Society, Seattle, Jan., 2017.

Presidential Lecture Univ. of Iowa, What goes around comes around, Feb., 2017

Invited Talk – Multihazard early warning systems, UN Workshop on Early Warning Systems, Cancun, Feb., 2017

Invited Talk - Improving Air Quality (*and Weather*) Predictions through Closer Integration of Observations and Models, NASA TEMPO Science team meeting, Huntsville, Al., and May, 2017

Keynote Lecture - Improving Air Quality (*and Weather*) Predictions through Closer Integration of Observations and Models, CMOS meeting, Chengdu, China, July 2017

Invited Talk - Improving Air Quality Predictions through Closer Integration of Observations and Models, Experiences from Recent Field Experiments, GEMS Science team meeting, Seoul Korea, October, 2017

Invited Talk – Recent Advances in Improving Air Quality Predictions, Regional Air Quality Management, Guangzhou, China, November, 2017

Invited Talk – Overview of the Global Atmospheric Watch program, African Workshop on Air Pollution Forecasting, Pretoria, Africa, December, 2017

2018

UI Alumni Educational Events - Big Data—Its Human Face and Impact on Scholarship, Teaching and More, Naples FL and Phoenix AZ, February 2018

Invited Talk – The Growing Importance of Atmospheric Composition Predictions in Air Quality Management and Sustainable Development, CMOS, Air Quality, Beijing May 2018

Invited Talk – The Growing Importance of Atmospheric Composition Predictions in Air Quality Management and Sustainable Development, Regional Air Quality Management, Chendu June 2018

Seminar- The Growing Importance of Atmospheric Composition Predictions in Air Quality Management and Sustainable Development, Jinan Univ. China, July 2018

Seminar - The Growing Importance of Atmospheric Composition Predictions in Air Quality Management and Sustainable Development, Hong Kong University of Technology, July 2018

Invited Talk – Improving Air Quality (and weather) Predictions via Closer Integration of Observations and Models, AMS-CAS Meeting on PM2.5, Xian, China, Oct. 2018.

Invited Talk – What goes around, comes around, AGU Honors session, Dec., 2018

Invited Talk – The Growing Importance of Atmospheric Composition Predictions in Air Quality Management and Sustainable Development, India Institute for Tropical Meteorology, Pune, March, 2019

Invited Talk – The Importance of Atmospheric Chemistry Research in Advancing Weather, Climate and Air Quality and Enhancing Associated Societal Services, Union Session, EGU, April 2019.

PRINCIPAL INVESTIGATOR ON CONTRACTS AND/OR GRANTS

| Contract or Grant Title | Annual Funding Rate | Starting & Expiration Date |
|---|---------------------|----------------------------|
| University Research Council, NIH Support for Junior Faculty Research | \$5,000 | 1979-80 |
| NASA | \$60,000 | 2/1/80-2/1/83 |
| Battelle Northwest Labs | \$17,000 | 10/1/80-10/1/85 |
| EPA Acid Rain Program | \$35,000 | 10/1/82-10/1/85 |
| EPA Mesoscale Program | \$50,000 | 1984- |
| DOE PRECIP Program | \$70,000 | 1985- |
| EPRI – Source Evaluation | \$60,000 | 1985-1988 |
| Iowa High Technology Council (Continuous Electrophoresis Column) | \$60,000 | 1985-1987 |
| NSF Sensitivity Analysis (Supercomputer Initiation Grant) | \$20,000 | 1984-85 |
| NASA/Goddard, Application of Chemistry Calculations, Calculations on the Massively Parallel Processor Computer (unlimited time on this unique computer) | \$40,000 | 1985- |
| Sigma Research (updating a photochemistry model for the California Air Resources Board) | \$28,000 | 1987-88 |
| IBM Computing Grant (200 hrs. supercomputing time) | ~\$100,000 | 1987-88 |
| NESCAUM, Photochemical modeling in the Northwest US | \$25,000 | 1988 |
| NSF Japan/US Project for Cooperative Research | \$5,000 | 1988-91 |
| Research & Development Program in Biochemical Engineering, Iowa Dept. of Economic Development | \$320,000 | 1989-91 |
| Processing Fermentation Waste | \$120,000 | 1990 |
| IBM Supercomputer Grant | \$5,000/400 hours | 1989-91 |
| NASA Grant | \$80,000 | 1990-93 |
| NSF/Korea Grant | \$10,000 | 1991-93 |
| Center for Global & Regional Environmental Research | \$120,000 | 1991-2001 |
| National Academy of Sciences, Polish Academy of Sciences | \$6,000 | 1992 |
| World Bank, Acid Rain in Asia | \$70,000 | 1992-94 |
| NOAA Global Change Program | \$60,000 | 1994-96 |
| NASA, Long Range Transport of Dust | \$100,000 | 1994-97 |
| Central Research Institute for Electric Power Generation Industry, Japan | \$30,000 | 1994-96 |
| DOE, Evaluation of UVB, Ozone and Aerosol | \$125,000 | 1994-97 |
| Air Quality in Mega-Cities, DOE | \$20,000 | 1997 |
| Urban Air Quality Issues in Asia, DOE, World Bank | \$50,000 | 1997 |
| NASA Mineral Aerosol in East Asia | \$120,000 | 1997-2000 |
| NASA China Map | \$75,000 | 1997-2000 |
| LIVE – Laboratory for Immersive Visualization of the Environment, co-investigator w/M. Armstrong, J. Brown, and G. Malanson, NASA | \$140,000 | 1998-99 |
| Integrated Framework for Analysis of Climate Change and Air Quality, DOE, co-PI w/Argonne National Laboratory, DOE | \$45,000 | 1998-99 |

| | | |
|--|-----------|-----------|
| Rains-Asia Phase II, World Bank, UI contract | \$60,000 | 1997-1998 |
| Heterogeneous Chemistry, DOE | \$150,000 | 1998-2000 |
| Taiwan Acid Deposition | \$10,000 | 1999 |
| Argonne National Lab | \$30,000 | 1999-2000 |
| IIASA/CRIEPI | \$10,000 | 1999 |
| WMO, Passive Samplers | \$45,000 | 1999 |
| Dreyfus Foundation Post Doctoral Programme In Environmental Science (with Vicki Grassian) | \$45,000 | 1998-2000 |
| WMO/GURME | \$35,000 | 2000 |
| NSF REU Program focused on Env. (with Vicki Grassian) | \$60,000 | 2000-2002 |
| Aerosol Chemistry Interactions, NASA | \$100,000 | 2000-2003 |
| Modeling Activities for Ace_Asia Experiment, NSF | \$90,000 | 2000-2003 |
| Modeling Activities for TRACE-P Experiment, NASA | \$90,000 | 2000-2003 |
| Heterogeneous Chemistry/A Laboratory & Modeling Study, DOE | \$140,000 | 2001-2005 |
| NOAA Intercontinental Transport of Pollutants | \$100,000 | 2002-2005 |
| NSF ITR | \$500,000 | 2002-2007 |
| MSF MRI (Co-I, Mark Young PI) | \$65,000 | 2001-2004 |
| NOAA Atmospheric Brown Cloud | \$75,000 | 2004-2007 |
| NASA Effect of Aerosols on Radiative Forcing | \$75,000 | 2004-2007 |
| NASA Improving CO and BC Emissions though Inversion | \$75,000 | 2004-2007 |
| NASA INTEX A | \$100,000 | 2004-2005 |
| NOAA test bed for data assimilation | \$150,000 | 2005-2006 |
| NASA INTEX-B | \$250,000 | 2006-2008 |
| NOAA Data Assimilation Test Bed | \$150,000 | 2005-2006 |
| NSF Collaborative Research: Field, Laboratory & Modeling Invest Transcontinental Transport of Air Pollution from central Asia to the US, E.H. Pechan & Associates, EPA | \$50,713 | 2006-2009 |
| International Science and Technology Center, US State Department | \$20,000 | 2007-2008 |
| Regional scale modeling in support of ARCTAS Experiment, NASA | \$160K | 2008-2011 |
| Dynamic Updating of Emissions by Systematic Integration of Bottom-Up Activities and Satellite-Based Top-Down Constraints to Support Air Quality Forecasting and Analysis, NASA | \$200K | 2008-2011 |
| VOCALS Experiment, NSF | \$75K | 2008-2010 |
| Applying Data Assimilation and Adjoint Sensitivity to Epidemiological and Policy Studies of Airborne Particulate Matter, co-PI, EPA | \$50K | 2008-2011 |
| NAST, Center for Nano Aerosol Science and Technology, US India Partnership | \$20K | 2008-2010 |
| Ladco, Data Analysis and Modeling of the LADCO Winter Nitrate Study | \$10k | 2010-2011 |
| Nsf, Iowa EPSCoR: Harnessing Energy Flows in the Biosphere | \$35k | 2009/2010 |
| NIEHS, Superfund Center, Modeling PCBs in the environment | \$100K | 2010-2014 |
| NASA Air Quality Applications Science Team | \$110K | 2011-2015 |
| NSF Aerosol climate Interactions in Asia | \$75K | 2011-2014 |
| EPA Star Grant Black carbon | \$300K | 2011-2013 |
| NASA SEAC4RS Field Experiment | \$200K | 2012-2014 |
| NASA ORACLES Field Experiment | \$80K | 2015-2020 |
| NASA KORUS-AQ Field Experiment | \$120K | 2016-2018 |
| NASA Health Applied Science Team | \$25K | 2016-2019 |
| NOAA FIREX | \$40K | 2017-2020 |
| NASA A-CCP Study | \$70k | 2019-2021 |

| | | |
|----------|--------|-----------|
| NASA MAP | \$100K | 2019-2021 |
|----------|--------|-----------|

PUBLICATIONS.

Books and monographs

1. Carmichael, G.R., Yoon, S-C., Jones, C., Hochfeld, C., and Oben, T., *Independent Environmental Assessment: Beijing 2008 Olympic Games*, United Nations Environment Programme, 2009.
2. Carmichael, G, and F. Dentener, co-lead authors chapter 5, *HEMISPHERIC TRANSPORT OF AIR POLLUTION 2007 AIR POLLUTION STUDIES No. 16*, Interim report prepared by the Task Force on Hemispheric Transport of Air Pollution acting within the framework of the Convention on Long-range Transboundary Air Pollution, ECONOMIC COMMISSION FOR EUROPE, Geneva, UNITED NATIONS PUBLICATION, Sales No. E.08.II.E.5 ISSN 1014-4625, ISBN 978-92-1-116984-3, 2007
3. *Preparing for Global Change: A Midwest Perspective*, Folk, E., J. Schnoor, and G. Carmichael, editors, SPB Academic Publishers, in Biometeorology Series, The Netherlands (1995).
4. Large Scale Computations in Air Pollution Modeling, NATO Science Series, Edited by Z. Zlatev, J. Brandt, P. Buitjes, and G. Carmichael, Kluwer Academic Publishers, 392 pages, 1998.
5. WMO Workshop on Regional Transboundary Smoke and Haze in Southeast Asia, Proceeding and Report, G. Carmichael, editor, 2 volumes, GAW Report, 131, 400 pages, World Meteorological Organization, Geneva, 1999
6. IMA Volumes in Mathematics and Its Applications, Vol 130: Atmospheric Modeling, Chock, D. and G. Carmichael, editors, Springer-Verlag, 2002.

Articles in technical journals with rigorous review procedures (*Web of Science H-index factor 51*)

1979-1996

1. Carmichael, G.R., and L. K. Peters, "Some Aspects of SO₂ Absorption by Water - Generalized Treatment", *Atmospheric Environment*, 13, 1979, 1505-1513.
2. Carmichael, G. R., and S-C Chang, "Mass Transfer Accompanied by Equilibrium and Second-Order Irreversible Reactions", *Chemical Engineering Science*, 35, 1980, 2459-2461
3. Carmichael, G.R., D-K Yang, and C. Lin, "A Numerical Technique for the Investigation of the Transport and Dry Deposition of Chemically Reactive Pollutants", *Atmospheric Environment*, 14, 1980, 1433-1438.
4. Carmichael, G.R., T. Kitada, and L.K. Peters, "Application of a Galerkin Finite Element Method to Atmospheric Transport Problems", *Computers and Fluids*, 8, 1980, 1455-176.
5. Carmichael, G.R., and L.K. Peters, Application of Mixing-Reaction in Series Model for Simultaneous Mixing and Chemical Reaction - NO_x-O₃ Plume

- Chemistry”, *Atmospheric Environment*, 15, 1981, 1069-1074 ..
6. Carmichael, G. R. and S-C Chang, “A Three-Zone Model for Mass Transfer Accompanied by Equilibrium and Very Fast Second-Order Irreversible Reactions”, *Chemical Engineering Science*, 35, 1981, 2463-2465.
 7. Carmichael, G. R., S.A. Shah, and E.L. Parrott, “A General Model for Dissolution Rates of n-Component, Nondisintegrating Spheres”, *J. of Pharmaceutical Sciences*, 12, 1981, 1331-1338.
 8. Adewuyi, Y., and G. R. Carmichael, “A Theoretical Investigation of Gaseous Absorption by Water Droplets from SO₂ - HNO₃ - NH₃ - CO₂- HCl Mixtures”, *Atmospheric Environment*, 16, 1982, 719-729.
 9. Reda, M., and G. R. Carmichael, “Non-Isothermal Effects on SO₂ Absorption by Water Droplets—Model Development”, *Atmospheric Environment*, 16, 1982, 145-150.
 10. Reda, M., and G. R. Carmichael, “Non-Isothermal Effects on SO₂ Adsorption by Water Droplets—Results and Discussion”, *Atmospheric Environment*, 16, 1982, 151-159.
 11. Reda, M., Y. Adewuyi, and G. R. Carmichael, “On the Influence of Gas Scavenging of Trace Gases on Precipitation Acidity”, *Energy and Environmental Chemistry: Acid Rain*, Ann Arbor Science, Pub., Vol. 2, 1982, 263-285
 12. Schnoor, J. L, G. R. Carmichael, and F. A. van Schepen, “An Integrated Approach to Acid Rainfall Assessments”, *Energy and Environmental Chemistry: Acid Rain*, Ann Arbor Science, publ., Vol. 2, 1982.
 13. Carmichael, G.R., “Estimation of the Drag Coefficient of Regularly Shaped Particles in Slow Flows from Morphological Descriptors”, *I & EC Process Design and Development*, 21, 1982, 401-403.
 14. Reda, M., and G. R. Carmichael, Non-Isothermal Effects on SO₂ Absorption by Water Droplets—The effects of Precipitation Intensity, Sulfate Aerosol Scavenging, and Aqueous S(IV) Oxidation”, *Atmos. Environment*, 16, 1982, 2905-2915.
 15. Carmichael, G.R., T. Kitada, and L.K. Peters, “:The Effect of In-cloud Scavenging on the Transport of Gas Phase Reactions of SO_x, NO_x, HC_x, H_xO_y, and O₃ Compounds,” *Precipitation Scavenging, Dry Deposition, and Resuspension*, Elsevier Science Publishing Co., 1983, 675-686.
 16. Hong, M-S. and G. R. Carmichael, “An Investigation of Sulfate Production in Clouds using a Flow-Through Chemical Reactor Model Approach,” *J. Geophysical Research*, 88, 1983, 10733-10744.
 17. Leung, W-K, and G. R. Carmichael, “Solute Redistribution During Normal Freezing”, *Water, Air and Soil Pollution*, 21, 1984, 141-150.
 18. Carmichael, G.R. and L. K. Peters, “Eulerian Modeling of the Transport and Chemical Processes Affecting the Long Range Transport of SO₂ and Sulfate,” *Symposium on Acid Precipitation: Modeling of Total Acid Precipitation Impacts*, Butterworth Publisher, Boston, 1984, p. 25-51.
 19. Carmichael, G.R. and L. K. Peters, “Sulfur Dioxide and Sulfates in the Atmosphere - Chemical and Physical Processes”, accepted for publication in

Advances in Environmental Science and Engineering, Gordon and Breach, Science Publishers.

20. Carmichael, G.R. and L. K. Peters, "An Eulerian Transport/Transformation/Removal Model for SO₂ and Sulfate: part I - Model Development, *Atmospheric Environment*, 18, 1984, 937-951.
21. Carmichael, G. R. and L. K. Peters, "Model Calculation of the SO_x Transport in the Eastern United States", *Atm. Environ.*, 18, 1984, 953-967.
22. Adewuyi, Y.G., S-Y Cho, R-P Tsay and G. R. Carmichael, "Importance of Formaldehyde in Cloud Chemistry," *Atmos. Environ.*, 18, 1984, 2413-2420.
23. Kitada, T., G. R. Carmichael, and L. K. Peters, "Numerical Simulation of the Transport of Chemically Reactive Species under Land and Sea Breeze Circulation", *J. Appl. Meteor.*, 23, 1984, 1153-1172.
24. Carmichael, G.R., "The Effect of Shape on Particle Solids Flow", *Modern Methods in Fine Particle Characterization*, J. K. Beddow, Editor, CRC Press, 1984, pp. 205-223.
25. Carmichael, G.R., Sources of Error and Uncertainty in Eulerian Long Range Transport Models, in *Quantifying Uncertainty in Long Range Transport Models*, K. Derejan, Am. Met. Soc., 1986.
26. Carmichael, G.R., Peters, L.K. and Kitada, T., "A Second Generation Eulerian Transport/Chemistry Removal Model", *Atmos. Environ.*, 20, 1986, 173-188.
27. Korndorf, L., Yoshisato, R., Carmichael, G. and Datta, R., "A Mathematical Analysis of Continuous Electrophoresis", *Sep. Science*, 21, 1986, 727-755.
28. Cho, Y-S and Carmichael, G.R., "Evaluation of Liquid Phase Chemical Production of Sulfate using Sensitivity Analysis", *Atmos. Environ.*, 20, 1986, pp. 1959-1988.
29. Hong, M-S and Carmichael, G.R., "Examination of a Subgrid-Scale Parameterization for the Transport of Pollutants in a Nonprecipitating Cumulus Cloud Ensemble", *Atmos. Environ.*, 20, 1986, pp. 2205-2217.
30. Kitada, T., Carmichael, G.R. and Peters, L.K., "Effects of Dry Deposition on the Concentration-Distribution of Atmospheric Pollutants within Land and Sea Breeze Circulations", *Atmos. Environ.*, 20, 1986, pp. 1999-2010.
31. Hong, M-S and Carmichael, G.R., "An Investigation of Sulfate Production in Clouds using a Detailed Transport/Chemistry Model Coupled with a Detailed Cloud Scavenging Model", *Atmos. Environ.*, 20, 1986, pp. 1989-1997.
32. Chang, Y-S., Carmichael, G.R., Ueda, H., and Kurita, H., "An Investigation of the Formation of Ambient NH₄NO₃ Aerosol", *Atmos. Environ.*, 20, 1986, pp. 1969-1977.
33. Datta, R., Yoshisato, R., and G. R. Carmichael, "Development of a Theoretical Model for Continuous Rotating Annular Electrophoresis Column for Biochemical Separation", *Recent Advances in Sep. Tech.*, AIChE, Symposium Series, 250
34. Carmichael, G.R., Peters, L.K., and T. Kitada, "Transport of Reaction Pollutants within Local Circulations", *Air Pollution Modeling and its Applications*, pp. 315-326 1986.

35. Carmichael, G.R., Response to comments on “Estimation of the Dry Coefficient of Regularly Shaped Particles in Slow Flows from Morphological Descriptors”, *Ind. Eng. Chem. Process Des. Dev.*, Vol 20, pp. 1979-87, 1987.
36. Adewuyi, Y-G and G. R. Carmichael, “Kinetics of Oxidation of Dimethyl Sulfide by Hydrogen Peroxide”, *Environ. Sci. and Tech.*, Vol 20, pp. 1017-1022, 1987.
37. Adewuyi, Y-G and G. R. Carmichael, “Kinetics of Oxidation of Carbon Disulfide by Hydrogen Peroxide”, *Environ. Sci. and Tech.*, Vol 21, pp. 170-177, 1987.
38. Yoshisato, R., Zingher, H., Carmichael, G.R. and Datta, R., “New Model for Electrophoresis”, *J. Chem. Technol & Biotechnology*, 41:207-221, 1988.
39. Dronumraju, M., L. K. Peters, G.R. Carmichael, P, Kasibhatla, and S-Y Cho, “An Eulerian Transport/Transformation Removal Model for SO₂ and Sulfate-III. Comparison with the July 1974 SURE Database, *Atmos. Environ.*, 22: 2003-2013, 1988.
40. Cho, Y-S, Carmichael, G.R., and Rabitz, H. , “Sensitivity Analysis of the Advection-Diffusion Equation”, *Atmos. Environ.*, 21:2589-2598, 1987.
41. Carmichael, G.R., Shieh, D., and Y. Chang, “Review of Methods for Solving Stiff Ordinary Differential Equations”, *Environmental Software*, 3:28-38, 1988.
42. Cho, S-Y, Carmichael, G.R. and H. Rabitz, “The Relationship between Primary Emissions and Acid Deposition in Eulerian Models Determined by Sensitivity Analysis”, *Water, Air and Soil Pollution*, 40:9-13, 1988.
43. Chang, Y., Carmichael, G.R., Ueda, H. and H. Kurita, “The Long Range Transport of Ozone in Central Japan”, *Atmos. Environ.*, 40:9-31, 1988.
44. Shim, S.G., Y-S Chang, S-Y Cho, and G. R. Carmichael, “An Evaluation of the Chemical and Physical Processes Affecting Sulfate and Nitrate Wet Deposition”, *Air Pollution Modeling and It's Applications*, 151-161, 1988.
45. Sasaki, K., Kurita, H., G.R. Carmichael, Y-S Chang, K. Murano, and H. Ueda, “Behavior of Sulfate, Nitrate and Other Pollutants in the Long-Range Transport of Air Pollution”, *Atmos. Environ.*, 22:1301-1308, 1988.
46. Yoshisato, R.A. and G. R. Carmichael, “Effect of Feed Location of the Performance of Single-Stage Membrane Permeators”, *Sep. Science*, 24:399-413, 1989.
47. Carmichael, G.R., D. Cohen, S-Y Cho, and M.H. Oguztuzun, “Coupled Transport/Chemistry Calculation on the MPP Computer”, *Computers in Chemical Engineering*, 9:1065-1073, 1989.
48. Chang, Y., G. Carmichael, H. Ueda, and H. Kurita, “The Transport and Formation of Sulfate and Nitrates in Central Japan”, *Atmos. Environ.*, 23:1749-1773, 1989.
49. Chang, Y., G. Carmichael, H. Kurita, and H. Ueda, “The Transport and Formation of Photochemical Oxidants in Central Japan”, *Atmos. Environ.*, 23:363-393, 1989.
50. Chang, Y., G. Carmichael, H. Ueda, and H. Kurita, “An Evaluation of the Effect of Emission Reduction on Pollutant Levels in Central Japan, *ES&T*, 24:1355-

1366, 1990.

51. Carmichael, G., S. Cho, and Y. Chang, "An Evaluation of the Effect of Reductions in Ambient Levels of Primary Pollutants on Sulfate and Nitrate Wet Deposition", *Atmos. Environ.*, 23:1009-1031, 1989.
52. Chang, Y-S., B.S. Ravishanker, G.R. Carmichael, H. Kurita, and H. Ueda, "Acid Deposition in Central Japan", *Atmos. Environ.*, 24A: 2035-2049, 1990
53. Kotamarthi, V., and G.R. Carmichael, "The Long Range Transport of Pollutants in the Pacific Rim Region", *Atmos. Environ.*, 24A:1521-1534, 1990.
54. Chang, Y-S., G.R. Carmichael, H. Kurita, and H. Ueda, "Diagnostic Evaluation of the Transport and Gas Phase Chemistry Components of the STEM-II Model", *Atmos. Environ.*, 24A:2715-2737, 1990.
55. Habib, K., G. R. Carmichael, and R. Lakes, "Stress Corrosion Cracking of 2826MB Metaglass", *Materials Characterization*, 24:471-476, 1990.
56. Yoshisato, R., R. Datta, J. Gorowicz, R. Beardsley, and G. R. Carmichael, "The CRAE column: A Novel Approach to Large-Scale Electrophoresis, *Downstream Processing and Bioseparations* (ed Hammel, Hunter, and Sikdar) ACS Symposium Series, 419, 1990.
57. Shim, S., and G. R. Carmichael, "Mesoscale Acid Deposition, *Atmos. Environ.*, 25B:25-45, 1991.
58. Carmichael, G. R., et. al., "The Stem II Regional Scale Acid Deposition of Photochemical Oxidant Model: An Overview of Model Development and Application", *Atmos. Environ.*, 25A: 2077-2090, 1991.
59. Carmichael, G.R., and W-C Shin, "Acid Deposition Modeling," *J Computational Mechanics*, Environ. Modeling, Computational Mechanics Pub., Elsevier, Applied Science, pp 119-134, 1992.
60. Carmichael, G., Y-Chang and W-C Shin, Photochemical Oxidants in Central Japan, *J. Computational Mechanics*, Environ. Modeling, Computational Mechanics Pub., Elsevier, Applied Science, pp 135-150, 1992.
61. Kothamarthi, V.R., Y. Sunwoo, G. Carmichael, H. Ueda and H. Kurita, "Long Range Transport of Trace Gases and Aerosols in East Asia: *Air Pollution Modeling and Its Application*, Plenum Publishing, pp 507-514, 1991.
62. Sunwoo, Y., V. Kothamarthi, and G. Carmichael, "The Regional Distribution of Tropospheric Ozone in East Asia from Satellite-Based Measurements", *J. Atmosph Chemistry*, 14:285-295, 1992.
63. Carmichael, G.R., and W-C Shin, Modeling and Control of Acid Deposition in Air Pollution: *Environmental Issues of Health Effects*, Majumdar, S, E. Miller, and J. Cahir Ed., Penn Acad of Science, 1992.
64. Yarmantino, R., J. Scire, S. Hanna, G. Carmichael and Y. Chong, formulation of the CALGRID Mesoscale Photochemical Grid Model, *Atm Environ*, 26A:1493-1512, 1992.
65. Shin, W. and G.R. Carmichael, "Comprehensive Air Pollution Modeling on a Multiprocessor System", *Computers and Chemical Engineering*, 16:805-815, 1992.
66. Shin, W. and G.R. Carmichael, "Analysis of Wet Deposition in the Eastern

- United States”, *Atm. Environ*, 26A: 465-484, 1992.
67. Habib, K., G.R. Carmichael, and R. Lakes, “Novel Technique for measuring the mechano-chemical anodic dissolution of metallic electrodes.” SPIE (Society of Photonic Instrumentation Engineering) -*International Soc of Optical Engineering*, issue on practical holography, 1990, Vol 1212, 357-371.
 68. Shin, W.C. , and G.R. Carmichael, “Sensitivity of Acid Production/Deposition to Emission Reductions, *ES&T*, 26: 715-775, 1992.
 69. Habib, K., G. R. Carmichael, R. Lakes and W. Stwalley, “Holographic Interferometry of Polarized and Loaded Metallic Electrodes in Aqueous Solution II.” *Applied Optics*, 1992.
 70. Sunwoo, Y., V. Kotamarthi and G. Carmichael, “Characteristics of Troposphere Ozone Product and Transport in East Asia,” In *Air Pollution Modeling and its Application*, Vol IX, pp 485-493, 1992.
 71. Bott, A., and G.R. Carmichael, “Multiphase Chemistry in a Microphysical Radiation Fog Model - A Numerical Study.” *Atm. Env*, 27A: 503-522, 1993
 72. Satsumabayashi, H., H. Kurita, Y. Chang, G. Carmichael and H. Ueda. “Diurnal variation of OH radical and hydrocarbons in a polluted air mass during long range transport in central Japan.” *Atm Environ* 26A: 2835-2844, 1992.
 73. Shin W., K. John and G. Carmichael, “The regional distribution of oxidants in the eastern United States and their sensitivity to reductions in anthropogenic emissions”, *Atmospheric Environment*, Dec., 1992.
 74. Crutzen, P. J. and G. R. Carmichael, “Modeling the Influence of Fires on Atmospheric Chemistry”, invited background paper in *Dahlem Workshop on Fires in the Environment: Its Ecological, Climatic and Atmospheric Chemical Importance*, Crutzen and Goldammer, ed., Wiley, 89-105, 1993.
 75. Habib, K., G. R. Carmichael, R. Lakes and W. Stwalley, Novel Techniques for measuring stress corrosion in aqueous solutions, *Corrosion*, 49:354-362, 1993.
 76. Galloway, J., J. Penner, C. Atherton, J. Prospero, H. Rodhe, G. Carmichael, and 25 other authors, Sulfur and nitrogen levels in the North Atlantic Ocean’s atmosphere: a synthesis of field and modeling studies, *Global Biogeochemical Cycles*, March, 1993.
 77. John, Kuruvilla, and G. R. Carmichael, “Potential impacts of global climate change and increased anthropogenic emissions on the regional tropospheric ozone cycle”, Transactions, Tropospheric Ozone and the Environment II: Effects, Modelling and Control, *Air & Waste Management Association*, 1992.
 78. Satsumabayashi, H. Kurita, Y. Chang, G. Carmichael, and H. Ueda, “Photochemical formations of lower aldehydes and lower fatty acids under long-range transport in central Japan”, *Atmospheric Environment*, 29:255-266, 1995.
 79. Sunwoo, Y. and G. Carmichael, “Tropospheric ozone in the western Pacific Rim: Analysis of the satellite and surface-based observations along with comprehensive 3-d model simulations”, *Quadrennial Ozone*, NASA Conf Publication 3266, 85-88, 1994.
 80. Carmichael, G., Y. Sunwoo, and Y. Zhang. “Long range transport of air pollutants in Asia”, *Air Pollution*, P. Zannetti and C. Brebbia editors, *Computational Mechanics and Elsevier Applied Sciences*, pp 281-292, 1993.

81. Sunwoo, Y., G. Carmichael, and H. Ueda, "Characteristics of background surface ozone in Japan", *Atmos. Environ.*, 28:25-37, 1994.
82. Kotamarthi, V. and G. R. Carmichael, "Long Range Transport of Dust in Asia", *Tellus*, 45B:426-441, 1993.
83. Crist, K., G. R. Carmichael and K. John, "UV-B exposure and atmospheric ozone: evaluation of radiative flux to changes in ambient ozone", *J. Hazardous Materials*, 37:527-538, 1994.
84. Peters, L.K., C. Berkowitz, G. Carmichael, R. Easter, G. Fairweather, S. Ghan, J. Hales, R. Saylor, R. Leung, W. Pennell, F. Potra, and T. Tsang, "The current status and future direction of Eulerian models in simulating tropospheric chemistry and transport of trace species: A review", *Atmospheric Environment*, 29:189-222, 1995.
85. Zhang, Y. Sunwoo, V. Kotamarthi and G. Carmichael, "Photochemical oxidant processes in the presence of dust: an evaluation of the impact of dust on ozone, nitrate and free radical formation" *J. Applied Meteorology*, 33:813-824, 1994.
86. Li, P-C., G. Carmichael, and K. Crist, "Estimation of Biologically Active Ultraviolet Radiation Exposure in Taipei, Taiwan", *Terrestrial, Atmospheric and Oceanic Sciences*, 6:461-471, 1995.
87. Chang, Y-S, R. Arndt, and G. Carmichael, "Mineral Base-Cation Deposition in Asia", *Atm. Env.*, 30: 2417-2427, 1996
88. Carmichael, G., Y. Zhang, L. Chen, M.S. Hing and H. Ueda, "Springtime Aerosol Composition at Cheju island, Korea", *Atm. Env.*, 30: 2406-2416, 1996.
89. Arndt, R., Y. Xu, G. Carmichael, Y. Sunwoo, and Y. Zhang, "Long Range Transport of SO₂ in Asia", *Air Pollution '94*, Barcelona, 10 pages, 1994.
90. Carmichael, G., Y. Chang, H. Sutsumaboyosh H. Kurita, and H. Ueda, "Effect of Tokyo Metropolitan Area on the Air Quality of the Kanto Plain", in *Urban Air Pollution*, Computational Mechanics, Inc., 187-219, 1994.
91. Carmichael, G., M-S Hong, H. Ueda and L. Chen, "Aerosol Composition at Cheju Island, Korea", *J. Geophys. Res.*, 102:6047-6061, 1997.
92. Jay, L., A. Sandu, F. Potra and G. Carmichael, "Improved QSSA Schemes for Integration of Stiff ODEs arising from Atmospheric Chemistry Problems", *SIAM - Scientific Computations*, 18: 1-20, 1997.
93. Dentener, F., Y. Zhang, G. Carmichael, P. Crutzen and J. Lebieveld, "The role of Mineral Aerosol as a Reactive Surface in the Global Troposphere," *J. Geophys. Res.*, 101(D17): 22869-22889, 1996.
94. Foell, W., C. Green, M. Amann, G. Carmichael, J-P., Lletlelingh, L. Hord, K, J. Shah, D. Streets, and D. Zhao, "Energy use, emissions and air pollution reduction strategies in Asia," *Water, Air and Soil Pollution*, 85: 2275-2281, 1995.
95. Arndt, R., and G. Carmichael, Long-Range Transport and Deposition of Sulfur in Asia," *Water, Air and Soil Pollution*, 85: 2283-2288, 1995.
96. Carmichael, G. and M. Ferm, "Distribution of SO₂ in Asia," *Water, Air and Soil Pollution* 85: 2289-2294, 1995.

1997

97. Arndt, R., G. Carmichael, and D. Streets, "Estimation of S emissions and deposition in Asia." *Atmos. Environment*, 31:1563-1572, 1997.
98. Sandu, A., G. Carmichael, and F. Potra, "Sensitivity analyses for atmospheric chemistry models via automatic differentiation." *Atmos. Environment*, 31: 475-489, 1997.
99. Sandu, A., G. Carmichael, and F. Potra, "Benchmark study of ODE solvers for atmospheric chemistry applications", *Atmospheric Environment*, 31: 3151-3166, 1997.
100. Sandu, A., G. Carmichael, and F. Potra, "The efficient use of sparsity in solving ODEs for chemical rate processes", *J. Computational Physics*, 129: 101-110, 1996.
101. Streets, D., G. Carmichael, and R. Arndt, "The role of emissions from shipping on sulfur deposition in Asia." *Atmos. Environment*, 31: 1573-1582, 1997.
102. Carmichael, G., A. Sandu, F. Potra, V. Damian, and M. Damian, The Current State and the Future Directions in Air Quality Modeling, *SAMS*, 25: 75-105., 1996
103. Chen, L.L., G. R. Carmichael, M-S Hong, H. Ueda, S. Shim, C. Song, Y. Kim, R. Arimoto, J. Prospero, D. Savoie, K. Murano, J. Park, H. Lee, and C. Kang., Influence of Continental Outflow Events on the Aerosol Composition at Cheju Island, South Korea, *J. Geophys. Res.* 102:28551-28574, 1997.
104. Xiao, H., G. Carmichael, J. Durchenwald, D. Thorton, and A. Bandy, Longrange transport of SOx and dust in East Asia during the PEM-WEST-B experiment. *J. Geophys. Res.*, 102: 28589-28612, 1997.
105. Hiyami, H. and G. R. Carmichael, Analysis of Aerosol Composition at Cheju Island, Korea, Using a Two-Bin Gas-Aerosol Equilibrium Model, *Atmospheric Environment*, 31:3429-3439, 1997.
106. Sandu, A., G. Carmichael, and F. Potra, "Benchmark study of ODE solvers for atmospheric chemistry applications- Part -II", *Atmospheric Environment*, 31: 3459-3472, 1997
107. Renshaw, M., R. Arndt, and G. Carmichael, "Environmental Impacts of Increased Acid Deposition in India and Nepal", *Science of the Total Environment*, 208: 71-79, 1997.

1998

108. Hiyami, H. and G. R. Carmichael, Factors Influencing the Seasonal Variation in Particulate Nitrate" *Atmospheric Environment*, 32:1378-1385, 1998.
109. Arndt, R., G. Carmichael, and J. Roorda, Seasonal Source-Receptor relationships in Asia, *Atmos. Environ.*, 32:1397-1406, 1998.
110. Olson, J., M. Prather, ..., G. Carmichael, Results from IPCC Photochemical Model Intercomparison, *J. Geophys. Res.*, 102: 1997.
111. Chang, Y., R. Arndt, G. Calori, G. Carmichael, D. Streets, and Haiping Su "Air Quality Impacts as a Result of Changes in Energy and Land Use in China's Jiangsu Province", *Atmos. Environ.*, 32:1383-1395, 1998.

112. Xu, S., and G. Carmichael, "Analysis of dry deposition in east Asia", *J. Applied Meteorology*, 37:1084-1099, 1998.
113. Phadnis, M., G. Carmichael, H. Hayami, I. Ichikawa, "Evaluation of Long Range Transport Models for Acidic Deposition in East Asia", *J. Applied Meteorology*, 37:1127-1142, 1998.
114. Hui, Xiao, Carmichael, G. and Y. Zhang, A Modeling Evaluation of the Impact of Mineral Aerosols on the particulate Sulfate Formation in East Asia, *Scientia Atmospherica Sinica*, 22(3):343-353, May, 1998.
115. Hui, Xiao, G. Carmichael, and Y. Zhang, Modeling Studies for the Effects of Spring-Time Mineral Aerosols on the Transport and Deposition of Sulfur in East Asia Using the STEM-II Model, *Climatic and Environmental Research*, 3(2):106-115, June, 1998.
116. Carmichael, G., I. Uno, M. Phadnis, Y. Zhang, and Y. Sunwoo, Tropospheric Ozone Production and Transport in the Springtime in East Asia, *J. Geophys. Res.*, 103(D9):10,649-10,671, May, 1998.

1999

117. Calori, G., and G. Carmichael, A trajectory model for sulfur in Asian megacities, *Atmos. Environ.*, 33:3109-3117, 1999.
118. Streets, D., G. Carmichael, M. Amann, and R. Arndt, Energy Consumption and Acid Deposition in Northeast Asia: Taming the Tigers, *Ambio*, 28: 135-143, 1999.
119. Song, C.H. and G. Carmichael, The Aging Processes of Naturally Emitted Aerosol During Long Range Transport, *Atmospheric Environment*, 33:2203 - 2218, 1999.
120. He, Shan and G. Carmichael, Sensitivity of Photolysis Rates and Ozone Production in the Troposphere to Aerosol Properties, *J. Geophys. Res.*, 104: 26307-26324, 1999.
121. Yienger, J.J., A.A. Klonecki, H. Levy II, W.J. Moxim, and G.R. Carmichael, An Evaluation of Chemistry's Role in the Winter-Spring Ozone Maximum Found in the Northern Midlatitude Free Troposphere, *J. Geophys. Res.*, 104: 3655-3667, 1999.
122. Zhang, Y., and G. Carmichael, Interactions of mineral aerosol with tropospheric chemistry, *J Appli. Meteor.*, 38: 353-366, 1999.
123. Jaffe, D., T. Anderson, D. Covert, R. Kotchenruther, B. Trost, J. Danielson, W. Simpson, T. Berntsen, S. Karlsdottir, D. Blake, J. Harris, G. Carmichael, and I. Uno, Transport of Asian Air Pollution to North America, *Geophys. Res. Letters*, 26: 711-714, 1999.
124. van Aardenne, J.A., G.R. Carmichael, H. Levy II, D. Streets, and L. Hordijk, Anthropogenic NO_x Emissions in Asia in the Period 1990-2020, *Atmospheric Environment*, 33:633-646, 1999.
125. Carmichael, G.R., A. Sandu, C.H. Song, S. He, M. Phadnis, D. Daescu, V. Damian-Iordache, and F. Potra, Computational Challenges of Modeling Interactions Between Aerosol and Gas Phase Processes in large Scale Air Pollution Models, in NATO Advanced Study Institute on *Computational Challenges in Air Pollution Modeling*, Plenum Press, 99-136, 1999.

126. Carmichael, G.R., A. Sandu, C.H. Song, S. He, M. Phadnis, D. Daescu, V. Damian-Iordache, and F. Potra, Modeling Interactions Between Aerosol and Gas Phase Processes in Large Scale Air Pollution Models, *Env. Management and Health*, 10:224-235, 1999.
127. Phadnis, M.J. and G.R. Carmichael, Forest Fire in the Boreal Region of China and its Impact on the Photochemical Oxidant cycle of East Asia, *Atmospheric Environment*, 34: 483-498, 1999.
128. Song, C.H., M.J. Phadnis, H. Hayami, and G.R. Carmichael, Modeling Aerosol Composition and Processes in Air Pollution Applications, in *Measuring and Modeling of Environmental Processes*, Vol. 2, 107-138, WIT Press, Computational Mech. Publications, 1999.
129. Streets, D.G., L. Hedayat, G.R. Carmichael, R.L. Arndt, and L.D. Carter, The Potential for Advanced Technology to Improve Air Quality and Human Health in Shanghai, *Environmental Management*, 23: 279-295, 1999.
130. Song, C., Phadnis, M., G. Carmichael, G. Underwood, and V. Grassian, Modeling heterogeneous reactions in air pollution models, in *Air Pollution VII*, Brebbie editor, WIT Press, 685-695, 1999.
131. Xu, A., and G. Carmichael, An assessment of sulfur deposition in Asia, *Atmos. Environ.*, 33: 3473-3486, 1999.

2000

132. Phadnis, M.J. and G.R. Carmichael, Transport and Distribution of Primary and Secondary Non-Methane Hydrocarbons in East Asia under Continental Outflow Conditions, *J. Geophys. Res.*, 105, 22,311-22,336, 2000.
133. Larssen, T. and G. Carmichael, Acid rain and acidification in China, the importance of base cations, *The Environment*, 110, 89-102, 2000.
134. Phadnis, M. and G. Carmichael, Influence of Mineral Dust on the Tropospheric Chemistry of East Asia, *J. Atmos. Chem.*, 36, 285-323, 2000.
135. Yienger, J.J., G.R. Carmichael, M.J. Phadnis, T.A. Holloway, M.K. Galanter, W.J. Moxim, and H. Levy II. The episodic nature of air pollution transport from Asia to North America, *J. Geophys. Res.*, 105, 26,931-26,945, 2000.
136. Streets, D.G., G.R. Carmichael, and S. Guttakunda, Sulfur dioxide emissions and sulfur deposition from international shipping in Asian waters 1985-1997, *Atmos. Environ.*, 34, 4425-4439, 2000.
137. Kim, Y., J. Lee, K. Moon, H. Kim, C. Lee, C. Song and G. Carmichael, Carbonaceous species in fine particles at the background sites in Korea, *Atmos. Environ.*, 34, 5053-5060, 2000.
138. Daescu, D., G. Carmichael, and A. Sandu, Adjoint implementation of Rosenbrock methods applied to variational data assimilation problems, *J. Computational Physics*, 165, 1-15, 2000.
139. Galanter, M., H. Levy II, and G.R. Carmichael, Impacts of Biomass Burning on Tropospheric CO, NO_x, and O₃, *J. Geophys. Res.*, 105, 6633-6653, 2000.
140. Shah, J., T. Nagpal, T. Johnson, M. Amann, G. Carmichael, W. Foell, C. Green, J-P Hettelingh, L. Hordijk, C. Peng, Y. Pu, R. Ramankutty, and D. Streets, Integrated Assessment of Acid Rain in Asia: Policy Implications and Results of RAINS-Asia, *Annual Review of Energy and Environment*, 25, 339-375, 2000.

141. Shrestha, A., C. Wake, J. Dibb, P. Mayewski, S. Whitlow, G. Carmichael, M. Fern, Seasonal Variations in Aerosol Concentrations and Composition in Nepal Himalaya, *Atmos. Environ.*, 34, 3349-3363, 2000.
142. Carmichael, G., Asia Megacities: Environment, Social and Health Implications, *Bulletin of the World Meteorological Organization*, 49, 327-332, 2000.
143. He, Shan, G.R. Carmichael, A. Sandu, B. Hotchkiss, and V. Damian-Iordache, Application of ADIFOR for Air Pollution Model Sensitivity Studies, *J. Env. Modeling*, 15: 549-557, 2000.

2001

144. Calori, G., C. Silibello, M. Volta, G. Brusasca, and G. Carmichael, Application of a Photochemical Modeling System to an Intense Ozone Episode over Northern Italy, *Env. Modeling and Software*, 2001.
145. Giuseppe Calori, Gregory R. Carmichael, David Street, Hiromasa Ueda, Narisara Thongboonchoo, Sarath K. Guttikunda, Interannual Variability in Sulfur Deposition in Asia, *J of Global Environmental Engineering*, Vol 7: 1-16, 2001
146. Galy-Lacaux, C., G. Carmichael, C.H. Song, J.P. Lacaux, and I. Modi, Analysis of Heterogeneous Processes Between Nitrogenous Compounds and Dust Particles in the Sahelian Region: Experimental Measurements and Numerical Analysis, *J. Geophys. Res.*, 106:12,559-12,578, 2001.
147. Song, C.H., and G.R. Carmichael, Partitioning of HNO₃ Modulated by Alkaline Aerosol Particles, *J. Atmos. Chem.*, 40:1-22, 2001.
148. Underwood, G., T. Miller, E. Balster, C. Song, M. Phadnis, G. C. Carmichael, and V. H. Grassian, Heterogeneous Reactions of NO₂ on Mineral Oxides and Mineral Dust: A Combined Laboratory and Modeling Study, *J. Geophys. Res.*, 106: 18,055-18,066, 2001.
149. Song, C. H., and G. Carmichael, A Model Study of the Evolution Processes of Dust and Sea Salt Particles During Long Range Transport, *J. Geophys. Res.*, 106: 18,131-18,154, 2001.
150. Guttikunda, S., N. Thongboonchoo, R. Arndt, G. Calori and G. Carmichael, Seasonal and sectoral analysis of sulfur deposition in Asia, *Water Air and Soil Pollution*, 131: 383-406, 2001.
151. Sokolik, I., Winkler, D. Gillette, G. Carmichael, J. Kaufman, H. Gomes, Schuetz and J. Penner, Outstanding Problems in Quantifying the Radiative Impact of Mineral Dust, *J. Geophys. Res.*, 106, 18,000-18,005, 2001.
152. Li, P., K.A. Perraeu, E. Covington, G.R. Carmichael, and V.H. Grassian, Heterogeneous Reactions of Volatile Organic Compounds on Mineral Oxide Particles: Surface Reactions of Acetaldehyde, Acetone and Propionaldehyde on SiO₂, Al₂O₃, Fe₂O₃, TiO₂ and CaO, *J. Geophys. Res.*, 106: 5517-5529, 2001.
153. Carmichael, G.R., H. Hayami, G. Calori, I. Uno, S.Y. Cho, M. Engardt, S.-B. Kim, Y. Ichikawa, Y. Ikeda, H. Ueda, and M. Amann, Model Intercomparison Study of Long Range Transport and Sulfur Deposition in East Asia (MICS-Asia), *Water, Air, and Soil Pollution*, 130, 51-62, 2001.

2002

154. Lee, Y.C., G. Calori, P. Hills, and G.R. Carmichael, Ozone Episodes in urban Hong Kong 1994-1999, *Atmos. Environ.*, 36:1957-1968, 2002.
155. Carmichael, G.R., D. Streets, G. Calori, M. Amann, M. Jacobson, J. Hansen, and H. Ueda, Changing Trends in Sulfur Emissions in Asia: Implications for Acid Deposition, Air Pollution, and Climate, *Environ. Science & Tech.*, 36:4707-4113, 2002.
156. Miehe, P., A. Sandu, G. Carmichael, Y. Tang, D. Daescu, A Communications Library for the Parallelization of Air Quality Models on Structured Grids, *Atmos. Env.*, 36:3917-3930, 2002.
157. Damian, V., A. Sandu, M. Damian, F. Potra, and G. Carmichael, The Kinetic Pre-Processor KPP-A Software Environ for Solving Chemical Kinetics, *Computers and Chemical Engineering*, 26:1567-1579, 2002.
158. Daescu, D. and G. Carmichael, An adjoint sensitivity method for adaptive location of the observations in air quality modeling, *J. Atmos. Sciences*, 60:434-450, 2002.
159. Carmichael, G.R., G. Calori, H. Hayami, I. Uno, S.Y. Cho, M. Engardt, S.-B. Kim, Y. Ichikawa, Y. Ikeda, J-H Woo, H. Ueda, and M. Amann, "The MICS-ASIA Study: Model Intercomparison of Long-Range Transport and Sulfur Deposition in East Asia", *Atmos. Environ.*, 36:175-199, 2002.
160. Guttikunda, S.K., G.R. Carmichael, Giuseppe Calori, Christina Eck, Jung-Hun Woo, The Contribution of Megacities to Regional Sulfur Pollution in Aisa, *Atmospheric Environment*, Vol. 37: 11-22, 2002.
161. Woo, J-H., D. Streets, G. Carmichael, J. Dorwart, N. Thongboonchoo, S. Guttikunda, Y. Tang, Development of the Emission Inventory System for supporting TRACE-P and ACE-Asia field experiments, *Air Pollution Modelling and Its Application XV*, 527-528, 2002.

2003

162. Streets, D.G., K.F. Yarber, J.-H. Woo, and G.R. Carmichael, Biomass burning in Asia: annual and seasonal estimates and atmospheric emissions, *Global Biogeochemical Cycles*, 17(4), 1099, 2003.
163. Uno, I., G.R. Carmichael, D. Streets, S. Satake, T. Takemura, J.-H. Woo, M. Uematsu, and S. Ohta, Analysis of Surface Black Carbon Distributions during ACE Asia using a Regional Scale Aerosol Model, *J. Geophys. Res.*, 108 (D23), 8636, 2003.
164. Woo, J-H., D. Streets, G.R. Carmichael, Y. Tang, B-I. Yoo, W-C. Lee, N. Thongboonchoo, S. Pinnock, G. Kurata, I. Uno, Q. Fu, S. Vay, G.W. Sachse, D.R. Blake, A. Fried, D.C. Thornton, The Contribution of Biomass and Biofuel Emissions to Trace Gas Distributions in Asia during the TRACE-P Experiment, *J. Geophys. Res.*, 108 (D21), 8812, 2003.
165. Ma, Y., R. J. Weber, Y.-N. Lee, D. C. Thornton, A. R. Bandy, A. D. Clarke, D. R. Blake, G. W. Sachse, H. E. Fuelberg, J.-H. Woo, D. Streets, G. R. Carmichael, F. L. Eisele, The Characteristics and Influence of Biomass Burning

Aerosols on Fine Particle Ionic Composition Measured in Asian Outflow During TRACE-P, *J. Geophys. Res.*, 108(D21), 8816, 2003.

166. Tang, T., G. R. Carmichael, J-H Woo, N. Thongboonchoo, G. Kurata, I. Uno, and D. G. Streets, The Influences of Biomass Burning during TRACE-P Experiment Identified by the Regional Chemical Transport Model, *J. Geophys. Res.*, 108 (D21), 8824, 2003.
167. Tang, Y., G. R. Carmichael, I. Uno, J-H Woo, G. Kurata, B. Lefer, R.E. Shetter, H. Huang, B. Anderson, M.A. Avery, A.D. Clarke, and D.R. Blake, Impacts of Aerosols and Clouds on Photolysis Frequencies and Photochemistry During TRACE-P, PART II: Three-Dimensional Study Using a Regional Chemical Transport Model, *J. Geophys. Res.*, 108(D21), 8822, 2003.
168. Uno, I., G.R.Carmicahel, D.G. Streets, Y.Tang, J.J.Yienger, S.Satake, Z.Wang, Jung-Hun Woo, S.Guttikunda, M.Uematsu, K. Matsumoto, H.Tanimoto, K.Yoshioka and T. Iida, Regional Chemical Weather Forecasting using CFORS: Model Descriptions and Analysis of Surface Observations at Japanese Island Stations During the ACE-Asia Experiment, *J. Geophys. Res.*, 108 (D23), 8668, 2003.
169. Zhang, M., I. Uno, Z. Wang, H. Akimoto, G.R. Carmichael, Y. Tang, J.-H. Woo, D.G. Streets, G.W. Sachse, M.A. Avery, R.J. Weber, and R.W. Talbot, Large-scale structure of trace gas and aerosol distributions over the Western Pacific Ocean during TRACE-P, *J. Geophys. Res.*, 108 (D21), 8820, 2003.
170. Streets, D.G., T.C. Bond, G.R. Carmichael, S.D. Fernandes, Q. Fu, D. He, Z. Klimont, S.M. Nelson, N.Y. Tsai, M.Q. Wang, J.-H. Woo, and K.F. Yarber, An inventory of gaseous and primary aerosol emissions in Asia in the year 2000, *J. Geophys. Res.*, 108 (D21), 8809, 2003.
171. Carmichael, Gregory R., Youhua Tang, Gakuji Kurata, Itsushi Uno, David Streets, J-H. Woo, H. Huang, J. Yienger, B. Lefer, R. Shetter, D. Blake, E. Atlas, A. Fried, E. Apel, F. Eisele, C. Cantrell, M. Avery, J. Barrick, G. Sachse, W. Brune, S. Sandholm, Y. Kondo, H. Singh, R. Talbot, A. Bandy, D. Thorton, A.D. Clarke, and B. Heikes, "Regional-Scale Chemical Transport Modeling in Support of the Analysis of Observations obtained during the TRACE-P Experiment", *J. Geophys. Res.*, 108(D21), 8823, 2003.
172. Woo, J-H., J. M. Baek, J.-W. Kim, G. R. Carmichael, N. Thongboonchoo, S. T. Kim, J. H. An, "Development of a multi-resolution emission inventory system for northeast Asia", *Water, Air, & Soil Pollution*, 148, 2003.
173. Carmichael, G.R., M. Ferm, N. Thongboonchoo, J-H Woo, L.Y. Chan, K. Murano, P. H. Viet, C. Mossberg, R. Bala, J. Boonjawat, P. Upatum, M. Mohan, S. Adhikary, A. Shrestha, J.J Pienaar, E.G. Brunke, T. Chen, T. Jie, D. Guoan, L. C. Peng, S. Dhiharto, H. Harjanto, A. M. Jose, W. Kimani, A. Kirouane, J.P Lacaux, S. Richard, O. Barturen, J. C. Cerda, A. Athayde, T. Tavares, J.S. Cotrina, E. Bilici, "Observed Regional Multi Air Pollutants In Asia, Africa, And South America Using Passive Sampler", *Atmospheric Environment*, 37:1293-1308, 2003.
174. Fried, A., J. Crawford, J. Olson, J. Walega, W. Potter, B. Wert, C. Jordan, B. Anderson, R. Shetter, B. Lefer, D. Blake, N. Blake, S. Meinardi, B. Heikes, D. O'Sullivan, J. Snow, H. Fuelberg, C. Kiley, S. Sandholm, D. Tan, G. Sachse, H.

- Singh, I. Faloon, C.N. Harward, G.R. Carmichael, "Airborne Tunable Diode Laser Measurements of Formaldehyde During TRACE-P: Distributions and Box-Model Comparisons", *J. Geophysical Research*, 108(D20), 8798, 2003.
175. Conant, W.C., J.H. Seinfeld, J. Wang, G.R. Carmichael, Y. Tang, I. Uno, P.J. Flatau, K.M. Markowicz, P.K. Quinn, "A Model for the Radiative Forcing During ACE-Asia Derived from CIRPAS Twin Otter and R/V Ronald H. Brown Data and Comparison with Observations", *J. Geophysical Research*, 108(D23), 8661, 2003.
176. Huebert, B.J., T. Bates, P.B. Russell, G. Shi, YU.J. Kim, K. Kawamura, G.R. Carmichael, T. Nakajima, "An Overview of ACE-Asia: Strategies for Quantifying the Relationships Between Asian Aerosols and Their Climatic Impacts", *J. Geophysical Research, ACE-Asia Special Issue A*, 108(D23), 8633, 2003.
177. Tu, F.H., D.C. Thornton, A.R. Bandy, M-S. Kim, G.R. Carmichael, Y. Tang, L. Thornhill and G. Sachse, "Dynamics and Transport of Sulfur Dioxide Over the Yellow Sea during TRACE-P", *J. Geophysical Research*, 108(D20), 8790, 2003.
178. Carmichael, Gregory R., Youhua Tang, Gakuji Kurata, Itsushi Uno, David Streets, Narisara Thongboonchoo, Jung-Hun Woo, Sarath Guttikunda, A. White, T. Wang, D.R. Blake, E. Atlas, A. Fried, B. Potter, M.A. Avery, G.W. Sachse, S.T. Sandholm, Y. Kondo, R.W. Talbot, A. Bandy, D. Thornton, A.D. Clarke, "Evaluating Regional Emission Estimates Using The Trace-P Observations", *J. Geophys. Res.*, 108 (D21), 8810, 2003.
179. Kiley, C.M., H.E. Fuelberg, P.I. Palmer, D.J. Allen, G.R. Carmichael, D.J. Jacob, C. Mari, R.B. Pierce, K.E. Pickering, Y. Tang, O. Wild, T.D. Fairlie, J.A. Logan, G.W. Sachse, and D.G. Streets, An Intercomparison and Evaluation of Aircraft-Derived and Simulated CO from seven Chemical Transport Models During the TRACE-P Experiment, *J. Geophys. Res.*, 108(D21), 8819, 2003.
180. Sandu, A., D.N. Daescu, G.R. Carmichael, Direct and Adjoint Sensitivity Analysis of Chemical Kinetic Systems with KPP: Part I – Theory and Software Tools, *Atmos. Environ.*, 37, 5083-5096, 2003.
181. Sandu, A., D.N. Daescu, G.R. Carmichael, Direct and Adjoint Sensitivity Analysis of Chemical Kinetic Systems with KPP: Part II – Numerical Validation and Applications, *Atmos. Environ.*, 37, 5097-5114, 2003.
182. Mendez, M.R., J.A. Souto, J.J. Casares, T. Lucas, G.R. Carmichael, The Effect of the Limited Availability of H₂O₂ in the Competitive Deposition of Sulfur and Oxidized Nitrogen, *Chemosphere*, 53, 1165-1178, 2003.

2004

183. Takegawa, N., Y. Kondo, M. Koike, T. Machida, T. Watai, D.R. Blake, D.G. Streets, J.-H. Woo, G.R. Carmichael, K. Kita, G. Chen, Y. Miyazaki, T. Shirai, and T. Ogawa, Removal of NO_x and NO_y in Asian outflow Plumes: Aircraft Measurements over the Western Pacific in January 2002, *J. Geophys. Res.*, 109, D23S04, doi:10.1029/2004JD004866.
184. Friedli, H.R., L.F. Radkel, R. Prescott, P. Li, J-H. Woo, and G.R. Carmichael, Gaseous Mercury in the Atmosphere Around Japan/Korea/China Observed

- During the 2001 ACE-Asia Field Campaign: measurements, Distributions, Sources and Implications, *J Geophys. Res.*, 109, D19S25, doi:10.1029/2003JD004244.
185. Tang, Y., G.R. Carmichael, J.H. Seinfeld, D. Dabdub, R.J. Weber, B. Huebert, A.D. Clarke, S.A. Guazzotti, D.A. Sodeman, K.A. Prather, I. Uno, J-H. Woo, J. Yienger, D.G. Streets, P.K. Quinn, J.E. Johnson, C-H. Song, V.H. Grassian, A. Sandu, R.W. Talbot, and J.E. Dibb, Three Dimensional Simulations of Inorganic Aerosol Distributions in East Asia During Spring 2001, *J. Geophys. Res.*, 109, D19S23, doi:10.1029/2003JD004201, 2004.
 186. Tang, Y., G. R. Carmichael, G. Kurata, I. Uno, R.J. Weber, C-H. Song, S.K. Guttikunda, J-H. Wook D.G. Streets, C. Wei, A.D. Clarke, B. Huebert, and T.L. Anderson, The Impacts of Dust on Regional Tropospheric Chemistry During the ACE-ASIA Experiment: A Model Study with Obserations, *J. Geophys. Res.*, doi:10.1029/2003JD003806, 2004.
 187. Li, J., S.K. Guttikunda, G.R. Carmichael, D.G. Streets, Y-S. Chang, V. Fung, Quantifying the Human Health Benefits of Curbing Air Pollution in Shanghai, *J. Environ. Mngmt.*, 70, 49-62, 2004.
 188. Uno, I., S. Satake, G.R. Carmichael, Y. Tang, Z. Wang, T. Takemura, N. Sugimoto, A. Shimizu, T. Murayama, T.A. Cahill, S. Cliff, M. Uematsu, S. Ohta, P.K. Quinn, and T.S. Bates, Numerical Study of Asian Dust Transport During the Springtime of 2001 Simulated with the CFORS Model, *J. Geophys. Res.*, VOL. 109, D19S24, doi:10.1029/2003JD004222, 2004.
 189. Clarke, A.D., Y. Shinozuka, V.N. Kapustin, S. Howell, B. Huebert, S. Doherty, T. Anderson, D. Covert, J. Anderson, Z. Hua, K.G. Moore II, C. McNaughton, and G.R. Carmichael, Size-Distributions and Mixtures of Dust and Black Carbon Aerosol in Asian Outflow: Physio-Chemistry and Optical Properties, *J. Geophys. Res.*, 109, D15S09, doi:10.1029/2003JD004378.
 190. Maxwell-Meier, K., D. Orsini, Y. Ma, R.Weber, B. Huebert, B. Bloomgist, A. Bardy, G. Carmichael, and D. Streets, Inorganic Composition of Particles in Mixed Dust: Pollution Plumes Observed on C130 Platform During Ace-Asia, *J. Geophys. Res.*, 109, D19S07, doi:10.1029/2003JD004464.
 191. De Gouw, J.A., O.R. Cooper, C. Warneke, P.K. Hudson, F.C. Fehsenfeld, J.S. Holloway, G. Hubler, D.K. Nicks, Jr., J.B. Nowak, D.D. Parrish, T.B. Ryerson, M. Trainer, E.L. Atlas, S.G. Donnelly, S.M. Schauffler, V. Stroud, K. Johnson, G.R. Carmichael, and D.G. Streets, Chemical Composition of Air Masses Transported from Asia to the U.S. West Coast During ITCT2k2: Fossil Fuel Combustion Versus Biomass Burning Signatures, *J. Geophys. Res.*, 109, D23S20, doi:10.1029/2003JD004202.
 192. Tang, Y., G.R. Carmichael, L.W. Horowitz, I. Uno, J-H. Woo, D.G. Streets, D. Dabdub, G. Kurata, A. Sandu, J. Allan, E. Atlas, F. Flocke, L.G. Huey, R.O. Jakoubek, D.B. Millet, D.D. Parrish, P.K. Quinn, Jm. Roberts, T.B. Ryerson, E. Williams, J.B. Nowak, D. Worsnop, A. Goldstein, S. Donnelly, S. Schauffler, V. Stroud, K. Johnson, M.A. Avery, H.B. Singh, and E.C. Apel, Multi-Scale Simulations of Tropospheric Chemistry in the Eastern Pacific and US West Coast During Spring 2002, *J. Geophys. Res.*, 109, D23S11, doi:10.1029/2004JD004513.

193. Dabberdt, W.F., M.A. Carroll, D. Baumgardner, G. Carmichael, R. Cohen, T. Dye, J. Ellis, G. Grell, S. Grimmond, S. Hanna, J. Irwin, B. Lamb, S. Madronich, J. McQueen, J. Meagher, T. Odman, J. Pleim, H.P. Schmid, and D. Westphal, Meteorological Research Needs for Improved Air Quality Forecasting: Report of the 11th Prospectus Development Team of the U.s. Weather Research Program, *Bulletin of the American Meteorological Society*, 85, 563-586, 2004.
194. Tu, F.H., D.C. Thornton, A.R. Bandy, M-S. Kim, G. R. Carmichael, and Y. Tang, Long-Range Transport of Sulfur Dioxide in the Central Pacific, *J. Geophys. Res.*, 109, D15S08, doi:10.1029/2003JD004309.
195. McNaughton, C.S., A.D. Clarke, S.G. Howell, K.G. Moore II, V. Brekhovskikh, R.J. Weber, D.A. Orsini, D.S. Covert, G. Buzorius, F.J. Brechtel, G.R. Carmichael, Y. Tang, F.L. Eisele, R.L. Mauldin, A.R. Bandy, D.C. Thornton, and B. Blomquist, Spatial distribution and size evolution of particles in Asian outflow: Significance of primary and secondary aerosols during ACE-Asia and TRACE-P, *J. Geophys. Res.*, 109, D19S06, doi:10.1029/2003JD003528.
196. Henze, D., J. H. Seinfeld, W. Liao and A. Sandu, and G. R. Carmichael, Inverse modeling of aerosol dynamics: Condensational growth, *J of Geophysical Research*, Vol. 109, D14201, doi:10.1029/2004JD004593, 2004.
197. Seinfeld, J.H., G. R. Carmichael, R. Arimoto, W. C. Conant, F. J. Brechtel, T. S. Bates, T. A. Cahill, A. D. Clarke, P. Flatau, B. J. Huebert, J. Kim, S. J. Masonis, P. K. Quinn, L. M. Russell, P. B. Russell, A. Shimizu, Y. Shinozuka, C. Song, Y. Tang, I. Uno, R. J. Weber, J. H. Woo & X. Y. Zhang, Regional Climatic and Atmospheric Chemical Effects of Asia Dust and Pollution, *Bulletin of the American Met. Society (BAMS)*, doi: 10.1175/BAMS-85-3-367, 2004.
198. Chistelle, M., C. Liousse, J.-M. Grégoire, K. Tansey, G.R. Carmichael and J.-H. Woo, Biomass burning emission inventory from burnt area data given by SPOT-Vegetation satellite in the frame of TRACE-P and ACE-Asia campaigns, *J of Geophysical Research*, 110, DO9304, doi:10.1029/2004JD005461, 2004.
199. Kurata, G., G.R. Carmichael, T. Kitada, Y. Tang, J.-H. Woo, N. Thongboonchoo, Relationships Between Emission Sources and Airmass Characteristics in East Asia During the TRACE-P Period, *Atmospheric Environment* 38 (2004) 6977–6987.
200. Satake, S., I. Uno, T. Takemura, G.R. Carmichael, Y. Tang, D. Streets, N. Sugimoto, A. Shimizu, M. Uematsu, J-S Han, and S. Ohta, Characteristics of Asian aerosol transport simulated with a regionalscale chemical transport model during the ACE-Asia observation, *J of Geophys Res.*, 109, D19S22, doi:10.1029/2003JD003997, 2004.
201. Satsumabayashi, H., M. Kawamura, T. Katsuno, K. Futaki, K. Murano, G.R. Carmichael, M. Kajino, M. Horiguchi, and H. Ueda, Effects of Miyake volcanic effluents on airborne particles and precipitation in central Japan, *J of Geophys Res.*, VOL. 109, D19202, doi:10.1029/2003JD004204, 2004.
202. Kurata, G., G.R. Carmichael, T. Kitada, Y. Tang, J.-H. Woo, Estimation of emission ratios using backward trajectory analysis from airborne observations for East Asia, *J of Global Environmental Engineering*, Vol 10: 39-51, 2004.

203. Bates T. S., et al. (2004), Marine boundary layer dust and pollutant transport associated with the passage of a frontal system over eastern Asia, *J. Geophys. Res.*, 109, D19S19, doi:10.1029/2003JD004094.
204. Jacobson, M.Z., J.H. Seinfeld, G.R. Carmichael, D.G. Streets, The effect on photochemical smog of converting the U.S. fleet of gasoline vehicles to modern diesel vehicles, *Geophys Res. Lett.*, 31, L02116, doi:10.1029/2003GL018448, 2004.
205. Sandu, A., D.N. Daescu, T. Chai, G.R. Carmichael, J.H. Seinfeld, P.G. Hess, and T.L. Anderson, Computational Aspects of 4D-Var Chemical Data Assimilation in Atmospheric Models, *Dynamic Data Driven Applications Systems*, ed., F Darema, Kluwer Academic Publishers, The Netherlands, 2004.
206. Sandu, A., W. Liao, G.R. Carmichael, D. Henze, J.H. Seinfeld, T. Chai, and D.N. Daescu, Computational aspects of Data Assimilation for Aerosol Dynamics, *Lecture Notes in Computer Science*, 3038, pp. 709-716, 2004.

2005

207. McKeen, S., J. Wilczak, G. Grell, I. Djalalova, S. Peckham, E.-Y. Hsie, W. Gong, V. Bouchet, S. Menard, R. Moffet, J. McHenry, J. McQueen, Y. Tang, G. R. Carmichael, M. Pagowski, A. Chan, T. Dye, Assessment of an ensemble of seven real-time ozone forecasts over Eastern North America during the summer of 2004, *J. Geophys. Res.*, 110, D21307, doi: 10.1029/2005JD008888, 2005.
208. Sandu, A., D. Daescu, G.R Carmichael, T. Chai, Adjoint Sensitivity Analysis of Regional Air Quality Models, *J. Computational Physics*, 204, 222-252, 2005.
209. Hakami, A., D. K. Henze, J. H. Seinfeld, T. Chai, Y. Tang, G. R. Carmichael, A. Sandu, Adjoint Inverse Modeling of Black Carbon During ACE-Asia, *J. Geophys. Res.*, 110, D14301, doi: 10.1029/2004JD005671.
210. Guttikunda, S.K., Y. Tang, G.R. Carmichael, G. Kurata, L. Pan, D.G. Streets, J-H. Woo, N. Thongboonchoo, and A. Fried, Impacts of Asian Megacity Emissions on Regional Air Quality during Spring 2001, *J. Geophys. Res.*, 110, D20301, doi: 10.1029/2004JD004921, 2005.
211. Sandu, A., Henze, D., J. H. Seinfeld, W. Liao, and G. R. Carmichael Inverse Modeling of Aerosol Dynamics using Adjoints: Theoretical and Numerical Considerations, *Aerosol Science & Technology*, 39, p. 1-18, DOI:10.1080/02786820500182289, 2005.
212. Sandu, A., E.M. Constantinescu, W.Y. Liao, G.R. Carmichael, T. Chai, J.H. Seinfeld, and D.N. Daescu, Ensemble-based Data Assimilation for Atmospheric Chemical Transport Models, *Lecture Notes in Computer Science*, 3515, pp. 648-655, 2005.
213. Pan, Li, and G.R. Carmichael, A Two-Phase Box Model to Study Mercury Atmospheric Mechanisms, *Environ. Chem.*, 2, 205-214, doi: 10.1071/EN05026, 2005.
214. Wang, Xuemei, G.Carmichael, D. Chen, Y. Tang, T. Wang, Impacts of Different Emission Sources on Air Quality During March 2001 in the Pearl River Delta

(PRD) Region, *Atmos. Environ.*, 39, 5227-5241, doi:10.1016/j.atmosenv.2005.04.035, 2005.

215. Streets, D.G., C. Yu, M.H. Bergin, X. Wang, and G.R. Carmichael, Modeling Study of Air Pollution Due to the Manufacture of Export Goods in China's Pearl River Delta, *Environ. Sci. and Technol.*, doi:10.1021/es051275n, 2005.

2006

216. Liao, W., A. Sandu, G.R. Carmichael, and T. Chai, Singular Vector Analysis for Atmospheric Chemical Transport Models, *Monthly Weather Review*, 134, 2443-2465, 2006.
217. Walter F. Dabberdt, Mary Anne Carroll, William Appleby, Darrel Baumgardner, Gregory Carmichael¹, Paula Davidson, J. Christopher Doran, Timothy G. Dye, Susan Grimmond, Paulette Middleton, William Neff, and Yang Zhang, USWRP Workshop on Air Quality Forecasting, *Bulletin of the American Meteorological Society*, 10.1175/BAMS-87-2-215 – 221, 2006.
218. Chai, T., G.R. Carmichael, A. Sandu, and D.N. Daescu, Chemical Data Assimilation with TRACE-P Flight Measurements, *J of Geophys Res.*, 111,D02301,doi:1029/2005JD005883,2006.
219. Wang, T.J., K.S. Lam, M. Xie, X.M. Wang, G.R. Carmichael, and Y.S. Li, Integrated Studies of a Photochemical Smog Episode in Hong Kong and Regional Transport in the Pearl River Delta of China, *Tellus*, 58B, 31-40, 2006.
220. Streets, D.G., Q. Zhang, L. Wang, K. He, J Hao, Y. Wu, Y. Tang, and G.R. Carmichael, Revisiting China's CO Emissions after TRACE-P" Synthesis of Inventories, Atmospheric Modeling, and Observations, *J. Geophys. Res.*, 2006JD007118, 2006.
221. Kim, J.Y., C.H. Song, Y.S. Ghim, J.G. Won, S.C. Yoon, G.R. Carmichael, J.-H. Woo, An Investigation on NH₃ Emissions and Particulate NH₄⁺-NO₃⁻ Formation in East Asia, *Atmos. Environ.*, 40, 2139-2150, 2006.
222. Bates, T.S., T.L. Anderson, T. Baynard, T. Bond, O. Boucher, G. Carmichael, A. Clarke, C. Erlick, H. Guo, L. Horowitz, S. Howell, S. Kulkarni, H. Maring, A. McComiskey, A. Middlebrook, K. Noone, C.D. O'Dowd, J. Ogren, J. Penner, P.K. Quinn, A.R. Ravishankara, D.L. Svoboda, S.E. Schwartz, Y. Shinozuka, Y. Tang, R.J. Weber, and Y. Wu, Aerosol Direct Radiative Effects over the Northwest Atlantic, Northwest Pacific, and North Indian Oceans: Estimates Based on In-Situ Chemical and Optical Measurements and Chemical Transport Modeling, *Atmospheric Chemistry and Physics*, 6, 1657-1732, 2006.
223. Pan, L., J.H. Woo, G.R. Carmichael, Y. Tang, H.F. Friedli, and L.F. Radke, The regional distribution and emissions of mercury in East-Asia: A modeling analysis of ACE-Asia observations, *J. Geophys. Res.*, 111, D07109, doi:10.1029/2005JD006381, 2006.

224. Hakami, A. , J. H. Seinfeld, T. Chai , Y. Tang , G. Carmichael, A. Sandu, Adjoint Sensitivity Analysis of Ozone Non-attainment over the Continental United States, *Environ. Sci. Tech.*, 40(12): 3855-3864, 2006.
225. Wilczak, J., S. McKeen, I. Djalalova, G. Grell, S. Peckham, W. Gong, V. Bouchet, R. Moffet, J. McHenry, J. McQueen, P. Lee, Y. Tang, and G.R. Carmichael, Bias-Corrected Ensemble and Probabilistic Forecasts of Surface Ozone over Eastern North America during the Summer of 2004, *J. Geophys. Res.*, 111, D23S28, doi:10.1029/2006JD007598, 2006.

2007

226. Constantinescu, E.M., A. Sandu, T. Chai, and G.R. Carmichael, Ensemble-Based Chemical Data Assimilation I; An Idealized Setting, *Atmos. Environ.*, 41, 18-36, 2007.
227. Constantinescu, E.M., A. Sandu, T. Chai, and G.R. Carmichael, Ensemble-Based Chemical Data Assimilation II: Covariance Localization, *Quart. J. Royal Met. Soc.*, 133, 1229-1243, 2007.
228. Constantinescu, E.M., A. Sandu, T. Chai, and G.R. Carmichael, Ensemble-Based Chemical Data Assimilation I: General Approach, *Quart. J. Royal Met. Soc.*, 133, 1245-1256, 2007.
229. Mena-Carrasco, M., Y. Tang, G.R. Carmichael, T. Chai, et al, Improving Regional Ozone Modeling through Systematic Evaluation of Errors Using the Aircraft Observations during ICARTT, *J. Geophys. Res.*, 112, D12S19, doi:10.1029/2006JD007762, 2007.
230. Chai, T., G.R. Carmichael, Y. Tang, A. Sandu, M. Hardesty, P. Pilewskie, S. Whitlow, E.V. Browell, M.A. Avery, P. Nedelec, J.T. Mererill, A.M. Thompson, and E. Williams, Four Dimensional Data Assimilation Experiments with ICARTT (International Consortium for Atmospheric Research on transport and Transformation), *J. Geophys. Res.*, 112, D12S15, doi:10.1029/2006JD007763, 2007.
231. Tang, Y., G.R. Carmichael, N. Thongboonchoo, T. Chai, et al., The influence of lateral and top boundary conditions on regional air quality prediction: A Multi-Scale study coupling regional and global chemical transport models, *J. Geophys. Res.*, 112, D10S18, doi:10.1029/2006JD007515, 2007.
232. Campbell, J.E., C.O. Stanier, G. R. Carmichael, Y. Tang, T. Chai, et al., Analysis of Anthropogenic CO₂ Signal in ICARTT Observations Using a Regional Chemical Transport Model and its Adjoint, *Tellus B*, 59, pp. 199-210, 2007.
233. Pan, L., T. Chai, G.R. Carmichael, D. Streets and Y. Tang, The top-down estimate of mercury emissions in China using the four-dimensional variation data assimilation (4D-Var) approach, *Atmos. Env.*, 41, 2804-2819, 2007.
234. Fast, J.D., B. de Foy, F. Acevedo Rosas, E. Caetano, G. Carmichael, L. Emmons, D. McKenna, M. Mena, W. Skamarock, X. Tie, R.L. Coulter, J.C. Barnard, C. Wiedinmyer, S. Madronich, *Atmos. Che. Phys.*, 2037-2089, SRef-ID: 1680-735/acpd/2007-7-2037, 2007.

235. Singh, H.B., L. Salas, D. Herlth, R. Kolyer, E. Czech, M. Avery, J.H. Crawford, R.B. Pierce, G.W. Sachse, D.R. Blake, R.C. Cohen, J. Dibb, G. Huey, R.C. Hudman, S. Turquety, L.K. Emmons, F. Flocke, Y. Tang, G.R. Carmichael, L.W. Horowitz, Reactive Nitrogen Distribution and Partitioning in the North American Troposphere and Lowermost Stratosphere, *J. Geophys. Res.* 112, D12S04, doi:10.1029/2006JD007664, 2007.
236. McKeen, S., S.H. Chung, J. Wilczak, G. Grell, I. Djalalova, S. peckham, W. Gong, V. Bouchet, R. Moffet, Y. Tang, G.R. Carmichael, R. Mathur, and S. Yu, Eavluatino of Several PM2.5 Forecast Models using Data collected during the ICARTT/NEAQS 2004 Field Study, *J. Geophys Res.*, 112, D10S20, doi:10.1029/2006JD007608, 2007.
237. Hadley, O., V. Ramanathan, G.R. Carmichael, Y. Tang, C.E. Corrigan, G.C. Roberts, and G.S. Mauger, Trans-Pacific Transport of Black Carbon and Fine Aerosols ($D < 2.5 \mu\text{m}$) into North America, *J. Geophys. Res.*, 112, D05309, doi:10.1029/2006JD007632, 2007.
238. Song, C.H., K.M. Han, J. Kim, G.R. Carmichael, H.J. Cho, G. Kurata, N. Thongboonchoo, Z. He, H.S. Kim, A Lagrangian Model Investigation of Chemico Microphysical Evolution in Northeast Asian Pollution Plumes within the MBL During TRACE-P, *Atmos. Environ.*, 41, 8932-8952, 2007.
239. Song, C.H., C.M. Kim, Y.J. Lee, B.K. Lee, D.S. Lee, and G.R. Carmichael, An Eevaluation of the Reaction Probabilities of Sulfate and Nitrate Precursors onto East Asian Dust Particles, *J. Geophys. Res.*, 112, D18206, doi:10.1029/2006JD008092, 2007.
240. Adhikary, B., G.R. Carmichael, Y. Tang, L.R. Leung, Y. Qian, J.J. Schauer, E.A. Stone, V. Ramanathan, and M.V. Ramana, Characterization of South Asian Aerosols during the ABC-Post Monsoon Experiment (ABC-APMEX): A Regional-Scale Modeling Analysis, *J. Geophys. Res.*, 112, D22S22, doi:10.1029/2006JD008143, 2007.
241. Ramanathan, V., F. Li, M.V. Ramana, P.S. Siva, D. Kim, C.E. Corrigan, H. Nguyen, E.A. Stone, J.J. Schauer, G.R. Carmichael, B. Adhikary, S.C. Yoon, Atmospheric Brown Clouds: Hemispherical and Regiona Variations in Long Range Transport, Absorption and Radiative Forcing, *J. Geophys. Res.*, 112, D22S21, doi:10.1029/2006JD008124, 2007.
242. Sullivan, Ryan, Sergio A. Guazzotti, David A. Sodeman, Youhua Tang, Gregory R. Carmichael, Kimberly A. Prather, Mineral dust is a sink for chlorine in the marine boundary layer, *Atmos. Env.*, 41, 7166-7179, 2007.
243. Constantinescu, E., T. Chai, A. Sandu, and G. Carmichael, Autoregressive models of background errors for chemical data assimilation, *J. Geophys. Res.*, 112, D12309, doi:10.1029/2006JD008103, 2007.

2008

244. Liu, C-M., M-T. Yeh, S. Paul, Y.C. Lee, D.J. Jacob, M. Fu, J.H. Woo, G.R. Carmichael, and D.G. Streets, Effect of Anthropogenic Emissions in East Asia on Regional Ozone Levels near Taiwan During Spring Dust-Storms: A Case Study, *Environ. Modeling and Software*, 23(5), 579-591, 2008.

245. Han, Z., T. Sakurai, H. Ueda, K. Matsuda, Y. Hozumi, G. R. Carmichael, D. Streets, S. U. Park, C. Fung, A. Chang, M. Kajino, N. Thongboonchoo, M. Engardt, C. Bennet, H. Hayami, K. Sartelet, T. Holloway, Z. Wang, and M. Amann. (2006, Companion paper). Model Intercomparison and Evaluation of Ozone and Relevant Species -MICS-Asia Phase II Study. *Atmos. Env.*, 42, 3491-3509, 2008.
246. Hayami, H., T. Sakurai, K. Matsuda, Z. Han, H. Ueda, G. R. Carmichael, D. Streets, T. Holloway, Z. Wang, N. Thongboonchoo, M. Engardt, C. Bennet, C. Fung, A. Chang, S. U. Park, M. Kajino, M. Amann. (2006, Companion paper). Model Intercomparison Study of Chemical Transport Models for East Asia (MICS-Asia): Particulate Sulfate, Nitrate and Ammonium. *Atmos. Env.*, 42(15), 3510-3527, 2008.
247. Holloway, T., T. Sakurai, Z. Han, and others, MICS-Asia II: Impact of Global Emissions on Regional Air Quality in Asia, *Atmos. Env.*, 42(15), 3543-3561, 2008.
248. Wang, Z. and others, Model Inter-comparison and Evaluation of Acid Deposition in MICS-Asia II, *Atmos. Env.*, 42(15), 3528-3542, 2008.
249. Carmichael, G.R., et al. . MICS-Asia II: The Model Intercomparison Study for Asia Phase II, Methodology and Overview of Findings. *Atmos. Env.*, 42(15), 3468-3490, 2008.
250. Pan, L., G.R. Carmichael, B. Adhikary, Y. Tang, D. Streets, J-H. Woo, H.R. Friedli, and L.F. Radke, A Regional Analysis of the Fate and Transport of Mercury in East Asia and an Assessment of Major Uncertainties, *Atmos. Env.*, 42(6), 1144-1159, 2008.
251. Adhikary, B., S. Kulkarni, A. D'allura, Y. Tang, T. Chai, L. R. Leung, Y. Qian, C. E. Chung, V. Ramanathan, and G. R. Carmichael, A regional scale chemical transport modeling of Asian aerosols with data assimilation of AOD observations using optimal interpolation technique, *Atmos. Env.*, 42(37), 8600-8615, 2008.
252. Zhang, L., E.M. Constantinescu, A. Sandu, Y. Tang, T. Chai, G.R. Carmichael, D. Byun, E. Olaguer, An Adjoint Sensitivity Analysis and 4D-Var Data Assimilation Study of Texas Air Quality, *Atmos. Environ.*, 42(23), 5787-5804, 2008.
253. Constantinescu, E., A. Sandu, and G. Carmichael, Modeling Atmospheric Chemistry and Transport with Dynamic Adaptive Resolution, *Computational Geosciences*, 12, 133-151, 2008.
254. Ramanathan, V., G. Carmichael, Global and regional climate changes due to black carbon, *Nature Geoscience*, 1, 221-227, 2008.
255. Sandu, A., E.M. Constantinescu, G.R. Carmichael, T. Chai, D. Daescu, and J.H. Seinfeld, Ensemble Methods for Dynamic Data Assimilation of Chemical Observations in Atmospheric Models, *J Applications and Computational Technology*, special DDDAS issue, September 2007.
256. McKeen, S., G. Grell, S. Peckham, J. Wilczak, I. Djalaloval, E.Y. Hsiel, G. Frost, J. Peischl, J. Schwarz, R. Spackman, J. Holloway, J. deGouw, C. Warneke, W. Gong, V. Bouchet, S. Gaudreault, J. Racine, J. McHenry, J. McQueen, P. Lee, Y. Tang, G.R. Carmichael, R. Mathur, An Evaluation of real-time air quality forecasts and their urban emissions over Eastern Texas during the summer of 2006 TexAQS field study, *J. Geophys. Res.*, 2008JD011697.
257. Campbell, J.E., G.R. Carmichael, T. Chai, et al., Photosynthetic control of atmospheric carbonyl sulfide during the growing season, *Science*, 322(5904), 1085-1088, 2008.
258. Carmichael, G.R., H. Ueda, MICS-Asia II: The model intercomparison study for Asia phase II, *Atmos. Environ.*, 42(15), 3465-3467, 2008.

259. Carmichael, G.R., A. Sandu, T. Chai, D.N. Daescu, E.M. Constantinescu, and Y. Tang, Predicting air quality: Improvements through advanced methods to integrate models and measurements, *J. Comput Phys.* 227(7), 3540-3571, doi:10.1016/j.jcp.2007.02.024, 2008.

2009

260. Chai, T., G. Carmichael, Y. Tang, and A. Sandu, Regional NO₂ emission inversion through four-dimensional variational approach using Sciamachy tropospheric column observations, *Atmos. Environ.*, 43, 5046-5055, 2009.
261. Zhang, Q., D.G. Streets, G.R. Carmichael, K. He, H. Huo, A. Kannari, Z. Klimont, I. Park, S. Reddy, J.S. Fu, D. Chen, L. Duan, Y. Lei, L. Wang, and Z. Yaoet, Asian emissions in 2006 for the NASA INTEX-B mission, *Atmos. Chem. Phys.* 14, 5131-5153, 2009.
262. Mena-Carrasco, M., G.R. Carmichael, J.E. Campbell, D. Zimmerman, Y. Tang, B. Adhikary, A. D'Allura, L.T. Molina, M. Zavala, A. Garcia, F. Flocke, T. Campos, A.J. Weinheimer, R. Shetter, E. Apel, D.D. Montzka, D.J. Knapp, and W. Zheng, Assessing the regional impacts of Mexico City emissions on air quality and chemistry, *Atmos. Chem. Phys.*, 9, 1-13, 2009.
263. Stith, J.L. V. Ramanathan, W.A. Cooper, G.R. Carmichael, et al., An overview of aircraft observations from the Pacific Dust Experiment campaign, *J Geophys. Res.*, 114, D05207, 2009.
264. Fiore, A.M., Dentener, F.J., O. Wild, G.R. Carmichael, et al., Multimodel estimates of intercontinental source-receptor relationships for ozone pollution, *J Geophys Res.*, 114, D04301, 2009.
265. Carmichael, G.R., B. Adhikary, S. Kulkarni, A. D'Allura, Y. Tang, D. Streets, Q. Zhang, T.C. Bond, V. Ramanathan, A. Jamroensan, P. Marrapu, Asian Aerosols: Current and Year 2030 distributions and implications to human health and regional climate change, *Env Sci. Tech.*, 43, 5811 -5817, 2009.
266. Carmichael, G. R.)¹, Adhikary B, Kulkarni S. Streets D, Zhang Q, Asian aerosols: Current and future distributions and implications to air quality and regional climate change, *GEOCHIMICA ET COSMOCHIMICA ACTA* ,73, A193-A193, 2009.
267. McKeen S, Grell G, Peckham S, Wilczak J, Djalalova I, Hsie EY, Frost G, Peischl J, Schwarz J, Spackman R, Holloway J, de Gouw J, Warneke C, Gong W, Bouchet V, Gaudreault S, Racine J, McHenry J, McQueen J, Lee P, Tang Y, Carmichael GR, Mathur R, An evaluation of real-time air quality forecasts and their urban emissions over eastern Texas during the summer of 2006 Second Texas Air Quality Study field study, *JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES* , 114, D00F11, 2009.

2010

268. Adhikary, B., Carmichael, G. R., Kulkarni, S., Wei, C., Tang, Y., D'Allura, A., Mena-Carrasco, M., Streets, D. G., Zhang, Q., Pierce⁴, R. B., Al-Saadi, J. A., Emmons, L. K., Pfister, G. G., Avery, M. A., Barrick, J. D., Blake, D. R., Brune, W. H., Cohen, R. C., Dibb, J. E., Fried, A., Heikes, B. G., Huey, L. G., O'Sullivan, D. W., Sachse, G.W., Shetter, R. E., Singh, H. B., Campos, T. L., Cantrell, C. A., Flocke, F. M., Dunlea, E. J., Jimenez, J. L., Weinheimer, A. J., Crouse, J. D., Wennberg, P. O., Schauer, J. J., Stone, E. A., Jaffe, D. A., and Reidmiller, D. R.: A regional scale modeling analysis of aerosol and trace gas distributions over the

- eastern Pacific during the INTEX-B field campaign, *Atmos. Chem. Phys.*, 10, 2091–2115, 2010.
269. Chung, C-E, V. Ramanathan, G. Carmichael, Y. Tang, B. Adhikary, L. R. Leung and Y. Qian, Anthropogenic aerosol radiative forcing in Asia derived from regional models with atmospheric and aerosol data assimilation, *Atmos. Chem. Phys.*, 10: 6007-6024, 2010.
270. Huang, M., G. R. Carmichael, B. Adhikary, S. Spak, S. Kulkarni, Y. Cheng, C. Wei, Y. Tang, D. Parrish, S. Oltmans, A. D'Allura, A. Kaduwela, C. Cai, A. Weinheimer, M. Wong, R. B. Pierce, J. A. Al-Saadi, D. Streets, Q. Zhang, Impacts of transported background O₃ on California air quality during the ARCTAS-CARB period --A multi-scale modeling study, *Atmos. Chem. & Phys.*, 10: 6947-6968, 2010
271. Lu, Z., D.G. Streets, Q. Zhang, S. Wang, G.R. Carmichael, Y.F. Cheng, C. Wei, M. Chin, T.L. Kucsera, Sulfur dioxide emissions in China and sulfur trends in East Asia since 2000, *Atmos. Chem. & Phys.*, 10; 6311-6331, 2010.
272. Ramana, M., V. Ramanathan, Y. Feng, S-C Yoon, S-W Kim, G R Carmichael, and J J Schauer, Warming influenced by black carbon to sulfate ratio and black carbon source, *Nature Geoscience*, 3; 542-545, 2010.
273. Lin, M., T. Holloway, G. Carmichael, A. M. Fiore, Quantifying pollution inflow and outflow 1 over East Asia in spring with regional and global models *Atmospheric Chemistry and Physics*, 10: 4221-4239, 2010.
274. Navea, J.G.; Chen, H.; Huang, M.; Carmichael, G.R.; Grassian, V.H. "A Comparative Evaluation of Water Uptake on Several Mineral Dust Sources" *Environmental Chemistry*, 7, 162. <http://dx.doi.org/10.1071/EN09122>, 2010
275. Fu, H.; Cwiertny, D.; Carmichael, G.R.; Scherer, M.; Grassian, V.H. "Photoreductive Dissolution of Fe-Containing Mineral Dust Particles in Acidic Media" *J. Geophys. Res.*, 115: D11304, 2010.
276. Pan, L, C. Lin, and G. Carmichael, Study of atmospheric mercury budget in East Asia using STEM-Hg modeling system, *SCIENCE OF THE TOTAL ENVIRONMENT*, 408: 3277-3291, 2010.

2011

277. Rubasinghe, G. S. Spak, C. Stanier, G. Carmichael, and V. Grassian, Abiotic Mechanism for the Formation of Atmospheric Nitrous Oxide from Ammonium Nitrate, *ES&T*, dx.doi.org/10.1021/es103295v, 2011.
278. Huang, M., G. Carmichael, S. Spak, B. Adhikary, S. Kulkarni, Y. Cheng, C. Wei, Y. Tang, A. D'Allura, P. Wennberg, G. Huey, J. Dibb, J. Jimenez, M. Cubison, A. Weinheimer, A. Kaduwela, C. Cai, M. Wong, R. Pierce, J. Al-Saadi, D. Streets, Q. Zhang, Multi-scale modeling study of the source contributions to near-surface ozone and sulfur oxides levels over California during the ARCTAS-CARB period, *ACP*, acp-2010-815, 2011
279. Saide, P.E., G. Carmichael, S. Spak, L. Gallardo, A. Osses, M. Mena-Carrasco, M Pagowski, Forecasting urban PM₁₀ and PM_{2.5} pollution episodes in very stable nocturnal conditions and complex terrain using WRFeChem CO tracer model, *Atmospheric Environment* (2011), doi:10.1016/j.atmosenv.2011.02.001.
280. D'Allura, A., S. Kulkarni, G. Carmichael, S. Finardi, B. Adhikary, C. Wei, D. Streets, Q. Zhang, R. Pierce, J. Al-Saadi, G. Diskin, Paul Wennberg, Meteorological and air quality forecasting products using WRF-STEM model during the 2008 ARCTAS field campaign, *Atmos. Environ.*, 2011.

281. Harrigan, D., H. E. Fuelberg, I. Simpson, D. Blake, G. Carmichael, and G. Diskin, Anthropogenic emissions during Arctas-A: mean transport characteristics and regional case studies, *Atmos. Chem. Phys.*, 11, 8677-8701, 2011
282. Li, P.; Lin Che-Jen; Carmichael Gregory R.; et al. Study of atmospheric mercury budget in East Asia using STEM-Hg modeling system *SCIENCE OF THE TOTAL ENVIRONMENT* Volume: 408 Issue: 16 Pages: 3277-3291.
283. Fu H.; Cwiertny David M.; Carmichael Gregory R.; et al. Photoreductive dissolution of Fe-containing mineral dust particles in acidic media *JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES* Volume: 115 D11304 DOI: 10.1029/2009JD012702.
284. Miller-Schulze Justin P.; Shafer Martin M.; Schauer James J., G. Carmichael Title: Characteristics of fine particle carbonaceous aerosol at two remote sites in Central Asia, *ATMOSPHERIC ENVIRONMENT* Volume: 45 Issue: 38 Pages: 6955-6964 DOI: 10.1016/j.atmosenv.2011.09.026

2012

285. Saide, P., S. N. Spak, G. R. Carmichael, M. A. Mena-Carrasco, S. Howell, D. C. Leon, J. R. Snider, A. R. Bandy, J. L. Collett, K. B. Benedict, S. P. de Szoeko, L. N. Hawkins, G. Allen, I. Crawford, J. Crosier, and S. R. Springston, Evaluating WRF-Chem aerosol indirect effects in Southeast Pacific marine stratocumulus during VOCALS-Rex, *ACP*, 12, 3045-3064, 2012.
286. Tsao, C.-C., Campbell, J.E., Mena-Carrasco, M., Spak, S.N., Carmichael, G.R., Chen, Y. Increased Estimates of Air Pollution Emissions from Brazilian Sugarcane Ethanol, *Nature Climate Change*, 53-5, 2012
287. Huang, M., G. Carmichael, S. Kulkarni, D. Streets, Z. Lu, Q. Zhang, R. B. Pierce, Y. Kondo, J. Jimenez, M. Cubison, B. Anderson, A. Wisthaler, Sectoral and geographical contributions to summertime continental United States (CONUS) black carbon spatial distributions, *Atmos. Environ.* <http://dx.doi.org/10.1016/j.atmosenv.2012.01.021>
288. Sandu, A., E.M. Constantinescu, G.R. Carmichael, T. Chai, D. Daescu, and J.H. Seinfeld: "Ensemble Methods for Dynamic Data Assimilation of Chemical Observations in Atmospheric Models". *Journal of Algorithms and Computational Technology*, Vol. 5, No. 4, DDDAS issue, pp. 667--692, 2011
289. Cheng, Y. F., H. Su, D. Rose, S. S. Gunthe, M. Berghof, B. Wehner, P. Achtert, A. Nowak, N. Takegawa, Y. Kondo, M. Shiraiwa, Y. G. Gong, M. Shao, M. Hu, T. Zhu, Y. H. Zhang, G. R. Carmichael, A. Wiedensohler, M. O. Andreae, and U. Pöschl, Size-resolved measurement of the mixing state of soot in the megacity Beijing, China: diurnal cycle, aging and parameterization, *Atmos. Chem. Phys.*, 12, 4477-4491, 2012
290. Yu, M., G. Carmichael, T. Zhu, Y. Cheng, Sensitivity of predicted pollutant levels to urbanization in China, *Atmos. Env.*, 60, p 544-554 DOI: 10.1016/j.atmosenv.2012.06.075, 2012
291. Fu, Hongbo; Lin, Jun; Shang, Guanfeng; Wenbo Dong, Vichi H. Grassian, Gregory R. Carmichael, Yan Li, and Jianmin Chen: Solubility of Iron from Combustion Source Particles in Acidic Media Linked to Iron Speciation, *ES&T*, 46, P. 11119-11127 DOI: 10.1021/es302558m, 2012
292. Tsao, C., J. E. Campbell, M. Mena-Carrasco, S. N. Spak, G. R. Carmichael, and Y. Chen, Biofuels That Cause Land-Use Change May Have Much Larger Non-GHG Air Quality Emissions Than Fossil Fuels, *ES&T*, 46, p. 11119-11127, 2012

293. Saide, P., Gregory R. Carmichael, Scott N. Spak, Patrick Minnis, and J. Kirk Ayers, Improving aerosol distributions below clouds by assimilating satellite-retrieved cloud droplet number, *PNAS*, 109 , P. 11939-11943, 2012
294. Worden, H., Yafang Cheng, Gabriele Pfister, Gregory R. Carmichael, Qiang Zhang, David G. Streets, Merritt Deeter, David P. Edwards, John C. Gille, John R. Worden, Satellite-based estimates of reduced CO and CO₂ emissions due to traffic restrictions during the 2008 Beijing Olympics, *Geophys. Res. Lett.*, 39 , DOI: 10.1029/2012GL052395, 2012
295. Stanier, C., A. Singh, W. Adamski, J. Baek, M. Caughey, G. Carmichael, E. Edgerton, D. Kenski, M. Koerber, J. Oleson, T. Rohlf, S. R. Lee, N. Riemer, S. Shaw, S. Sousan, and S. N. Spak, Overview of the LADCO winter nitrate study: hourly ammonia, nitric acid and PM_{2.5} composition at an urban and rural site pair during PM_{2.5} episodes in the US Great Lakes region, *Atmos. Chem. Phys.*, 12, 11037-11056, 2012

2013

300. Huang, M., G. R. Carmichael, T. Chai, R. B. Pierce, S. J. Oltmans, D. A. Jaffe, K. W. Bowman, A. Kaduwela, C. Cai, S. N. Spak, A. J. Weinheimer, L. G. Huey, and G. S. Diskin, Impacts of transported background pollutants on summertime western US air quality: model evaluation, sensitivity analysis and data assimilation, *Atmos. Chem. Phys.*, 13, 359–391, 2013.
301. von Glasow, R.; Jickells, Tim D.; Baklanov, Alexander, Gregory R. Carmichael, Tom M. Church, Laura Gallardo, Claire Hughes, Maria Kanakidou, Peter S. Liss, Laurence Mee, Robin Raine, Purvaja Ramachandran, R. Ramesh, Kyrre Sundseth, Urumu Tsunogai, Mitsuo Uematsu, Tong Zhu, Megacities and Large Urban Agglomerations in the Coastal Zone: Interactions Between Atmosphere, Land, and Marine Ecosystems , *AMBIO* , 42, 13-28 DOI: 10.1007/s13280-012-0343-9, 2013
302. Streets, D., T. Canty, G. Carmichael, B. de Foy, R. Dickerson,, B. Duncan, D. Edwards, J. Haynes, D. Henze, M. Houyoux, D. Jacob, N. Krotkov, L. Lamsal, Y. Liu, Z. Lu, R. Martin, . Pfister, R. Pinder, R. Salawitch, and K. Wecht, Emissions estimation from satellite retrievals: A review of current capability, *Atmos. Environ.*, May 2013.
303. Wang, X., Liu, H., Pang, J., Carmichael, G., He, K., Fan, Q., Zhong, L., Wu, Z., Zhang, J., Reductions in sulfur pollution in the Pearl River Delta region, China: Assessing the effectiveness of emission controls, *Atmospheric Environment* (2013), doi: 10.1016/j.atmosenv.2013.04.074.
304. Huang, Min; Bowman, Kevin W.; Carmichael, G. R.; et al., Impact of Southern California anthropogenic emissions on ozone pollution in the mountain states: Model analysis and observational evidence from space *JOURNAL OF*

305. Petrich, Nicholas T.; Spak, Scott N.; Carmichael, G. R.; et al., Simulating and Explaining Passive Air Sampling Rates for Semivolatile Compounds on Polyurethane Foam Passive Samplers, *ENVIRONMENTAL SCIENCE & TECHNOLOGY* Volume: 47 Issue: 15 Pages: 8591-8598 Published: AUG 6 2013
306. Chen, Boris B.; Sverdlik, Leonid G.; Imashev, Sanjar A.; Carmichael, G. et al., Empirical relationship between particulate matter and aerosol optical depth over Northern Tien-Shan, Central Asia, *AIR QUALITY ATMOSPHERE AND HEALTH* Volume: 6 Issue: 2 Pages: 385-396 Published: JUN 2013
307. Chen, Boris B.; Imashev, Sanjar A.; Sverdlik, Leonid G.; Carmichael G., et al., Ozone Variations over Central Tien-Shan in Central Asia and Implications for Regional Emissions Reduction Strategies, *AEROSOL AND AIR QUALITY RESEARCH* Volume: 13 Issue: 2 Pages: 555-562 Published: APR 2013
308. Saide, P. E. Carmichael, G. R.; Liu, Z.; et al., Aerosol optical depth assimilation for a size-resolved sectional model: impacts of observationally constrained, multi-wavelength and fine mode retrievals on regional scale analyses and forecasts, *ATMOSPHERIC CHEMISTRY AND PHYSICS* Volume: 13 Issue: 20 Pages: 10425-10444 Published: 2013

2014

309. Yu, Man; Carmichael, Gregory R.; Zhu, Tong; et al. Sensitivity of predicted pollutant levels to anthropogenic heat emissions in Beijing, *ATMOSPHERIC ENVIRONMENT* Volume: 89 Pages: 169-178 Published: JUN 2014
310. Lapina, Kateryna; Henze, Daven K.; Milford, Jana B.; Carmichael, G., et al., Assessment of source contributions to seasonal vegetative exposure to ozone in the US, *JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES* Volume: 119 Issue: 1 Pages: 324-340 Published: JAN 16 2014
311. Kim, Y.J., S.N. Spak, G.R. Carmichael, N. Riemer, C.O. Stanier (2014). Modeled aerosol nitrate formation pathways during wintertime episodes in the Great Lakes region of North America. *Journal of Geophysical Research-Atmospheres* 119, 12,420–12,445, doi: 10.1002/2014JD022320.
312. Nordmann S., Y. F. Cheng, G. R. Carmichael, M. Yu, H. A. C. Denier van der Gon, Q. Zhang, P. E. Saide, U. Pöschl, H. Su, W. Birmili, and A. Wiedensohler, Atmospheric black carbon and warming effects influenced by the source and absorption enhancement in central Europe, *Atmos. Chem. Phys.*, 14, 12683–12699, 2014
313. Park, M. E.; Song, C. H.; Park, R. S., Carmichael, G., et al., New approach to monitor transboundary particulate pollution over Northeast Asia, *ATMOSPHERIC CHEMISTRY AND PHYSICS* Volume: 14 Issue: 2 Pages:

314. Baklanov, A.; Schluenzen, K.; Suppan, P.; Carmichael, G, et al. Online coupled regional meteorology chemistry models in Europe: current status and prospects, *ATMOSPHERIC CHEMISTRY AND PHYSICS* Volume: 14 Issue: 1 Pages: 317-398 Published: 2014
315. Amnuaylojaroen, T; Barth, MC; Emmons, LK; Carmichael, G., Kreasuwun, J (Kreasuwun, J.); Chantara, S, Effect of different emission inventories on modeled ozone and carbon monoxide in Southeast Asia, *ATMOSPHERIC CHEMISTRY AND PHYSICS*, 14, 12983-13012, 2014
316. Kumar, R; Barth, MC; Madronich, S; Naja, M; Carmichael G.; Pfister, GG ; Knote, C; Brasseur, GP; Ojha, N ; Sarangi, T, Effects of dust aerosols on tropospheric chemistry during a typical pre-monsoon season dust storm in northern India, *ATMOSPHERIC CHEMISTRY AND PHYSICS*, 14, 6813-6834, 2014
317. Huang, Min; Bowman, Kevin W.; Carmichael, Gregory R , Changes in nitrogen oxides emissions in California during 2005-2010 indicated from top-down and bottom-up emission estimates , *JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES*, 119, 12928-12952, 2014

Saide, P., J. Kim, C.H. Song, M. Choi, Y. Cheng, G.R. Carmichael **Assimilation of next generation geostationary aerosol optical depth retrievals to improve air quality simulations**
Geophys. Res. Lett., 41 (2014), pp. 9188-9196, [10.1002/2014gl062089](https://doi.org/10.1002/2014gl062089)

2015

318. Saide, P.E., S.N. Spak, R.B. Pierce, J.A. Otkin, T. Schaack, A. Heidinger, A. M. da Silva, M. Kacenelenbogen, J. Redemann, G.R. Carmichael (2015). Central American biomass burning smoke can increase tornado severity in the US, *Geophysical Research Letters* 42, doi: 10.1002/2014GL062826.
319. Kulkarni S., N. Sobhani, J. P. Miller-Schulze, M. M. Shafer, J. J. Schauer, P. A. Solomon, P. E. Saide, S. N. Spak, Y. F. Cheng, H. A. C. Denier van der Gon, Z. Lu, D. G. Streets, G. Janssens-Maenhout, C. Wiedinmyer, J. Lantz, M. Artamonova, B. Chen, S. Imashev, L. Sverdlik, J. T. Deminter, B. Adhikary, A. D'Allura, C. Wei, and G. R. Carmichael, Source sector and region contributions to BC and PM_{2.5} in Central Asia, *Atmos. Chem. Phys.*, 15, 1683–1705, 2015
320. Gao, M, Guttikunda SK, Carmichael GR, Wang Y, Liu Z, Stanier CO, Saide PE, Yu M5, Health impacts and economic losses assessment of the 2013 severe haze event in Beijing area. *Sci Total Environ.* 2015 Apr 1;511:553-61. doi: 10.1016/j.scitotenv.2015.01.005. Epub 2015 Jan 10
321. Wyant, MC; Bretherton, CS; Wood, R; Carmichael, G., Clarke, A; Fast, J , George, R; Gustafson, WI; Hannay, C ; Lauer, A and regional modeling of clouds and aerosols in the marine boundary layer during VOCALS: the VOCA

- intercomparison, *ATMOSPHERIC CHEMISTRY AND PHYSICS*, 15, 153-172, 2015
322. Martinez A, Spak SN, Petrich NT, Hu D, Carmichael GR, Hornbuckle KC. Atmospheric dispersion of PCB from a contaminated Lake Michigan harbor, *ATMOSPHERIC ENVIRONMENT*, 122, 791-798, 2015
323. Feng, F.; Wang, Z.; Li, j., Carmichael, G, A nonnegativity preserved efficient algorithm for atmospheric chemical kinetic equations, *APPLIED MATHEMATICS AND COMPUTATION*, 271, 519-531, 2015
324. Turner, M., DavenKHenze, Shannon L Capps, Amir Hakami, Shunliu Zhao, Jaroslav Resler, GregoryR Carmichael, CharlesOStanier, Jaemeen Baek, Adrian Sandu, ArmisteadGRussell, Athanasios Nenes, RobWPinder, Sergey L Napelenok, JesseOBash, Peter B Percell, and Tianfeng Chai, Premature deaths attributed to source-specific BC emissions in six urban US regions *ENVIRONMENTAL RESEARCH LETTERS*, 10, 2015
325. Dewan, N., Brian J. Majestic, Michael E. Ketterer, Justin P. Miller-Schulze, Martin M. Shafer, James J. Schauer, Paul A. Solomon, Maria Artamonova, Boris B. Chen, Sanjar A. Imashev, Greg R. Carmichael, Stable isotopes of lead and strontium as tracers of sources of airborne particulate matter in Kyrgyzstan , *ATMOSPHERIC ENVIRONMENT*, 120, 438-446 , 2015
326. Miller-Schulze, J., M. M. Shafer, J. J. Schauer; J. Heo, P. A. Solomon, M. Artamonova, J. Lantz; S. Imashev, L. Sverdlik, G. Carmichael, and J. DeMinter, . Seasonal Contribution of Mineral Dust and Other Major Components to Particulate Matter at Two Remote Sites in Central Asia. *Atmospheric Environment*. 119, 11-20, 2015
327. Saide, P. E., D. A. Peterson, A. da Silva, B. Anderson, L. D. Ziemba, G. S. Diskin, G. Sachse, J. Hair, C. Butler, M. A. Fenn, J. L. Jimenez, P. Campuzano-Jost, A. Perring, J. Schwarz, M. Markovic, P. Russell, J. Redemann, Y. Shinozuka, D. Streets, F. Yan, J. Dibb, R. Yokelson, O. B. Toon, E. Hyer, and G. Carmichael, Revealing important nocturnal and day-to-day variations in fire smoke emissions through a multiplatform inversion, *GEOPHYSICAL RESEARCH LETTERS*, 42, 3609-3618, 2015
328. Huang, Min; Bowman, Kevin W.; Carmichael, Gregory R , Improved western US background ozone estimates via constraining nonlocal and local source contributions using Aura TES and OMI observations , *JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES* 120 , 3572-3592 , 2015
329. Lu Z, Streets DG, Winijkul E, Yan F, Chen Y, Bond TC, Feng Y, Dubey MK, Liu S, Pinto JP, Carmichael GR. Light Absorption Properties and Radiative Effects of Primary Organic Aerosol Emissions, *ENVIRONMENTAL SCIENCE & TECHNOLOGY*, 49 , 4868-4877 , 2015
330. Turner MD; Henze DK; Hakami A; Zhao S; Resler J; Carmichael GR; Stanier CO; Baek J; Sandu A; Russell AG; Nenes A; Jeong GR; Capps SL; Percell PB; Pinder RW; Napelenok SL; Bash JO; Chai , Differences Between Magnitudes and Health Impacts of BC Emissions Across the United States Using 12 km Scale Seasonal Source Apportionment , *ENVIRONMENTAL SCIENCE & TECHNOLOGY* , 49 , 4362-4371 2015

331. Bocquet, M., H. Elbern, H. Eskes, M. Hirtl, R. Žabkar, G. R. Carmichael, J. Flemming, A. Inness, M. Pagowski, J. L. Pérez Camaño, P. E. Saide, R. San Jose, M. Sofiev, J. Vira, A. Baklanov, C. Carnevale, G. Grell, and C. Seigneur, Data assimilation in atmospheric chemistry models: current status and future prospects for coupled chemistry meteorology models , *ATMOSPHERIC CHEMISTRY AND PHYSICS* , 15 , 5325-5358 , 2015
332. Kumar, R., M. C. Barth, V. S. Nair, G. G. Pfister, S. Suresh Babu, S. K. Satheesh, K. Krishna Moorthy, G. R. Carmichael, Z. Lu, and D. G. Streets, Sources of black carbon aerosols in South Asia and surrounding regions during the Integrated Campaign for Aerosols, Gases and Radiation Budget (ICARB) , *ATMOSPHERIC CHEMISTRY AND PHYSICS* 15, 5415-5428, 2015

2016

333. Saide, P., Mena-Carrasco, M., Tolvett, S., Hernandez, P., Carmichael, G. Air quality forecasting for winter-time PM_{2.5} episodes occurring in multiple cities in central and southern Chile , *JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES* 121, : 558-575, 2016
334. Sadavarte, P., C. Venkataraman, R. Cherian, N. Patil, B.L. Madhavan, T. Gupta, S. Kulkarni, G.R. Carmichael, B. Adhikary, Seasonal differences in aerosol abundance and radiative forcing in months of contrasting emissions and rainfall over northern South Asia , *ATMOSPHERIC ENVIRONMENT* , 125, 512-523, 2016
335. Gao, M., G. R. Carmichael, Y. Wang, P. E. Saide, M. Yu, J. Xin, Z. Liu, and Z. Wang, Modeling study of the 2010 regional haze event in the North China Plain, *Atmos. Chem. Phys.*, 16, 1673-1691, 2016
337. Saide, Pablo E.; Thompson, G.; Eidhammer, T., and G. Carmichael, Assessment of biomass burning smoke influence on environmental conditions for multiyear tornado outbreaks by combining aerosol-aware microphysics and fire emission constraints, *JGR*, 17, 10294-10311, 2016.
336. West, J. Jason; Cohen, Aaron; Dentener, Frank, Carmichael, G. et al., “What We Breathe Impacts Our Health: Improving Understanding of the Link between Air Pollution and Health”, *ES&T*, 50, 4895-4904, 2016.
337. Sadavarte, P.; Venkataraman, C., Cherian, R., Carmichael G., et al., Seasonal differences in aerosol abundance and radiative forcing in months of contrasting emissions and rainfall over northern South Asia, *Atmos. Environ.*, 125, 512-523, 2016.
338. M. Li, Q. Zhang, J. Kurokawa, J.-H. Woo, K. B. He, Z. Lu, T. Ohara, Y. Song, D. G. Streets, G. R. Carmichael, Y. F. Cheng, C. P. Hong, H. Huo, X. J. Jiang, S. C. Kang, F. Liu, H. Su, and B. Zheng, MIX: a mosaic Asian anthropogenic emission inventory for the MICS-Asia and the HTAP projects, *Atmos. Chem. Phys.*, 15, 34813-34869, doi:10.5194/acpd-15-34813-2015, 2015

339. Cheng, Y., Zheng, G., Qing, W., Zheng, B., Gao, M., Zhang, Q., He, K., Carmichael, G., Poschl, U., and Su, H., Reactive nitrogen chemistry in aerosol water as a source of sulfate during haze events in China, *Science Advances* 21, Vol. 2, no. 12, e1601530, DOI: 10.1126/sciadv.1601530, Dec 2016.
340. Gao, M., G. Carmichael, Y. Wang, D. Ji, Z. Liu, and Z. Wang, Improving simulations of sulfate aerosols during winter haze over Northern China: the impacts of heterogeneous oxidation by NO₂, *Frontiers of Environmental Science & Engineering*, 10: 16. doi:10.1007/s11783-016-0878-2, 2016.
341. Gao, M., Carmichael, G. R., Saide, P. E., Lu, Z., Yu, M., Streets, D. G., and Wang, Z.: Response of winter fine particulate matter concentrations emission and meteorology changes in North China, *Atmos. Chem. Phys.*, 16, 11837-11851, 2016b.

2017

342. Gao, M., Saide, P.E., Xin, J., Wang, Y., Liu, Z., Wang, Z., Pagowski, M., Guttikunda, S., and Carmichael, G.R. Reduced Uncertainties in Health Impacts and Radiative Forcing Estimates in Winter Haze in eastern China through constraints of surface PM_{2.5} predictions. *ES&T*, 2017.
343. Marrapu, P., Y. Cheng, G. Beig, S. Sahu, R. Srinivas, and G. R. Carmichael, Air quality in Delhi during the Commonwealth Games, *Atmos. Chem. Phys.*, 14, 10619-10630, 2014
344. Galmarini, S ; Koffi, B ; Solazzo, E ; Keating, T ; Hogrefe, C ; Schulz, M ; Benedictow, A ; Griesfeller, JJ ; Janssens-Maenhout, G ; Carmichael, G. Technical note: Coordination and harmonization of the multi-scale, multi-model activities HTAP2, AQMEII3, and MICS-Asia3: simulations, emission inventories, boundary conditions, and model output formats, *ATMOSPHERIC CHEMISTRY AND PHYSICS*, 17, 1543-1555, 2017
345. Li, M ; Zhang, Q ; Kurokawa, J ; Woo, JH ; He, KB Lu, ZF ; Ohara, T, Song, Y ; Streets, DG ; Carmichael, GR , MIX: a mosaic Asian anthropogenic emission inventory under the international collaboration framework of the MICS-Asia and HTAP, *ATMOSPHERIC CHEMISTRY AND PHYSICS*, 17, 935-963, 2017
346. Huang, H., Gregory R. Carmichael, R. Bradley Pierce, Duseong S. Jo, Rokjin J. Park, Johannes Flemming, Louisa K. Emmons, Kevin W. Bowman, Daven K. Henze, Yanko Davila, Kengo Sudo, Jan Eiof Jonson, Marianne Tronstad Lund, Greet Janssens-Maenhout, Frank J. Dentener, Terry J. Keating, Hilke Oetjen, and Vivienne H. Payne: Impact of Intercontinental Pollution Transport on North American Ozone Air Pollution: An HTAP Phase II Multi-model Study, *ACP*, in press 2017
347. Galmarini, S¹ ; Koffi, B ; Solazzo, E ; Keating, T ; Hogrefe, C ; Schulz, M Benedictow, A ; Griesfeller, JJ ; Janssens-Maenhout, G ; Carmichael, G, Technical note: Coordination and harmonization of the multi-scale, multi-model activities HTAP2, AQMEII3, and MICS-Asia3: simulations, emission inventories, boundary conditions, and model output formats, *ATMOSPHERIC CHEMISTRY AND PHYSICS*, 17: 1543-1555, 2017

- 348 Baklanov, A., D. Brunner, G. Carmichael, J. Flemming, S. Freitas, M. Gauss, Hov, R. Mathur, K. Schlünzen, C. Seigneur, and B. Vogel, 2017: Key issues for seamless integrated chemistry-meteorology modeling. *Bull. Amer. Meteor. Soc.* doi:10.1175/BAMS-D-15-00166.1, in press.
- 349 Hov, O; Terblanche, D., Carmichael G., Jones, S; Ruti, PM; Tarasova, O , Five priorities for weather and climate research *NATURE* , 552, 168-170 , 2017
- 350 Gao, M; Liu, ZR; Wang, YS; Lu, X; Ji, DS; Wang, LL; Li, M; Wang, ZF; Zhang, Q; Carmichael, GR , Distinguishing the roles of meteorology, emission control measures, regional transport, and co-benefits of reduced aerosol feedbacks in "APEC Blue" ,*ATMOSPHERIC ENVIRONMENT*, 167, 476-486, 2017
- 351 Liang, FC; Gao, M; Xiao, QY; Carmichael, GR ; Pan, XC; Liu, Y, Evaluation of a data fusion approach to estimate daily PM_{2.5} levels in North China, *ENVIRONMENTAL RESEARCH*, 158 , 54-60 . 2017
- 352 Huang, M; Carmichael, GR; Crawford, JH ; Wisthaler, A¹; Zhan, XW ; Hain, CR ; Lee, P; Guenther, AB Biogenic isoprene emissions driven by regional weather predictions using different initialization methods: case studies during the SEAC(4)RS and DISCOVER-AQ airborne campaigns, *GEOSCIENTIFIC MODEL DEVELOPMENT* 10 , 3085-3104, 2017

2018

353. Meng Gao. Carmichael, G., Air Quality and Climate Change, Topic 3 of the Model Inter-Comparison Study for Asia Phase III (MICS-Asia III), Part I: overview and model evaluation, *ATMOSPHERIC CHEMISTRY AND PHYSICS*, accepted Feb., 2018
354. Sobhani, Negin; Kulkarni, Sarika; Carmichael G., Source sector and region contributions to black carbon and PM_{2.5} in the Arctic, *ACP*, 18, 18123-18148, 2018
355. Gao, Meng; Beig, Gufran; Song, Carmichael G., Shaojie; et al. The impact of power generation emissions on ambient PM_{2.5} pollution and human health in China and India , *Environmental International*, 121, 250-259, 2018
356. Abdi-Oskouei, Maryam; Pfister, Gabriele; Carmichael G., Flocke, Frank; et al., Impacts of physical parameterization on prediction of ethane concentrations for oil and gas emissions in WRF-Chem, *ACP*, 18, 16863-16883, 2018
358. Lennartson, Elizabeth M.; Wang, Jun; Carmichael G., Gu, Juping; et al., Diurnal variation of aerosol optical depth and PM_{2.5} in South Korea: a synthesis from AERONET, satellite (GOCI), KORUS-AQ observation, and the WRF-Chem model, *ACP.*, 18, 15125-15144, 2018
357. Huang, Min; Crawford, James H.; Carmichael, G., Diskin, Glenn S.; et al. Modeling Regional Pollution Transport Events During KORUS-AQ: Progress and Challenges in Improving Representation of Land-Atmosphere Feedbacks, *JGR*, 123, 10732-10756, 2018
358. Park, Changhyoun; Gerbig, Christoph; Carmichael G. Newman, Sally CO₂ Transport, Variability, and Budget over the Southern California Air Basin Using the High-Resolution WRF-VPRM Model during the CalNex 2010 Campaign, *Carmichael G.*, 57, 1337-1352 , 2018
359. Gao, Meng; Han, Zhiwei; Carmichael G., Liu, Zirui; et al., Air quality and climate change, Topic 3 of the Model Inter-Comparison Study for Asia Phase III

(MICS-Asia III) - Part 1: Overview and model evaluation, *ACP*, 18, 4859-4884, 2018

2019

360. Goldberg, Daniel L.; Saide, Pablo E.; Lamsal, Lok N.; Carmichael, G., et al. A top-down assessment using OMI NO₂ suggests an underestimate in the NO_x emissions inventory in Seoul, South Korea, during KORUS-AQ *ACP*, 19, 1801-1818, 2019
361. Saide PE, Kim J, Song CH, Choi M, Cheng Y, Carmichael GR. Assimilation of next generation geostationary aerosol optical depth retrievals to improve air quality simulations. *Geophysical Research Letters* [Internet]. 2014;41 (24) :9188–9196. Publisher's Version
362. Lyu, C., Shannon L Capps, Amir Hakami, Shunliu Zhao, Jaroslav Resler, Gregory R Carmichael, Adrian Sandu, Armistead G Russell, Tianfeng Chai and Daven K Henze , Elucidating emissions control strategies for ozone to protect human health and public welfare within the continental United States, *Environmental Research Letters*, Volume 14, 2019
363. Kong, L., Xiao Tang, Jiang Zhu, Zifa Wang, Joshua S. Fu, Xuemei Wang, Syuichi Itahashi, Kazuyo Yamaji, Tatsuya Nagashima, Hyo-Jung Lee, Cheol-Hee Kim, Chuan-Yao Lin, Lei Chen, Meigen Zhang, Zhining Tao, Jie Li, Mizuo Kajino, Hong Liao, Kengo Sudo, Yuesi Wang, Yuepeng Pan, Guiqian Tang, Meng Li, Qizhong Wu; Baozhu Ge, Gregory R. Carmichael, Evaluation and uncertainty investigation of the NO₂, CO and NH₃ modeling over China under the framework of MICS-Asia III, *Atmos. Chem. Phys.*, <https://doi.org/10.5194/acp-2018-1158>
364. Beig G., Reka Srinivas, Neha S.Parkhi G.R.Carmichael SiddharthaSingh Saroj K.Sahu AditiRathod SujitMaji , Anatomy of the winter 2017 air quality emergency in Delhi, *Science of The Total Environment*, Volume 681, 1 September 2019, Pages 305-311

2020

365. Ruti, P., O. Tarasova, G. Carmichael, Øystein Hov, Sarah C. Jones, Deon Terblanche, Research for Seamless Earth System Prediction BAMS, JAN. 2020
366. Tao, Z; Chin, Mi; Gao, M; Kucsera, T; Kim, D; Carmichael, G; et al. Evaluation of NU-WRF model performance on air quality simulation under various model resolutions – an investigation within the framework of MICS-Asia Phase III *Atmospheric Chemistry and Physics* (2020): 2319-2339. DOI:10.5194/acp-20-2319-2020
367. Meng G., ZiruiLiu,Bo Zheng, DongshengJi, Peter Sherman,Shaojie Song,Jinyuan Xin, Cheng Liu, Yuesi Wang, Qiang Zhang, Jia Xing, Jingkun Jiang, Zifa Wang, Gregory R.Carmichael, and Michael B. McElroy China's emission control strategies have suppressed unfavorable influences of climate on wintertimePM_{2.5} concentrations in Beijing since 2002 *Atmos. Chem. Phys.*, 20, 1497–1505, 2020
368. Huang, M. James H. Crawford Gregory R. Carmichael Joseph A. Santanello Sujay V. Kumar Ryan M. Stauffer Anne M. Thompson Andrew J. Weinheimer Jun

- Dong Park, Impact of Aerosols From Urban and Shipping Emission Sources on Terrestrial Carbon Uptake and Evapotranspiration: A Case Study in East Asia, JGR, 2020 <https://doi.org/10.1029/2019JD030818>
369. Kim, J., et al., New Era of Air Quality Monitoring from Space: Geostationary Environment Monitoring Spectrometer (GEMS) <https://doi.org/10.1175/BAMS-D-18-0013.1> BAMS Jan 2020
370. Goa, M., Zhiwei Han, Zhining, Tao, Jiawei Li, Jeong-Eon Kang, Kan Huang, Xinyi Dong, Bingliang Zhuang, Shu Li, Baozhu Ge, Qizhong Wu, Hyo-Jung Lee, Cheol-Hee Kim, Joshua S. Fu, Tijian Wang, Mian Chin, Meng Li, Jung-Hun Woo, Qiang Zhang, Yafang Cheng, Zifa Wang, and Gregory R. Carmichael, Air quality and climate change, Topic 3 of the Model Inter-Comparison Study for Asia Phase III (MICS-Asia III) – Part 2: aerosol radiative effects and aerosol feedbacks Atmos. Chem. Phys., 20, 1147–1161, 2020
371. Tan, J., Joshua S. Fu, Gregory R. Carmichael, Syuichi Itahashi, Zhining Tao, Kan Huang, Xinyi Dong, Kazuyo Yamaji, Tatsuya Nagashima, Xuemei Wang, Yiming Liu, Hyo-Jung Lee, Chuan-Yao Lin, Baozhu Ge, Mizuo Kajino, Jia Zhu, Meigen Zhang, Liao Hong, and Zifa Wang, Why models perform differently on particulate matter over East Asia? – A multi-model intercomparison study for MICS-Asia III, ACPD, in review 2020.
372. Shinozuka, Y., Pablo E. Saide, Gonzalo A. Ferrada, Sharon P. Burton, Richard Ferrare, Sarah J. Doherty, Hamish Gordon, Karla Longo, Marc Mallet, Yan Feng, Qiaoqiao Wang, Yafang Cheng, Amie Dobracki, Steffen Freitag, Steven G. Howell, Samuel LeBlanc, Connor Flynn, Michal Segal-Rosenhaimer, Kristina Pistone, James R. Podolske, Eric J. Stith, Joseph Ryan Bennett, Gregory R. Carmichael, Arlindo da Silva, Ravi Govindaraju, Ruby Leung, Yang Zhang, Leonhard Pfister, Ju-Mee Ryoo, Jens Redemann, Robert Wood, and Paquita Zuidema, Modeling the smoky troposphere of the southeast Atlantic: a comparison to ORACLES airborne observations from September of 2016, ACPD, in review 2020.
373. Saide, P., Meng Gao, Zifeng Lu, Dan Goldberg, David G. Streets, Jung-Hun Woo, Andreas Beyersdorf, Chelsea A. Corr, Kenneth L. Thornhill, Bruce Anderson, Johnathan W. Hair, Amin R. Nehrir, Glenn S. Diskin, Jose L. Jimenez, Benjamin A. Nault, Pedro Campuzano-Jost, Jack Dibb, Eric Heim, Kara D. Lamb, Joshua P. Schwarz, Anne E. Perring, Jhoon Kim, Myungje Choi, Brent Holben, Gabriele Pfister, Alma Hodzic, Gregory R. Carmichael, Louisa Emmons, and James H. Crawford, Understanding and improving model representation of aerosol optical properties for a Chinese haze event measured during KORUS-AQ, ACPD, in review 2020.
374. M. Abdi-Oskouei, G. Carmichael, M. Christiansen, G. Ferrada, B. Roozitalab, N. Sobhani, K. Wade, A. Czarnetzki, R. B. Pierce, T. Wagner, C. Stanier, Sensitivity of meteorological skill to selection of WRF-Chem physical parameterizations and impact on ozone prediction during the Lake Michigan Ozone Study (LMOS), JGR 2020

PATENTS

February, 1987: "Continuous Rotating Electrophoresis Column" #4,642,169