

Senior Research Scientist
Atmospheric Sciences & Global Change Division
Fundamental Science Directorate
PACIFIC NORTHWEST NATIONAL LABORATORY

PERSONAL DATA

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Birth: October 1, 1969, Mumbai (Bombay), India
Marital Status: Married, no children
Citizenship: India
USA Visa Status: Permanent Resident

EDUCATION

Post-doctoral, Atmospheric Sciences, Pacific Northwest National Laboratory, **1998**
Ph.D., Chemical Engineering, Virginia Tech, **1997**
M.S., Chemical Engineering, University of Kentucky, **1993**
B.S., Chemical Engineering, University of Bombay, **1991**

PROFESSIONAL EXPERIENCE

Pacific Northwest National Laboratory, Richland, Washington, 1/03 to present
Senior Research Scientist III, Atmospheric Sciences & Global Change Division

Pacific Northwest National Laboratory, Richland, Washington, 10/98 to 12/02
Research Scientist II, Atmospheric Sciences & Global Change Division

Pacific Northwest National Laboratory, Richland, Washington, 7/97 to 7/98
Post-doctoral Fellow, Atmospheric Sciences/Associated Western Universities

Virginia Tech, Blacksburg, Virginia, 8/93 to 6/97
Graduate Research Assistant, Department of Chemical Engineering

University of Kentucky, Lexington, Kentucky, 10/91 to 8/93
Graduate Research Assistant, Department of Chemical Engineering

Hindustan Organic Chemicals Limited, Patalganga, India, 6/90 to 7/90
Summer Intern, nitrochlorobenzene Plant

RESEARCH EXPERTISE

Dr. Zaveri's professional expertise is in developing, implementing and evaluating models describing the photochemical mechanisms of trace tropospheric species in the gas, cloud and aerosol phases. He has significant experience in using such models in analysis of complex atmospheric chemistry problems.

RESEARCH INTERESTS

Gas-phase mechanisms leading to secondary organic and inorganic aerosol formation; heterogeneous chemical processes; chemistry-climate interactions; Eulerian and Lagrangian modeling of the transport, chemical transformation, and removal of atmospheric trace species; and application of such models in the analysis and interpretation of field observations.

PROFESSIONAL SERVICE

Reviewer of manuscripts for the Journal of Geophysical Research, Atmospheric Environment, Journal of Atmospheric Chemistry, Aerosol Science and Technology, Journal of the Air and Waste Management Association.

Proposal reviewer for NASA's Atmospheric Chemistry Modeling and Data Analysis Program, DOE's Atmospheric Chemistry Program, and Canadian Foundation for Climate and Atmospheric Sciences (CFCAS).

PROFESSIONAL AFFILIATIONS

American Geophysical Union – Member
American Meteorological Society – Member
American Association for Aerosol Research – Member

HONORS

Associated Western Universities Postgraduate Fellowship, Pacific Northwest National Laboratory, **7/97 to 7/98**.

Selected to attend the 1993 National Oceanic and Atmospheric Administration colloquium on Operational Environmental Prediction, **6/93 to 7/93**.

Graduate Research Assistantship, Department of Chemical Engineering, Virginia Tech, **8/93 to 6/97**.

Graduate Research Assistantship, Department of Chemical Engineering, University of Kentucky, **10/91 to 8/93**.

THESES

Zaveri R.A., **1997**. Development and Evaluation of a Comprehensive Tropospheric Chemistry Model for Regional and Global Applications. Ph.D. dissertation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 249 pages.

Zaveri R.A., **1993**. A Diagnostic Modeling Study of Summertime Diurnal Ozone Behavior at High-Elevation Rural Mountainous Locations. M.S. thesis, University of Kentucky, Lexington, Kentucky. 142 pages.

PROJECTS & GRANTS

“Nighttime Aerosol, Oxidant Plume Experiment (NAOPEX),” Atmospheric Chemistry Program, Department of Energy, PI’s: C.M. Berkowitz and R.A. Zaveri, Team Member: C.W. Spicer, **FY01 – FY04**.

“The Effect of Feedback Mechanisms and Transport Processes on oxidants and Aerosols at Multiple Scales,” Atmospheric Chemistry Program, Department of Energy, PI’s: J.D. Fast and L.A. Barrie, Team Members: R.A. Zaveri, X. Bian, and E.G. Chapman, **FY01 – FY04**.

“Aerosols, Clouds, Chemistry and Radiative Forcing,” National Aeronautics and Space Administration, PI’s: S. J. Ghan and R.C. Easter, Team Members: R.A. Zaveri, N.S. Laulainen, E.G. Chapman, and Y. Zhang, **FY00 – FY02**.

“Development of a Tool for Investigating Multi-phase and Multi-scale Atmospheric Chemical and Physical Processes,” PI’s: C.M. Berkowitz, W.R. Barchet and R.A. Zaveri, **FY99 – FY 01**.

“Develop and Apply a Global Aerosol Model to Estimate Radiative Forcing of Climate Change,” National Aeronautics and Space Administration, PI’s: S.J. Ghan, R.D. Saylor and R.C. Easter, Team Members: R.A. Zaveri, Y. Zhang, L.K. Peters, E.G. Chapman and N.S. Laulainen, **FY97 – FY99**.

“Anthropogenic Sulfate, Clouds and Climate Forcing,” co-funded by the National Aeronautics and Space Administration and the U.S. Environmental Protection Agency, PI’s: S.J. Ghan, R.D. Saylor and L.K. Peters, Team Members: R.A. Zaveri, E.G. Chapman, Y. Zhang and N.S. Laulainen, **FY94 – FY97**.

“SERON: Application of STEM-II to the Production of Tropospheric Ozone in the South,” U.S. Environmental Protection Agency, PI: R.D. Saylor, Team Members: R.A. Zaveri, L.K. Peters, A. Song, and R. McNider, **FY91-FY92**.

REFEREED PUBLICATIONS

Zaveri R.A., R.C. Easter, and L.K. Peters. Model for Simulating Aerosol Interactions and Chemistry (MOSAIC): 1. Computationally efficient activity coefficient model and technique for solving solid-liquid equilibrium. Manuscript in preparation.

Zaveri R.A., R.C. Easter, J.D. Fast, and L.K. Peters. Model for Simulating Aerosol Interactions and Chemistry (MOSAIC): 2. Computationally efficient technique for solving gas-aerosol mass transfer and model evaluation. Manuscript in preparation.

Easter, R.C., S.J. Ghan, Y. Zhang, R.D. Saylor, E.G. Chapman, N.S. Laulainen, H. Abdul-Razzak, L.R. Leung, X. Bian, and R.A. Zaveri, MIRAGE: Model Description and Evaluation of Aerosols and Trace gases, J. Geophysical Research, in review.

Zaveri R.A., C.M. Berkowitz, L.I. Kleinman, S.R. Springston, P.V. Doskey, W.A. Lonneman, and C.W. Spicer, **2003**. Ozone Production Efficiency and NO_x Depletion in an Urban Plume: Interpretation of Field Observations and Implications for Evaluating O₃-NO_x-VOC Sensitivity, J. Geophysical Research, 108(D14), 4436, doi:10.1029/2002JD003144.

Cho H., P.B. Shepson, L.A. Barrie, J.P. Cowin, and R. Zaveri, **2002**. NMR Investigation of Disordered Water in Ice/Brine Mixtures. J. Physical Chemistry B, 106, 11226-11232.

Fast J.D., R.A. Zaveri, X. Bian, E.G. Chapman, and R.C. Easter, **2002**. The Effect of Regional-scale Transport on Oxidants in the Vicinity of Philadelphia during the 1999 NE-OPS Field Campaign. J. Geophysical Research, 107(D16), 10.1029/2001JD000980.

Ghan S.J., R. C. Easter, E. Chapman, H. Abdul-Razzak, Y. Zhang, R. Leung, N. Laulainen, R. Saylor and R.A. Zaveri, **2001**. A Physically Based Estimate of Radiative Forcing by Anthropogenic Sulfate Aerosol, J. Geophysical Research, 106, 5279-5293.

Berkowitz C.M., R.A. Zaveri, E.G. Chapman, N.S. Laulainen, R.S. Disselkamp, and X. Bian, **2001**. Aircraft Observations of Aerosols, O₃ and NO_y in a Nighttime Urban Plume. Atmospheric Environment, 35, 2395-2404.

Disselkamp, R. S., M. A. Carpenter, J. P. Cowin, C. M. Berkowitz, E. G. Chapman, R. A. Zaveri, and N. S. Laulainen, **2000**. Ozone Loss in Soot Aerosols. J. Geophysical Research, 105, 9767-9772.

Zaveri R.A. and L.K. Peters, **1999**. A New Lumped Structure Photochemical Mechanism for Large-scale Applications. J. Geophysical Research, 104, 30,387-30,415.

Lee P.C.S., R.A. Zaveri, R.C. Easter and L.K. Peters, **1999**. On the Parallelization of a Global Climate-Chemistry Modeling System. Atmospheric Environment, 33, 675-681.

Zaveri R.A., R.D. Saylor, L.K. Peters, R. McNider and A. Song, **1995**. A Model Investigation of Summertime Diurnal Ozone Behavior in Rural Mountainous Locations. Atmospheric Environment, 29, 1043-1065.

CONFERENCE PROCEEDINGS

Zaveri R.A., C.M. Berkowitz, L.I. Kleinman, S.R. Springston, P.V. Doskey, and C.W. Spicer, **2002**. Evaluation of Ozone Production Efficiency in an Urban Plume Using a Lagrangian Box Model. *EOS Trans., AGU, 83(47) Fall Meeting Supplement, Abstract, A51B-0047*, San Francisco, California.

Berkowitz, C.M., R.A. Zaveri, C.W. Spicer, P.V. Doskey,, and J. Weinstein-Lloyd, **2002**. Ozone Production Efficiency at the Williams Tower. *Proceedings of the Conference on Atmospheric Chemistry, American Meteorological Society Annual Meeting*, Orlando, Florida.

Laulainen N., S. Ghan, R. Easter, and R.A. Zaveri, **2000**. Comparison of Simulated and Observed Aerosol Optical Depth. *Proceedings of the 15th International Conference on Nucleation and Atmospheric Aerosols*, pp. 573-576, American Institute of Physics, Rolla, Missouri.

Ghan S., R.C. Easter, E.G. Chapman, N. Laulainen, R. Leung, R.A. Zaveri, R.D. Saylor, Y. Zhang, and H. Abdul-Razzak, **1999**. A Physically based Estimate of Aerosol Radiative Forcing by Anthropogenic Sulfur. *Proceedings of the American Geophysical Union Fall Meeting*, San Francisco, California.

Zaveri R.A. and L.K. Peters, **1998**. A Modified Carbon Bond Mechanism-IV for Regional and Global Scale Applications. *Proceedings of the 91st Annual Meeting and Exhibition, Air and Waste Management Association*, San Diego, California.

Ghan S.J., R.C. Easter, L.R. Leung, P.C.S. Lee, L.K. Peters, R.D. Saylor, R.A. Zaveri, and Y. Zhang, **1997**. Radiative Forcing of Climate by Aerosols: A Physically-Based Modeling Approach. *Proceedings of the Conference on Atmospheric Chemistry*, pp. 64-69, American Meteorological Society Annual Meeting, Long Beach, California.

Zaveri R.A., R.D. Saylor, and L.K. Peters, **1994**. A Diagnostic Study of Mesoscale Atmospheric Physical and Chemical Processes in Southeastern United States Mountainous Locations. *Proceedings of the Conference on Atmospheric Chemistry*, pp. 218-224, American Meteorological Society Annual Meeting, Nashville, Tennessee.

RESEARCH PRESENTATIONS (presenter underlined)

Zaveri R.A. and L.K. Peters: An Overview of Atmospheric Chemistry and Aerosol Modeling at PNNL: Current Research and Future Directions. Atmospheric Chemistry Seminar Series, **Pacific Northwest National Laboratory**, Richland, WA, September 24, 2003.

Zaveri R.A., C.M. Berkowitz, and J.M. Hubbe, Nighttime Aerosol-Oxidant Plume Experiment (NAOPEX - 2002): Preliminary Results. Oral presentation at DOE's **Atmospheric Science Program Meeting**, Orlando, FL, March 4, 2003.

Zaveri R.A., C.M. Berkowitz, L.I. Kleinman, S.R. Springston, P.V. Doskey, and C.W. Spicer, Evaluation of Ozone Production Efficiency in an Urban Plume Using a

Lagrangian Box Model. Poster presentation, **American Geophysical Union Meeting**, San Francisco, California, December 6-10, 2002.

Zaveri R.A., C.M. Berkowitz, L.I. Kleinman, S.R. Springston, P.V. Doskey, and C.W. Spicer, Ozone Production Efficiency in the Nashville Urban Plume. Atmospheric Sciences Seminar, **Pacific Northwest National Laboratory**, Richland, WA, April 25, 2002.

Zaveri R.A. and B.T. Jobson, Blimps as Research Platforms. Oral presentation at **DOE's Atmospheric Science Program Meeting**, Albuquerque, NM, March 21, 2002.

Berkowitz, C.M., R.A. Zaveri, C.W. Spicer, P.V. Doskey, and J. Weinstein-Lloyd, Ozone Production Efficiency at the Williams Tower. Conference on Atmospheric Chemistry, **American Meteorological Society Annual Meeting**, Orlando, Florida, January 13-17, 2002.

Zaveri, R. A. The Role of Organics in Troposphere. ACP Science Steering Group Meeting, **Environmental Molecular Sciences Laboratory**, Richland, Washington, March 1, 2000.

Easter, R., S. Ghan, E. Chapman, N. Laulainen, R. Leung, R. Zaveri, R. Saylor, Y. Zhang, H. Abdul-Razzak, R. Wagener, S. Nemesure, and J. Hudson. Evaluation of Aerosols, Direct, and Indirect Forcing in a Global Aerosol and Climate Model. Presented at the **4th Workshop on the Northern Regional Climate Model**, Toronto, Canada, March 1-2, 2000.

Berkowitz, C. M., E. G. Chapman, R. A. Zaveri, N. S. Laulainen, R. S. Disselkamp, X. Bian, and S. Zhong. Field Observations and Modeling Results Suggesting the Nighttime Loss of Ozone on Newly Formed Aerosols. Special Session on Tropospheric Aerosol Chemistry, **American Geophysical Union Meeting**, December 12-16, 1999, San Francisco, California.

Zaveri R.A., C.M. Berkowitz, E.G. Chapman, R.S. Disselkamp, J.M. Hubbe and N.S. Laulainen. Interpreting ITEX Aircraft Ozone and Aerosol Measurements for Evidence of Heterogeneous Chemistry. Atmospheric Sciences Seminar, **Pacific Northwest National Laboratory**, Richland, Washington, February 18, 1999.

Zhang Y., R.C. Easter, S.J. Ghan and R.A. Zaveri. Intercomparison of the Sectional and the Modal Aerosol Size Representations in a 1-D Global Aerosol Model. **The Joint Symposium of CACGP and IGAC**, Seattle, Washington, August 19-26, 1998.

Zaveri R.A. Development and Use of Condensed Chemical Mechanisms. Atmospheric Sciences Seminar, **Pacific Northwest National Laboratory**, Richland, Washington, June 24, 1998.

Zaveri R.A. and L.K. Peters. A Modified Carbon Bond Mechanism-IV for Regional and Global Scale Applications. 91st Annual Meeting and Exhibition, **Air and Waste Management Association**, San Diego, California, June 14-18, 1998.

Ghan S.J., R.C. Easter, L.R. Leung, P.C.S. Lee, L.K. Peters, R.D. Saylor, R.A. Zaveri and Y. Zhang. Radiative Forcing of Climate by Aerosols: A Physically-Based Modeling

Approach. Conference on Atmospheric Chemistry, **American Meteorological Society Annual Meeting**, Long Beach, California, 1997.

Zaveri R.A. Development of a Model for Simulating Aerosol Chemistry. Atmospheric Sciences Seminar, **Pacific Northwest National Laboratory**, Richland, Washington, September 12, 1997.

Zaveri R.A., R.D. Saylor, L.K. Peters, R. McNider and A. Song. A Model Investigation of Summertime Diurnal Ozone Behavior in Rural Mountainous Locations. Atmospheric Sciences Seminar, **Pacific Northwest National Laboratory**, Richland, Washington, February 4, 1994.

Zaveri R.A., R.D. Saylor and L.K. Peters. A Diagnostic Study of Mesoscale Atmospheric Physical and Chemical Processes in Southeastern United States Mountainous Locations. Conference on Atmospheric Chemistry, **American Meteorological Society Annual Meeting**, Nashville, Tennessee, January 23-28, 1994.