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EDUCATION

- *Undergraduate:* Physics (*magna cum laude*), 1970. New York University, School of Engineering and Science, Bronx, New York.
- *Graduate:* Atmospheric Science, 1974. University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Coral Gables, Florida.

RESEARCH INTERESTS

- Observational and theoretical studies of ozone and other minor constituents
- Modeling of atmospheric waves: Excitation, propagation, and dissipation mechanisms
- Modeling and observational studies of tropical circulation systems
- General circulation and climate modeling of the middle and upper atmosphere

EXPERIENCE

- 1991– : Senior Scientist., Atmospheric Chemistry Division
- 1987–1991: Scientist III. Atmospheric Chemistry Division
- 1985–1987: Scientist II. Atmospheric Chemistry Division
- 1983–1984: Scientist I. Atmospheric Chemistry Division
- 1976–1983: Support Scientist. Atmospheric Chemistry Division
- 1974–1976: Support Scientist. Environmental and Societal Impacts Group

PROFESSIONAL SERVICE

- Lecturer, NASA Short Course on Middle Atmosphere Dynamics, Snowmass, CO (1985)
- Committee on Assessment Models, NASA Ozone Assessment Report (1984–1985)
- Organizing Committee, NATO Advanced Research Workshop on Transport Processes in the Middle Atmosphere (1986)
- Editor, Journal of the Atmospheric Sciences (1986–89)
- Co-chairman, AMS Seventh Conference on the Meteorology of the Middle Atmosphere, San Francisco, CA (1989)
- American Meteorological Society Committee on the Middle Atmosphere (1987–1992); Chairman (1990–1992)
- International Commission on the Meteorology of the Upper Atmosphere (1987–2003)
- ICMUA/IAMAP Working Group on Modeling of the Middle Atmosphere (1988–2003)
- Committee on Solar-Terrestrial Research, National Research Council (1990–1994)
- Chairman, Special Session on Coupling between the Upper and Lower Atmosphere, AGU Fall Meeting, San Francisco, CA (1990)

- Chairman, Eighth Conference on the Middle Atmosphere, American Meteorological Society, Atlanta, CA (1992)
- Convenor, Middle Atmosphere Sciences Symposium, IUGG XXI General Assembly, Boulder, Colorado (1995)
- Macelwane Award Committee, American Geophysical Union (1998–2000)
- Lecturer, Short Course on Dynamics of the Middle Atmosphere. University of Buenos Aires, Argentina (1999)
- Lecturer, Short Course on Dynamics of the Tropical Atmosphere, Abdus Salam International School of Theoretical Physics, Trieste, Italy (2001)
- Convenor, Workshop on the Whole Atmosphere Commmunity Climate Model, Longmont, CO (2002)
- Review Panel member, WMO/UNEP Scientific Assessment of Ozone Depletion (2002)
- Member, NASA Sun-Climate Task Group; co-author of the task group report "Living with a star: New opportunities in sun-climate research" (2003)
- Guest Editor, Special Issue on "Vertical coupling in the atmosphere-ionosphere system", Journal of Atmospheric and Solar-Terrestrial Physics (2006)
- Contributor, WMO/UNEP Scientific Assessment of Ozone Depletion (2006)
- Stratospheric Processes and their Relation to Climate (SPARC): Steering Committee on Gravity Waves (1995–)
- NCAR Community Climate System Model: Whole Atmosphere WG (2008–)
- Editor, Journal of the Atmospheric Sciences (2010–)
- Co-chair, Scientific Organizing Committee, School on Dynamics and Chemistry of the Upper Atmosphere, N.S.F. Pan-American Advanced Study Institute, San Juan, Argentina (2010).

EDUCATIONAL ACTIVITIES

Dissertation committees

- Eric Jensen, PhD., University of Colorado, 1989.
- Fabrizio Sassi, D.Sci., Universitá degli Studi Bologna, 1991.
- Andrew Fusco, PhD., University of Colorado, 1997.
- Gene Francis, PhD., University of Colorado, 1997.
- Matthew Wheeler, PhD., University of Colorado, 1998.
- Lucrezia Ricciardulli, D. Sci., Universitá dell'Aquila, 1999.
- Walter Legnani, PhD., Universidad de Buenos Aires, 2001.
- Natalia Calvo Fernández, D. Sci., Universidad Complutense de Madrid, 2005.

Mentoring and collaborations

- Christopher McKay, PhD., University of Colorado, 1982.
- Hélène Le Texier, D.Sci., Universite de Paris, 1987.
- Robert Portmann, PhD., University of Colorado, 1994.
- Aimee Merkel, PhD., University of Colorado, 2003-2007.
- Jadwiga Beres, PhD., University of Washington, 2004-2005.
- Katja Matthes, PhD., Freie Universität Berlin, Marie Curie E.U. Fellow, 2005-2008.

- Simone Tilmes, PhD., NCAR Advanced Studies Program Fellow, 2005-2007.
- Natalia Calvo Fernández, D.Sci., Universidad Complutense de Madrid, Fulbright International Exchange Scholar and NCAR Advanced Studies Program Fellow, 2007-2010.
- Amal Chandran, Ph.D., University of Alaska, Fairbanks, 2010-2011.

HONORS

- Samuel B. Morse Physics Medal, New York University, 1970.
- University Corporation for Atmospheric Research Graduate Fellowship, 1972–1974.
- Distinguished Scientific Publication Award, National Oceanographic and Atmospheric Administration / Environmental Research Lab, 1987.
- Outstanding Publication Award, National Center for Atmospheric Research, 1990.
- Editor's Citation for Excellence in Refereeing, *Journal of Geophysical Research – Atmospheres*, 1992, 1993.
- Distinguished Scientific Publication Award, National Oceanographic and Atmospheric Administration / Environmental Research Laboratory, 1998.
- Editor's Citation for Excellence in Refereeing, *Journal of Geophysical Research – Atmospheres*, 2009.
- Bernard Haurwitz Memorial Lecturer, American Meteorological Society, 2010.
- Fellow, American Geophysical Union, 2010.

AFFILIATIONS

- American Meteorological Society
- American Geophysical Union

PUBLICATIONS

updated April 5, 2011

1. Garcia, R.R. and J.E. Geisler, 1974: Vertical structure of stationary planetary waves in the presence of altitude-dependent zonal wind and dissipation. *J. Geophys. Res., 79,* 5613-5623.
2. Geisler, J.E. and R.R. Garcia, 1977: Baroclinic instability at long wavelengths on a beta plane. *J. Atmos. Sci., 34,* 311-321.
3. Hartmann, D.L. and R. R. Garcia, 1979: A mechanistic model of ozone transport by planetary waves in the stratosphere. *J. Atmos. Sci., 36,* 350-364.
4. Garcia, R.R. and D.L. Hartmann, 1980: The role of planetary waves in the maintenance of the zonally-averaged ozone distribution of the upper stratosphere. *J. Atmos. Sci., 37,* 2248-2264.
5. Katz, R.W. and R.R. Garcia, 1980: Statistical relationships between hailfall and damage to wheat. *Agric. Meteor., 24,* 29-43.
6. Garcia, R.R. and J.E. Geisler, 1981: Stochastic forcing of small-amplitude oscillations in the stratosphere. *J. Atmos. Sci., 38,* 2187-2197.
7. Garcia, R.R. and S. Solomon, 1983: A numerical model of the zonally-averaged structure of the middle atmosphere. *J. Geophys. Res., 88,* 1379-1400.
8. Solomon, S. and R.R. Garcia, 1983: On the distribution of nitrogen dioxide in the high latitude stratosphere. *J. Geophys. Res., 88,* 5229-5239.
9. Solomon, S. and R.R. Garcia, 1983: Simulation of NO_x partitioning along isobaric parcel trajectories. *J. Geophys. Res., 88,* 5497-5501.
10. Garcia, R.R., S.Solomon, R. Roble and D.W. Rusch, 1983: A numerical study of the response of the atmosphere to changing solar activity. In *Weather and Climate Responses to Solar Variations*, B.M. McCormac (ed.), Colorado Associated University Press, Boulder, Colorado, pp. 197-202.
11. Garcia, R.R., S. Solomon, R. Roble and D.W. Rusch, 1984: A numerical study of the response of the middle atmosphere to the 11-year solar cycle. *Planet. Space Sci., 32,* 411-423.
12. Solomon, S. and R.R. Garcia, 1984: Transport of thermospheric NO to the upper stratosphere? *Planet. Space Sci., 32,* 399-409.
13. Hamilton, K. and R.R. Garcia, 1984: Long period variations in the solar semidiurnal atmospheric tide. *J. Geophys. Res., 89,* 11705-11710.
14. Solomon, S. and R.R. Garcia, 1984: On the distribution of long lived tracers and chlorine species in the middle atmosphere. *J. Geophys. Res., 89,* 11633-11644.
15. Garcia, R.R. and S. Solomon, 1985: The effect of breaking gravity waves on the dynamics and chemical composition of the mesosphere and lower thermosphere. *J. Geophys. Res., 90,* 3850-3868.
16. Solomon, S., R.R. Garcia, J.J. Olivero, R.M. Bevilacqua, P.R. Schwartz, R.T. Clancy and D.O. Muhleman, 1985: Photochemistry and transport of carbon monoxide in the middle atmosphere. *J. Atmos. Sci., 42,* 1072-1083.
17. Austin, J., R.R. Garcia, J.M. Russell, S. Solomon and A.F. Tuck, 1985: On the atmospheric photochemistry of nitric acid. *J. Geophys. Res., 91,* 5477-5484.
18. Solomon, S., R.R. Garcia and F. Stordal, 1985: Transport processes and ozone perturbations. *J. Geophys. Res., 90,* 12981-12989.

19. Solomon, S., J.T. Kiehl, R.R. Garcia and W. Grose, 1986: Tracer transport by the diabatic circulation deduced from satellite observations. *J. Atmos. Sci.,43,* 1603-1617.

20. Hamilton, K. and R.R. Garcia, 1986: El Niño/Southern Oscillation events and their associated midlatitude teleconnections 1531-1841. *Bull. Am. Meteor. Soc., 67,* 1354-1361.

21. Hamilton, K. and R.R. Garcia, 1986: Theory and observations of the short period normal mode oscillations of the atmosphere. *J. Geophys. Res., 91,* 11867-11875.

22. Solomon, S., R.R. Garcia, F.S. Rowland, and D. Wuebbles, 1986: On the depletion of Antarctic ozone. *Nature, 321,* 755-758.

23. Salby, M.L. and R.R. Garcia, 1987: Transient response to localized episodic heating in the tropics. Part I: Excitation and short-time, near-field response. *J. Atmos. Sci., 44,* 458-498.

24. Garcia, R. R. and M.L. Salby, 1987: Transient response to localized episodic heating in the tropics. Part II: Far-field behavior. *J. Atmos. Sci., 44,* 499-530.

25. Garcia, R.R., S. Solomon, S.K. Avery and G.C. Reid, 1987: Transport of nitric oxide and the D-region winter anomaly. *J. Geophys. Res., 92,* 977-994.

26. Roble, R.G., B.A. Emery, T.L. Killeen, G.C. Reid, S. Solomon, R.R. Garcia, D.S. Evans, P.B. Hays, G.R. Carignan, R.A. Heelis, W.B. Hanson, D.J. Winningham, N.W. Spencer and L.H. Brace, 1987: Joule heating in the mesosphere and lower thermosphere during the July 13, 1982, solar proton event. *J. Geophys. Res., 92,* 6083-6090

27. Bjarnason, G., S. Solomon and R.R. Garcia, 1987: Tidal influences on vertical diffusion and diurnal variability of ozone in the mesosphere. *J. Geophys. Res., 92,* 5609-5620.

28. Salby, M.L. and R.R. Garcia, 1987: Vacillations induced by interference of stationary and traveling planetary waves. *J. Atmos. Sci., 44,* 2679-2711.

29. Garcia, R.R. and S. Solomon, 1987: A possible relationship between interannual variability in Antarctic ozone and the quasi-biennial oscillation. *Geophys. Res. Lett., 14,* 848-851.

30. Le Texier, H., S. Solomon and R.R. Garcia, 1987: Seasonal variability of the OH Meinel bands. *Planet. Space Sci., 35,* 977-989.

31. Garcia, R.R., 1987: On the mean meridional circulation of the middle atmosphere. *J. Atmos. Sci., 44,* 3599-3609.

32. Solomon, S. and R.R. Garcia, 1987: Current understanding of mesospheric transport processes. *Phil. Trans. Royal Soc., A323,* 655-666.

33. Stordal, F. and R.R. Garcia, 1987: Sensitivity studies and a simple ozone perturbation experiment with a truncated 2-D model of the stratosphere. *J. Geophys. Res., 92,* 11909-11918.

34. Visconti, G. and R.R. Garcia (eds.), 1987: **Transport Processes in the Middle Atmosphere,** *NATO Advanced Study Institutes Series, C 213*, D. Reidel Publishing Company, Dordrecht, 485pp.

35. Le Texier, H., S. Solomon and R.R. Garcia, 1988: The role of molecular hydrogen and methane oxidation in the water vapour budget of the stratosphere. *Quart. J. Royal Meteor. Soc., 114,* 281-295.

36. LeTexier, H., S. Solomon, R.J. Thomas and R.R. Garcia, 1988: OH*(7-5) Meinel band airglow measured by the SME limb scanning near infrared spectrometer: Comparison of the simulated seasonal variability with two-dimensional model simulations. *Ann. Geophys., 7*, 365-374.

37. Garcia, R.R., 1989: Dynamics, radiation, and photochemistry in the mesosphere: Implications for the formation of noctilucent clouds. *J. Geophys. Res., 94,* 14605-14615.

38. Salby, M.L., R.R. Garcia, D. O'Sullivan, and J. Tribbia, 1990: Global transport calculations with an equivalent barotropic system. *J. Atmos. Sci., 47*, 188-214.

39. Salby, M.L. and R.R. Garcia, 1990: Dynamical perturbations to the ozone layer. *Physics Today, 43*, 38-46.

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41. Salby, M.L., D. O'Sullivan, R.R. Garcia, and P. Callaghan, 1990: Air motions accompanying the development of a planetary wave critical layer. *J. Atmos. Sci., 47,* 1179-1204.

42. Salby, M.L., R.R. Garcia, D. O'Sullivan, and P. Callaghan, 1990: The interaction of horizontal eddy transport and thermal drive in the stratosphere. *J. Atmos. Sci., 47,* 1647-1665.

43. Garcia, R.R. and R.T. Clancy, 1990: Seasonal variation in equatorial mesospheric temperatures observed by SME. *J. Atmos. Sci., 47,* 1666-1673.

44. Salby, M.L., P. Callaghan, S. Solomon, and R.R. Garcia, 1990: Chemical fluctuations associated with vertically-propagating equatorial Kelvin waves. *J. Geophys. Res., 95,* 20491-20506.

45. Garcia, R.R., 1991: Parameterization of planetary wave breaking in the middle atmosphere. *J. Atmos. Sci.,48,* 1405-1419.

46. Reid, G.C., S. Solomon and R.R. Garcia, 1991: Response of the middle atmosphere to the solar proton events of August-December, 1989. *Geophys. Res. Lett., 18*, 1019-1022.

47. Garcia, R.R., 1992: Transport of thermospheric NO_x to the stratosphere and mesosphere. *Adv. Space Res., 12*, (10)57-(10)-66.

48. Garcia, R.R., 1992: Middle atmosphere cooling. *Nature, 357*, 18.

49. Adams, J., R.R. Garcia, B. Gross, J. Hack, D. Haidvogel and V. Pizzo, 1992: Applications of multigrid software in the Atmospheric Sciences. *Mon. Wea. Review, 120*, 1447-1458.

50. Garcia, R.R., F. Stordal, S. Solomon and J. Kiehl, 1992: A new numerical model of the middle atmosphere. I. Dynamics and transport of tropospheric source gases. *J. Geophys. Res., 97*, 12967-12991.

51. Garcia, R.R., 1993: Modeling the effects of planetary wave breaking in the stratosphere. In **Coupling Processes in the Lower and Middle Atmosphere**, E.V. Thrane, T.A. Blix, and D.C. Fritts, eds., 77-94, Kluwer Academic Publishers, Netherlands.

52. Sassi, F., R.R. Garcia, and B.A. Boville, 1993: The stratopause semiannual oscillation in the NCAR Community Climate Model. *J. Atmos. Sci.,* 50, 3608-3624.

53. Solomon, S., R.W. Sanders, R.R. Garcia, and J.G. Keys, 1993: Enhanced chlorine dioxide and ozone depletion in Antarctica due to volcanic aerosols. *Nature, 363* 245-248.

54. Solomon, S., R.W. Sanders, R.O. Jakoubek, K. Arpag, S.L. Stephens, J.G. Keys, and R.R. Garcia, 1994: Visible and near-ultraviolet spectroscopy at McMurdo Station, Antarctica 10. Reductions of stratospheric NO_2 due to Pinatubo aerosols. *J. Geophys. Res., 99,* 3509-3516.

55. Randel, W.J. and R.R. Garcia, 1994: Comparison of planetary wave breaking parameterization with stratospheric circulation statistics. *J. Atmos. Sci., 51*, 1157-1168.

56. Garcia, R.R. and B.A. Boville, 1994: "Downward control" of the mean meridional circulation and temperature distribution of the polar winter stratosphere. *J. Atmos. Sci., 51*, 2238-2245.

57. Salby, M.L., R.R. Garcia, and H.H. Hendon, 1994: Planetary circulations in the presence of climatological and wave-induced heating. *J. Atmos. Sci., 51*, 2344-2367.

58. Garcia, R.R. and S. Solomon, 1994: A new numerical model of the middle atmosphere. II. Ozone and related species. *J. Geophys. Res., 99*, 12937-12951.

59. Solomon, S., R.R. Garcia and A.R. Ravishankara, 1994: On the role of iodine in ozone depletion. *J. Geophys. Res., 99*, 20491-20499.

60. Solomon, S., J.B. Burkholder, A.R. Ravishankara and R.R. Garcia, 1994: On the ozone depletion and global warming potentials of CF_3I. *J. Geophys. Res., 99*, 20929-20935.

61. Sassi, F. and R.R. Garcia, 1994: A One-dimensional model of the semiannual oscillation driven by convectively-forced gravity waves. *J. Atmos. Sci., 51*, 3167-3182.

62. Garcia, R.R., 1994: Causes of ozone depletion. *Phys. World, 7*, no. 4, 49-55.

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64. Solomon, S., R.W. Portmann, R.R. Garcia, L.W. Thomason, L.R. Poole, and M.P. McCormick, 1996: The role of aerosol variations in anthropogenic ozone depletion at northern mid-latitudes. *J. Geophys. Res., 101*, 6713-6727.

65. R.W. Portmann, S.Solomon, R.R. Garcia, L.W. Thomason, L.R. Poole, and M.P. McCormick, 1996: The role of aerosol variations in anthropogenic ozone depletion in the polar regions. *J. Geophys. Res., 101*, 22991-23006.

66. Prusa, J.M., P.K. Smolarkiewicz, and R.R. Garcia, 1996: On the propagation and breaking at high altitudes of gravity waves excited by tropospheric forcing. *J. Atmos. Sci., 53*, 2186-2216.

67. Garcia, R.R. and J.M. Prusa, 1996: The propagation and breaking of gravity waves excited by forcing in the troposphere. In **Gravity Wave Processes and Their Parameterizations in Global Climate Models**, ed. K. Hamilton, *NATO ASI Series I, vol. 50*, 169-186, Springer.

68. Sassi, F. and R.R. Garcia, 1997: The role of equatorial waves forced by convection in the tropical semiannual oscillation. *J. Atmos. Sci., 54*, 1925-1942.

69. Solomon, S., S. Bormann, R.R. Garcia, R.Portmann, L. Thomason, L.R. Poole, D. Winker and M.P. McCormick, 1997: Heterogeneous chlorine chemistry in the tropopause region. *J. Geophys. Res., 102*, 21411-21429.

70. Garcia, R.R., T.J. Dunkerton, R.S. Lieberman and R.A. Vincent, 1997: Climatology of the semiannual oscillation of the tropical middle atmosphere. *J. Geophys. Res., 102*, 26019-26032.

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75. Garcia, R.R. and F. Sassi, 1999: Modulation of the semiannual oscillation by the quasibiennial oscillation. *Earth, Planets and Space, 51,* 563-570.

76. Garcia, R.R., P. Hess, and A.K. Smith, 1999: Atmospheric dynamics and transport. In **Atmospheric Chemistry and Global Change**, ed. G.P. Brasseur, J.J. Orlando and G.S. Tyndall , *Ch. 2*, 23-84, Oxford, 654pp.

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79. Ricciardulli, L. and R.R. Garcia, 2000: The excitation of equatorial waves by deep convection in the NCAR Community Climate Model (CCM3). *J. Atmos. Sci., 57*, 3461-3487.

80. Garcia, R.R., 2000: The role of equatorial waves in the semiannual oscillation of the middle atmosphere. In **Atmospheric Science Across the Stratopause**, ed. D.E. Siskind, S.D. Eckermann, and M.E. Summers, *Meteor. Monogr., 123*, 161-176.

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85. Sassi, F., R.R. Garcia, B. Boville, and H. Liu, 2002: On temperature inversions and the mesospheric surf zone. *J. Geophys. Res., 107 (D19)*, 4380, doi:10.1029/2001JD001525.

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88. Sassi, F., D.Kinnison, B. A. Boville, R.R. Garcia and R.G. Roble, 2004: The effect of ENSO on the dynamical, thermal and chemical structure of the middle atmosphere. *J. Geophys. Res., 109*, D17108, doi:10.1029/2003JD004434.

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90. Sassi, F., D.Kinnison, B. A. Boville, R.R. Garcia and R.G. Roble, 2004: The effect of ENSO on the dynamical, thermal and chemical structure of the middle atmosphere. *J. Geophys. Res., 109,* D17108, doi:10.1029/2003JD004434.

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92. Beres, J.H., R.R. Garcia, B.A. Boville and F. Sassi, 2005: Implementation of a gravity wave source spectrum parameterization dependent on the properties of convection in the

Whole Atmosphere Community Climate Model (WACCM). *J. Geophys. Res., 110*, D10108, doi:10.1029/2004JD005504.

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95. Garcia, R.R., R. Lieberman, J.M. Russell and M.G. Mlynczak, 2005: Large-scale waves in the mesosphere and lower thermosphere observed by SABER, *J. Atmos. Sci., 62,* 4384-4399.
96. Richter, J. and R.R. Garcia, 2006: On the forcing of the mesospheric semi-annual oscillation in the Whole Atmosphere Community Climate Model, *Geophys. Res. Lett., 33*, L01806, doi:10.1029/2005GL024378.
97. Garcia-Herrera, R., N. Calvo, R. R. Garcia, and M. A. Giorgetta, 2006: Propagation of ENSO temperature signals into the middle atmosphere: A comparison of two general circulation models and ERA-40 reanalysis data, *J. Geophys. Res., 111*, D06101, doi: 10.1029/2005JD006061.
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RECENT PRESENTATIONS

updated April 5, 2011

2007

"Short period waves in the equatorial middle atmosphere", invited talk, *Symposium on Coupling Processes in the Equatorial Atmosphere*, Kyoto, Japan, March 2007.

"Past and predicted secular trends in the middle atmosphere", invited talk, Instituto de Astrofísica de Andalucía, Spain, May 2007.

"Extension of Salby's asynoptic sampling technique for obtaining spectra of short-period equatorial waves", contributed talk, *IUGG International Assembly*, Perugia, Italy, July 2007.

"Modeling the response of the atmosphere to solar variability", invited talk, *AMS Middle Atmosphere Conference*, Portland, Oregon, August 2007.

"Mechanisms for the acceleration of the Brewer-Dobson circulation in a climate change scenario", International CAWSES Symposium, Kyoto, Japan, October, 2007.

2008

"Ozone recovery and climate change in the 21st century", *AGU Spring Meeting*, Fort Lauderdale, Florida, May 2008.

"Observations and model simulations of coupling between the MLT and the lower atmosphere", invited talk, 37th COSPAR Scientific Assembly, Montreal, Canada, July 2008.

"Mechanisms for the acceleration of the Brewer-Dobson circulation in a climate change scenario", Fourth SPARC General Assembly, Bologna, Italy, September 2008.

"Acceleration of the Brewer-Dobson Circulation under Climate Change", invited seminar, NASA Goddard Space Flight Center, Greenbelt, MD, October 2008.

2009

"Simulation of the tides in the Whole Atmosphere Community Climate Model", invited paper, *AGU Spring Meeting*, Toronto, Canada, May 2009.

"Large-scale atmospheric waves observed by TIMED/SABER", Haurwitz Award Lecture, *AMS Middle Atmosphere and Atmosphere-Ocean Fluid Dynamics Conference*, Stowe, VT, June 2009.

"Observed and modeled variability of the migrating diurnal tide", invited paper, IAMAS Joint Assembly, Montreal, Canada, July 2009.

"The role of the QBO in the stratospheric response to solar variability", invited paper, NASA International Living With a Star Symposium, Ubatuba, Brazil, October 2009.

"The response of the stratosphere to solar variability: What role does the QBO play?", invited

paper, AGU Fall Meeting, San Francisco, CA, December 2009.

2010

"Climatology of Stratospheric Sudden Warmings in the Whole Atmosphere Community Climate Model", invited paper, 38th COSPAR Scientific Assembly, Bremen, Germany, July 2010.

" Dynamics and transport in the middle atmosphere", tutorial lecture, Pan-American Advanced Institute, *School on the Dynamics and Chemistry of the Middle Atmosphere*, San Juan, Argentina, October 2010.

"Large-scale waves in the middle and upper atmosphere observed by the SABER satellite instrument", invited talk, Center for Space Science and Applied Research, Chinese Academy of Science, Beijing, China, October 2010.

"On the acceleration of the stratospheric Brewer-Dobson circulation as a result of climate change", invited talk, Institute of Atmospheric Physics, Chinese Academy of Science, Beijing, China, October 2010.

"World-avoided simulations using a fully-coupled climate-chemistry model", invited talk, AGU Fall Meeting, San Francisco, CA, December 2010.

2011

"Gravity wave parameterizations in chemistry-climate models: Successes and problems", Invited talk, Chapman Conference on Atmospheric Gravity Waves and their Effects on the General Circulation and Climate, Honolulu, Hawaii, February 2011.