RAYMOND G. ROBLE

Raymond G. Roble received the PhD from the University of Michigan and currently is a senior scientist at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. His research concentrates on the chemistry, physics, and dynamics of the upper atmosphere and on global atmospheric electricity. He has constructed a hierarchy of general circulation models of the coupled thermosphere/ionosphere/mesosphere system and his most recent model is called a Thermosphere/Ionosphere/Mesosphere/ Electrodynamics general circulation model (TIME-GCM) that extends between 30 to 500 km altitude range. These various general circulation models have been used to analyze data from the NSF CEDAR and GEM programs as well as the NASA programs, Atmosphere Explorer, Dynamics Explorer, Solar Mesosphere Explorer, Upper Atmosphere Research Satellite, the International Solar-Terrestrial Program/Global Geospace Science Programs, and the Thermosphere, Ionosphere, Mesosphere, Energetics and Dynamics satellite. He has served on numerous national and international committees and has authored and co-authored over 350 publications. He is a fellow of the American Geophysical Union and has received the Arctowski medal from the National Academy of Sciences. He is also highly cited in space sciences by the ISI (http://isihighlycited.com) and has received the World Meteorological Organization Norbert-Gerbier Mumm Award for co-authoring the paper "Review of Mesospheric Temperature Trends" published in *Reviews of Geophysics* in 2003 (http://www.wmo.ch/news/news.html).

RAYMOND G. ROBLE

DATE OF BIRTH 14 March 1935

EDUCATION

1969	PhD, Aeronomy, University of Michigan
1961	MSE, Mechanical Engineering, University of Michigan
1957	BSE, Engineering Mathematics, University of Michigan
1957	BSE, Engineering Physics, University of Michigan

THESIS TITLE A Theoretical and Experimental Investigation of the Stable Mid-Latitude Red Arc (SAR-arc)

RESEARCH INTERESTS Solar-terrestrial interactions, aeronomy, thermosphere/ionosphere/ mesosphere dynamics, global atmospheric electricity, planetary atmospheres, whole atmosphere solar-terrestrial couplings

EXPERIENCE

2005–Present	Senior Scientist, High Altitude Observatory, Phased retirement, working 1/2 time
1986–2001	Head, Terrestrial Impact of Solar Output Section, High Altitude Observatory, National Center for Atmospheric Research
1/1995–3/1995	Acting Director, High Altitude Observatory, National Center for Atmospheric Research
1993–1995	Deputy Director, High Altitude Observatory, National Center for Atmospheric Research
1984–Present	Senior Scientist, High Altitude Observatory, National Center for Atmospheric Research
1978–1984	Scientist, Atmospheric Chemistry and Aeronomy Division, National Center for Atmospheric Research
1973–1977	Scientist, Atmospheric Quality and Modification Division, National Center for Atmospheric Research
1978–1984	Project Leader, Thermospheric Dynamics and Aeronomy Project, Atmospheric Chemistry and Aeronomy Division, National Center for Atmospheric Research
1970–1973	Scientist, Laboratory for Atmospheric Sciences, National Center for Atmospheric Research
1969–1970	Postdoctoral Fellow, Advanced Study Program, National Center for Atmospheric Research
1964–1969	Research Scientist, Space Physics Research Laboratory, University

	of Michigan
1961–1964	Engineer, Bendix Research Laboratories, Southfield, MI
1957–1960	Engineer Officer, USS Taussig, DD746, US Navy

PROFESSIONAL SERVICE

2003–2005	Member, Space Physics and Aeronomy Fellows Committee for the American Geophysical Union
2001–2002	Member search committee for editor of *JGR Space Physics*
1997–2001	Member, Arecibo Observatory Visiting Committee, Cornell University
1996–1998	Chairman, Space Physics and Aeronomy Fellows Committee for the American Geophysical Union
1995–2001	Member, Global Geospace Circulation Modeling (GGCM), Committee of the National Science Foundation GEM Program
1991–1994	Member, Evaluation Board of Canadian Network for Space Research, Natural Sciences and Engineering Research Council of Canada
1991–1994	Member, Steering Committee for NSF CEDAR Program
1992–1995	Member, Advisory Panel for NSF GEM Program
1990–1992	Member, Steering Committee for National Science Foundation (NSF) RISE Program
1992–1993	Search Committee for Editor, *Journal of Geophysical Research (Space Physics)*
1992–1993	Program Committee for AGU Chapman Conference (Mesosphere-Lower Thermosphere)
1992–1993	Program Chairman, 1993 NSF CEDAR Workshop
1990–1991	Member, Science Definition Working Group, TIMED Satellite Mission, NASA
1988–1992	Member, AGU Committee on Atmospheric and Space Electricity
1987–1990	Member, Committee on Solar and Space Physics, Space Science Board, National Academy of Sciences (NAS)
1985–1987	Member, NAS Panel on Long Term Observations
1984–Present	Member, Geophysical Institute Advisory Board, University of Alaska
1984–1988	Chairman, AGU Committee on Atmospheric and Space Electricity
1984–1988	Member, Earth Sciences Task Group Study, Major Directions for

	Space Sciences: 1995–2015, Space Science Board
1984–1986	Chairman, NAS Committee for Solar-Terrestrial film, “Planet Earth,” WQED Pittsburgh
1983–Present	Member, IUGG Committee on Solar-Terrestrial Relationships
1982–1984	Member, AGU Committee for Public Affairs
1982–1984	Chairman, AGU Subcommittee for Publicity
1982–1984	Secretary, Aeronomy Division of the Solar-Planetary Relationships Section, AGU
1981–Present	Member, IUGG Committee on Atmospheric Electricity
1981–1986	Member, Middle Atmosphere Program Panel, NAS
1980–1984	Member, Geophysics Study Committee for the Geophysical Research Board, NAS
1980–1983	Member, Committee on Solar and Space Physics, Space Science Board, NAS
1979–1981	Member, Panel on Survey of Solar-Terrestrial Research in the 1980's, Committee on Solar-Terrestrial Research Geophysical Research Board, NAS
1978–Present	Lecturer, Department of Astrophysical, Planetary, and Atmospheric Sciences (APAS), University of Colorado
1978–1982	Member, Space Power System Overview Committee, Institute of Telecommunications
1978–1981	Member, Atmospheric and Space Physics Management Operations Working Group, NASA Solar-Terrestrial Physics Program
1977–1991	Theoretician, NASA Dynamics Explorer Satellite Team Member
1977–1984	AGU Committee for Publicity
1977–1982	Member, Panel on Sun, Weather and Climate Geophysics Study Committee, Geophysical Research Board, NAS
1977–1978	Member, NASA Science Definition Panel, UARS Satellite Program
1977–1979	Member, USRA Panel on Computer Simulation in Space Physics
1976–1977	Member, Panel on Upper Atmosphere Geophysics, Geophysics Study Committee, Geophysical Research Board, NAS
1976–1978	Member, USRA Panel on Science Definition for Atmosphere, Magnetosphere and Plasmas in Space Payload

1975–1980 Guest Investigator, NASA Atmospheric Explorer Satellite Team

1975–1979 Guest Investigator, OSO-8 Satellite Team–Occultation Studies

1975–1977 Member, URSI Commission III Working Group 8 "Incoherent Scatter"

HONORS

2005 UARS Team–NASA Honor Group Achievement Award 2006, Co-I 3 on instrument teams on UARS; HRDI, PEM, Solstice

2003 World Meteorological Organization Norbert-Gerbier Mumm Award for the paper "Review of Mesospheric Temperature Trends" published in *Reviews of Geophysics* in 2003 (http://www.wmo.ch/news/news.html)

2001 ISI Highly cited in Space Sciences (http://isihighlycited.com)

1996 Nicolet Lecture–American Geophysical Union

1996 Arctowski Medal–National Academy of Sciences

1994 CEDAR Prize Lecture

1993 Outstanding Alumni Award, Atmospheric, Oceanic and Space Sciences Department, University of Michigan

1986 Fellow, American Geophysical Union (AGU)

1980 National Center for Atmospheric Research, Prize for Outstanding Publication

1968 College of Engineering Distinguished Achievement Award, University of Michigan

NASA PROGRAM PARTICIPATION

Co-Investigator: Particle Environment Monitor (PEM) (J. D. Winningham, PI) on the NASA UARS Satellite Team

Principal Investigator: Global-Scale Interactions between the Thermosphere, Ionosphere, and Magnetosphere (NASA) Space Physics Theory Program

Co-Investigator: Sounding of the Atmosphere using Broadband Emission Radiometery Experiment (SABRE) (J. Russell, PI, NASA Langley Research Center) for the NASA TIMED Satellite Mission

Co-Investigator: Solar Extreme Ultraviolet (EUV) Spectral Irradiance Experiment (T. Woods, PI, HAO/NCAR) for the NASA TIMED Satellite Mission

Co-Investigator: A TIMED Doppler Interferometer (T. L. Killeen, PI, University of Michigan) for the NASA TIMED Satellite Mission

Co-Investigator: Dynamical and Chemical Signature in the Mesosphere (M. Hagan, PI, HAO/NCAR) for the NASA UARS Guest Investigator Program

Co-Investigator: An Investigation of Middle Atmosphere Properties using UARS and Rocket Data and Simulations from the TIME-GCM (W. Sharp, PI, University of Michigan) for the NASA UARS Guest Investigator Program

Co-Investigator: Solar EUV Irradiance Measurements on the NASA Spacecraft (T. Woods, PI, HAO/NCAR)

Principal Investigator: Dynamics Explorer Satellite Program (NASA)

Co-Investigator: High Resolution Doppler Imager (HRDI) (P. B. Hays, PI, University of Michigan) on the NASA UARS Satellite Team

Co-Principal Investigator: Modeling of the Atmosphere/Magnetosphere/Ionosphere System (M. H. Rees, Co-PI, University of Alaska), NASA ISTP/GGS Program

Co-Investigator: NCAR Project to Interface Climate Modeling on Global and Regional Scales with Earth Observation System (EOS) Observations (NASA)

Co-Investigator: X-Ray Imaging Experiment (and Optional Particle Detectors) on Earth Observing System (EOS) (NASA)

Co-Investigator: The Solar Stellar Irradiance Comparison Experiment on Earth Observing System (EOS) (NASA)

Theoretician: Dynamics Explorer Satellite Team (NASA)

Guest Investigator: German AEROS Satellite Team

Guest Investigator: Atmospheric Explorer Satellite Team (NASA)

Theoretician: Electrodynamics Explorer Satellite Study Team (NASA)

PROFESSIONAL AFFILIATIONS

American Geophysical Union

U.S. AIR FORCE PROGRAMS

Co-Investigator: Development of Vector Spherical Harmonic (VSH) Model for Operational Predictions of Thermospheric Density for Satellite Drag (T. L. Killeen, PI, University of Michigan)

Co-Investigator: Environment Impact Analysis of High Power Radar (HARP) Program

U.S. NAVY PROGRAM

Principal Investigator: Office of Naval Operations and Naval Research Laboratory for the development of an upper atmosphere general circulation model, 1996–present

RAYMOND G. ROBLE
PUBLICATIONS

1. Roble, R. G., G. T. Burton, and H.-K. Hsi. Power supplies for mobile lunar vehicles. *Progress in Astronautics and Aeronautics*, **Vol. II**, Academic Press, 1963.

2. Roble, R. G., H. A. Schulte, and J. H. Tarter. Fuel cell, solar cell, and chemical dynamic power systems comparison. *Progress in Astronautics and Aeronautics*, **Vol. II**, Academic Press, 1963.

3. Hays, P. B. and R. G. Roble. Atmospheric properties from the inversion of planetary occultation data. *Planet. Space Sci.*, **16**, 1197-1198, 1968.

4. Hays, P. B. and R. G. Roble. Stellar spectra and atmospheric composition. *J. Atmos. Sci.*, **25**, 1141-1153, 1968.

5. Roble, R. G., P. B. Hays, and A. F. Nagy. Calculated OI 6300 A nightglow doppler temperatures for solar cycle minimum. *Planet. Space Sci.*, **16**, 1109-1113, 1968.

6. Hays, P. B., A. F. Nagy, and R. G. Roble. Interferometric measurement of the 6300 AA doppler temperature during a magnetic storm. *J. Geophys. Res.*, **74**, 4162-4168, 1969.

7. Roble, R. G. A theoretical and experimental investigation of the stable mid-latitude red arc (SAR-arc). Ph.D. Thesis, University of Michigan, 1969.

8. Nagy, A. F., R. G. Roble, and P. B. Hays. Stable mid-latitude red arcs: Observations and theory. *Space Sci. Rev.*, **11**, 709-727, 1970.

9. Roble, R. G. and R. E. Dickinson. Atmospheric response to heating within a stable mid-latitude red arc. *Planet. Space Sci.*, **18**, 1489-1498, 1970.

10. Roble, R. G., P. B. Hays, and A. F. Nagy. Photometric and interferometric observations of a mid-latitude stable auroral red arc. *Planet. Space Sci.*, **18**, 431-439, 1970.

11. Roble, R. G., P. B. Hays, and A. F. Nagy. Comparison of calculated and observed features of a stable midlatitude red arc. *J. Geophys. Res.*, **75**(22), 4261-4265, 1970.

12. Dickinson, R. E., R. G. Roble, and E. C. Ridley. Responses of the neutral thermosphere at F-layer heights to large-scale anomalies of ionization. *J. Atmos. Sci.*, **28**, 1280-1293, 1971.

13. Hays, P. B. and R. G. Roble. A technique for recovering doppler line profiles from Fabry-Perot interferometer fringes of very low intensity. *Appl. Opt.*, **10**, 193-200, 1971.

14. Hays, P. B. and R. G. Roble. Direct observations of thermospheric winds during geomagnetic storms. *J. Geophys. Res.*, **76**, 5316-5321, 1971.

15. Roble, R. G. The stable auroral red arc of October 31-November 1, 1968 and its interaction with the neutral atmosphere, in *Colloquium on Physics of Space Environment*, (R. E. Smith and S. T. Wu, eds.), NASA SP-305, 45-69, 1971.

16. Roble, R. G., R. B. Norton, J. A. Findlay, and E. Marovich. The calculated and observed features of stable auroral red arcs during three geomagnetic storms. *J. Geophys. Res.*, **76**, 7648-7662, 1971.

17. Dickinson, R. E. and R. G. Roble. Thermospheric motion and temperature perturbations from global-scale winds flowing through F-region ionization anomalies. *Space Res.*, **XII**, 1079-1085, 1972.

18. Hays, P. B., R. G. Roble, and A. N. Shah. Terrestrial atmospheric composition from stellar occultations. *Science*, **176**, 793-794, 1972.

19. Roble, R. G. and R. E. Dickinson. Time-dependent behavior of a stable auroral red arc excited by an electric field. *Planet. Space Sci.*, **20**, 591-605, 1972.

20. Roble, R. G. and P. B. Hays. A technique for recovering the vertical number density profile of atmospheric gases from planetary occultation data. *Planet. Space Sci.*, **2**, 1727-1744, 1972.

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23. Hays, P. B. and R. G. Roble. Stellar occultation measurements of molecular oxygen in the lower thermosphere. *Planet. Space Sci.*, **21**, 339-348, 1973.

24. Hernandez, G. and R. G. Roble. On determining the major SAR-arc properties from a few measurable parameters. *J. Geophys. Res.*, **79**, 1057-1064, 1973.

25. Roble, R. G. and R. E. Dickinson. Is there enough solar EUV to maintain the global mean thermospheric temperature? *J. Geophys. Res.*, **78**, 249-257, 1973.

26. Roble, R. G. and P. B. Hays. The nighttime distribution of ozone in the low-latitude mesosphere. *Pure and Appl. Geophys.*, **106**, 1281-1289, 1973.

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31. Roble, R. G., B. A. Emery, J. E. Salah, and P. B. Hays. Diurnal variation of neutral thermospheric winds determined from incoherent scatter radar data. *J. Geophys. Res.*, **79**, 2868-2876, 1974.

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33. Rees, M. H. and R. G. Roble. Observations and theory of the formation of stable auroral red arcs. *Rev. Geophys. Space Phys.*, **13**, 201-242, 1975.

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39. Hernandez, G. and R. G. Roble. Direct measurements of nighttime thermospheric winds and temperatures. II. Geomagnetic storms. *J. Geophys. Res.*, **81**, 5173-5181, 1976.

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43. Dickinson, R. E., E. C. Ridley, and R. G. Roble. Meridional circulation in the thermosphere. II. Solstice conditions. *J. Atmos. Sci.*, **34**, 178-192, 1977.

44. Hastings, J. T. and R. G. Roble. An automatic technique for solving coupled vector systems of non-linear parabolic partial differential equations in one space dimension. *Planet. Space Sci.*, **25**, 209-215, 1977.

45. Hernandez, G. and R. G. Roble. Direct measurements of nighttime thermospheric winds and temperatures. III. Monthly variations during solar minimum. *J. Geophys. Res.*, **82**, 5505-5511, 1977.

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48. Norton, R. B. and R. G. Roble. Seasonal variations in molecular oxygen near 100 km. *J. Geophys. Res.*, **82**, 3659-3660, 1977.

49. Roble, R. G. Variations of the mean meridional circulation in the thermosphere, in *Dynamical and Chemical Coupling Between the Neutral and Ionized Atmosphere*, NATO Advanced Study Institute Series, (B. Grandal and J. A. Holtet, eds.), D. Reidel Publishing Co., Dordrecht, Holland, 217-233, 1977.

50. Roble, R. G. The thermosphere, Chapter 3 in *Upper Atmosphere and Magnetosphere Monograph*, for the Geophysical Research Board of the National Academy of Sciences, National Academy of Sciences, Washington, D.C., 1977.

51. Roble, R. G. The auroras, in *Natural History*, October 1977, 60-68, 1977.

52. Roble, R. G. and J. T. Hastings. Thermal response properties of the Earth's ionospheric plasma. *Planet. Space Sci.*, **25**, 217-231, 1977.

53. Roble, R. G. and M. H. Rees. Time-dependent studies of the aurora: Effects of particle precipitation on the dynamic morphology of ionospheric and atmospheric properties. *Planet. Space Sci.*, **25**, 991-1010, 1977.

54. Roble, R. G., R. E. Dickinson, and E. C. Ridley. Seasonal and solar-cycle variations of the zonal mean circulation in the thermosphere. *J. Geophys. Res.*, **82**, 5493-5504, 1977.

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63. Hays, R. B. and R. G. Roble. Quasi-static model of global atmospheric electricity. I. The lower atmosphere. *J. Geophys. Res.*, **84**, 3291-3305, 1979.

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68. Millier, F., A. Vidal-Madjar, J. Guidon, and R. G. Roble. Ozone number density profiles in the lower mesosphere as determined by the French experiment on board OSO-8. *Geophys. Res. Lett*., **11**, 863-865, 1979.

69. Rees, M. H. and R. G. Roble. The morphology of *N* and *NO* in auroral substorms. *Planet. Space Sci.*, **27**, 453-462, 1979.

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McCormac and T. A. Seliga, eds.), D. Reidel Publishing Co., Dordrecht, Holland, 233-241, 1979.

73. Roble, R. G. and P. B. Hays. A quasi-static model of global atmospheric electricity. II. Electrical coupling between the upper and lower atmosphere. *J. Geophys. Res.*, **84**, 7247-7256, 1979.

74. Roble, R. G. and P. B. Hays. Solar-terrestrial coupling through atmospheric electricity, in Proceedings of the Workshop, *The Role of the Electrodynamics of the Middle Atmosphere on Solar Terrestrial Coupling*, (N. W. Maynard, ed.), NASA CP-2090, 89-139, 1979.

75. Roble, R. G. and G. Schmidtke. Calculated ionospheric variations due to changes in the measured solar EUV flux. *J. Atmos. Terr. Phys*., **41**, 153-160, 1979.

76. Roble, R. G., R. E. Dickinson, and E. C. Ridley. Thermospheric response to the 8-9 November 1969 magnetic disturbances. *J. Geophys. Res.*, **84**, 4207-4216, 1979.

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83. Kasting, J. F. and R. G. Roble. A zonally-averaged chemical-dynamical model of the lower thermosphere. *J. Geophys. Res.*, **86**, 9641-9653, 1981.

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85. Roble, R. G. and A. D. Richmond. The thermosphere. *Scientific American*, (Japan), August, 1981.

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89. Anderson, D. N., A. D. Richmond, B. B. Balsley, R. G. Roble, M. A. Biondi, and D. P. Sipler. In-situ generated gravity waves as a possible seeding mechanism for equatorial spread-F. *Geophys. Res. Lett*., **9**, 969-972, 1982.

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