Curriculum Vitae
January, 2018
Jeffrey M. Forbes

Research Interests

Professor Forbes' research interests include the upper atmosphere environments of Earth, Mars, and other planets; coupling of these environments to lower altitudes and to solar variability; geomagnetic storm effects on satellite drag variability; the vertical propagation of tides and planetary waves in planetary atmospheres, and their electrodynamic and chemical effects; utilization of accelerometer, satellite drag, and satellite remote sensing data to elucidate atmospheric variability, and to test, validate and develop upper atmosphere models. He also conducts numerical simulations of the above phenomena.

h-index: 53 citations: 10,097

Professional Experience

September, 2017-Present	Professor Emeritus and Research Professor, Ann and H.J. Smead Department of Aerospace Engineering Sciences, University of Colorado, Boulder, CO
September, 1993-2017	Professor of Aerospace Engineering Sciences, University of Colorado, Boulder, CO
July, 2005-2017	Glenn Murphy Endowed Chair, College of Engineering & Applied Science and Department of Aerospace Engineering Sciences, University of Colorado, Boulder, CO
August, 2008-2012	Department Chair, Department of Aerospace Engineering Sciences, University of Colorado, Boulder, CO
July, 2006-November, 2006	Consultant on Natural Environment Description for Design (NEDD), Constellation Project, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA
September, 1992-August, 1993	Visiting Scientist, High Altitude Observatory, National Center for Atmospheric Research, Boulder, CO
September, 1987-August, 1994	Professor, Department of Electrical, Computer, and Systems Engineering Boston University, Boston, MA
January, 1992-August, 1994	Professor, Department of Aerospace and Mechanical Engineering Boston University, Boston, MA
January, 1992-August, 1992	Chairman ad interim, Department of Aerospace and Mechanical Engineering Boston University, Boston, MA
August, 1990-June, 1991	Visiting Scientist, High Altitude Observatory, National Center for Atmospheric Research, and Visiting Professor, Department of Electrical and Computer Engineering, University of Colorado, Boulder, CO
July, 1987-June, 1990	Director, Division of Engineering and Applied Science Boston University, Boston, MA
September, 1987-August, 1993	Associate Director, Center for Space Physics Boston University, Boston, MA

October, 1987- October, 1988	Research Consultant on the Interaction between Large Space Structures and the Neutral Environment, Jet Propulsion Laboratory California Institute of Technology, Pasadena, CA
January, 1984- August, 1987	Associate Professor of Electrical, Computer, and Systems Engineering Boston University, Boston, MA
June 1984- June, 1986	Research Affiliate, Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139
July, 1981- January, 1984	Senior Research Physicist, Department of Physics, Boston College, Chestnut Hill, MA 02167
October, 1979- August, 1983	Research Associate (non-stipend), Division of Applied Sciences Harvard University, Cambridge, MA 02138
January, 1980 January, 1995	United States Air Force Reserves, Ionospheric Physics Division, Air Force Geophysics Laboratory Hanscom AFB, Bedford MA 01730. Rank: Lt. Col. (April, 1992)
December, 1981- December, 1984	Research Consultant on Interaction Measurements from Space Shuttle, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109
June, 1975- July, 1981	Research Scientist, Space Data Analysis Laboratory, Boston College, Chestnut Hill, MA 01730
September, 1975- October, 1979	Research Fellow in Atmospheric Physics (Hon.), Center for Earth and Planetary Physics, Harvard University, Cambridge, MA 02138
June, 1975- December, 1983	Research Consultant on Ionospheric Modification, Department of Astronomy, Boston University, Boston, MA 02215
September, 1977- December, 1983	Adjunct Faculty, Department of Geology and Geophysics, and Department of Physics, Boston College, Chestnut Hill, MA 02167
1974-1975	Graduate Research Assistant, Center for Earth and Planetary Physics, Harvard University, Cambridge, MA 02138
1970-1974	Air Force Captain (Electronics Engineer), Aeronomy Laboratory, Air Force Cambridge Research Laboratories, Bedford, MA 01730
1969-1970	Graduate Research Assistant, Aeronomy Laboratory, Department Of Electrical Engineering, University of Illinois, Urbana, IL 61801

Teaching Experience

- Mathematical Physics (advanced undergrads)
- Fluid Mechanics (advanced undergrads)
- "Climate and Man" (non-science undergrads)
- Introduction to Oceanography (non-science undergrads)
- "Oceanic Dilemmas" (non-science undergrads)
- Ionospheric and Space Physics (graduate students)
- Electric Circuit Theory (sophomores)
- Linear Network Theory (advanced undergrads)
- Fluid Dynamics (graduate students)
- Aerospace Environment (graduate students)
- Intro to Engineering Computing (MatLab/FORTRAN, freshman)
- Exploration of the Solar System (advanced undergrads)
- Aerospace Engineering Senior Projects (advanced undergrads)
- Space Weather Projects (advanced graduate students)
- Tides and Planetary Waves (advanced graduate students)
- Aerodynamics (sophomores)

Education

B.S. in Electrical Engineering (Honors Program), 1968, University of Rhode Island, Kingston, RI 02881. Elected to Tau Beta Pi and Phi Kappa Phi Honor Societies.

M.S. in Electrical Engineering, 1970, University of Illinois, Urbana, IL 61801. Elected to Chi Gamma Iota Honor Society. M.S. Thesis: "*Production and Loss of Singlet-D Oxygen in the Nighttime F Region"* (S.A. Bowhill, advisor).

Special Student, Department of Meteorology, Massachusetts Institute of Technology, 1971-1974. Coursework in Dynamic Meteorology, Geophysical Fluid Dynamics, Numerical Weather Prediction, Dynamic Oceanography.

Ph.D. in Applied Physics, 1975, Harvard University, Cambridge, MA, 02138. Dissertation: "*Atmospheric Solar Tides and Their Electrodynamic Effects"* (R.S. Lindzen, advisor).

Awards and Honors

Air Force Commendation Medal, 1974, for "*major contributions to the effectiveness and success of research projects involving the development, testing, and evaluation of upper-atmosphere density models for predicting satellite ephemeredes.*"

Distinguished Visiting Scholar, February 1-April 30, 1986, Department of Physics, University of Adelaide, South Australia.

Air Force Meritorious Service Medal, 1991, for "*major contributions to the effectiveness and success of Air Force research programs in the field of neutral atmospheric dynamics.*"

Nicolet Lecturer, Fall 2004 Meeting of the American Geophysical Union, "Comparative Dynamics and Aeronomy of the Atmospheres of Earth and Mars".

Glenn Murphy Endowed Chair, Department of Aerospace Engineering Sciences and College of Engineering and Applied Science, University of Colorado, Boulder, CO, 2005-present.

Associate Fellow, American Institute of Aeronautics and Astronautics, 2006.

Fellow, American Geophysical Union, 2008.

CU College of Engineering Dean's Research Award, 2009.

AIAA Robert M. Losey Atmospheric Sciences Award, 2010.

Fellow, American Institute of Aeronautics and Astronautics, 2012.

CEDAR Prize Lecture, "Atmosphere-Ionosphere Coupling by Tides and Planetary Waves", Seattle, June, 2014.

Julius Bartels Medal and Bartels Lecture, European Geophysical Union, April, 2016.

Shen Kuo Medal for Interdisciplinary Achievements and Shen Kuo Lecture, International Association of Geomagnetism and Aeronomy (IAGA), 2017.

Professional Society Memberships

- American Geophysical Union (AGU) **(Fellow)**
- European Geophysical Union (EGU)
- American Meteorological Society (AMS)
- American Association for the Advancement of Science (AAAS)
- American Institute of Aeronautics and Astronautics (AIAA) **(Fellow)**
- American Society for Engineering Education (ASEE)

Service Activities

Service to the Profession and Research Community: *Ongoing and Recent Activities*

Academic Affairs Committee, American Institute of Aeronautics & Astronautics (AIAA), 2006-present; Chair, 2010-2012.

AIAA/ABET Evaluator for Programs leading to the Bachelor of Science in Aerospace Engineering, 2008-present.

AIAA/ABET Evaluator Mentor, 2013, 2015.

AIAA/ASEE Evaluator for Programs leading to the Bachelor of Science in Engineering Physics, Engineering Science and General Engineering, 2008-present.

Editorial Board, Journal of Atmospheric and Solar-Terrestrial Physics, 1999-present.

Executive Committee, International Association of Geomagnetism and Aeronomy (IAGA), 2011-2015.

Selection Committee, EGU Julius Bartels Medal for Excellence in Solar-Terrestrial Science, 2016-2017.

International Science Working Group, QB50 satellite mission of the European Commission, 2015-2017.

Service to the Profession and Research Community: *Prior Activities*

Committee on the Extension of the U.S. Standard Atmosphere (COESA), 1970-1990.

Study Group on the Satellite Power System Environmental Assessment, 1977-1980.

Chairman, Working group on Tides in the Mesosphere and Lower Thermosphere, International Commission on the Meteorology of the Upper Atmosphere (ICMUA), International Association of Meteorology and Atmospheric Physics (IAMAP), 1981-1988.

Coordinator, Atmospheric Tides Middle Atmosphere Program, of the International Middle Atmosphere Program (MAP), 1981-1988.

Co-Director (with R.L. Carovillano), Theory Institute in Solar Terrestrial Physics, Co-sponsored by Boston College and NASA, August 9-26, 1982, Boston College Campus.

MAP Study Group on Equatorial Observatory, 1982-1988.

IAMAP/ICMUA Working Group on Climatology of the Middle Atmosphere, 1982-1988.

Committee on the Meteorology on the Upper Atmosphere, American Meteorological Society, 1982-1985.

Engineering Science Working Group for Interactions Measurements from Shuttle (IMPS), 1983-1984.

Associate Editor, Journal of Geophysical Research (Space Physics), 1982-1985.

COSPAR Task Group on the International Reference Atmosphere, 1984-1988.

NASA Dynamics Explorer Proposal Review Team, 1985 and 1987.

NSF Review Panel for Science and Technology Centers, Spring 1988.

Working Panel on Atmospheric Tides and Gravity Waves, European Geophysical Society, 1985-1990.

MST Meteor Radar Subcommittee for the CEDAR (Coupling, Energetics, and Dynamics of Atmospheric Regions) Program, 1986-1988.

Project Leader, Lower Thermosphere Coupling Study (LTCS), an international program conducted under the auspices of the CEDAR and WITS (World Ionosphere Thermosphere Study) Programs, 1986-1992.

Earth-Mars Aeronomy Orbiter Science Definition Team, 1986-1988.

Committee on Solar and Space Physics, National Academy of Sciences, 1985-1988.

Co-Chair, MLTCS (Mesosphere-Lower Thermosphere Coupling Study) Project of International Solar-Terrestrial Energy Program (STEP), 1989-1995.

Guest Editor, Atmospheric Tides Middle Atmosphere Program Special Issue, Journal of Atmospheric and Terrestrial Physics, July/August, 1989.

Guest Editor, Lower Thermosphere Coupling Study Special Issue, Journal of Geophysical Research, February, 1991.

COSPAR Sub-Commission C2 “The Earth’s Middle Atmosphere and Lower Ionosphere,” 1990-1992.

Committee on Solar-Terrestrial Research, National Academy of Sciences, 1987-1990.

NASA Science Definition Team (1991-1992) for the TIMED (Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics) Mission.

CEDAR Proposal Review Panel, 1993, 1994 (Chair), 1995, 2003.

Chair, NSF/CEDAR Science Steering Committee, 1994-1996.

NSF/GEM (Geospace Environment Modeling) Science Steering Committee, 1994-1996, ex-officio.

AIAA Atmosphere and Space Environment Committee on Standards, 1995-1998.

IUGG/International Commission on the Middle Atmosphere, Working Group on Numerical Modeling, 1996-2002.

American Geophysical Union, Direction and Review Committee for Journal of Geophysical Research-Space Physics, and Search Committee for the Editor, 1995-1996.

NASA Hq (Office of Space Science) Science Definition Team for the Tethered Satellite System, 1996.

NASA Hq (Office of Space Science) Sun-Earth Connections Strategy Roadmap Integration Team, 1996-1997.

Co-Chair, EPIC (Equatorial Processes Including Coupling) Project of the International Solar-Terrestrial Energy Program (STEP), 1997-2002.

CRISTA/MAHRSI Working Group on Atmospheric Tides, 1997-1999.

Book Board, American Geophysical Union, 1999-2002.

Scientific Advisory Committee for EISCAT (European Incoherent Scatter Radar), 2001-2003.

Integrated Programme Review Committee (IPRC) for the British Antarctic Survey (BAS), 2001-2005.

Co-Director, School on the Physics of the Equatorial Atmosphere, International Center for Theoretical Physics (ICTP), Trieste, Italy, September 24-October 6, 2001.

Sun-Earth Connections Advisory Subcommittee, SECAS (NASA Hq Office of Space Science), 2001-2004.

Review Panel for the Deutsche Forschungsgemeinschaft priority program 'CAWSES - Climate and Weather of the Sun-Earth System', January, 2005 and January, 2007.

Sun-Solar System Connections Roadmap Team, 'Legacy' and APIO-level (NASA Hq Science Directorate), 2004-2005.

Proposer, Co-organizer, Co-Director and lecturer, Advanced International School on Space Weather, International Center for Theoretical Physics (ICTP), Trieste, Italy, May 2 – 19, 2006.

National Academy of Sciences Committee, "Review of Mars Exploration Architecture", 2006.

NASA Human Exploration of Mars Heliophysics Focus Group, 2007.

Board of Directors, eSpace: The Center for Space Entrepreneurship, 2008-2012; Executive Committee, Compensation Committee, Investment Advisory Team.

Chair, Atmosphere-Ionosphere-Magnetosphere Panel, Solar and Space Physics Decadal Survey, National Academy of Sciences, 2011-2012.

NASA Planetary Atmospheres Proposal Review Panel, September, 2012.

External Evaluator, Department of Earth and Space Science and Engineering, York University, Toronto, Canada, October, 2012.

Reviewer of Research Productivity for the Engineering Physics Program at Embry-Riddle, 2016.

Expert Review Committee, Canadian Foundation for Innovation (Atmospheric and Space Science), Jan-Feb, 2017.

Service to the University

Boston College

Graduate Affairs Committee, Department of Physics, 1981-1983.

Undergraduate Enrollment and Recruitment Policy Task Force, Department of Physics, 1982-1988.

President's Council on New Technologies, 1982-1983.

Boston University

Chairman, Graduate Program Committee, College of Engineering, 1986-1990; member since 1984.

Chairman, Ph.D. Committee, Department of Electrical, Computer, and Systems Engineering, 1984-1986.

Chairman, Publicity Committee, Department of Electrical, Computer, and Systems Engineering, 1985-1986.

Chairman, College of Engineering Ph.D. Examination Committee, 1985-1987.

Associate Director and co-founder, Center for Space Physics, Boston University Graduate School.

Member, Appointments, Promotions, and Tenure Committee, College of Engineering, 1987-1992.

Member, University Search Committee for the Dean of Engineering, 1987-1989.

Member, University Task Force on Reaccreditation (Research), 1988-1989.

Member, Boston University Industrial Liaison Doctoral Program (BUILD) Committee, 1989-1990.

Member (elected), Executive Committee of CLA/GRS (College of Liberal Arts/Graduate School), 1989-1992.

University of Colorado

Faculty Advisor, Tau Beta Pi Engineering Honor Society, College of Engineering and Applied Sciences, 1994-present.

Chair, Facilities Committee, Department of Aerospace Engineering Sciences, 1994-1995.

External Review Committee, Center for Advanced Decision Support for Water and Environmental Systems (CADSWES), May/June, 1995.

Executive Committee, Environmental Engineering Program, 1994-1999.

Environmental Engineering Committee, Integrated Teaching and Learning Laboratory, 1994-1995.

University Representative, Board On Oceans and Atmospheres, Association of Public and Land-grant Universities (APLU) (formerly National Association of State Universities and Land-Grant Colleges (NASULGC)), 1995-present.

Chair, First-Level Review Committee (College-level tenure and promotions) 1995-1996; member, 1994-1997.

Faculty Advisory Board, Women in Engineering Program, 1995-2001.

Search Committee for the Director, Women in Engineering Program, 1996/1997; 2000/2001.

Vice Chair, Curriculum and Teaching Committee, Department of Aerospace Engineering Sciences, 1997-1999.

University Program Review Panel, 1999-2002.

Chair, Search Committee, Department of Aerospace Engineering Sciences, 2000-2001.

Search Committee for the Dean, College of Engineering and Applied Science, 2000-2001.

Executive Committee, Department of Aerospace Engineering Sciences, 2000-2001, 2003-present.

ABET Coordinator and Chair of Aerospace Engineering Sciences ABET Committee, 2004-2005.

University Task Force on Program Review, 2005-2007.

Post Tenure Review Committee, Department of Aerospace Engineering Sciences, spring, 2006

IGERT pre-proposal reviews (9) for Vice Chancellor for Research, spring 2006

Primary Unit Evaluation Committees, member and Chair, Fall, 2006, 2007.

Faculty Search Committee, Department of Aerospace Engineering Sciences, 2006-2008.

Vice Chancellor's Advisory Committee (VCAC), Spring 2007-Spring 2009 & Spring 2012.

Faculty Search Committee, Department of Aerospace Engineering Sciences (AES), 2014, 2015 (Chair).

AES Awards Committee, 2013-present; Chair, 2016-present.

Graduate Focus Area Faculty Lead, Remote Sensing Earth and Space Sciences, 2015-2016; Led revision of Certificate in Remote Sensing.

National Solar Observatory Faculty Search Committee, 2016-2017.

Provost's Grievance Committee, 2016-2017.

Journal Articles

1. Forbes, J.M., *Yield of Singlet-D Oxygen by Dissociative Recombination of O_2^+ from Night Airglow Observations,* J. Atmos. Terr. Phys., 32, 1901-1908, 1970.
2. Forbes, J.M. and M.A. Geller, *Lunar Semidiurnal Variation in OI (5577A) Nightglow,* J. Geophys. Res., 77, 2942-2947, 1972.
3. Forbes, J.M. and F.A. Marcos, *Thermospheric Density Variations Associated with Auroral Electrojet Activity,* J. Geophys. Res., 78, 3841-3847, 1973.
4. Forbes, J.M. and H.B. Garrett, *Variations in the Atmospheric Neutral Density at 145 Km*., Planet. Space Sci., 23, 1399-1404, 1975.
5. Forbes, J.M. and R.S. Lindzen, *Atmospheric Solar Tides and Their Electrodynamic Effects. Part I. The Global Sq Current System*, J. Atmos. Terr. Phys., 38, 897-910, 1976.
6. Forbes, J.M., *Wind Estimates near 150 Km from the Variation in Inclination of Low-Perigee Satellite Orbits*, Planet. Space Sci., 23, 726-731, 1975.
7. Forbes, J.M. and R.S. Lindzen, *Atmospheric Solar Tides and Their Electrodynamic Effects. Part II. The Equatorial Electrojet*, J. Atmos. Sci. 38, 911-920, 1976.
8. Forbes, J.M. and M. Mendillo, *Diffusion Aspects of Ionospheric Modification by the Release of Highly Reactive Molecules in the F-Region*, J. Atmos. Terr. Phys. 38, 1299-1307, 1976.
9. Forbes, J.M. and H.B. Garrett, *Solar Diurnal Tide in the Thermosphere*, J. Atmos. Sci. 33, 2226-2241, 1976.
10. Marcos, F.A., H.B. Garrett, K.S.W Champion and J.M. Forbes, *Density Variations in the Lower Thermosphere from Analysis of the AE-C Accelerometer Measurements*, Planet. Space Sci. 25, 499-507, 1977.
11. Forbes, J.M. and R.S. Lindzen, *Atmospheric Solar Tides and Their Electrodynamic Effects. Part III. The Polarization Electric Field*, J. Atmos. Terr. Phys. 39, 1369-1377, 1977.
12. Mendillo, M. and J.M Forbes, *Artificially-Created Holes in the Ionosphere*, J. Geophys. Res. 83, 1511-162, 1978.
13. Garrett, H.B. and J.M. Forbes, *Tidal Structure of the Thermosphere at Equinox*, J. Atmos. Terr. Phys. 40, 657-668, 1978.
14. Forbes, J.M. and H.B. Garrett, *Seasonal –Latitudinal Structure of the Diurnal Thermospheric Tide*, J. Atmos. Sci. 35, 146-159, 1978.
15. Forbes, J.M., F.A. Marcos, and K.S.W Champion, *Lower Thermosphere Response to Geomagnetic Activity*, Space Research XVIII, 173-176, 1978.
16. Forbes, J.M., *Tidal Variations in Thermospheric O, O_2, N_2, Ar, He, and H*, J. Geophys, Res. 83, 3691-3698, 1978.
17. Forbes, J.M., and H.B. Garrett*, Solar Tidal Wind Structures and the E-Region Dynamo*, J. Geomag. Geoelec. 31, 173-182, 1979.
18. Lindzen, R.S. and J.M. Forbes, *Boundary Layers Associated with Thermally-Forced Planetary Waves*, J. Atmos. Sci. 35, 1441-1449, 1978.
19. Champion, K.S.W. and J.M. Forbes, *Some Recent Mesospheric and Lower Thermospheric Data and Models*, Ann. Geophys. 34, 285-300, 1978.
20. Forbes, J.M. and F.A. Marcos, *Tidal Variation in Total Mass Density as Derived from the AE-E MESA Experiment*, J. Geophys. Res. 64, 31-35, 1979.
21. Forbes, J.M. and M.E. Hagan, *Tides in the Joint Presence of Friction and Rotation: An f-plane Approximation*, J. Geophys. Res. 84, 803-810, 1979.

22. Forbes, J.M. and H.B. Garrett, *Solar Cycle Variability of Diurnal and Semidiurnal Thermospheric Temperatures*, J. Geophys. Res. 84, 1947-1949, 1979.

23. Forbes, J.M. and H.B. Garrett, *Thermal Excitation of Atmospheric Tides Due to Isolation Absorption by O_3 and H_2O*, Geophys. Res. Lett. 5, 1013-1016, 1978.

24. Forbes, J.M. and H.B. Garrett, *Theoretical Studies of Atmospheric Tides*, Rev. Geophys. Space Phys. 17, 1951-1981, 1979.

25. Garrett, H.B. and J.M. Forbes, *Time Evolution of Ion Containment Clouds at Geosynchronous Orbit*, Geophys. Res. Lett. 6, 941-944, 1979.

26. Forbes, J.M., *Upper Atmosphere Modification due to Chronic Discharges of Water Vapor from Space Launch Vehicle Exhausts, in "Space Systems and Their Interactions with the Earth's Space Environment*," edited by C. Pike and H.B. Garrett, Vol. 71, Progress in Astronautics and Aeronautics, AIAA, 1980.

27. Forbes, J.M. and F.A. Marcos, *Seasonal-Latitudinal Tidal Structures of O, N2, and Total Mass Density in the Thermosphere*, J. Geophys. Res. 85, 3489-3493, 1980.

28. Forbes, J.M. and M.E. Hagan, *Tidal Dynamics and Composition Variations in the Thermosphere*, J. Geophys. Res. 85, 3401-3406, 1980.

29. Forbes, J.M., *Tidal Effects on D and E Region Ion Chemistries*, J. Geophys. Res. 86, 1551-1563, 1981.

30. Forbes, J.M., *Mesospheric and Thermospheric Tides*, J. Meteor. Soc. Japan 58, 298-301, 1980.

31. Garrett, H.B. and J.M. Forbes, *A Model of Solar Flux Attenuation During Eclipse Passage and Its Effects on Photoelectron Emission from Satellite Surfaces*, Planet. Space Sci. 29, 601-607, 1981.

32. Forbes, J.M., *The Equatorial Electrojet*, Rev. Geophys. Space Phys. 19, 469-504, 1981.

33. Forbes, J.M., *Atmospheric Tides. I. Model Description and Results for the Solar Diurnal Component*, J. Geophys. Res. 87, 5222-5240, 1982.

34. Forbes, J.M., *Atmospheric Tides. II. The Solar and Lunar Semidiurnal Components*, J. Geophys. Res. 87, 5241-5252, 1982.

35. Forbes, J.M., *Temperature and Solar Zenith Angle control of D-Region Positive Ion Chemistry*, Planet. Space Sci. 30, 1065-1072, 1982.

36. Mendillo, M. and J.M. Forbes, *Theory and Observation of a Dynamically Evolving Negative Ion Plasma*, J. Geophys. Res. 87, 5253-5259, 1982.

37. Forbes, J.M. and M.E. Hagan, *Thermospheric Extensions of the Classical Expansion Functions for Semidiurnal Tides*, J. Geophys. Res. 87, 5253-5259, 1982.

38. Crary, D. (MS student) and J.M. Forbes, *On the Extraction of Tidal Information from Observations Covering a Fraction of a Day*, Geophys. Res. Lett. 10, 580-582, 1983.

39. Lindzen, R.S. and J.M. Forbes, *Turbulence Originating from Convectively Stable Internal Waves*, J. Geophys. Res. 88, 6549-6553, 1983.

40. Forbes, J.M., *Middle Atmosphere Tides*, J. Atmos. Terr. Phys. 46, 1049-1067, 1984.

41. Forbes, J.M., M.E. Hagan, and K.S.W. Champion, *Neutral Temperatures from Thomson Scatter Measurements: Comparisons with the CIRA (1972)*, Adv. Space Res. 3, 125-126, 1983.

42. Groves, G.V. and J.M. Forbes, *Equinox Tidal Heating of the Upper Atmosphere*, Planet. Space Sci. 32, 447-456, 1984.

43. Forbes, J.M., Middle-Atmosphere Tides: Recent Advances in Theory and Observation, Adv. Space Res. 4, 87-96, 1984.

44. Marcos, F.A. and J.M. Forbes, *Thermospheric Winds from the Satellite Electrostatic Triaxial Accelerometer (SETA) System*, J. Geophys. Res. 90, 6543-6552, 1985.

45. Groves, G.V. and J.M. Forbes, *Mean Zonal and Meridional Accelerations and Mean Heating Induced by Solar Tides for Equinox and Solstice Conditions*, Planet. Space Sci. 33, 296-293, 1985.

46. Forbes, J.M., *MST Radar Detection of Middle Atmosphere Tides*, Radio Sci. 20, 1435-1440, 1985.

47. Crary, D. (PhD student) and J.M. Forbes, *The Dynamic Ionosphere Over Arecibo: A Theoretical Investigation*, J. Geophys. Res. 91, 249-256, 1986.

48. Forbes, J.M. and G.V. Groves, *Diurnal Propagating Tides in the Low-Latitude Middle Atmosphere*, J. Atmos. Terr. Phys. 49, 153-164, 1987.

49. Forbes, J.M., R. Vincent, G. Fraser, S. Avery, S. Bowhill, R. Clark, K. Greisiger, A. Manson, R. Roper, and T. Tsuda, *On the Specification of TGCM Tidal Lower Boundary Conditions from Radar Wind Measurements During the June 1984 GTMS Period*, Adv. Space Res. 7, 295-298, 1987.

50. Forbes, J.M. and G.V. Groves, *Atmospheric Structure Between 80 and 120 Km*, Adv. Space Res. 10, 135-141, 1987.

51. Forbes, J.M., W.L. Oliver, R.C. Burnside, and C.A. Tepley, *Thermospheric Tides During Thermospheric Mapping Study Periods*, Adv. Space Res. 10, 277-283, 1987.

52. Forbes, J.M. and M.E. Hagan, *Diurnal Propagating Tide in the Presence of Mean Winds and Dissipations: A Numerical Investigation*, Planet. Space Sci. 36, 579-590, 1988.

53. Roble, R.G., J.M. Forbes, and F.A. Marcos, *Thermospheric Dynamics During the March 22, 1979 Magnetic Storm (1.) Model Simulations*, J. Geophys. Res. 92, 6045-6068, 1987.

54. Forbes, J.M., R.G. Roble, and F.A. Marcos, *Thermospheric Dynamics During the March 22, 1979 Magnetic Storm (2.) Comparisons of Model Predictions with Observations*, J. Geophys. Res. 92, 6069-6081, 1987.

55. Forbes, J.M., *Modelling the Propagation of Atmospheric Tides from the Lower to the Middle and Upper Atmosphere*, Physics Scripta T18, 241-246, 1987.

56. Forbes, J.M., M. Codrescu (PhD student), and T.J. Hall, *On the Utilization of Ionosonde Data to Analyze the Latitudinal Penetration of Ionospheric Storm Effects*, Geophys. Res. Lett. 15, 249-252, 1988.

57. Forbes, J.M. and M. Harel, *Magnetosphere-Thermosphere Coupling: An Interactive Experiment*, J. Geophys. Res. 94, 2631-2644, 1989.

58. Forbes, J.M. and R.A. Vincent, *Effects of Mean Winds and Dissipation on the Diurnal Propagating Tide: An Analytic Approach*, Planet. Space Sci. 37, 197-209, 1989.

59. Forbes, J.M., *Evidence for the Equatorward Penetration of Electric Fields, Winds, and Compositional Effects in the Asian/Pacific Sector During the 17-24 September, 1984, ETS Interval*, J. Geophys. Res. 94, 16999-17008, 1989.

60. Forbes, J.M. and F. Vial, *Monthly Simulations of the Solar Semidiurnal Tide in the Mesosphere and Lower Thermosphere*, J. Atmos. Terr. Phys. 51, 649-662, 1989.

61. Vial, F. and J.M. Forbes, *Recent Progress in Tidal Modelling*, J. Atmos. Terr. Phys. 51, 663-671, 1989.

62. Anderson, D.N., J.M. Forbes, and M. Codrescu, *A Fully Analytic Low and Middle Latitude Ionospheric Model*, J. Geophys. Res. 94, 1520-1524, 1989.

63. Codrescu, M. (PhD student), J.M. Forbes, and R.G. Roble, *Thermospheric Dynamics: A System Theory Approach*, Radio Sci. 25, 299-308, 1990.

64. Forbes, J.M. and R.G. Roble, *Thermosphere-Ionosphere Coupling: An Experiment in Interactive Modeling*, J. Geophys. Res. 95, 201-208, 1990.

65. Forbes, J.M., *The Lower Thermosphere Coupling Study of the CEDAR and WITS Programs*, Adv. Space Res. 6, 251-259, 1990.

66. Forbes, J.M. and J.E. Salah, *Mesosphere-Thermosphere Tidal Coupling during the September 21-25, 1987, LTCS-1 Campaign*, J. Geophys. Res. 96, 1135-1145, 1991

67. Miyahara, S., Yu.I. Portnyagin, J.M. Forbes, and T.V. Solovjeva, *Mean Zonal Acceleration and Heating of the 70-110 Km region*, J. Geophys. Res. 96, 1225-1238, 1991.

68. Forbes, J.M. and F. Vial, *Semidiurnal Tidal Climatology of the E-Region*, J. Geophys. Res., 96, 1147-1157, 1991.

69. Portnyagin, Yu.I., J.M. Forbes, G.J. Fraser, R.A. Vincent, I.A. Lysenko, and N.M. Makarov, *Dynamics of the Antarctic and Arctic Mesosphere/Lower Thermosphere Regions*, Adv. Space Res., 12(10), 89-96, 1992.

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A Summary of Rocket-Induced Ionospheric Perturbations (with M. Mendillo), AGARD Conference on Physical Basis of the Ionosphere in the Solar-Terrestrial System, Naples, Italy, October, 1980.

Atmospheric Tides; A Review (invited), IAMAP Assembly, Hamburg, Germany, August, 1981.

Temperature and Solar Zenith Angle Control of D-Region Positive Ion Chemistry, IAMAP Assembly, Hamburg, Germany, August, 1981.

Lower Thermosphere Tides from Incoherent Scatter Observations, IAMAP Assembly, Hamburg, Germany, August, 1981

Thermospheric Tides (invited), NASA Goddard Workshop in Thermospheric Dynamics, Greenbelt, MD, October, 1981.

Geomagnetic Storm Variations and Prediction of Low Perigee Satellite Ephemeredes (invited), NOAA/SESC Workshop on Satellite Drag, Boulder, CO, March, 1982.

Waves in the Equatorial Mesosphere: Theories and Observational Needs (invited), Workshop on Equatorial Middle Atmosphere Dynamics and Middle Atmosphere Radars, Estes Park, CO, May, 1982.

Contributions of an Incoherent Scatter Chain to the Study of Thermospheric Tides (invited), Workshop on the Incoherent Scatter Database, NCAR, Boulder, CO, February, 1983.

Variability of the Diurnal Tide, Symposium on the Meteorology of the Upper Atmosphere, American Meteorological Society, Boston, MA, March, 1983.

MST Radar Detection of Middle Atmosphere Tides (invited), Workshop on Technical Aspects of MST Radar, Urbana, IL, May 23-27, 1983.

Diurnal Propagating Tides in the Low-Latitude Middle Atmosphere, International Symposium on Equatorial Aeronomy, Hong Kong, March, 1984.

Atmospheric Tides Between 80 Km and 120 Km, CIRA Workshop, XXV COSPAR Meeting, Graz, Austria, July, 1984.

Atmospheric Tides Below 80 Km (with G.V. Groves), CIRA Workshop, XXV COSPAR Meeting, Graz, Austria, July, 1984.

Middle Atmosphere Tides: Recent Advances in Theory and Observation (invited), MAP Symposium, XXV COSPAR Meeting, Graz, Austria, June, 1984.

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Numerical Simulations of Middle Atmosphere Tides (invited), Workshop on Atmospheric Tides, Kyoto, Japan, December 5-6, 1984.

Middle Atmosphere Tides (invited), International Middle Atmosphere Symposium, Kyoto, Japan, November 26-30, 1984.

Neutral-Wind Magnetosphere Coupling: An Interactive Experiment (with M. Harel), Fall Meeting of the AGU, San Francisco, CA, December 9-13, 1985.

Incoherent Scatter Observations of Tides, Global Thermosphere Mapping Study Workshop, MIT, July, 1985.

Temperature Structure of the 80-120 Km Region, IAGA Assembly, Prague, Czechoslovakia, August 5-16, 1985.

Propagation of Tides in the Mesosphere and Lower Thermosphere, IAGA Assembly, Prague, Czechoslovakia, August 5-16, 1985.

Magnetic Storm Response of the Thermosphere as Observed from Millstone Hill (with W.L. Oliver), National Radio Science Meeting, Boulder, CO, January 13-16, 1986.

On the Specification of TGCM Tidal Lower Boundary Conditions from Radar Wind Measurements During the June 1984 GTMS Period, Thermosphere Mapping Study Workshop, XXVI COSPAR Meeting, Toulouse, France, June 30-July 12, 1986.

Atmospheric Structure Between 80 and 120 Km (with G.V. Groves, invited), CIRA Workshop, XXVI COSPAR meeting, Toulouse, France, June 30-July 12, 1986.

Thermospheric Tides During Thermosphere Mapping Study Periods (invited), Thermosphere Mapping Study Workshop, XXVI COSPAR Meeting, Toulouse, France, June 30-July 12, 1986.

Model ling the Propagation of Tides from the Lower to Middle and Upper Atmosphere (invited), International Symposium on Solar-Terrestrial Physics, XXVI COSPAR Meeting, Toulouse, France, June 30-July 12, 1986.

Diurnal Propagating Tide in the Presence of Mean Winds and Dissipation (invited), International Symposium on Space Physics, Beijing, People's Republic of China, November 10-14, 1986.

On the Specification of TGCM Tidal Lower Boundary Conditions From Radar Wind Measurements, Fall Meeting of the AGU, San Francisco, CA, December 8-12, 1986.

Propagation of Tides From the Middle to Upper Atmosphere, CEDAR Workshop, Boulder, CO, June, 1987.

Lower Thermosphere Coupling (invited) (with D. Fritts, R. Garcia, and A.D. Richmond), WITS Workshop, IUGG Assembly, Vancouver, Canada, August, 1987.

Mesosphere-Thermosphere Coupling, Workshop on Atmospheric Density and Aerodynamic Drag and Models for Air Force Operations, Air Force Geophysics Laboratory, October 20-22, 1987.

Ionospheric Response in the USSR/Japan Sector During the September 17-24 ETS Period, ETS/GTMS Workshop, Air Force Geophysics Laboratory, January 27-29, 1988.

Lower Thermosphere Coupling Study (invited), Spring Meeting of the AGU, Baltimore, MD, May 1988, and XXVII COSPAR Meeting, Helsinki, Finland, July, 1988.

Magnetosphere-Ionosphere-Thermosphere Coupling During a Magnetic Storm, inaugural symposium for the Center for Space Physics, Boston University, Boston, MA, November 9, 1988.

The Atmospheric Tides Middle Atmosphere Program (invited), XXVII COSPAR Meeting, Helsinki, Finland, July, 1988.

Global Mesosphere-Thermosphere Coupling During the LTCS-1 Campaign Period, 21-25 September, 1987 (invited), Fall Meeting of the AGU, San Francisco, CA, December 6-10, 1989.

Atmospheric Tides in the 80-120 Km Region (invited), International Middle Atmosphere Symposium, Dushanbe, USSR, November 12-19, 1989.

Coupling Parameterization in Magnetosphere-Ionosphere-Thermosphere Modeling, (invited), XXVIII COSPAR Meeting, The Hague, Netherlands, July, 1990.

Middle Atmosphere Tides and Coupling Between Atmospheric Regions, (invited), STP Symposium, XXVIII COSPAR Meeting, The Hague, Netherlands, July, 1990.

Tidal Coupling Between Atmospheric Regions (invited), Front Range Meeting of the AGU, February, 1991.

Interhemispheric Coupling Via Ducting of the 16-Day Planetary Wave, IUGG, Assembly, Vienna, Austria, August, 1991

Coupling Between the Middle Atmosphere and Thermosphere (invited), IUGG Assembly, Vienna, Austria, August, 1991.

Magnetic Activity Dependence of High-Latitude Thermospheric Winds and Densities Below 200 Km, Fall Meeting of the AGU, San Francisco, CA, December, 1991.

Quasi 16-Day Oscillation in the Ionosphere (Poster), Spring Meeting of the AGU, Montreal, Canada, May, 1992.

Tidal and Planetary Waves (Invited Tutorial), Chapman Conference on the Mesosphere and Lower Thermosphere, Asilomar, CA, November, 1992, and CEDAR Workshop, Boulder, CO, June, 1993.

Magnetic Disturbance and Planetary Wave Effects in the Low-Latitude Ionosphere/Thermosphere (invited), IAGA 1993, Buenos Aires, Argentina, August, 1993.

Lower Thermosphere Dynamics During the CEDAR LTCS-2/-6 Campaigns, Fall Meeting of the AGU, San Francisco, December, 1993.

The Lower Thermosphere and Coupling with Other Atmospheric Regions (Invited Union Lecture), Fall Meeting of the AGU, San Francisco, December, 1993.

On the Interactions Between Gravity Waves, Tides, and Planetary Waves in the Middle and Upper Atmosphere (invited), International Conference on Gravity Waves in the Atmosphere, Lake Louise, Alberta, Canada, March 22-26, 1994.

Planetary Waves in the Thermosphere-Ionosphere System, Eighth International Symposium on Solar Terrestrial Physics, Sendai, Japan, June 5-10, 1994.

Zonal Mean and Tidal Dynamics from Space: An Empirical Examination of Aliasing and Sampling Issues, Workshop on Wind Observations of the Middle Atmosphere, CNES, Paris, France, November 15-18, 1994.

Planetary Wave Influences on the Ionosphere (invited), XXI General Assembly of IUGG, Boulder, CO, July 2-14, 1995.

Unusual Dynamics in the Mesopause Region over South Pole (with Yu.I. Portnyagin and N.A. Makarov), Fall Meeting of the American Geophysical Union, San Francisco, December, 1995.

Dynamics of the Mesopause Region over South Pole (with Yu.I. Portnyagin and N.A. Makarov), XXI General Assembly of the European Geophysical Society, The Hague, Netherlands, May, 1996.

Troposphere-MLT Coupling Due to Deep Convective Activity: Modeling Perspectives (with M.E. Hagan, X. Zhang, and K. Hamilton), Second Workshop on Wind Measurements in the Middle Atmosphere, Toronto, Canada, May, 1996.

Overview of Tidal Dynamics: Model Results (with M.W. Hagan), COSPAR Meeting, Birmingham, England, July, 1996.

Longitude Structure of the Ionosphere F-Region, Including the Quasi-Two-Day Oscillation (with D. Revelle, X. Zhang, and R.E. Markin), COSPAR Meeting, Birmingham, England, July, 1996.

Dynamical Influences on Atomic Oxygen and the 5577A Emission, (with M. Angelatis i Coll), IAGA Meeting, Uppsala, Sweden, August, 1997.

The 12-Hour Wind Oscillation in the Mesosphere Region over South Pole, (with Yu.I. Portnyagin and N.A. Makarov), XXII General Assembly of the European Geophysical Society, Vienna, Austria, April, 1997.

Upper Atmosphere Tidal Oscillations due to Latent Heat Release in the Tropical Troposphere (with M.E. Hagan, X. Zhang, and K. Hamilton), XXII General Assembly of the European Geophysical Society, Vienna, Austria, April, 1997.

Dynamics of the Lower Thermosphere Over South Pole From Meteor Radar Wind Measurements (with Y. Portnyagin, N. Makarov, S. Palo, E. Merzlyakov, and X. Zhang), International Symposium on dynamics of the mesopause region (DYSMER), Kyoto, Japan, March, 1998.

Intradiurnal Oscillations in Antarctic Lower Thermosphere Winds: South Pole Observations and Global Implications (with S. Palo, X. Zhang, Y. Portnyagin, N. Makarov, and E. Merzlyakov), annual meeting of the European Geophysical Society, Nice, France, April, 1998.

Kelvin Waves in the Mesosphere and Thermosphere (with M. Hagan), Spring Meeting of the American Geophysical Union, Boston, MA, May, 1998.

Upper Atmosphere Tidal Variability Due to Latent Heat Release in the Tropical Troposphere (with M.E. Hagan, X. Zhang and J. Hackney), Fall Meeting of the American Geophysical Union, San Francisco, December, 1998.

Ionospheric Variability (with S.E. Palo, and X. Zhang), Spring Meeting of the American Geophysical Union, Boston, MA, May, 1999.

Stationary Planetary Waves in Mars' Atmosphere? AAS Meeting, Division of Planetary Sciences, Padua, Italy, October, 1999.

Stationary Planetary Waves in the Mesosphere and Thermosphere (55-120 Km) (with X. Zhang, W. Ward and E. Talaat), Fall Meeting of the American Geophysical Union, San Francisco, December, 1999.

Vertical Wave Coupling in the Martian Atmosphere, Chapman Conference on Comparative Planetary Atmospheres, Yosemite, CA, February, 2000.

Climatology of Stationary Planetary Waves in the Mesosphere and Thermosphere (with X. Zhang, W. Ward and E. Talaat), Meeting of the European Geophysical Society, Nice, France, April, 2000.

Nonmigrating Tides in the Thermosphere of Mars (with A.F.C. Bridger, M.E. Hagan, J. Murphy, S.W. Bougher, J.L. Hollingsworth, and G.M. Keating), Mars Global Surveyor Science Workshop, Boulder, CO, June 2000, and Western Pacific Geophysics Meeting, Tokyo, Japan, June, 2000.

An Ultra-Fast Kelvin Wave in the Mesosphere and Thermosphere, Western Pacific Geophysics Meeting, Tokyo, Japan, June, 2000.

Kelvin Wave Propagation in the Upper Atmospheres of Mars and Earth (with M.E. Hagan, S.W. Bougher and J.L. Hollingsworth), COSPAR Meeting, Warsaw, Poland, July, 2000.

Wave Coupling in the Atmospheres of Earth, Mars and Venus: A Comparative Planetary Perspective (invited), Fall Meeting of the European Geophysical Society, March 26-30, 2001.

Simulation of Diurnal Tides due to Tropospheric Heating from the NCEP/NCAR Reanalysis Project, Annual Meeting of the European Geophysical Society, March 26-30, 2001.

Diurnal Nonmigrating Tides in the Tropical Lower Thermosphere (with M. Hagan, X. Zhang, S. Miyahara, Y. Miyoshi), Symposium on "Equatorial Processes Including Coupling", Kyoto, Japan, March 18-22, 2002.

The S=3 Eastward-Propagating Diurnal Tide (DE3) in the Mesosphere and Thermosphere due to Heating Rates from the NCEP/NCAR Reanalysis Project: An Interim Report (with M. Hagan and X. Zhang), Spring Meeting of the AGU, Washington, D.C., May 27-May 31, 2002.

Nonmigrating Semidiurnal Tides in the Lower Thermosphere (with S. Miyahara, M. Hagan, S. Miyoshi, and X. Zhang), Western Pacific Geophysics Meeting, Wellington, New Zealand, July 8-12, 2002.

Nonmigrating Tides in the Thermosphere of Mars: A Quasi-Empirical Description (invited) (with G. Keating and M. Angelatis I Coll), Western Pacific Geophysics Meeting, Wellington, New Zealand, July 8-12, 2002.

Nonmigrating Semidiurnal Tides in the Lower Thermosphere (with S. Miyahara, M. Hagan, S. Miyoshi, and X. Zhang), Planetary-Scale Mesopause Observing System (PSMOS) Conference, Foz do Iguacu, Brazil, October 4-8, 2002.

Seasonal Cycle of Nonmigrating Diurnal Tides in the MLT Region Due to Tropospheric Heating Rates from the NCEP/NCAR Reanalysis Project (with M. Hagan and X. Zhang), COSPAR (Committee on Space Research) Meeting, Houston, Texas, October 13-17, 2002.

Tides in the Middle and Upper Atmospheres of Mars and Venus (Invited), COSPAR (Committee on Space Research) Meeting, Houston, Texas, October 13-17, 2002.

Nonmigrating Tides in the Thermosphere of Mars: A Quasi-Empirical Description (with G. Keating and M. Angelatis I Col), COSPAR (Committee on Space Research) Meeting, Houston, Texas, October 13-17, 2002.

Thermospheric Density Response to Solar Disturbances During April 15-24, 2002: CHAMP/STAR Accelerometer Measurements (with S. Nerem, S. Bruinsma and X. Zhang), Fall Meeting of the AGU, San Francisco, CA, December 5-10, 2002.

Thermospheric Density Response to Solar Disturbances During April 15-24, 2002: CHAMP/STAR Accelerometer Measurements (with S. Nerem, S. Bruinsma and X. Zhang), Workshop on the April, 2002, Solar disturbance Period, Applied Physics Laboratory, Laurel, Maryland, August 6-9, 2002.

A Fast Semidiurnal Tide in the Lower Thermospheres of Mars and Earth, Spring Meeting of the EGS, April, 2003.

Nonmigrating Tides as Measured by the Saber Instrument on Timed During April-May, 2002 (with J. Russell, S. Miyahara, C. Mertens, S. Palo, X. Zhang, and R. Garcia), Spring meeting of the EGS, April, 2003, and Storm Workshop, Applied Physics Laboratory, August, 2003.

Nonmigrating Tides in the Lower and Middle Thermosphere on the Equatorial Region (with S. Mihahara, Y. Miyoshi, X. Zhang), IUGG Meeting, Sapporo, Japan, July, 2003.

On the Use of Hough Mode Extensions (HMES) to Fit Tidal Structures from Saber and TIDI Measurements (with A. Svoboda), Fall Meeting of the AGU, December, 2003.

Neutral Thermosphere Response to Geomagnetic Disturbances (with G. Lu, S. Nerem, S. Bruinsma, and X. Zhang), Workshop on Sun-Earth Connection Space Weather During the April 14-24 2002 Storms, The Johns Hopkins University, Applied Physics Laboratory, Laurel, Maryland, August 19-21, 2003.

Tide-mean flow interactions in the Upper atmospheres of Earth and Mars, (with S. Miyahara), Annual Meeting of the European Geophysical Union, Nice, France, 25-30 April, 2004.

Migrating and Nonmigrating Trapped Diurnal tides in the Temperature Field at 70-80 km as Measured by the SABER Instrument on TIMED, (with Russell, J., Zhang, X., Mertens, C.J., Palo, S., and M. Mlynczak), COSPAR Meeting, Paris, France, July 18-25, 2004.

Nonmigrating Tides as Measured by the SABER Instrument on TIMED, (with Russell, J., Zhang, X., Mertens, C.J., Palo, S., and M. Mlynczak), Spring Meeting of the AGU, Montreal, Canada, May 17-21, 2004.

Migrating and Nonmigrating Diurnal Tides from the TIMED Mission: Implications for Zonal Mean Winds and Temperatures, (with S. Miyahara), Western Pacific Geophysics Meeting, Honolulu, Hawaii, August 16-20, 2004.

Comparative Dynamics and Aeronomy of the Atmospheres of Earth and Mars (invited, Nicolet Lecture), Fall 2004 Meeting of the American Geophysical Union, San Francisco, CA, Dec 12-17, 2004.

Mesosphere-Thermosphere Coupling (invited), (with A. Svoboda, M.E. Hagan, S.E. Palo, S. Miyahara, M. Yoshikawa, and X. Zhang), Fall 2004 Meeting of the American Geophysical Union, San Francisco, CA, Dec 12-17, 2004.

New Perspectives on Atmospheric Tides and Planetary Waves from the TIMED Mission (invited), (with S.E. Palo, M.E. Hagan, S. Miyahara, F. Vial, Yu.I. Portnyagin and the TIMED Team), Fall 2004 Meeting of the American Geophysical Union, San Francisco, CA, Dec 12-17, 2004.

Geomagnetic Storm Response of Global Thermospheric Density from CHAMP Accelerometer Measurements, (with G. Lu, S. Nerem, X. Zhang, E. Sutton, A.D. Richmond, R.G. Roble, and S. Bruinsma), LWS Workshop, Boulder, CO, March 22-26, 2004.

Thermospheric Density Variations from Accelerometer Measurements on the CHAMP Satellite, (with S. Nerem, E. Sutton, X. Zhang, G. Lu, A.D. Richmond, R.G. Roble, and S. Bruinsma), Atmospheric Neutral Density and Solar Indices Workshop, Peterson AFB, CO springs, CO, May 25-26, 2004.

Nonmigrating Tides in Planetary Atmospheres, Summer School on Geophysical Fluid Mechanics, Woods Hole Oceanographic Institute, July 14-17, 2004.

Comparative Dynamics and Aeronomy of the Atmospheres of Earth and Mars, NCAR Advanced Study Program, December 8, 2004.

Neutral Density and Wind Responses to the Severe 2003 Geomagnetic Storms from CHAMP & GRACE Accelerometer Data (invited), (with E. K. Sutton, R. S. Nerem), International Symposium on Equatorial Aeronomy (ISEA), Taipei, Taiwan, 9-15 May, 2005.

Thermosphere Density and Wind Responses to Solar and Geomagnetic Activity (invited), (with E. K. Sutton, R. S. Nerem and S. Bruinsma), NCAR Advanced Study Program (ASP) Summer School on Space Weather, June 2005.

Troposphere-Thermosphere Planetary Wave Coupling During the 2002 Southern Hemisphere Pre-Stratwarm Period (invited), (with S.E. Palo, J. Russell, C.J. Mertens, M.G. Mlynczak, G. Burns, P. Espy, and T.D. Kawahara), 2005 IAGA Meeting, Toulouse, France, 18-29, July, 2005.

Thermosphere Density Response to the 20-21 November 2003 Solar and Geomagnetic Storm from CHAMP and GRACE Accelerometer Data (invited), (with S. Bruinsma and R. S. Nerem), Atmospheric Neutral Density and Solar Indices Workshop, Colorado Springs, CO, 12-13 October, 2005.

Neutral Density and Wind Responses to the Severe 2003 Geomagnetic Storms from CHAMP & GRACE Accelerometer Data (invited), (with E. K. Sutton and R. S. Nerem), Atmospheric Neutral Density and Solar Indices Workshop, Colorado Springs, CO, 12-13 October, 2005.

Thermosphere Response to Solar Disturbances From CHAMP and GRACE Accelerometer Measurements (invited), (with S. Bruinsma, E.K. Sutton, R.S. Nerem and X. Zhang), Fall AGU Meeting, San Francisco, CA, 5-9 December, 2005.

Troposphere-Thermosphere Planetary Wave Coupling During the 2002 Southern Hemisphere Pre-Stratwarm Period, (with S.E. Palo, J. Russell, C.J. Mertens, M.G. Mlynczak), Fall AGU Meeting, San Francisco, CA, 5-9 December, 2005.

Solar-terrestrial coupling effects in the thermosphere: new perspectives from CHAMP and GRACE accelerometer measurements of winds and densities (invited), (with S. Bruinsma, E.K. Sutton, R.S. Nerem and X. Zhang), STP-11 Symposium, Rio de Janeiro, Brazil, 6-10 March 2006.

New Perspectives on Thermosphere Weather from CHAMP and GRACE Accelerometer Measurements (invited), (with S. Bruinsma, E.K. Sutton, R.S. Nerem), Atmospheric Neutral Density Forecast Workshop, Colorado Spring, Colorado, April 20-21, 2006.

Mesosphere-thermosphere penetration of stratosphere planetary waves from TIMED/SABER temperature measurements (invited), (with S.E. Palo, X. Zhang, J. Russell, C.J. Mertens and M. Mlynczak), COSPAR Scientific Assembly, Beijing, China, July 16-22, 2006.

Satellite Drag Variability at Earth, Mars and Venus due to Solar Rotation (with S. Bruinsma, F.G. Lemoine, B.R. Bowman, A. Konopliv), AIAA/AAS Astrodynamics Specialist Conference, Keystone Resort & Conference Center, Keystone, Colorado, August 21-24, 2006.

Vertical Coupling by Planetary Waves as Revealed by the SABER Instrument on TIMED (invited), (with S.E. Palo, X. Zhang, J. Russell, C.J. Mertens and M. Mlynczak), The 3rd IAGA/ICMA Workshop on "Vertical Coupling in the Atmosphere-Ionosphere System", Varna, Bulgaria, 18-22 September 2006.

Variability of the Satellite Drag Environments of Earth, Mars and Venus Due to Rotation of the Sun, (with S. Bruinsma, F.G. Lemoine, B.R. Bowman, A. Konopliv), Fall AGU Meeting, San Francisco, CA, 11-15 December, 2006

MLT Longitudinal Structures due to Nonmigrating tides; Planetary Wave Vertical Coupling in the Mesosphere, Thermosphere & Ionosphere: An Opportunity for Clustered and Distributed Platform Investigation; & Theory and Modeling Campaign Focus: Quasi-2-day Wave in the Mesosphere, Thermosphere & Ionosphere, CEDAR Annual Workshop, Santa Fe, NM, June 19-22, 2006.

Vertical Coupling by the Semidiurnal Tide in Earth's Atmosphere (invited keynote), International Symposium on Coupling Processes in the Equatorial Atmosphere (CPEA Symposium), Kyoto University, Kyoto, Japan, March 20-23, 2007.

Oscillation of Venus' Upper Atmosphere (with A. Konopliv), EGU General Assembly, Vienna, Austria, April 15-20, 2007

Kelvin Waves as Observed by the SABER Instrument on the TIMED Spacecraft (invited) (with X. Zhang, S. Miyahara, S.E. Palo, J. Russell, C.J. Mertens and M. Mlynczak), International CAWSES (Climate and Weather of the Sun-Earth System) Symposium. Kyoto, Japan, October 23-27, 2007.

Thermosphere Responses of the Terrestrial Planets to Solar Variability (invited) (with F.G. Lemoine, S. Bruinsma, B.R. Bowman, A. Konopliv, S.W. Bougher, and M.D. Smith), IUGG Meeting, Perugia, Italy, July 2-13, 2007.

Comparative Planetary Study: How do the Exosphere Temperatures of Earth, Mars and Venus Respond to Long-Term Solar Change? (with F.G. Lemoine, S. Bruinsma, M.D. Smith and X. Zhang), Fall Meeting of the AGU, December 10-14, 2007.

A Solar Terminator Wave in Thermosphere Neutral Densities Measured by the CHAMP Satellite (with S. Bruinsma, Y. Miyoshi and H. Fujiwara), COSPAR General Assembly, Montreal, Canada, July 13-20, 2008.

Kelvin Waves as Observed by the SABER Instrument on the TIMED Spacecraft (with X. Zhang, S. Miyahara, S.E. Palo, J. Russell, C.J. Mertens and M. Mlynczak), EGU General Assembly, Vienna, Austria, April 14-18, 2008.

Response Characteristics of Orbit-Mean Satellite Drag to Varying Geomagnetic Conditions (with X. Zhang, E.K. Sutton, J. Lei, R.S. Nerem, S. Bruinsma, and D.J. Knipp), AIAA Astrodynamics Specialists meeting, Honolulu, HI, August 18-21, 2008.

Neutral Atmosphere Density Interdisciplinary Research: (NADIR) (Invited), Workshop on Space Situational Awareness, Washington, D.C., February 20, 2008.

Neutral Atmosphere Density Interdisciplinary Research: (NADIR), Space Weather Workshop, Boulder, Colorado, April 28 - May 2, 2008.

Troposphere-Thermosphere Coupling by Thermal Tides at Earth and Mars (Invited), Spring Meeting of the AGU, Fort Lauderdale, FLA, May 27-May 30, 2008.

Nonmigrating Tides in Exosphere Temperature at the Equator From CHAMP and GRACE Accelerometer Measurements, Fall Meeting of the AGU, San Francisco, CA, December 15-19, 2008.

Exosphere Temperature Variability at Earth, Mars and Venus due to Solar Irradiation, International Conference on Comparative Planetology: Venus-Earth-Mars, ESA/ESTEC, Noordwijk, Netherlands, May 11-15, 2009.

Earth's Exosphere Temperature Variability Linked to Surface by Thermal Tides, EGU Meeting, Vienna, Austria, April 19-24, 2009.

Thermosphere Tides as Viewed from Space: CHAMP and GRACE as a "Mini-Constellation", ESA Second Swarm International Science Meeting, Potsdam, Germany, June 24-26, 2009.

Solar Cycle Variability of the Global Diurnal and Semidiurnal Thermospheric Tides (with S. Bruinsma, J. Oberheide, and X. Zhang), 6th Annual Meeting of the Asia Oceania Geosciences Society (AOGS), Singapore, 11-15 August, 2009.

Wave Coupling Between the Lower Atmosphere and Thermosphere: Solar Cycle Influences (with S. Bruinsma, M.E. Hagan, X. Zhang), Fall Meeting of the AGU, San Francisco, CA, December 14-18, 2009.

NADIR: Neutral Atmosphere Density Interdisciplinary Research (with T.J. Fuller-Rowell), Space Weather Session, Annual Meeting of the American Meteorological Society, Atlanta, GA, Jan 17-21, 2010.

Interannual Variability of the Ionosphere due to ENSO, "Global Change and the Solar-Terrestrial Environment", Aspen Global Change Institute (AGCI), Aspen, Colorado, June 13-17, 2010.

Atmospheric Tides: Linking Deep Tropical Convection to Ionosphere-Thermosphere Variability, Center for Space Physics Seminar, Boston University, Boston, MA, November 11, 2010.

Stratosphere Warming-Ionosphere Coupling During 2009 (with N. Pedatella), Committee on Space Research (COSPAR) 38th Scientific Assembly, Bremen, Germany, July 18-25, 2010.

Diurnal and Semidiurnal Sun-Synchronous Tides in Exosphere Temperature from CHAMP and GRACE Density Measurements (with S. Bruinsma), General Assembly of the European Geosciences Union, Vienna, Austria, May 2-7, 2010.

Atmosphere-Ionosphere-Magnetosphere Science Imperatives, CEDAR Plenary Session, June 26 - July 1, 2011, Sante Fe, New Mexico.

Solar Cycle Variability of the Thermospheres of Mars and Earth (with S. Bruinsma, J.-C. Marty, and X. Zhang), AAS Division of Planetary Sciences (DPS) Meeting, Nantes, France, October 3-7, 2011.

Middle Thermosphere Response to Tidal Forcing from Below (with X. Zhang and J. Oberheide), Fall Meeting of the AGU, December 5-9, 2011.

Department of Aerospace Engineering Sciences at CU-Boulder, Space Weather and Satellite Drag, Seminar to North Carolina A&T Faculty and Students, November 28, 2011.

Troposphere Weather to Space Weather: Quantifying the Role of Atmospheric Tides (invited), Meeting of the American Meteorological Society, New Orleans, LA, Jan 22-27, 2012.

Gravitational Tides and Their Influence on the Thermosphere (with X. Zhang, S.L. Bruinsma, and J. Oberheide), Annual Meeting of the European Geophysical Union (EGU), Vienna, Austria, April 23-27, 2012.

Gravitational Tides and Their Influence on the Thermosphere (with X. Zhang, S.L. Bruinsma, and J. Oberheide), International Symposium on Equatorial Aeronomy (ISEA), Paracus, Peru, March 12-17, 2012.

Tides, Planetary Waves, and Vertical Coupling of Atmospheric Regions (invited), NSF Workshop on Exploring the Interaction of our Atmosphere with Space: A Large Aperture Lidar/Optical Facility for Upper Atmosphere Research (30-1000 km), Chicago, IL, May 15-17, 2012.

Coupling to the Lower Atmosphere, an Observation-Based Perspective, (with X. Zhang, S.L. Bruinsma, J. Oberheide, and J. Leonard), Neutral Atmosphere Interdisciplinary Research (NADIR) MURI Meeting, Boulder, CO, September 25-26, 2012.

Non-Migrating tides from the Ground and From Space (invited), Tutorial Lecture, CEDAR Student Workshop, Santa Fe, NM, June 24, 2012.

Thoughts on Comparative Planetary Environments (invited), CEDAR Workshop, Santa Fe, NM, June 24-30, 2012.

Space Weather (invited), Smead Fellow Workshop, Vail, CO, May 10-11, 2012.

Development of an Inter-calibrated Exosphere Temperature Database for Thermosphere Space Weather Studies From the Ground and From Space (invited), First ESA-Swarm Validation Workshop, Frascati, Italy, June 18-20, 2012.

Coupling Between the Lower Atmosphere and Thermosphere as Revealed in GOCE and Swarm Accelerometer Measurements (with X. Zhang, J.T. Zhang, E. Doornbos, S. Bruinsma), ESA Living Planet Symposium, Edinburgh, UK, Sept 9-13, 2013.

Wave Coupling in the Atmosphere-Ionosphere System (invited), Fall Meeting of the American Geophysical Union (AGU), San Francisco, CA, Dec 9-13, 2013.

New Perspectives on Non-Migrating Tides in the Thermosphere, International CAWSES-II (Climate and Weather of the Sun-Earth System) Symposium, Nagoya, Japan, Nov 18-22, 2013.

Coupling Between the Lower Atmosphere and Thermosphere as Revealed in GOCE and CHAMP Accelerometer Measurements (with X. Zhang, E. Doornbos, S. Bruinsma), 12th Assembly of the International Association of Geomagnetism and Aeronomy (IAGA), Merida, Mexico, Aug 26-31, 2013.

Perspectives on Ionosphere-Thermosphere Science Using Swarm: The GOCE-CHAMP-GRACE-DMSP Mini-Constellation (with E. Doornbos, M. Conde, S.L. Bruinsma, G. Lu, and D. Ober), 12th Assembly of the International Association of Geomagnetism and Aeronomy (IAGA), Merida, Mexico, Aug 26-31, 2013.

Nonlinear Interactions Between Large-Scale Waves in the Atmosphere: Basic Theory and Observational Evidence (with Y. Moudden and S.E. Palo), Workshop on Nonlinear Waves and Chaos, La Jolla, CA, Mar 3-8, 2013.

Neutral Atmosphere Density Interdisciplinary Research (NADIR), Space Weather Workshop, Boulder, CO, Apr 16-19, 2013.

Solar Cycle Dependence of Middle Atmosphere Temperatures (with X. Zhang and D. Marsh), 12th Assembly of the International Association of Geomagnetism and Aeronomy (IAGA), Merida, Mexico, Aug 26-31, 2013.

Ionospheric Electron Density Response to Solar Flares, (with Ryan Handzo and Bodo W. Reinisch), Space Weather Conference at the 94th annual Meeting of the AMS, Atlanta, Georgia, February 2-6, 2014.

The Lunar Atmospheric tide as Viewed by Multiple Satellites, Boston University Center for Space Physics Seminar, Boston, MA, February 27, 2014

Atmosphere-Ionosphere Coupling by Tides, Planetary Waves, and their Interactions, CEDAR Prize Lecture, Annual NSF CEDAR Meeting, Seattle, WA, June 23-26, 2014.

Lunar Tide Variability in the Thermosphere as Derived from GOCE, CHAMP and GRACE Accelerometer Data (with Jesse T. Zhang, Eelco Doornbos, Sean L. Bruinsma, Xiaoli Zhang, and Casey Zhang), European Geosciences Union General Assembly, Vienna, Austria, April 27-May 2, 2014.

The Lunar Thermospheric Tide as Viewed by Multiple Satellites (with Jesse T. Zhang, Eelco Doornbos, Sean L. Bruinsma, Xiaoli Zhang, and Casey Zhang), Asia Oceania Geosciences Conference, Sapporo, Japan, July 28-August 1, 2014.

Atmosphere-Ionosphere Wave Coupling as Revealed in plasma densities and drifts (with David Knudsen, Stephen Buchert, and Jonathan Burchill), Swarm Science Meeting, Copenhagen, Denmark, June 19-20, 2014.

Forbes, J.M., Bruinsma, S.L., and X. Zhang, Thermosphere Density Variability at Small Scales from GOCE Accelerometer Measurements, European Geophysical Union Assembly, Vienna, Austria, April 13-17, 2015.

Forbes, J.M., The Lunar Tide: An Enduring Atmospheric Problem (Invited), Marvin Geller Symposium, 96th Annual Meeting of the AMS, New Orleans, LA, January 10-14, 2016.

Forbes, J.M., The Lunar Tide: An Enduring Atmospheric Problem (Invited), Utah State University Physics Department Seminar, Logan, UT, February 9, 2016.

Forbes, J.M., Atmosphere-Ionosphere Coupling due to Atmospheric Tides (Julius Bartels Medal Lecture) (Invited), Annual Meeting of the European Geophysical Union, Vienna, Austria, April 17-22, 2016.

Forbes, J.M., Decadal Survey Atmosphere--Ionosphere-Magnetosphere Interactions (AIMI) Panel (Invited), Plenary Talk, CEDAR Workshop, Santa Fe, NM, June 20-24, 2016.

Forbes, J.M., Electrical Connections and Consequences in the Earth System (ECCWES) (Invited), Plenary Talk, CEDAR Workshop, Santa Fe, NM, June 20-24, 2016.

Forbes, J.M. (with Zhang, X., Gasperini, F., and Y. Moudden), Planetary wave--tide interactions and consequences in the middle and upper atmosphere (Invited), International Symposium on the Whole Atmosphere (ISWA), Tokyo, Japan, September 14-16, 2016.

Forbes, J.M., Wave Coupling in the Atmosphere-Ionosphere System (Invited), AGU Fall Meeting, San Francisco, CA, December 12-16, 2016.

Forbes, J.M., A. Maute, X. Zhang, M.E. Hagan, and F. Gasperini, Planetary Wave-Tide Interactions in Atmosphere-Ionosphere Coupling, IAPSO-IAMAS-IAGA Joint Assembly, Cape Town, South Africa, 27 Aug - 1 Sept, 2017.

Forbes, J.M., Vertical Wave Coupling and Space Weather in the Atmospheres of Earth and Mars, Shen Kuo Medal Lecture, IAPSO-IAMAS-IAGA Joint Assembly, Cape Town, South Africa, 27 Aug - 1 Sept, 2017.

The above list does not include presentations by students and/or other colleagues on which I was co-author

Book Reviews

Dynamics of the Upper Atmosphere by Susumu Kato, D. Reidel Publishing Company, in Science, July, 1981

Book Chapters

Forbes, J.M., *Upper Atmosphere Modification due to Chronic Discharges of Water Vapor from Space Launch Vehicle Exhausts, in "Space Systems and Their Interactions with the Earth's Space Environment,"* edited by C. Pike and H.B. Garrett, Vol. 71, Progress in Astronautics and Aeronautics, AIAA, 1980.

Forbes, J.M., *Physics of the Mesopause Region*, in Solar-Terrestrial Physics; Principles and Theoretical Foundations, Ed. By R.L. Carovillano and J.M. Forbes, D. Reidel Publishing Company, 1983.

Forbes, J.M., *Atmospheric Tides*, in the Upper Atmosphere: Data Analysis and Interpretation, W. Dieminger et al. [eds.], Springer-Verlag, New York, 97-109, 1996.

Parish, H.F., Forbes, J.M., and F. Kamalabadi, *Analysis of Wave Signatures in the Equatorial Ionosphere*, in the Upper Mesosphere and Lower Thermosphere: A Review of Experiment and Theory, edited by R.M. Johnson and T.L. Killeen, Geophysical Monograph Series, vol. 87, American Geophysical Union, 1995, pp. 356.

Forbes, J.M., *Tidal and Planetary Waves* (A Tutorial), in the Upper Mesosphere and Lower Thermosphere: A Review of Experiment and Theory, edited by R.M. Johnson and T.L. Killeen, Geophysical Monograph Series, vol. 87, American Geophysical Union, 1995, pp. 356.

Hagan, M.E., Forbes, J.M., and A.D. Richmond, *Atmospheric Tides*, in The Encyclopedia of Atmospheric Sciences, ed. By J.R. Holton, J. Pyle, and J.A. Curry, Academic Press, 159-165. 2002.

Forbes, J.M., *Wave Coupling in Terrestrial Planetary Atmospheres*, in Atmospheres in the Solar System: Comparative Aeronomy, Geophys. Mong. 130, 171-190, American Geophysical Union, 2002.

Immel, T. J., G. Crowley, J. M. Forbes, R. S. Nerem and E. K. Sutton, Neutral Composition and Density Effects in the October-November 2003 Magnetic Storms, in Midlatitude Ionospheric Dynamics and Disturbances, Geophys. Monogr. Ser., Vol. 181, edited by P.M. Kintner Jr., A.J. Coster, T.J. Fuller-Rowell, A.J. Mannucci, M. Mendillo and R. Heelis, 2008.

Forbes, J.M., Semidiurnal Tide in Earth's Atmosphere, Climate and Weather of the Sun-Earth System, Selected Papers from the 2007 Kyoto Symposium, Edited by T. Tsuda, R. Fujii, K. Shibata, and M. A. Geller, Terra Scientific Publishing Company, 337-348, 2009.

Books

Solar-Terrestrial Physics; Principles and Theoretical Foundations, Ed. By R.L. Carovillano and J.M. Forbes, D. Reidel Publishing Company, 1983.

History of Funded Research

Boston College

Upper Atmosphere Density Data and models, Air Force Geophysics Laboratory, 1 Oct. 75-30 Sept. 78, $166,000

Structure of the Thermosphere, AFOSR, 1 Feb. 77- 1 Feb. 81, $66,000

Theoretical Studies of Atmospheric Tides, Naval Research Laboratory, 1 Oct. 77 – 30 Sept. 78, $50,000

Atmospheric Density Models, Including Tides, Air Force Geophysics Laboratory, 28 March 79 – 28 March 82, $173,382

Tides in the Mesosphere and Lower Thermosphere, NSF/ATM Aeronomy, 15 Oct. 79 – 15 Oct. 81, $92,000

Dynamical-Chemical Coupling in the Mesosphere and Lower Thermosphere, AFOSR, 1 Feb. 81 – 31 Dec. 83, $165,407

Thermospheric Structure Variations during High Solar and Magnetic Activity Conditions, Air Force Geophysics Laboratory, 10 Mar. 82 – 31 Dec. 83, $108,717

Dynamics of the Stratosphere, Mesosphere, and Lower Thermosphere, NSF/ATM Aeronomy, 1 Apr. 82 – 31 Dec. 83, $94, 350

Boston University

Dynamics of the Stratosphere, Mesosphere, and Lower Thermosphere, (Re-awarded from Boston College), NSF/ATM Aeronomy, 1 May 84 – 1 May 85, $35,650

Structure and Variability of Mesosphere and Lower Thermosphere Densities and Temperature, Air Force Geophysics Laboratory (via subcontract from Boston College), $93,783

Dynamical-Chemical Coupling in the Mesosphere and Lower Thermosphere, (Re-awarded from Boston College), AFOSR, 1 May 84 – 31 Dec. 84, $19,326

Mesosphere and Thermosphere Tides and Related Phenomena, NSF/ATM Aeronomy, 1 July 84 – 30 Sept. 87, $211,824

Global Density Specification in the Lower Thermosphere, Air Force Geophysics Laboratory, 1 June 85 – 1 June 88, $192,000

Electromechanical Feedback Processes in the Ionosphere, AFOSR, 1 Dec. 84 – 31 Nov. 87, $150,360

Lower Thermosphere Coupling Study, NSF/ATM Aeronomy, 1 Oct. 87 – 30 Sept. 90, $372,975

Self-Consistent Modelling of the Ionosphere-Thermosphere-Magnetosphere System, AFOSR, 1 Aug. 88 – 31 July 91, $197,500

Dynamics of the Antarctic Mesosphere and Lower Thermosphere, NSF Division of Polar Programs, 1 Dec. 89 – 30 Nov. 91, $79,673

Upper Atmosphere Neutral and Plasma Density Modeling, Air Force Geophysics Laboratory, 26 Feb. 90 – 26 May 93, $590,909

Lower Thermosphere coupling Study, NSF/ATM Aeronomy, 1 Sept. 91 – 31 Aug. 94 ($45,000 residual funds transferred to U. Colorado with no-cost extension to 31 May 96), $345,000

Metallic Ions and Atoms in the Upper Atmosphere, AFOSR, 1 Jan. 92 – 31 Dec. 93, $163,419

University of Colorado

Planetary Wave Signatures in Upper Atmosphere Density 80-250 Km, Air Force Phillips Laboratory (via subcontract from Boston University), 1 Nov. 93 – 31 Dec. 95, $162,734

Planetary Waves in the Antarctic Mesopause Region, NSF Office of Polar Programs15 Aug 94 – 31 Dec 96, $113,433

Planetary Waves in the Ionosphere, AFOSR, 1 Jan 95 – 31 Dec 97, $173,256

Operation of the CEDAR Science Steering Committee, NSF/ATM Aeronomy, 1 Jun 94 – 31 May 97, $70,569

Advanced Data Assimilation for CEDAR, (R. Akmaev, P.I.; J. Forbes, Co-P.I.), NSF/ATM CEDAR Program, 1 Jan 96 – 31 Dec 97, $100,592

Lower Thermosphere Coupling Study, NSF/ATM Aeronomy, 1 Sept 94 – 31 May 96, (Transfer of residual funds from B.U.; full amount of award, $390,000 over 1 Sept 91 – 31 Aug 94), $45,000

Wave-Wave Interactions and Mean Flow Accelerations in the MLT Region, NSF/ATM Aeronomy, 1 Jan 95 – 31 Dec 98, $304,605

Natural Oscillations of the Thermosphere-Ionosphere System, NASA/Hq Space Physics Division, 1 May 95 – 30 Apr 98, $123,178

Dynamical Influences on Chemistry and Emissions in the MLT Region (funded as continuation of "Natural Oscillations of the Thermosphere-Ionosphere system"), NASA/Hq Space Physics Division, 1 May 97 – 30 Apr 02 (includes 1-year phase-down), $308,054

Thermospheric Density Variability and Forecast Model Development, (T. Fuller-Rowell, Co-P.I.), U.S. Air Force Phillips Laboratory, 1 Jan 96 – 31 Dec 99, $432,154

Meteorological Influences on the Thermosphere-Ionosphere System, AFOSR (AASERT Award), 1 Jun 96 – 31 May 99, $114,409

Data Assimilation for Thermospheric Forecasting, with Application to Satellite Ephemeris Prediction, AFOSR (AASERT Award), 1 Jun 97 – 31 May 01, $103,384

Dynamics of the Mesospheres and Lower Thermospheres of the Arctic and Antarctic, NSF/ATM Aeronomy, 1 May 98 – 30 Apr 01, $307,829

Vertical Coupling and Variability in the Tropical Atmosphere/Ionosphere System, AFOSR, 1 Jan 98 – 31 Dec 01 (with 1-year NC extension), $196,269

Wave Structures and Vertical Coupling in the Martian Atmosphere, NASA Mars Data Analysis Program, 1 Jun 99 – 31 May 02, $128,854

Inter-calibration of Mesosphere/Lower Thermosphere Winds from Space-Based and Ground-Based Measurements, NASA JURISS Program, 15 Aug 99 – 14 Aug 02, $48,000

Tides and Zonal Mean Circulation from Satellite-Based Measurements, NASA Goddard (GSRP-grad student support only), 1 Jul 99 – 30 Jun 02, $66,000

Density Structures in the Thermosphere of Mars: Assimilative Analyses of MGS Accelerometer and TES Data NASA Mars Global Surveyor Data Analysis Program, 1 Sep 01 – 31 Aug 03, $97,000

Tidal Variability in the Mesosphere and Thermosphere, NSF/ATM Aeronomy, 1 Jan 01 – 31 Dec 03, $320,000

Planetary-Scale Waves and Ionosphere "Weather", NASA Goddard (GSRP – grad student support only), 1 Jul 01 – 30 Jun 04, $70,000

Space Weather Program: Thermospheric Density and Wind Perturbations during Geomagnetically Disturbred Periods, NSF/ATM Aeronomy, 1 Jun 02 - 31 May 07, $400,000

Density Variations and Other Parameters from UARS Wind Measurements, AFOSR, 1 Mar 03 - 31 Dec 04, $92,901

Numerical Modeling of Wave Coupling Effects on the Mesosphere-Thermosphere, NSF/ATM Aeronomy, 1 Jan 04 - 31 Dec 08, $585,527

Gravity Waves and Their Effects on the Mean State and Variability of Mars' Upper Atmosphere, NASA Mars Data Analysis Program, 15 May 04 – 15 May 07, $167,627

Thermosphere Density Response Characteristics as Derived From CHAMP/SETA Satellite Experiments, NASA Goddard (GSRP – grad student support only), 1 Jul 04 – 30 Jun 07, $70,000

Galilean Moons Environments Modeling for JIMO, JPL, 15 Sep 04 – 15 Feb 05, $75,000

Thermosphere Density Response to Geomagnetic Storms, AFOSR, 1 Jan 05 – 31 Dec 07, $261,352

CHAMP Atmospheric Density Estimates (R.S. Nerem, PI, J.M. Forbes, Co-PI), AFRL via Boston College, 15 Dec 05 – 14 Jul 05, $67,000

Mars Upper Atmosphere Density and Wind Variability, JPL Director's Fund (with Dr. Dong Wu at JPL), 1 Sep 06 – 31 Jan 08, $67,000

Tides, Planetary Waves, and Eddy Forcing of the Mean MLT Circulation for the TIMED Science Working Group, National Aeronautics and Space Administration, 07 Jan 02 – 31 Dec 08 (with 1-year no-cost extension), $2,206,697.00

Air Force University NanoSAT Program: Distributed Neutral Density, Explorer (DANDE) (Faculty Co Investigator), AFOSR, Phase A, $0.0

Wave and Mean State Interactions in Mars' Middle and Upper Atmosphere, Mars Scout Mission "The Great Escape", (Co-Investigator and Deputy Chief Scientist), NASA Planetary Division, Phase A, $20,000

Space Weather of the Thermosphere from CHAMP and GRACE Accelerometer Measurements (P.I. with Co-P.I. Prof. R. Steven Nerem), NSF/ATM-Space Weather Program, 1 Sep 07 – 31 Aug 12, $537,930

Neutral Atmosphere Density Interdisciplinary Research (NADIR) (P.I., with Co-P.I. T. Fuller-Rowell and 10 Co-investigators), DoD/AFOSR MURI Program, 12 Aug 2007 – 12 Aug 2012, $7.2M

Thermosphere Variability due to Wave Coupling from Below, NASA Guest Investigator (TIMED), 1 Jun 08 - 31 May 11, $304,746

Wave Interactions in the Atmosphere of Mars, (Co-I; Dr. Y. Moudden is PI), NASA Mars Fundamental Research, 1 Apr 09 – 31 Mar 12, $253,751

Ionosphere Response to Recurrent Geomagnetic Activity during Solar Cycles 20-23, NASA Geospace, 1 May 09 – 30 Apr 12, $313,688

Mars Thermosphere Density Variability and Empirical Model Development, NASA Mars Data Analysis Program, 1 May 09 – 30 Apr 10, $50,000

Atmospheric Tides and their Effects on ITM Dynamics, Composition & Structure, NSF/ATM Aeronomy, 1 Jun 09 - 31 May 13, $574,785

USPI-GOCE: Response of the Middle Thermosphere to Forcing from Above and Below (CoPIs: X. Zhang, CU; M. Hagan and G.Lu, NCAR) – $1M subcontract to NCAR, NASA/Explorer USPI, 4 Jan 12 - 3 Jan 18, $2,076,206

Electrical Connections and Consequences Within the Earth System (Co-PIs: J. Thayer, CU; V. Pasko, PSU; A. Richmond, NCAR; W. Deierling, NCAR) – Subcontracts to NCAR and PSU (total $3M), NSF Frontiers in Earth System Dynamics (FESD) Program, 1 Oct 11 - 30 Sep 16, $4.5M

Heliophysics GI: Planetary Waves (PW), Their Interactions and Manifestations in the Mesosphere and Lower Thermosphere (MLT), NASA Heliophysics Guest Investigator Program, 01 May 12 – 30 Apr 16, $409,772

Mars Thermosphere Density Variability and Empirical Model Development, NASA Mars Data Analysis Program, 01 May 12 – 30 Apr 15, $371,759

ICON-CU: Atmospheric tides (PI: J.M. Forbes), NASA through U. Cal Berkeley, 15 Mar 13 – 30 Jun 20, $900,000 (approximate, pending pre-launch negotiations; launch, first half of 2018)

CEDAR: Atmosphere-Ionosphere Coupling as Revealed in Global Magnetic Field Perturbations, J.M. Forbes, PI, NSF/ATM Aeronomy, 15 May 16 – 14 May 19, $343,509

Nonlinear Interactions and Complexity in the Atmosphere-Ionosphere System, J.M. Forbes, PI (A, Maute, NCAR, M.E. Hagan, USU, Co-I's), NASA Heliophysics Supporting Research, 15 May 16 – 14 May 19, $599,205

Wave-Wave Interactions and Upper Atmosphere Variability, NSF/ATM Aeronomy, 1 June 16 – 31 May 2020, $595,095

Lower Thermosphere Science Using a New Meteor Radar at McMurdo, S.E. Palo, PI; J.M. Forbes, Co-PI, NSF Polar Programs, 01 Oct 16 – 30 Sep 21, $1,012,212

Spatial-Temporal Variability of Mars' Upper Atmosphere and Consequences for Aerobraking Predictions, J.M. Forbes, PI, NASA Mars Data Analysis Program, 15 May 16 – 14 May 20, $557,329

AWE-CU: Global Variability of Mesopause Gravity Waves, J.M. Forbes, PI, NASA through Utah State University, 03 Apr 17 – 30 Oct 24, $1,182,112 (pending successful completion of Phase A in 2018)